WESTERN CONSTRUCTION NEWS

CIVIL ENGINEERING AND CONSTRUCTION IN THE FAR WEST

PUBLISHED SEMI-MONTHLY
VOLUME IV NUMBER 23

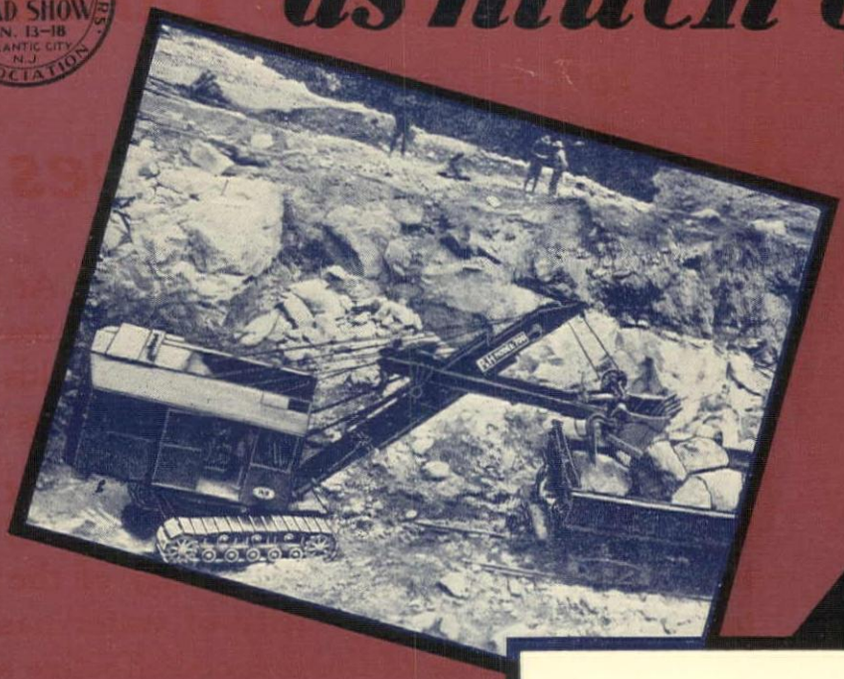
SAN FRANCISCO, DECEMBER 10, 1929

25 CENTS A COPY
$3.00 PER YEAR

BORROW PIT FOR ECHO ROLLED EARTH-FILL DAM, SALT LAKE BASIN PROJECT, BUREAU OF RECLAMATION, UTAH

Cheap Fuel *and Just one-half as much of It*

AMERICAN ROAD BUILDERS' ASSOCIATION
1930 CONVENTION AND ROAD SHOW
JAN. 13–18
ATLANTIC CITY N.J.



1, 1¼, 1½, 2½, 3½ Cu. Yds.

THE P & H Diesel uses cheap fuel .... costing one-third to one-half as much as gasoline, depending upon locality. Only one-half as many gallons are consumed with the Diesel, reducing fuel cost from 75 to 85%.

In addition to this fuel saving, you get from 10 to 15% greater yardage because a P & H Diesel-equipped machine will pull through heavy digging without stalling. The torque actually increases as the speed decreases.

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3890 National Ave., Milwaukee, Wis.,
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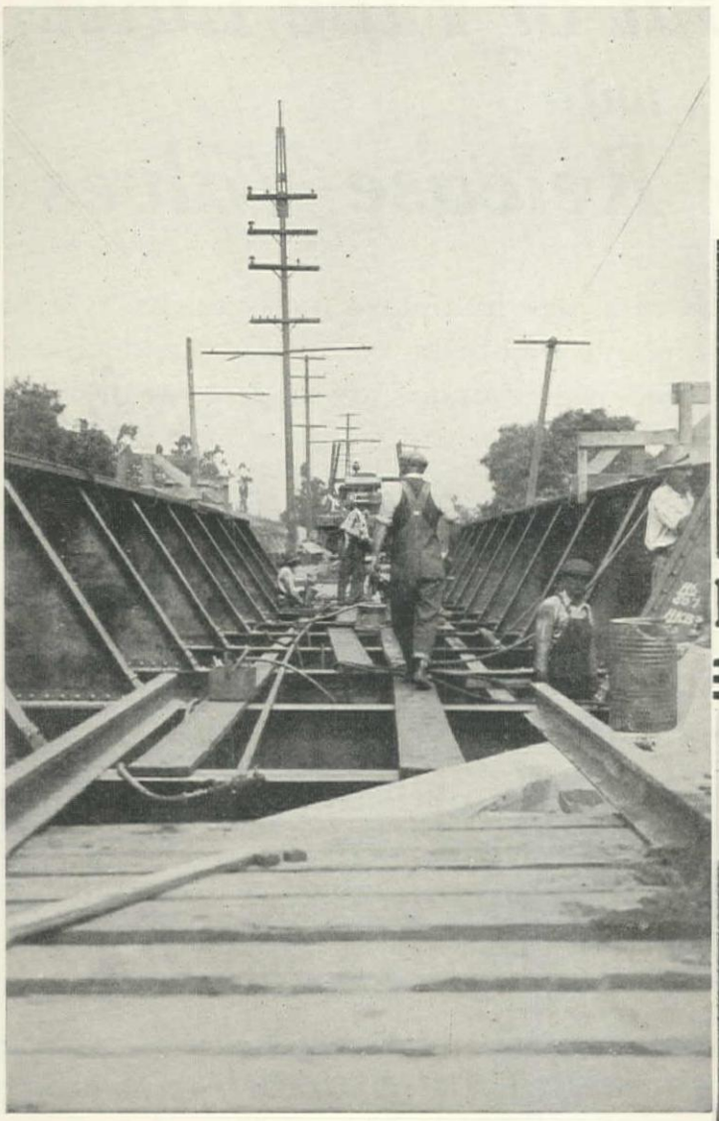
ROBERT M. TAYLOR, *Pacific Coast Manager*
Service Stations, Complete Repair Part Stocks and Excavators at San Francisco, Los Angeles and Seattle, Wash.

P & H

DIESEL EXCAVATORS

Speeding Bridge Construction



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

RIX

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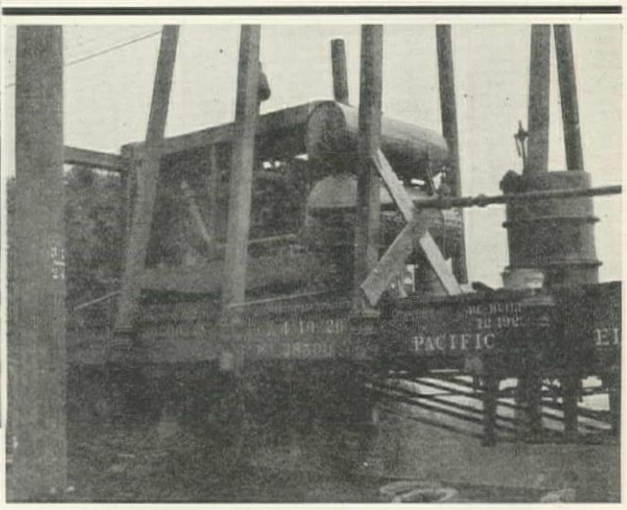

If you need AIR you need RIX

COMPRESSED AIR MACHINERY — RIX — SAN FRANCISCO LOS ANGELES

Since 1877

RIX COMPANY, Inc.

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

WESTERN CONSTRUCTION NEWS

DEVOTED TO CIVIL ENGINEERING AND CONSTRUCTION IN THE FAR WEST

Volume IV DECEMBER 10, 1929 Number 23

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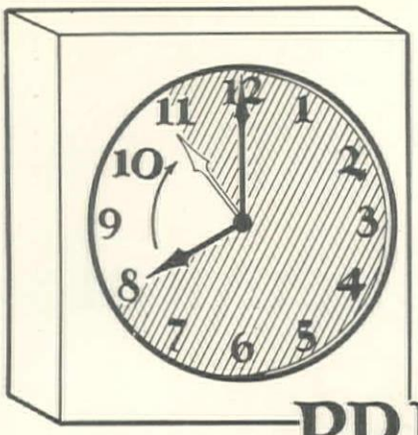
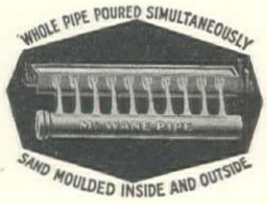


3 MEN - 3 HOURS *and* 1052 feet *of* PRECALKED Pipe Laid!

TIME is money in these days of high labor costs. Saving money by speeding the job is one of the primary purposes of Precalked Joint Cast Iron Pipe. The above-mentioned speed was made in a normal way, laying the 4-inch McWane Precalked Joint Cast Iron Pipe pictured at the left.

These Precalked Joints are but one more good reason for the West to "go cast iron" for its underground pipe. Pacific States pipe gives you not only permanent freedom from rust and rot, but a western product, made from western iron and coke.

"Pipe the West with western pipe" is the new slogan.



NOTE

We also make open bell (beaded) Bell and Spigot pipe for trench-made joints. Send your inquiries to nearest office, please.

WRITE FOR ILLUSTRATED LITERATURE

Pipe Sizes 1¼ through 12" for Water, Gas, etc.

McWANE CAST IRON PIPE

Standard Lengths. Fittings.

McWANE CAST IRON PIPE CO. BIRMINGHAM, ALA.

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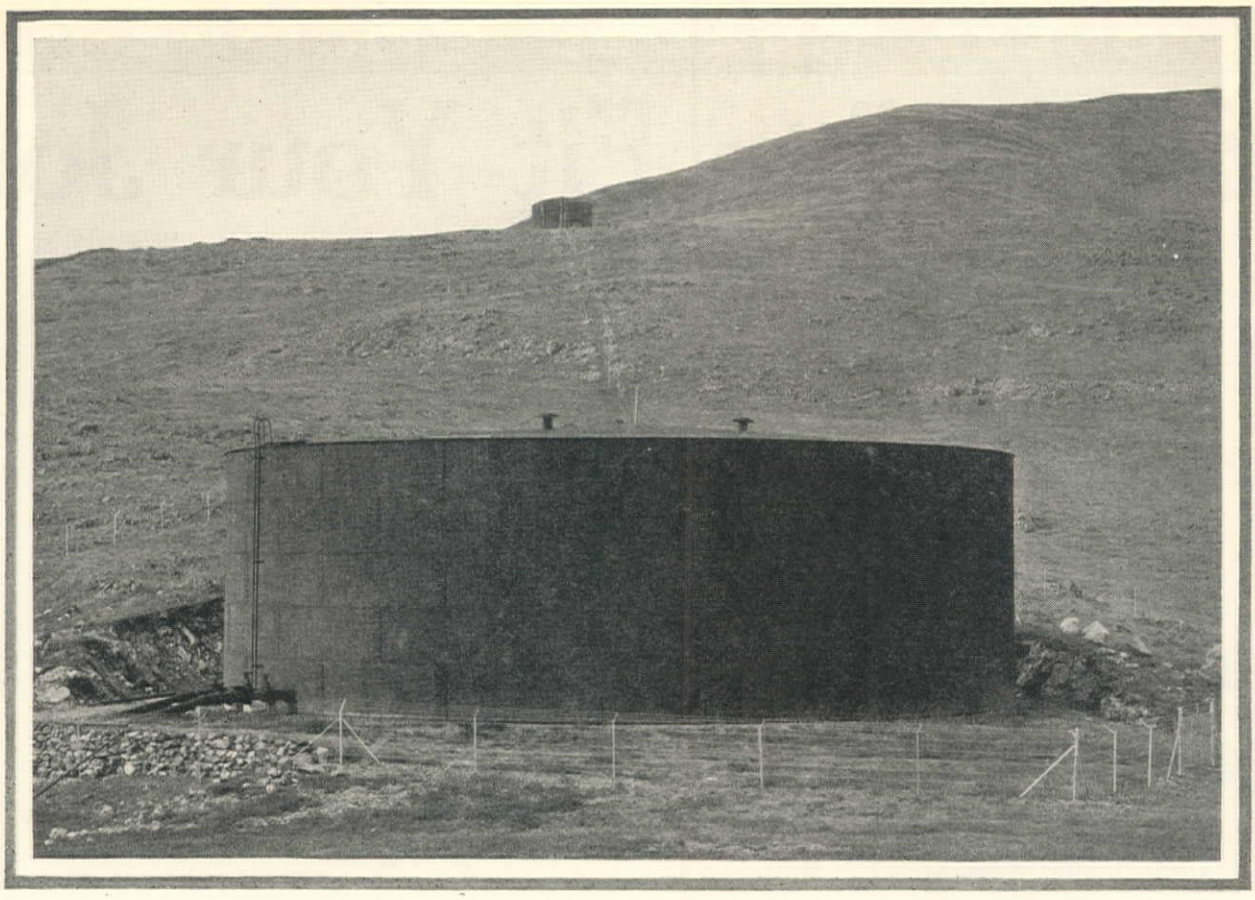
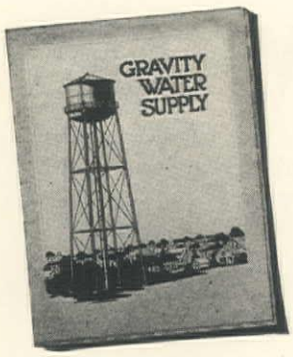


The Marin Municipal Water District installed this 1,500,000-gallon steel tank near Tiburon, Calif., in 1927. It acts as a balancing reservoir.

Provide adequate water storage *close* to the point of consumption



ONE of the most important things a water company or department can do to insure good water service is to provide plenty of storage close to the consumers who use it. Such storage performs three distinct duties:*

First: Take care of normal daily peak load consumption. *Second:* Take care of abnormal consumption such as major fires or breakdowns in trunk lines. *Third:* Act as balancing reservoirs at the ends of long trunk lines where water may be stored during hours of low consumption for use during peak load hours.

Balancing a system with properly located and designed tanks adds many years to the useful life of pipe lines that would otherwise have to be renewed with larger mains. It allows such trunk lines to work 24 hours per day instead of 14 to 16 hours, which is often the case. Balancing reservoirs also maintain pressures in a system by providing a two-way supply during peak hours.

Ask us for quotations on balancing reservoirs or elevated tanks where no natural elevation is available.

**From a paper by J. S. Peters, Chief Engineer of the Marin Municipal Water District.*

CHICAGO BRIDGE & IRON WORKS

1013 Rialto Building, San Francisco

B-115

HORTON TANKS

KOEHRING WEIGH MIX

MATERIALS and water *proportioned by weight*—mixing period accurately timed—the Koehring *Weigh Mix* is the accurate producer of specification concrete!

It's a standard Heavy Duty Koehring mixer with weighing batch hopper and water tank mounted on an auxiliary frame. All operations are controlled from platform.

All aggregate weighed in one hopper—any number of grades weighable without extra equipment. Water weighed on same beam!

Fast discharging *vibrating* hopper permits mixer to operate at full capacity, and self clearing is so accurate that weighing scale always returns to balance. Absolute, easy, one-man operation!

—and of course the Koehring remixing action makes its own contribution to uniform, dominant strength concrete.

FROM whom you buy your equipment is almost as important as *what* equipment you buy! You get a continuing interest and service with equipment you buy through this organization which appreciates that time is money for you.

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(SINCE 1875)

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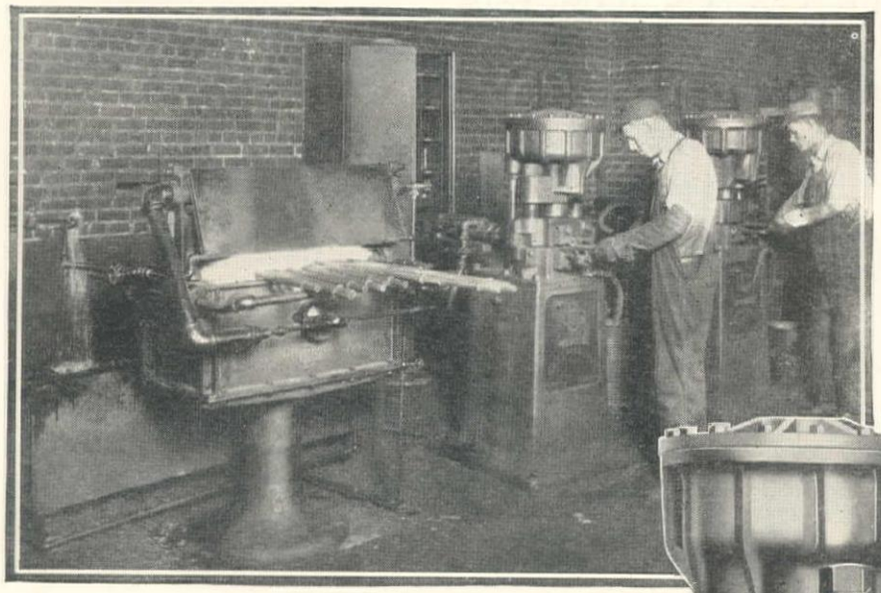
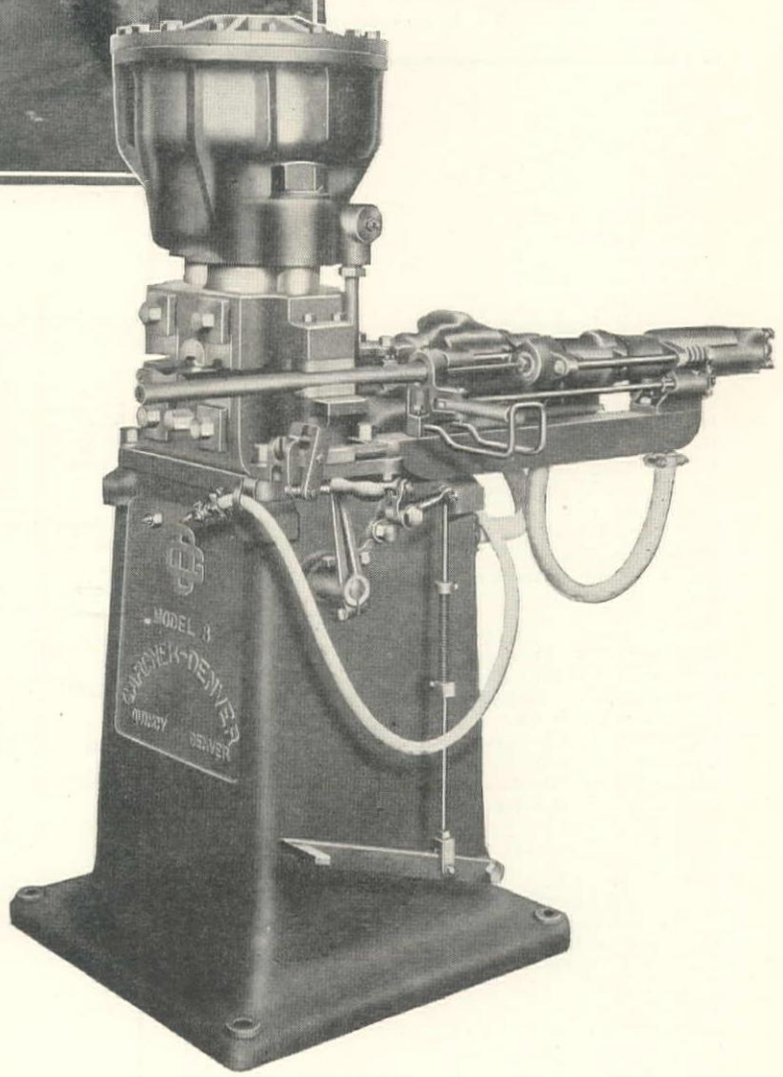
A5091-I-R

For Sharp Drill Steel

Model DS-8 Sharpener





FOR many years the Model DS-8 has met all requirements of discriminating users of Drill Steel Sharpeners the world over. Although continually improved as time has gone by, no major or radical change has been necessary to keep this machine abreast of the times. The purchase of a Model DS-8 is equivalent to the purchase of perfect drill bits and shanks in large daily quantities at very low cost for operation and maintenance.

Combined with a Model HP-20 Bit and Shank Punch and supplemented by a Model DF-1 Oil Forge, the Model DS-8 makes an ideal installation where a large quantity of drill steel is required.

Write for Bulletin

GARDNER-DENVER COMPANY
ROCK DRILL DIVISION
DENVER, COLORADO
Sales Offices Throughout the World

GARDNER-DENVER

These Manufacturers Have Chosen CONTINENTAL!

THE list of manufacturers shown on this page is in effect a roll call of successful users of Continental Heavy Duty Industrial Engines. While widely diversified industries are represented each is securing that dependable power and certainty of performance so necessary to the profitable operation of his product and the satisfaction of users.

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The Largest Exclusive Motor Manufacturer in the World

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Acme Road Mchy.
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Barnes Mfg. Co.
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Beach Mfg. Co. (Montrose, Pa.)
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Bel Kel Mfg. Co.
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Binks Mfg. Co.
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Buhl Co.
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Cotton Harvester Co.

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Ebel Hoist & Pump Co.
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Elgin Sweeper Co.
Ellicott Mch. Corp.
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Fairmont Ry.
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Goulds Pumps, Inc.

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Hvass, Chas. & Co.

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Jones Superior Co.

Kanawha Mfg. Co.
Karth Co.
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Modern Equipment Co.
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Continental Engines

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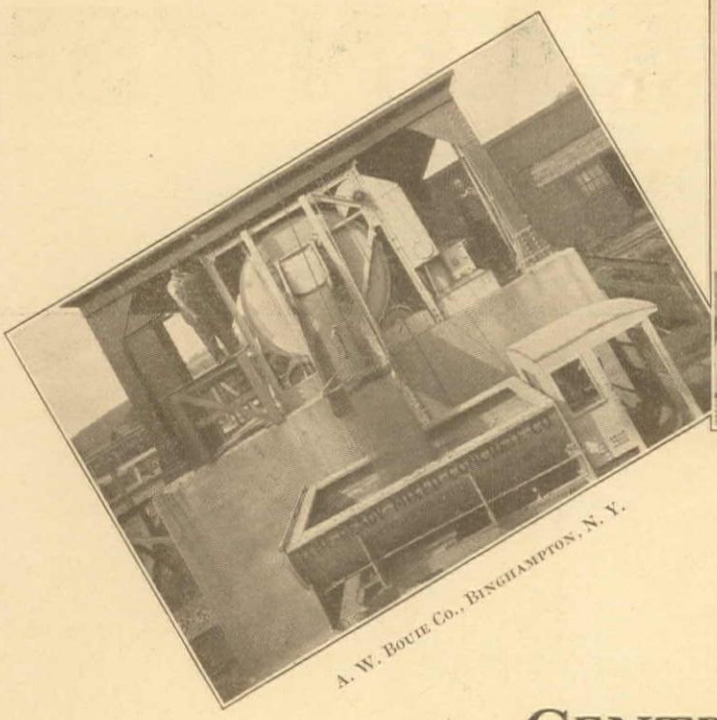
[SEE TEN JENISON MACHINERY COMPANY PAGES FOLLOWING]



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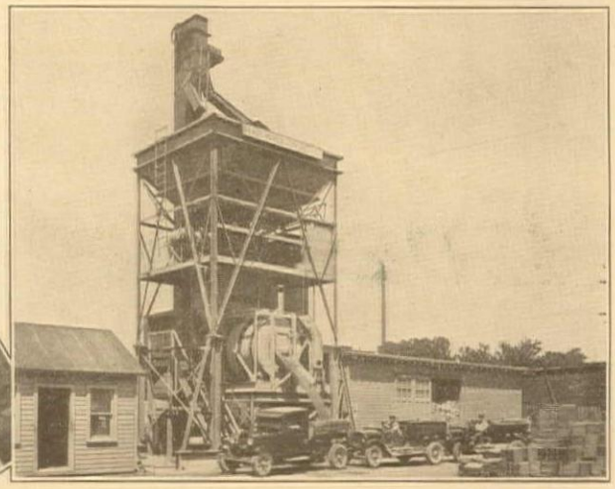

READY MIXED CONCRETE CO., OMAHA, NEB.

REX
CENTRAL PLANT MIXERS

CROSBY LITERAGE CO., SEATTLE, WASH.

BIG-PRODUCTION central plant concrete mixers with their requirements for large daily yardages bring up radically new design and construction problems.

Rex 28-S, 56-S, and 84-S Mixers are designed and constructed especially to meet these demands. Charging speed is assured with a 55°, funnel feed hopper with a radial cut-off. Big, specially designed buckets dump the concrete onto the discharge chute which extends to the center of the drum and provide a faster discharge. Accurate water, automotive clutch, chain drive, Timken equipped drum rollers, enclosed gear reduction running in oil give you the speed and long life for which Rex Mixers are noted. Write for full information on Rex designed Central Mixing Plants.

REX MIXERS
REG. U.S. PAT. OFF.

JENISON MACHINERY CO.

58 Fremont Street **San Francisco, Calif.**

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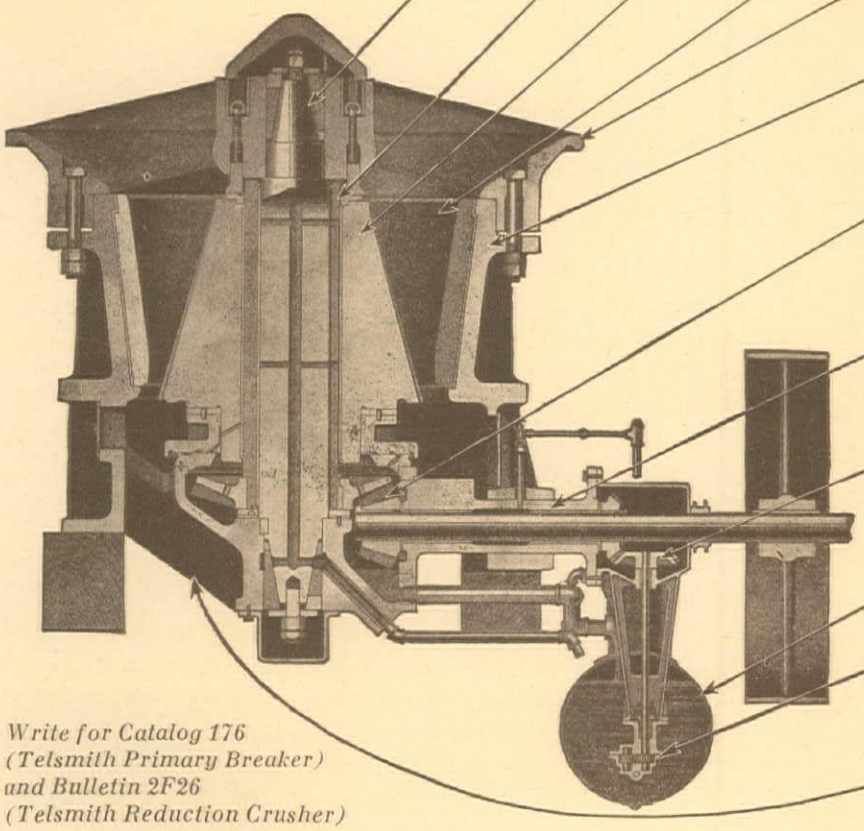
12 Reasons WHY Engineers Are Picking TELSMITH *Crushers*



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

1 Fixed shaft, guaranteed against breakage even by tramp iron. Held rigidly at top and bottom by expansible bushings. This shaft serves as a huge steel bolt through the whole crusher.

2 Long sleeve eccentric, rotating on fixed shaft. Eccentric bearings are three times greater than in other gyratory crushers. Renewable babbitt sleeves.

3 Crushing cone gyrates horizontally. The crushing pinch is as long at top of head as at bottom of the bowl. Exerts full stroke on the big chunks just as they enter crusher. Very little slippage even with gravel boulders.

4 Head and concave diameters are both greater than in other gyratory crushers, with consequent increase in receiving openings and crushing areas.

5 Low-arched, heavily metalled crown. Made of STEEL, guaranteed against breakage by tramp iron.

6 Frame is short—with thick walls and heavy ribs. It is made of STEEL, and guaranteed against breakage, even by tramp iron.

7 Steel drive gears, practically noiseless. Run in oil bath. Teeth never strip until worn out.

8 Removable countershaft box with renewable babbitt bushings, automatic lubrication and sight feed.

9 Pump drive gears are steel, completely housed with sight feed oiler.

10 Big oil supply tank, readily accessible and easily cleaned. Oil flow subject to instant inspection. All oil strained and cooled before re-use.

11 Gear oil pump. All bearings lubricated by oil under pressure, with perfect exclusion of dirt.

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

TELSMITH

Consult the nearest representative or write or wire direct to TELSMITH

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SMITH ENGINEERING WORKS

1826 HOLTON STREET :: :: MILWAUKEE, WISCONSIN

B-8

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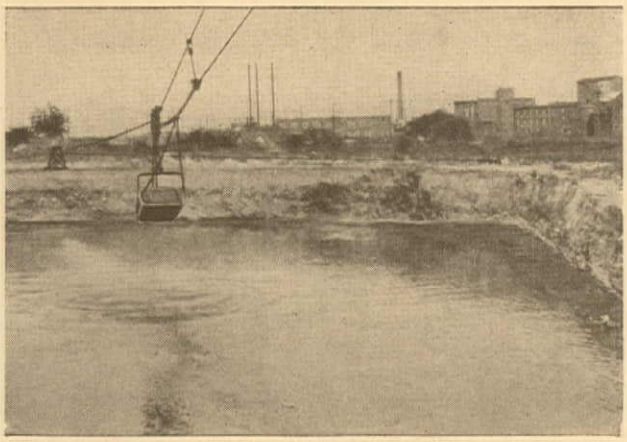

DIGGING A WATER STORAGE RESERVOIR

REMOVING BLASTED ROCK FROM CANAL

Putting Long Range Excavating on an Economy Basis....

THE sketch below shows the simplicity of the slackline cableway method of making a large excavation. Here you see a pit 1000 ft. wide and 100 ft. or more in depth, completed with a single Sauerman machine.

Sauerman Cableways demand serious consideration from every contractor who has excavating work where the excavated material must be moved any distance from 200 to 1500 ft.

Furnished with electric, gasoline, steam or Diesel engine-driven power units. Handling capacities: 10 to 300 tons per hour.

YOU can handle your cut and fill work, levee building, dam construction, etc., at lowest cost by using a Sauerman Slackline Cableway. On many excavating jobs you can reduce your cost one-half.

A Sauerman Slackline Cableway does the combined work of excavating, elevating and hauling equipment. It digs, elevates and conveys to bin, spoil pile or car in one continuous operation.

Your initial cost for a Sauerman Slackline Cableway is much less and your maintenance costs are low in comparison with any other excavating and conveying equipment that is capable of rendering an equal amount of service.

Furthermore, a Sauerman Slackline Cableway only requires one man for operating, which helps to reduce the payroll—something worth thinking about in these days of close bidding. In addition, you can move a Sauerman Slackline Cableway easily from one job to another. It is a simple machine, can be handled quickly in transit, and can be set up with little loss of time.

Write for the "Excavating for Profit" Catalog—56 pages of useful data, illustrated with over a hundred photographs and diagrams

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Pacific Coast Distributors:

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58 Fremont St., San Francisco

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

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

SAUERMAN

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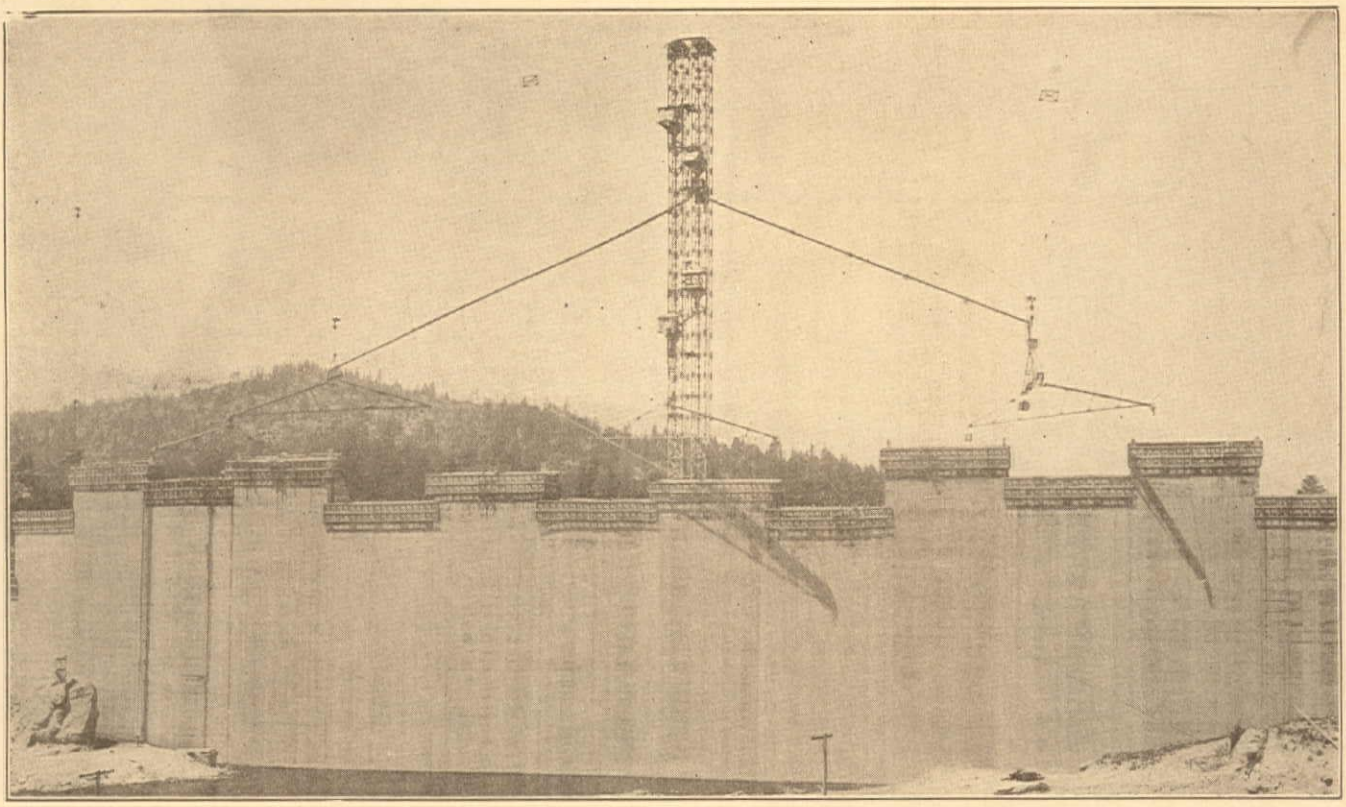


The Lakewood Double Compartment Steel Tower as shown above was 360 ft. high and each compartment handled a 2½ cu. yd. Elevator Bucket.

The Shaver Lake Dam

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

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

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

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

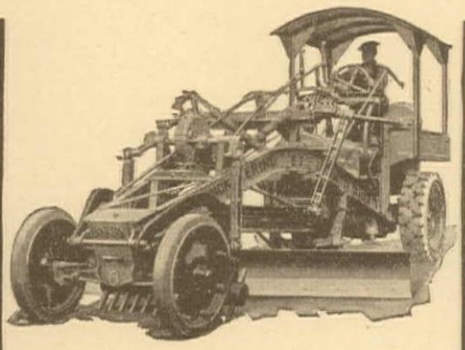
LAKEWOOD

The Lakewood Engineering Co., CLEVELAND - O.

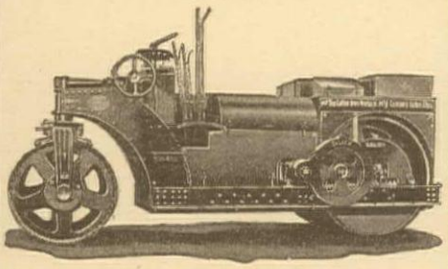
California Representatives: JENISON MACHINERY CO., 58 Fremont Street, San Francisco; THE BROWN-BEVIS CO., 49th Street and Santa Fe, Los Angeles

★ LOCAL STOCKS JENISON MACHINERY COMPANY AND SERVICE ★

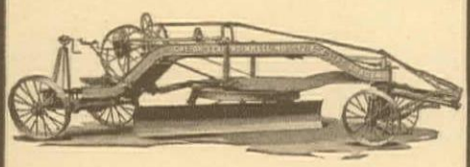
GALION



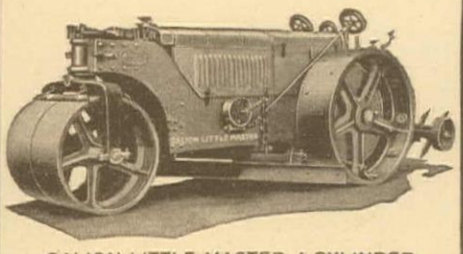
GALION E-Z LIFT ONE MAN MOTOR GRADER



GALION 4-CYLINDER MOTOR TANDEM ROLLER. 5 TO 10 TON



GALION E-Z LIFT ADJUSTABLE LEANING WHEEL GRADER



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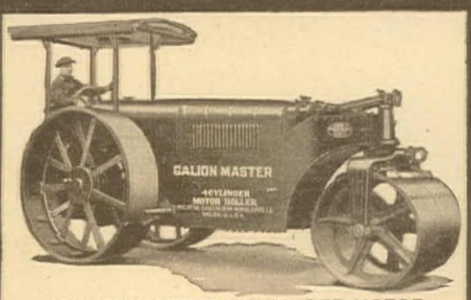

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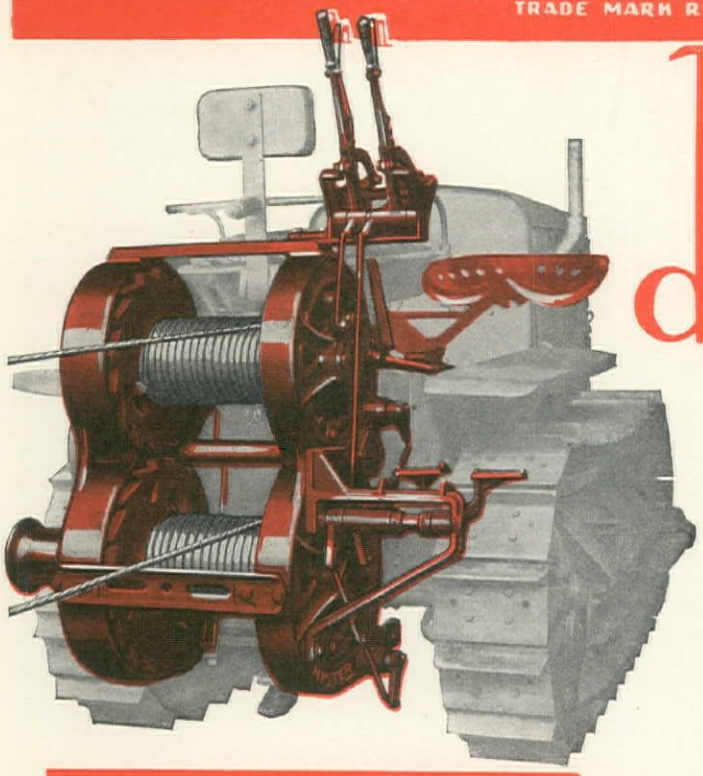

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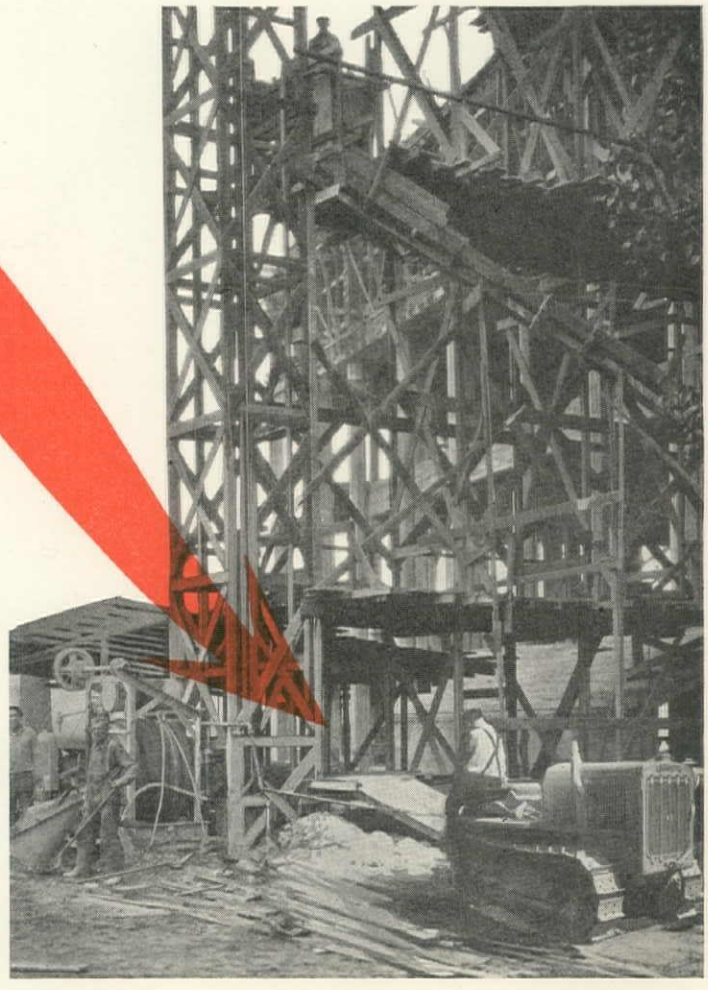

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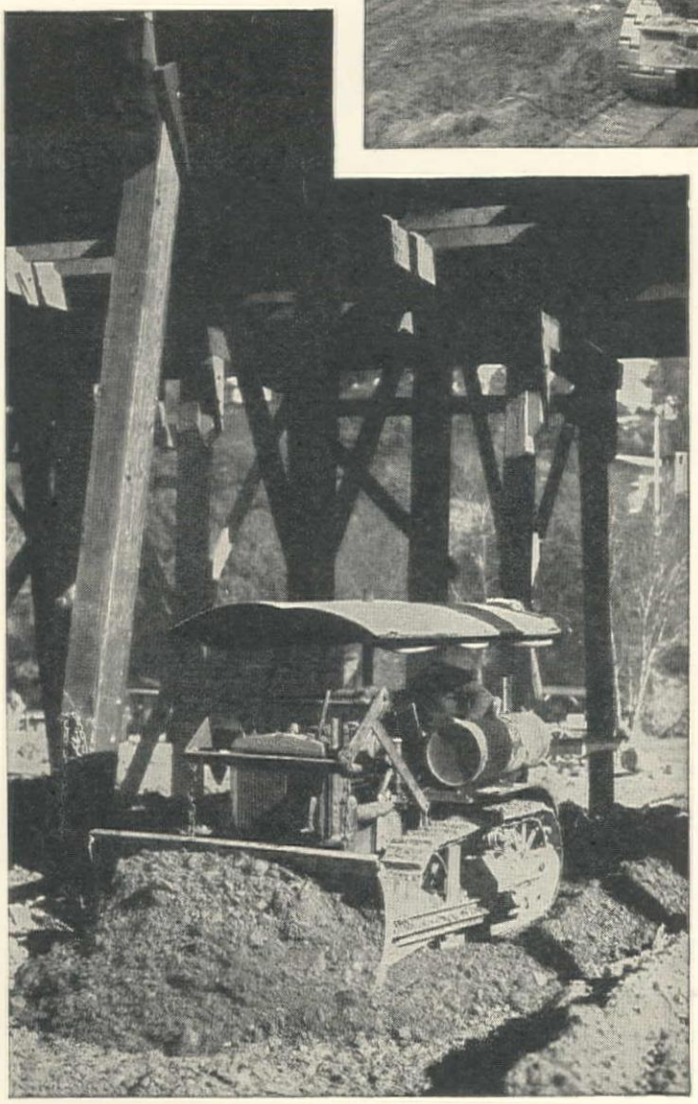

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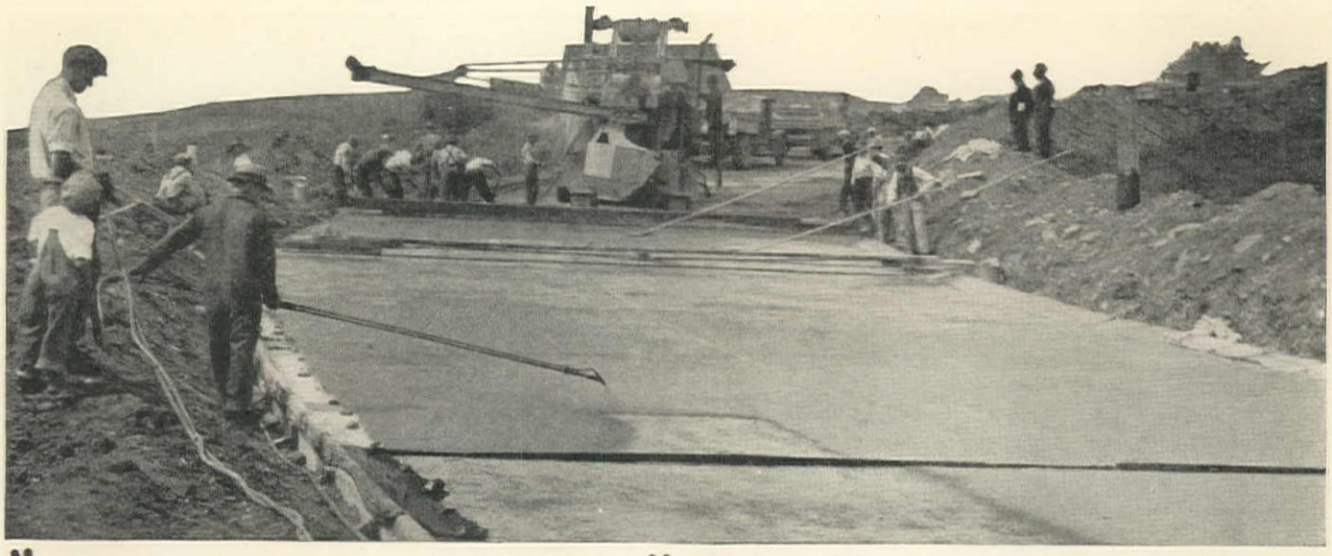

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A two-minute mix was used and a very dry consistency. Most of the project was on a six per cent grade and curves which were super-elevated. In the pictures above and below, notice the character of the excavation material—mostly clay and loose rock—very undesirable for earth and water cure. Note also how closely the application of the "Hunt Process" follows the spreader—forming an impervious coating which prevents evaporation of mixing water.

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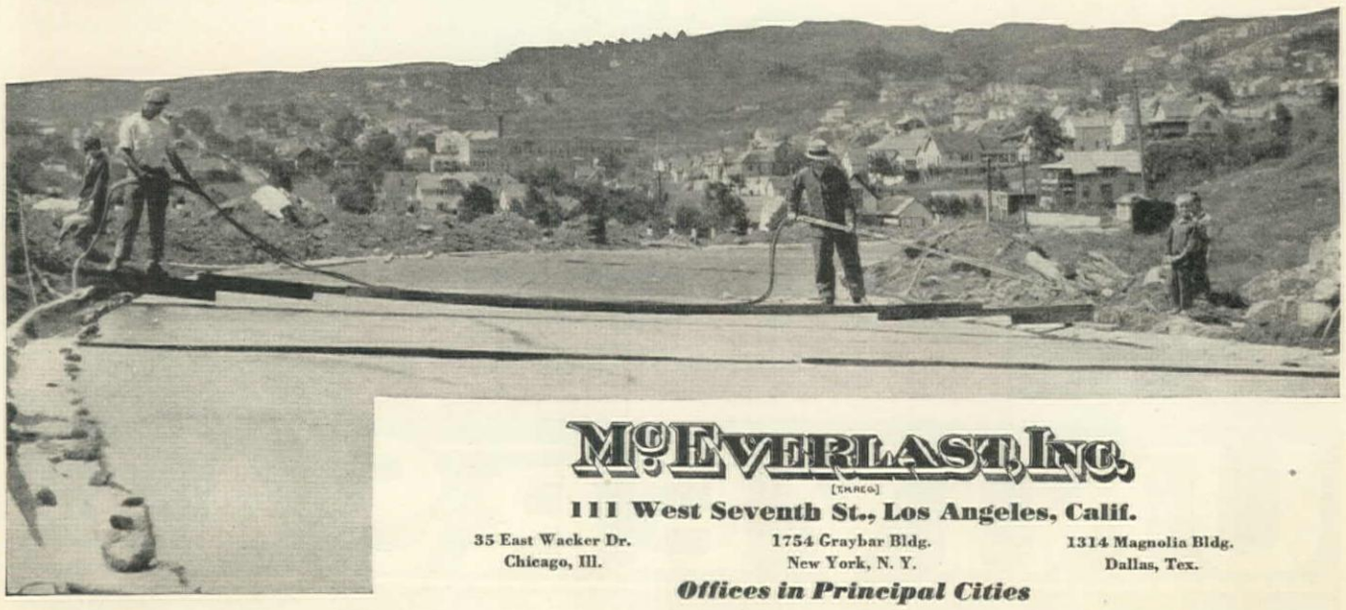

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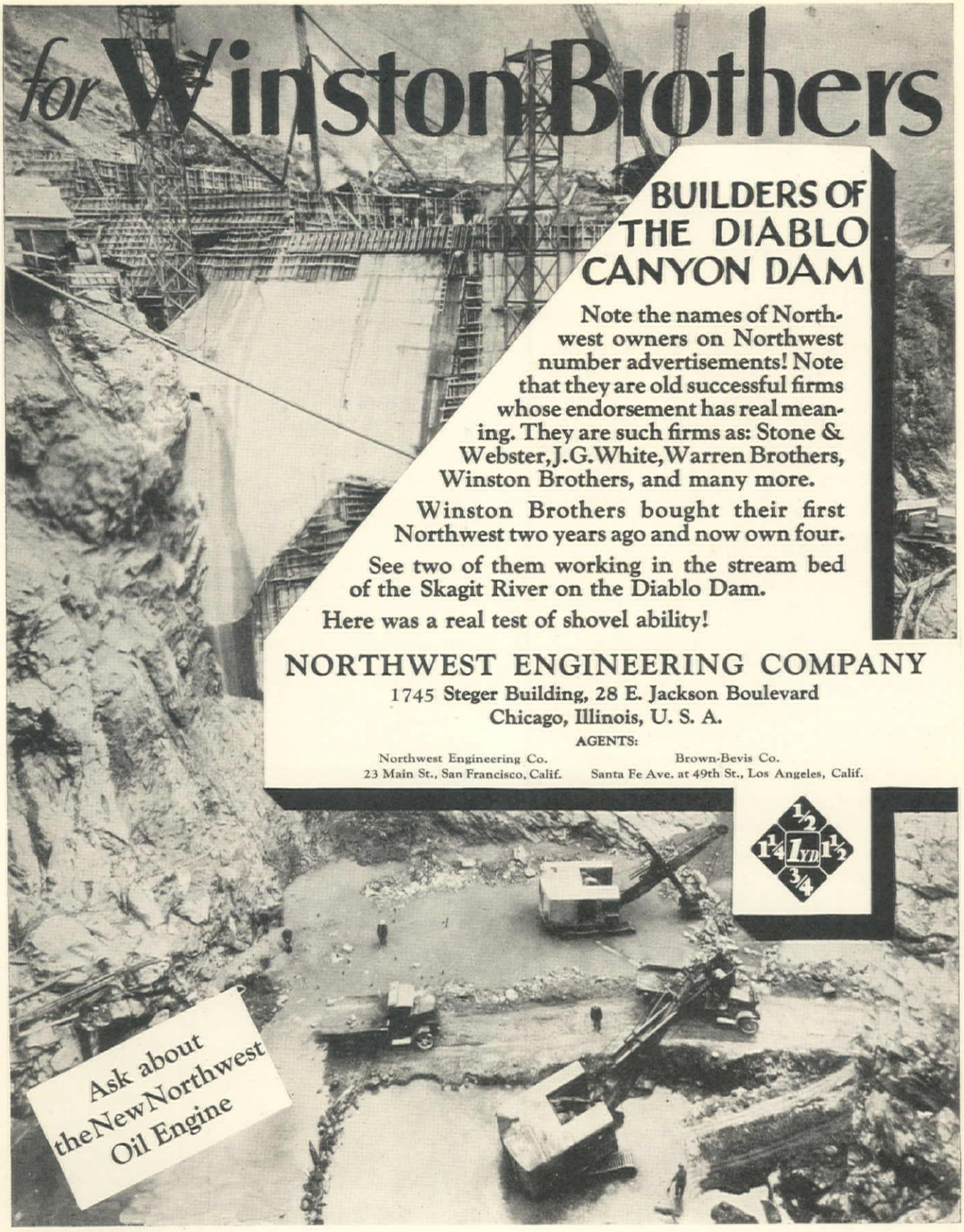

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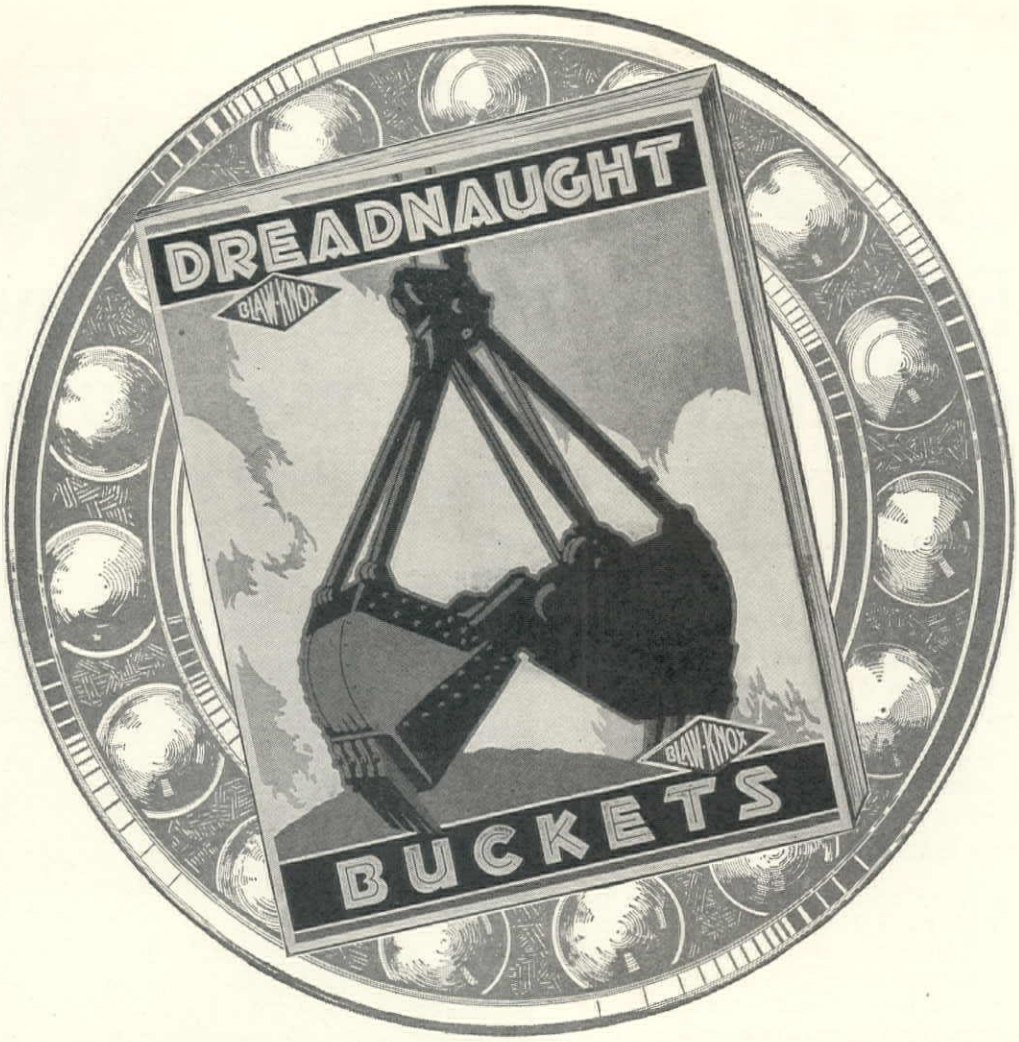

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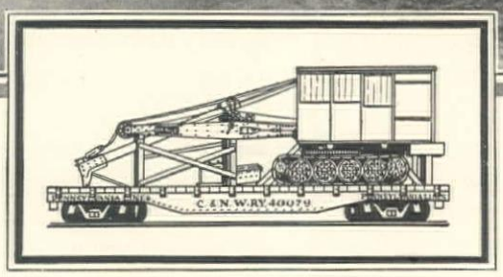

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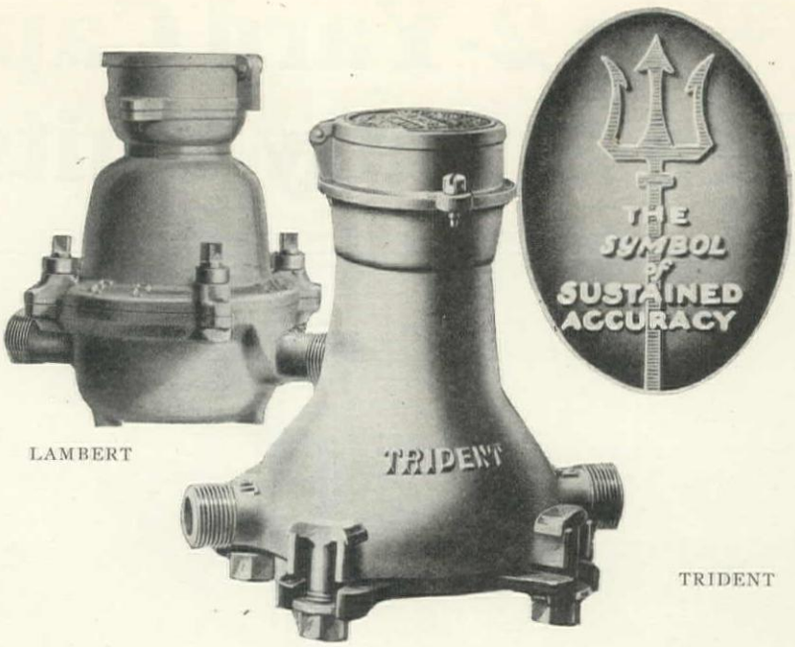

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VOLUME IV | DECEMBER 10, 1929 | NUMBER 23

For some unaccountable reason the proper easement and banking of highway curves has not received sufficient attention by highway engineers. Not only are some new highways being constructed with flat curves, but many of those banked are still being laid out apparently in a hit-and-miss manner. The curves on highways should receive as much, if not more, attention than those on railroads. Speed is the order of the day, and curves must be made as safe as the straight stretches. A sharp curve to be safe at a 30- to 40-mile speed must be most carefully designed. Therefore, the article in this issue on the 'Easement and Banking of Highway Curves', by N. B. Putnam, should be of interest and value to all engineers on highway design and construction.

Banking of Highway Curves

In the arid regions of the far west where water is our most precious commodity, and is rapidly increasing in value as the population grows, estimating runoff from the winter snows and rains is one of the major problems of the hydraulic engineer. Rainfall records in these regions extend back only 80 years and do not fully cover the territory. We now know that dry and wet years come in cycles of varying length, and that the sun spots have an influence on these cycles. We have also known for some time that our trees record the wet and dry years by the width of the rings of annual growth.

Forecasting Wet and Dry Cycles

But, it is only within the past two or three years that a chronological calendar, as so accurately recorded by trees, has been worked out. Credit for this most valuable contribution to science is due Andrew Ellicott Douglas, director of Steward Observatory, University of Arizona, and leader of the National Geographic Society's recent tree-ring expeditions.

Although the object of these research expeditions was to determine the age of the cliff dwellers and Indian pueblos, the method is applicable to the chronology of the weather and will probably prove of inestimable help to hydraulic engineers in determining the necessary storage capacity of reservoirs. In the words of Professor Douglas in the December issue of 'The National Geographic Magazine': "When a real theory of climate has been developed and we can predict drought and flood over a period of years, this Arizona story in tree rings will have played a creditable part in developing that climatic foresight which is perhaps the most valuable economic advantage yet lying beyond our reach."

The U. S. Government could well collaborate with the state governments in further research toward securing a tree chronology for rainfall forecast.

In California we look forward to a population of twenty or thirty millions, and industrially we are planning accordingly. But, we already find ourselves short of water. Therefore, the state water conservation program must be most carefully planned.

Fortunately for the United States we had a constructive engineer-manager in the White House at Washington, D. C., when the inevitable stock market crash occurred. President Hoover acted promptly to halt the swing of the pendulum toward pessimism and depression and divert it back to optimism and confidence, by calling on the industries, states, and municipalities, to increase their constructive programs.

Construction Prosperity for 1930

The response has been most gratifying and 1930 promises to exceed the past year in construction activity. There is no reason why it should not—but, if the mental attitude of the people had not been diverted from pessimism to optimism, there is no telling what might have happened.

The consensus of opinion is that 'money' will again look to bond issues as a good investment, which in itself will accelerate construction.

Highway and street work will be considerably greater, and there will be more railroad construction. The public utilities will continue with annually-increasing large programs based on their ten-year forecast requirements, with some probable emergency increases occasioned by the excessive dry spell in the far west. Municipal improvements should show a good increase, as bond-issues will be saleable. The record-breaking dry spell will undoubtedly bring to a head many irrigation, water supply, and water conservation projects. Building construction, which slowed up during the past six months, should gradually increase during the year. Last, but not least, the government of the United States has pledged itself to a big construction program.

Nothing short of some unlooked for calamity can prevent 1930 from being a prosperous year for the engineering-construction industry.

Development of a Community

Construction of Modern Improvements by Three Small Communities at Cost of $900,000 Transforms Pismo Beach into One of the Playgrounds of California

By S. G. WHITTELSEY
Consulting Engineer, San Francisco

As the motorist passes through a gap in the Santa Lucia mountains on the Coast highway a few miles south of San Luis Obispo, California, a magnificent view of San Luis bay and the Pacific ocean is spread before him. From this point southerly, the highway parallels the shore for about four miles to the town of Pismo Beach, where it again turns into the hills. For twelve miles of highway southerly from the town there stretches a fine, safe, and beautiful beach. This is the beach that the State Park Commission is seriously considering including in its park system which was made possible under the recently voted $6,000,000 bond issue. It, however, has not experienced deserved popularity on account of its inaccessibility, there being no paved roads. To develop the area much organization was necessary.

Preliminary Work—In the summer of 1926, a small group of forward looking citizens met at the Oceano hotel under the auspices of the chamber of commerce of Oceano, a town on the coast division of the Southern Pacific Co. railroad, three miles south of Pismo Beach. It was an epochal meeting for the community, inspiring talks were made, and there was general discussion on the possibilities of the district and ways and means to make these improvements realities. I had the good fortune to be present at that meeting and outlined a method of procuring a paved highway to make the district and the beach easily accessible to the people of our state.

To recount the many vicissitudes, trials and tribulations, and struggles which resulted in its final construction would be tedious, but a description of a few of the obstacles met and overcome may be interesting.

After much interest was aroused in the community by mass meetings and conferences with property owners and the county authorities, I was appointed engineer on the project by the county board of supervisors, in November, 1926, and a study of several possible routes was made.

Road Situation—The old county road as it existed at that time crossed the railroad at grade in the town of Grover about half way between Pismo Beach and Oceano. It was decided to change the route of this road so as to take advantage of a cut in the railroad right-of-way just north of Oceano, thereby separating the grades by an overhead crossing. After months of negotiating with railroad officials, the Southern Pacific Co. finally agreed to bear one-half the cost of this structure, the other half to be paid by the district. The county board of supervisors contributed one-quarter of the cost, so that only one-quarter was left to be assessed to the property included in the district.

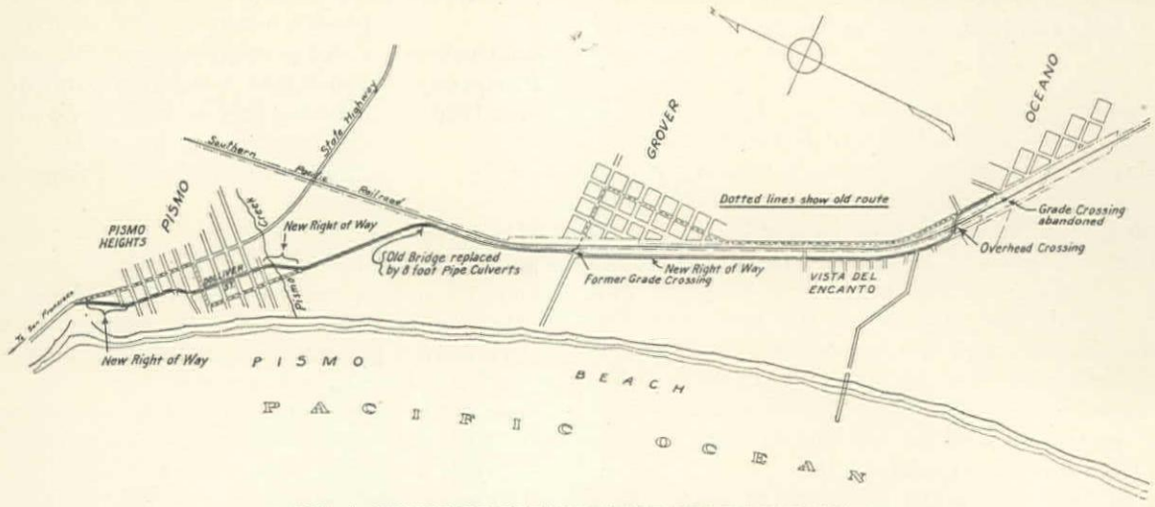


FIG. 1. ROUTE OF OCEANO-PISMO BEACH HIGHWAY

Much opposition from property owners was here encountered, some of whom objected to the change of route, and others to closing the grade crossing in the station grounds at Oceano. The latter was one stipulation in the agreement finally entered into between the county board of supervisors and the Southern Pacific Co.

The hearing before the board of supervisors for the abandonment of this crossing was held in November, 1927, and the opponents of the project made a determined effort to block the move. It was continued in order to determine the real sentiment of the majority of the property owners. Many petitions were circulated and meetings held, but finally, in December, 1927,

the board passed a resolution confirming the abandonment, thereby allowing the main project to proceed.

Of course, the inevitable controversies over type of pavement ensued and consumed more time, but finally, in March, 1928, the 'resolution of intention' under the provisions of the Acquisition and Improvement Act of 1925 (Mattoon Act) was passed, providing for a new bridge over Pismo creek, and the construction of an asphaltic concrete pavement (Warrenite type) to be laid on a gravel base compressed to 4-in. final thickness. Fortunately, the county owned a gravel deposit a short distance from the road. This deposit was composed of gravel mixed with clay of a high cementing value and the material made a satisfactory sub-base.

It had been previously decided, for legal reasons, to put the construction of the overhead crossing under a separate set of proceedings which were carried forward simultaneously.

Bridge Replacement—At one point in the old road there existed a wooden bridge which was in bad con-

Fig. 2. Town of Pismo Beach, California, with Ocean and Beach in Background. Taken from Pismo Heights

dition. After much study, plans were drawn providing for the replacement of this bridge with a battery of two Armco corrugated iron culvert pipes 8 ft. in diam., joined by concrete headwalls. This was found to fit the conditions both economically and otherwise. One decided advantage was that it was only necessary to divert traffic for one day; the old structu e being removed, excavation made, pipes placed and backfilled, all within 24 hours. Of course, the headwalls were constructed subsequently. The location of this bridge and the completed structure are shown in Fig. 1 and 4.

The hearing on the 'resolution of intention' was held in April, 1928, and after several continuances a resolution ordering the work was passed in June, 1928, and construction was started. The bridge was completed in December, 1928. The county board of supervisors also contributed several thousand dollars toward this project.

Street Improvements—The reason that the old county road had not brought more travel to the district was that the only access from the north was through the narrow streets of Pismo Beach, with two right-angle turns.

With the cooperation of interested property owners, a proceeding under the Mattoon Act was commenced in October, 1927, to acquire property for the opening, widening, and extension of Dolliver st. in Pismo Beach. This included a new right-of-way both at the northerly and southerly ends of town. The acquisition of a right-of-way connecting the southerly end of Dolliver st. with the northerly end of Oceano road, and the construction of a new bridge over Pismo creek, was included in the Oceano-Pismo road project previously described. The property to be acquired at the northerly end of town gave a suitable connection with the state highway. These proceedings did not reach the point where possession of the acquired property was possible until November, 1928.

As far back as 1926, the property owners on Price st. (state highway) had attempted to widen the right-of-way through town by acquiring property along the easterly side of that street. These efforts were made with the cooperation of the right-of-way department of the California Division of Highways, Division V, at San Luis Obispo, to conform with a widening and extension program on either side of town. They were unsuccessful, as the entire project was blocked by a few property owners who refused to sell. In November, 1927, I was requested to start proceedings under the Mattoon Act to accomplish this purpose. After much negotiation, the California Division of Highways appropriated $19,800 toward acquiring the necessary land and moving back the buildings.

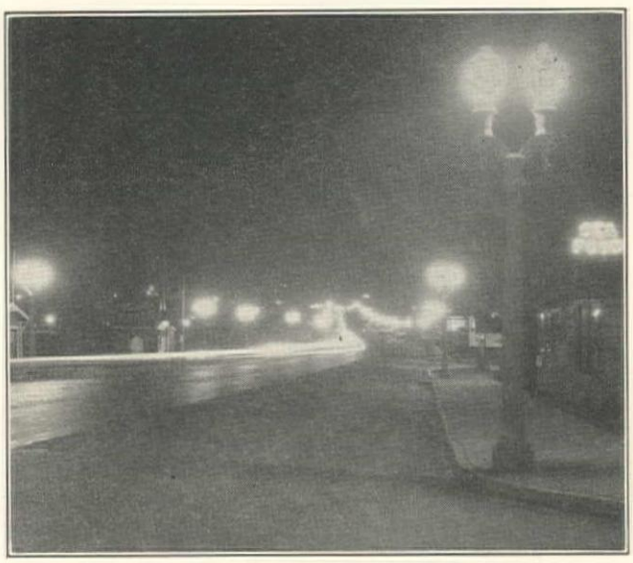


Fig. 3. Night Illumination in Pismo Beach Using Marbelite Double Light Standards and Prizmalite Glassware with 250-c.p. Lamps

General Improvements—In the meantime, continual talk of improvements both in public meetings and on the streets had brought the people to a realization of the pressing need for a complete set of improvements throughout the entire town of Pismo Beach. A petition had been circulated some time previously with this in view, but was not acted upon until public sentiment was such that it was believed the project would go through without too great opposition. Plans were finally completed and the 'resolution of intention' under the provisions of the 'County Improvement Act of 1921' (using also the provisions of the 'Improvement Bond Act of 1915') was passed, calling for installation of an entirely new water distribution system for domestic use and fire protection; extension of the existing sewer system; paving the streets with 5-in. portland cement concrete; and constructing culverts, curbs, gutters and sidewalks on all streets in the town proper. On many of these streets, ornamental light

standards were included in the plans. This resolution was passed in February, 1929.

Construction of improvements on Dolliver st. and the state highway were not included in these plans, as widening proceedings had not reached the point where 'immediate possession' was possible. Work on the town improvements was started in August, 1928. Construction on Dolliver st. and the state highway was completed later, the final acceptance of these improvements being in September, 1929.

Improvements on the state highway bear special mention, as the existing street has been described as one of the finest on the coast highway between San Francisco and Los Angeles.

The original right-of-way was 50 ft. wide, the curbs being constructed on the property line. Before the widening proceeding was started, owners on the westerly side of the street deeded an 8-ft. strip for sidewalk purposes along the entire length of the improvement. On the easterly side of the street, a strip

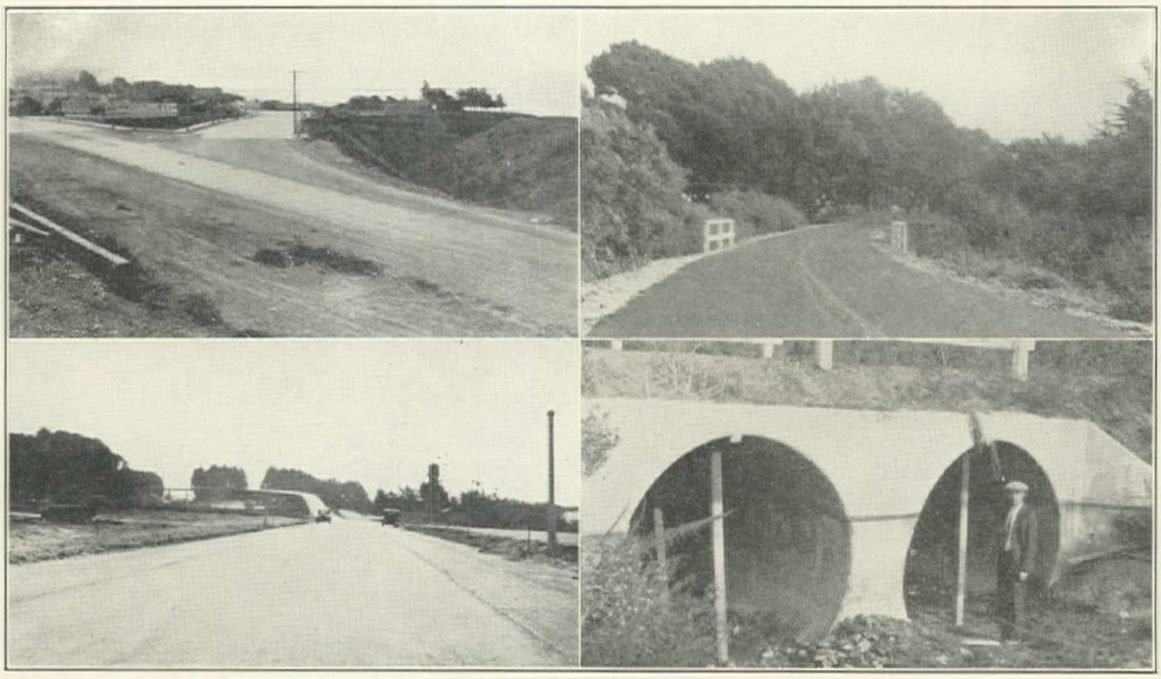


Fig. 4. (Upper Left) Looking South on Dolliver St. from Stimson Ave. Entrance from State Highway After Improvements Had Been Made. (Upper Right and Lower Right) Old Bridge Replaced by Corrugated Iron Culvert. (Lower Left) View of Overhead Crossing from Vista Del Encanto

23 ft. wide was included in the acquisitions; 8 ft. for sidewalk and 15 ft. for roadway purposes; making the final width of right-of-way 81 ft., 65 ft. between curbs with an 8-ft. sidewalk on each side.

The California State Highway Commission built the culverts within the 65-ft. width and constructed a 30-ft. portland cement concrete pavement in the center. Proceedings under the County Improvement Act of 1921 and the Improvement Bond Act of 1915 were instituted for paving the remainder of the roadway, constructing the necessary curbs, sidewalks, driveways, and extending the sewer and water mains.

Ornamental Lighting System—For this work Marbelite double light standards were used, 15 ft. to light center, six to a block, spaced opposite and approximately 100 ft. apart longitudinally, with four at each intersection. Prizmalite glassware with 250 c.p. lights, two to each pole, were installed on these standards. The visibility given by this installation is unique, as even colors are discernible for a long distance. This feature is of great value in diminishing the liability of accident.

The cost of the entire improvements has amounted to $570,000. This is a remarkable achievement in such a limited area and with a population of not over 3000 permanent residents. The entire construction was accomplished in a little over two years.

Many other improvements also have accompanied and followed those mentioned, such as the forming of water and lighting districts, the construction of improvements in Pismo Heights, overlooking the town, and in Vista Del Encanto, a subdivision on the line of the state highway between Pismo Beach and Oceano. Oceano has also improved its street. The total improvements amounted to over $900,000. There are other improvements under consideration.

Personnel—Many interesting legal problems have arisen, as we have used several different improvement acts with overlapping assessment districts. These have been handled in a peculiarly able manner by Charles N. Kirkbride. He was particularly fitted for the task, as he was one of the committee who originally drafted the 'Improvement Act of 1911', and is the author of the 'Improvement Bond Act of 1915'.

The contractors were Irving T. Ryder, San Jose, M. J. Bevanda, Stockton, and the Cornwall Construction Co., Santa Barbara.

I acted in an advisory capacity to the various committees fostering these improvements, prepared the plans and specifications, and supervised the construction.

Materials were supplied by the following firms: asphalt—Union Oil Co. of California; cement—Santa Cruz Cement Co.; culverts—California Corrugated Culvert Co.; lighting standards—Marbelite Corp. of America; globes—Prizmalite Corp. of California.

Much credit should be given to the group of public-spirited citizens who at considerable personal sacrifice accomplished this achievement, aided by civic organizations, including the chambers of commerce of Oceano and Pismo Beach, the Central Coast Exchange Club, and the Women's Civic Club of Pismo Beach. Credit is also due the board of supervisors of San Luis Obispo county and especially Asa Porter, supervisor of this district. Without his comprehensive view of the needs of the entire district and his helpful advice and cooperation the development of the district in so admirable a manner would not have been possible.

LEGAL PROCEDURE OF PISMO BEACH STREET WORK

By CHARLES N. KIRKBRIDE
Attorney-at-Law, San Francisco and San Mateo

Some interesting legal questions arose and had to be decided in connection with the ambitious program of street and highway work carried through at Pismo Beach and vicinity as mentioned in the foregoing article by S. G. Whittelsey.

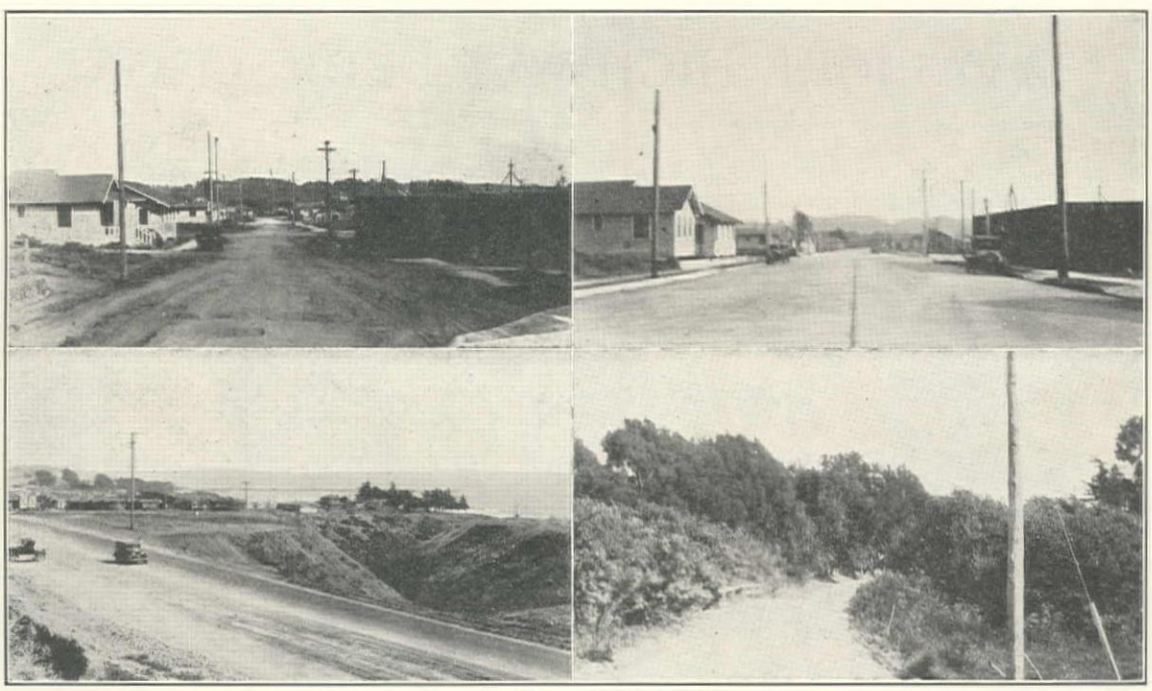


Fig. 5. (Upper Left and Upper Right) Residence Street in Pismo Beach Before and After Improvements. (Lower Left) Entrance to Pismo Beach from State Highway Before Improvement. (Lower Right) Typical Road and Wooden Bridge Before Improvements

Perhaps the ones of most interest were those involved in the separation of grades at Oceano. Here a new right-of-way had to be obtained leading up to and crossing the tracks of the Southern Pacific Co., and a bridge had to be constructed over the railroad at this point. Then, an extensive fill had to be made for the approach on the westerly side of the tracks. This involved proceedings for closing a crossing at grade and also for the opening of the new overhead crossing. The consent of the Railroad Commission had to be obtained in each instance and careful legal proceedings taken to obtain a valid closing. Then the commission ordered that one-half of the cost of the bridge should be borne by the railroad company. In the meantime, inasmuch as an assessment proceeding was involved, money had to be provided to cover the ultimate contribution of the company.

Litigation was anticipated and the proceedings were therefore so grouped that the points of law upon which minds might more easily differ, were limited to the one proceeding where they would cast less weight from a practicable standpoint, and the large cash contribution from the county and railroad company was allocated to this proceeding. Results proved the wisdom of this action because the litigants passed this proceeding entirely by in their technical fight.

When it came to choosing statutes to operate under, the Acquisition and Improvement Act of 1925, commonly known as the Mattoon Act, proved an admirable measure for use in widening and opening the highways. For work in the towns where streets had already been opened, or the right to immediate possession obtained, the County Improvement Act of 1921 was generally chosen. This act follows the ordinary procedure of the Improvement Act of 1911 for construction, but in our case we provided that the bonds should issue under the Improvement Bond Act of 1915. These bonds proved to be readily salable.

One of the pitfalls in which public authorities frequently stumble in opening and widening work is to create limited districts. This error was avoided and ample districts were provided.

When it came to determining the property to be acquired for the approach to the overhead crossing, an interesting problem developed for the reason that the fill in places was over twenty feet high and provision for earth slopes had to be made. The width of these slopes was carefully computed and necessary land acquired to provide for the same. This overhead structure, according to highway officials, was the first to be constructed in California where the cost was borne by a county assessment district. In its erection

and use, no interference in the operation of traffic on the railroad main line was permitted.

In order to expedite the improvements, full use was made of the constitutional provision permitting the court to determine in advance the amount to be deposited 'in the court's hands' in order that the county might take immediate possession. In determining the amount to be put up, careful estimates were made and evidence produced before such court orders were requested.

In the Mattoon Act acquisition proceedings, frequent use was made of the procedure provided in the 1927 amendment to that statute permitting the entry of interlocutory judgments on stipulation. This greatly facilitated the disbursement of money due the property owners. In one condemnation case we had about one hundred defendants and, without that procedure, a severe hardship would have been worked due to the necessary delays consequent on the service of process.

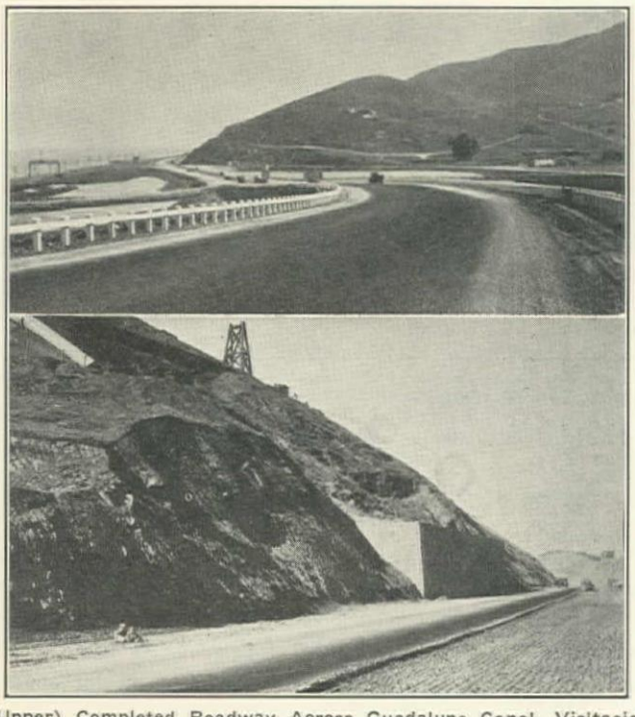
The street opening disclosed the need for a further amendment to the Mattoon Act to provide for the acquisition of small triangles and split lots under the theory of excess condemnation. These triangles and small parcels are created by the cutting of highways through lots diagonally and we had the usual run of such cases to contend with. Provision should be made for acquiring such parcels and later for selling them and turning the proceeds into the redemption fund.

In the laying out of this work the ideals of city planning were kept in mind. Highways were made to curve on comfortable radii. Water pipes and electrical conduits, as well as sewer laterals were laid under permanent pavements, and the future needs of the community kept in mind. Such improvements always entail an unusual burden upon property owners. This burden was minimized as much as possible by extending the bond limit beyond the usual ten years. No bond term less than fifteen years was specified.

The designs for the work in my judgment reflected much credit upon the engineer. The accomplishment of so much in so short a time speaks volumes for the enterprise of the local community and will have a far reaching effect in drawing attention to one of the most delightful sections of the state.

BAYSHORE HIGHWAY DEDICATION

The 3½-mile section of the Bayshore highway in San Francisco and San Mateo counties constructed by H. W. Rohl Co. was formally dedicated and opened to traffic on October 20. Speakers at the dedication were: C. C. Young, governor of California; James Rolph, Jr., mayor of San Francisco; B. B. Meek, director, state department of public works; R. J. Welch, congressman; M. M. O'Shaughnessy, city engineer of San Francisco; Franck R. Havenner, member of the San Francisco board of supervisors; and Horace Amphlett. A. J. Gallagher, San Francisco supervisor, acted as master of ceremonies and Miss Clara Carli was queen for the day.



(Upper) Completed Roadway Across Guadalupe Canal, Visitacion Valley. (Lower) Bayshore Highway, Showing Heavy Retaining Wall and One-Half of Roadway Surface Completed

The Bayshore highway is 18 miles long and 199 ft. wide. It was constructed within the city and county of San Francisco under the boulevard program described in the September 10th issue and that portion in San Mateo county was built by the California Highway Commission. The highway soon will be extended to San Jose and will relieve the traffic congestion on El Camino Real. Rohl's contract included one million yards of excavation, with one thorough cut containing more than 300,000 cu.yd. Although there were many heavy slides in this section and considerable increased yardage beyond the preliminary estimate, the work was completed within one year.

(Upper) Bayshore Highway Dedication on October 20, 1929, on Section North of Wheat St. (Lower) Dedication Ceremonies at Visitacion Valley

Echo Dam, Weber River, Utah

Bureau of Reclamation Constructing Earth-Fill Dam for Salt Lake Basin Project

The Echo dam, the first unit of the Salt Lake Basin project in Utah, is being constructed by the U. S. Bureau of Reclamation on the Weber river, 30 miles northeast of Salt Lake City and 45 miles above Ogden. The dam will impound 74,000 ac.ft. of water, which the Weber River Water Users' Association will employ to supplement the irrigation supply for the rich valley lands near Ogden. The reservoir will cost $2,750,000 and a diversion canal from the Weber to Provo Valley will bring the total cost to $3,000,000.

Dam—The river channel at the damsite is a natural stream, with a conglomerate outcrop on both sides. Because of heavy overburden—25 to 30 ft. of soil, underlaid by the same thickness of pervious sand and gravel—an earth-fill dam was the only type economically feasible. The dam will be a rolled earth and rock-fill structure, 125 ft. above the original riverbed and 1887 ft. long on the crest, containing 1,350,000 cu.yd. of earth and 250,000 cu.yd. of rock.

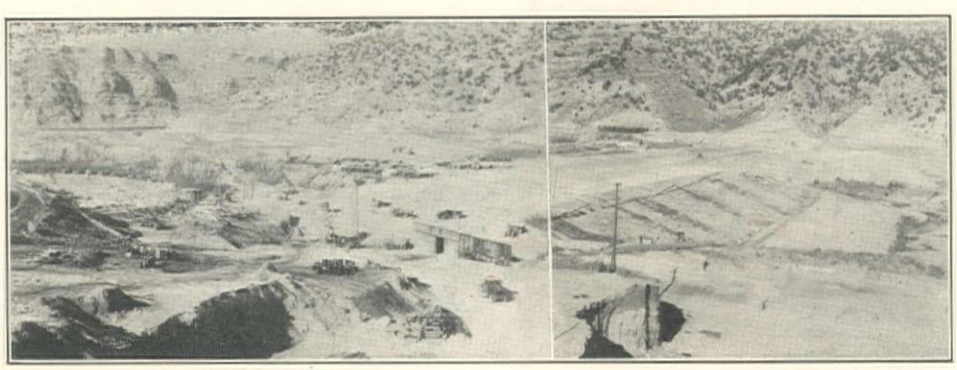
The cutoff trench was excavated through sand and gravel to the underlying conglomerate and was backfilled with earth. A concrete cutoff wall is keyed to the underlying conglomerate and extends 12 ft. into the sprinkled and rolled earth of the cutoff trench.

The embankment has a top width of 20 ft., with upstream and downstream slopes of 3:1 and 2:1, respectively. A reinforced cantilever wall or parapet, extending 3 ft. above the top of the dam, will increase the width to 25 ft. At 90 ft. below the crest, the upstream and downstream slopes are each broken by a 20-ft. berm. On the downstream slope this berm is the top of a conglomerate fill which serves the purposes of a downstream cofferdam, 2:1 slopes, during construction. The downstream portion of the embankment is composed of gravel and cobbles, top slope 2:1 and under slope 1.6:1, with a width of 10 ft. at the top of the dam. The upstream slope of the embankment is protected above the berm by 4 ft. of dumped conglomerate riprap. The remainder of the fill is composed of clay, sand, gravel, and cobbles in 8-in. layers, moistened to secure maximum consolidation and thrice compacted with a roller weighing at least 2000 lb. per lin.ft.

Spillway—An overflow-type spillway, controlled by four 18 by 17-ft. motor-operated radial gates at the intake of a concrete-lined channel, is to be constructed at the left abutment. The spillway channel is 30 ft. wide on the bottom, with side slopes of 1:1, and the concrete is 12 in. thick. This spillway will discharge 15,000 c.f.s. at normal water surface, or about three times the maximum flood of record.

The radial gate structure and the upper part of the spillway channel lining are designed to rest on earth and the lower part of the channel on conglomerate. The gate structure and channel lining will be heavily reinforced and underdrained. A stilling pool is provided at the lower end of the concreted spillway channel.

Outlet Works—The reservoir storage will be discharged through a 14-ft. horseshoe-shaped pressure tunnel in the left abutment, driven under the crest of the dam. The discharge will be controlled by two 60-in. balanced needle valves, mounted at the lower end of 72-in. steel pipes. These pipes connect with two 5 by 6-ft. high-pressure slide gates at the upper end of the tunnel. The upstream end of the tunnel is protected by a concrete trash-rack structure, the velocity at the racks being reduced to 1⅔ ft. per sec. Each valve discharges a maximum of 1100 c.f.s. under the full reservoir head of 110 ft.



Echo Rolled Earth-Fill Dam Under Construction. Camp in Background Behind Dry Slope

The outlet tunnel is used to bypass the flow of Weber river during construction. This tunnel was driven, lined, and the trash-rack structure installed before river diversion was begun. A bypass tunnel was driven around the emergency gate structure and the gate installation left for a later date.

Contracts—The contract for the dam was awarded to A. Guthrie & Co., of Portland, for $1,125,097, bids being opened in the fall of 1927. By November 27, 1929, the contractor had placed 911,000 cu.yd. of earth and 60,000 cu.yd. of rock. The dam was then 80 ft. high, or 45 ft. below crest elevation. During Octo-

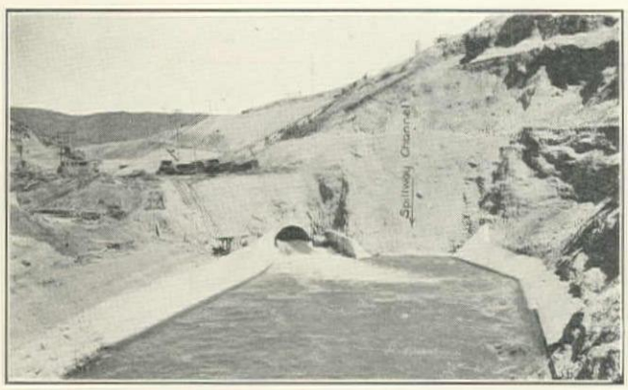
ber, 1929, the record month, 196,341 cu.yd. of earth fill was placed. Construction of the dam will be completed early in 1930.

Besides the Echo dam, a diversion canal from the Weber river to the Provo valley will be constructed at a cost of $250,000. The contract for this canal was awarded to S. H. Newell & Co. of Portland, but construction has not yet started.

The Utah Construction Co. reconstructed the Lincoln highway and Union Pacific railroad, Park City branch, above the flowline of Echo reservoir. This contract was awarded in November, 1927, and included: common excavation—148,000 cu.yd., common borrow—140,000 cu.yd., rock excavation—190,000 cu.yd., rock borrow—72,000 cu.yd., overhaul—1,478,000 sta.yd., concrete—5600 cu.yd. Grading on this contract was sublet to Thorn & Whiting and the Heiselt Construction Co., and concrete work was sublet to Wattis-Samuels Co. (see January 25th, 1929, issue, p. 54-55).

Contract Quantities on Dam—The A. Guthrie contract included the following major quantities:

Diversion and care of river	$20,000.00
Clearing and grubbing 10 acres at	50.00
Stripping for embankment—40,000 cu.yd. at	.50
Plow dam foundation	500.00
Tunnel excavation—8000 cu.yd. at	10.00
Cutoff excavation—300 cu.yd. at	12.00



Outlet Tunnel and Paved Outlet Channel for Echo Dam on June 19

Open trench excavation—1000 cu.yd. at	2.00
Rock trench excavation—300 cu.yd. at	5.00
Rock excavation for spillway—50,000 cu.yd. at	1.00
Downstream embankment—5000 cu.yd. at	.90
Clay, sand and gravel embankment—1,350,000 cu.yd.	.46
Downstream gravel and cobble embankment—140,000 cu.yd. at	.55
Riprap embankment on upstream face—50,000 cu.yd.	.95
Clay embankment—50,000 cu.yd. at	.50
Spillway backfill—2500 cu.yd. at	1.00
Puddled clay backfill—600 cu.yd. at	1.50
Earth and gravel highway embankment—3200 cu.yd.	.45
Rolled earth highway embankment—2000 cu.yd. at	.90
Rock-fill highway embankment—16,000 cu.yd. at	.45
and 1000 cu.yd. at	1.00
Drill grout holes—1000 lin.ft. at	2.50
Pressure grouting—500 cu.ft. at	2.00
Place gravel in spillway—175 cu.yd. at	2.50
Concrete cutoff wall in open cut—900 cu.yd. at	11.00
Concrete cutoff wall in open trench—400 cu.yd. at	9.00
Concrete in stoped excavation—300 cu.yd. at	12.00
Concrete tunnel lining—1700 cu.yd. at	12.50
Concrete shaft lining—70 cu.yd. at	22.00
Concrete in gate structure—600 cu.yd. at	12.50
Concrete in trash rack structure—160 cu.yd. at	14.00
Concrete in spillway structure—1800 cu.yd. at	14.00
Concrete in spillway channel—1200 cu.yd. at	12.50
Concrete in needle valve structure—300 cu.yd. at	13.00
Construct needle valve house	1,800.00
Concrete in parapet wall—725 cu.yd. at	14.25
Cradles for outlet—35 cu.yd. at	25.00
Rubble concrete paving—1000 cu.yd. at	8.00
Place reinforcing steel—400,000 lb. at	.02
Install radial gates—90,000 lb. at	.025
Install high-pressure gates—220,000 lb. at	.02
Install 72-in. outlet pipe—280,000 lb. at	.0225
Install 60-in. needle valves—180,000 lb. at	.02
Install trash rack structure—70,000 lb. at	.015

Earth-moving equipment now being used by the general contractor and two subcontractors includes: shovels—one 50B Bucyrus, one No. 700 P&H, one No. 490 Marion electric, one 1¼-yd. Marion, and one 1¼-yd. Osgood; trucks—seven 5-yd. White, six 5-yd. International, six 5-yd. Mack, ten 7-yd. Linn tractor, and seven 16-yd. LeTourneau trailers; tractors—seven 'Caterpillar' 60's for hauling LeTourneau trailers, two 'Caterpillar' 30's, two caterpillars for rolling, and two LaPlante-Choate bulldozers mounted on 'Caterpillar' 60's; rollers—four Rohl tampers.

F. F. Smith is construction engineer for the U. S. Bureau of Reclamation, with headquarters at Coalville, Utah. R. F. Walter is chief engineer and J. L. Savage is chief designing engineer in the Denver office of the Bureau.

Routes for Colorado River Aqueduct

A. J. Wiley, Thaddeus Merriman, and R. R. Lyman, members of the Colorado river aqueduct engineering board of review, have completed a study of available records and are now preparing to make a field inspection of three proposed routes. These routes are known as the Pichacho, Blythe, and Mojave plans—they all provide for a gravity aqueduct from San Gregorio pass, to which water would be forced by pumping.

In the Pichacho plan, water would be taken from the Colorado river a short distance above Yuma, whereas in the Blythe plan the intake would be at Blythe. The Mojave plan incorporates many features of the Pichacho and Blythe programs.

A notice of appointment of the engineering board of review was given in the September 10th issue, p. 454.

Spokane County Road Program

Spokane county, Washington, plans 36 miles of highway construction for the spring of 1930. Some of the work will be done with state gasoline tax funds—under the farm-to-market road program—and other construction will be included in the county's permanent highway budget.

The projects include: Hampton park road, Newman lake—¾ mile; Moab-Trent highway—1¾ miles; Stringham road near Rockford—4 miles; Madison road from Opportunity to Irvin—2 miles; Jefferson-Plaza road southwest of Waverly—4 miles; Four Mound road—4 miles; Coulee heights extension—4 miles; Wild Rose extension west of Deer park—6 miles; Orchard prairie road—1 mile; East Peone extension—1½ miles; Day road on Peone prairie—1 mile; Spring valley-Latah road—6 miles.

Bosworth Street Bridge Over Bernal Cut, San Francisco

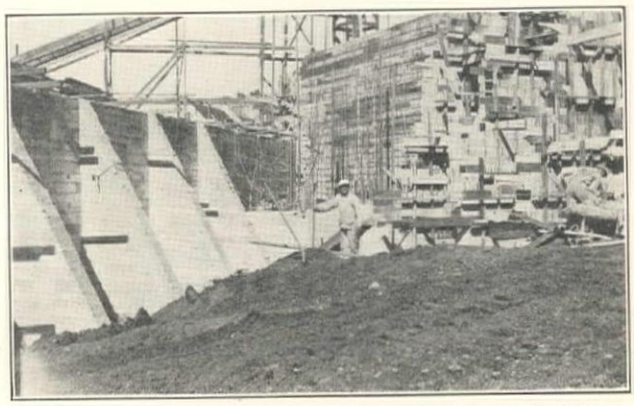
By R. B. ROTHSCHILD, JR.*
MacDonald & Kahn, Inc., San Francisco

Bernal cut soon will alleviate much of the highway congestion along Mission st., San Francisco, and will join the two loose ends of San Jose ave. so as to make a direct route for north and south traffic. This project is part of the San Francisco boulevard program, authorized by 1927 bond issues aggregating $10,780,000 (see June 10th and December 10th, 1927; November 25th, 1928; and May 10th and September 10th, 1929, issues). The cut runs from the intersection of San Jose ave, and Dolores st. to the intersection of San Jose ave. and Monterey blvd. It is 4200 ft. long and will accommodate two Southern Pacific Co. tracks, two Municipal Railway tracks, a 42-ft. roadway, and an 8-ft. sidewalk, with additional walks at the top of each slope. It is spanned by three bridges—at Bosworth st., Richland ave., and Highland ave.—the one at Bosworth st. being the largest.

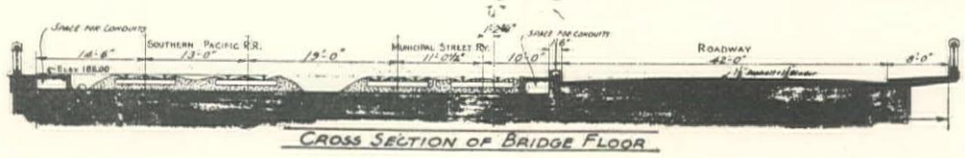
The general contract for Bernal cut was let to MacDonald & Kahn, Inc., of San Francisco, in October, 1928, for $504,729. The work includes grading for the highway and tracks; embankments, pavements, retaining walls, stairways, copings, sewers, and the three bridges.

Bosworth st. bridge is skewed, with overall dimensions of 109 by 186 ft. The cut runs parallel to the earth at the end of the abutments. The piers and abutment walls are so arranged as to allow two Bosworth st. cars and two autos to pass abreast between piers. There is a span of 40 ft. between piers and 13 ft. between abutments and piers.

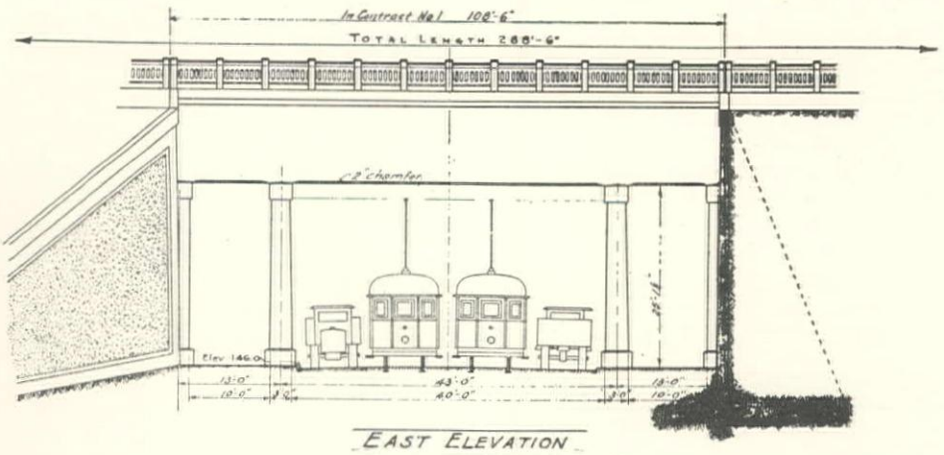
Contract quantities and unit prices for the Bosworth st. bridge follow: concrete—6400 cu.yd. at $17.62; reinforcing steel—692,000 lb. at $0.038; 12-in. concrete piling—1900 lin.ft. at $1.54; 14-in. concrete piling—4325 lin.ft. at $1.85; 15-in. concrete piling—3400 lin.ft. at $1.88; concrete handrail—380 lin.ft. at $3.45; surface—4420 sq.ft. at $0.11; plaster wall—920 yd. at $1.15; bronze plates—23 pairs at $372; remove existing structures—$6750; timber steps (complete)—$200.



Counterforted Retaining Wall for Bosworth St. Bridge



CROSS SECTION OF BRIDGE FLOOR



EAST ELEVATION

BOSWORTH ST. BRIDGE OVER BERNAL CUT, SAN FRANCISCO

shorter dimension, while Bosworth st. is parallel to the longer dimension.

The bridge is of the slab and beam type. The substructure includes two abutment walls and two piers, all on piles. There are also wing walls to retain the

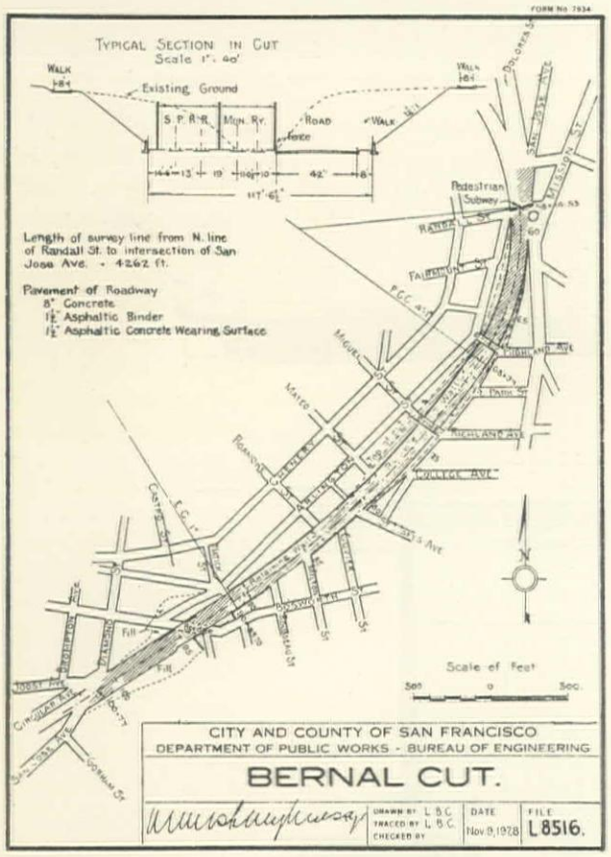
Foundation—Reinforced concrete piles have been

*Junior, American Society of Civil Engineers.

driven under the piers, the outer toe of the abutment walls, and some of the wing walls. There are 530 square piles in the foundation, from 12 in. to 15 in., and 6 to 42 ft. long. They contain a total of 85 tons of reinforcing steel and each pile also has a 30-lb. steel shoe. Many of the piles were driven to refusal against rock. They were all designed for 3000 lb. at 28 days and were precast near the bridge site.

Abutments—The main abutment walls are counterforted and are 185 ft. long and 30 ft. high. The counterforts are 18 in. wide, spaced 10 ft. on centers. The piers are 187 ft. long, 30 ft. high, and 3 ft. wide. The ends of the piers and abutments are rounded off to make a good appearance. There are 15 arch openings, each 5 ft. long, in both piers. The retaining walls are of the cantilever and counterfort type. They vary in height from 40 ft. for counterfort walls to 3 ft. for cantilever walls. The 40-ft. walls contain 5.83 cu.yd. of concrete and 7.65 lb. of steel per lin.ft.

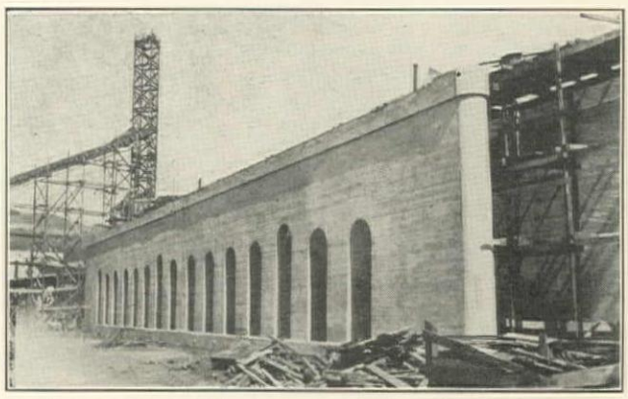
Bridge Design—The load of the superstructure is transmitted to the piers through 23 pairs of bronze bearing plates, placed under the cross beams. At each end, and parallel to Bernal cut, is a large skew girder. These girders are 109 ft. long by 3 by 11 ft. in cross-section. There are 23 cross beams, of variable depth,



perpendicular to the long dimension of the bridge. They are spaced at 10-ft. intervals, varying in depth from 6⅔ to 10½ ft., and in width from 2 to 2½ ft. There are five smaller beams at right angles to the cross beams. These are spaced 10 ft. 9 in. on centers and are 2 ft. deep by 1 ft. wide. At the outer edges of the bridge, and parallel to Bosworth st., are two large beams. These are 1 ft. 9 in. wide and have a maximum depth of 10 ft. 9 in.

The floor slab under the railroad and street car tracks is 14 in. thick. Under the roadway it averages 14 in., with a crown at the center. As the elevation of the slab at the tracks is lower than at the roadway, the two are separated by a beam. To provide for pedestrian traffic, a sidewalk is cantilevered from the eastern skew girder. There is a precast concrete railing on both sides of the bridge parallel to the cut.

Concrete in the bridge, abutment walls, retaining walls, and piers is 2500 lb., 1:2:4 mix, with 3% celite



Pier Construction for Bosworth St. Bridge with Concreting Hoist in Background

and 5 gal. of water per sack. Concrete for the railings is designed for 3000 lb. at 28 days.

Temperature movements in the main slab are provided for by two Carey elastite expansion joints in the floor. Other expansion joints are formed of ⅛-in. copper strips, there being 3 tons of these copper joints in the bridge.

Drainage is accomplished through 4-in. cast-iron pipes, imbedded in the concrete, and 6-in. tile along the walls. Both pipes and tile empty into a sewer.

Contractor's Plant—The plant and equipment layout is ideal from the contractor's viewpoint. As there are 7000 cu.yd. of concrete in Bosworth st. bridge and 2000 cu.yd. in the Richland and Highland ave. bridges, the contractor decided to use one central concrete plant. This plant was erected at the Bosworth st. bridge and concrete is delivered ready-mixed by trucks to the other bridges. Materials and aggregates are brought to the site by train along a Southern Pacific spur, the contractor having sole use of this spur during construction of Bernal cut. Aggregates are unloaded onto trucks by a clamshell bucket. Trucks carry the aggregates up an inclined wooden runway, and dump from the end of the runway into bunkers. The concrete plant and hoist are built adjacent to the bunkers. Concrete is hoisted and chuted into buggies.

The estimated cost of the bridge is $172,000. Work is rapidly nearing completion and the entire Bernal cut project will be finished about April, 1930. M. M. O'Shaughnessy is the city engineer and Emil Muheim is the resident engineer; Al Rodenberg is the superintendent for MacDonald & Kahn, Inc.

Washington Automobile License Receipts

The 1929 automobile license receipts for Washington exceeded those of 1928 by $600,000. Over $104,000 had been received by November 29 to apply on 1930 licenses.

Separate Sludge Digestion*

By CHESTER A. SMITH†
Consulting Engineer, Burns-McDonnell-Smith Engineering Co., Los Angeles and Kansas City

General and Definition—The definition of separate sludge digestion adopted by the American Society of Civil Engineers is 'The digestion of sludge in basins or tanks to which it is removed from the basins or tanks in which it originally settled'. My own definition would perhaps draw a more clearly defined line, that is: 'the digestion of sludge in a basin or tank entirely separated from the basin, tank, or device used in settling or removing the settleable solids from sewage'. The idea is to differentiate the separate sludge digestion tanks from the two-story or Imhoff tank, where sludge is digested in a separate compartment from the flowing-through or sedimentation chamber.

Separate sludge digestion actually pertains only to digestion of sewage solids without reference to the process used in precipitating or collecting these solids. The term is commonly used to define the process of sedimentation and those separate sludge digestion tanks used for preliminary or partial sewage treatment. I will treat the subject as a process and describe the sedimentation basins, method of collecting sludge, and the handling of sludge at the digestion tanks.

History—Sludge lagooning was probably the first crude attempt at separate sludge digestion. According to the statement in 'Solving Sewage Problems' by Fuller & McClintock, separate sludge digestion technically had its origin about 1899 at Lawrence, Massachusetts. It was first recommended by Hazen in 1906 for Paterson, New Jersey, but the earliest actual installation was at Birmingham, England, in 1912.

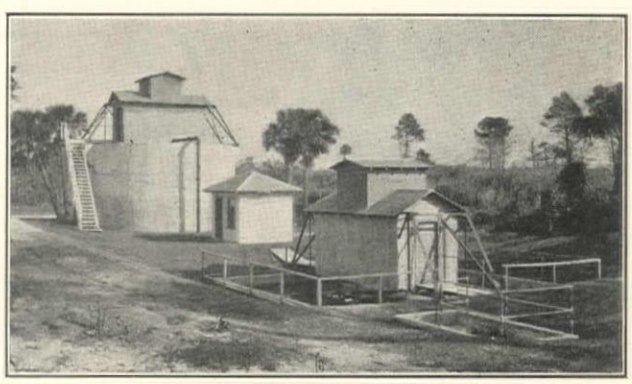
The invention of the two-story tank by Imhoff apparently had the effect of checking the development of separate sludge digestion. Many engineers believed that the Imhoff tank would solve the former troubles of septic and plain sedimentation tanks. The foaming of Imhoff tanks, odors, necessity for providing large sludge storage capacities in deep and often costly excavation, and, later, scientific research and studies of sludge digestion, have again brought a rapid development of the true separate sludge digestion process.

There are now in operation or in the course of construction over 100 separate sludge digestion plants in the United States.

Typical Plant—The following is a brief description of a typical separate sludge digestion plant, as commonly termed a process. Three units are necessary—the settling tank, digestion tank, and sludge drying beds. Where sewage from a combined storm and sanitary sewer system is to be treated, a grit chamber or some device for detritus removal is also essential.

The settling basin (or basins) is designed to give a retention period of one to two hours at the average daily rate of sewage flow. This period should effect a reduction of 50 to 70% of the total settleable solids in the raw sewage. The depth of the tanks ordinarily need not be over 8 ft. on smaller plants. The floor is sloped about one inch per foot to a sump, usually in the center of the tank, and a mechanical device is provided with revolving scrapers or squeegees that will slowly concentrate the settled sludge to the sump. This device may be operated continuously or intermittently, depending upon local conditions.

At certain intervals, the concentrated sludge is withdrawn from the settling tanks by special sludge pumps and is discharged into digestion tanks. The frequency of sludge pumping also depends upon local conditions, in many smaller plants, once or twice daily being sufficient to prevent scum formation or overloading of the clarifier apparatus. The settling tanks are usually uncovered, except in the colder climates in the northern states, where they are enclosed by buildings or housings.



Separate Sludge Digestion Plant for 1.2 M.G.D. Flow and 2-Hour Detention. Clarifier in Foreground is 30-ft. Square and Digester is 30-ft. Diameter and 19 ft. Deep Inside. Vero Beach, Florida

The digestion tank is designed on a basis of sludge storage sufficient to permit complete digestion over a certain period of time. The common term is cubic feet of sludge storage capacity per capita of contributing population. This is an uncertain factor, as it depends upon temperature, quality of sewage, water content of entering sludge, length of storage required in certain climates, and many other factors. Probably, a common practice for average sewage conditions without artificial heating, is to provide from two to three cubic feet per capita. Unless the designer has made a thorough study of the local conditions and, as the expression goes, 'knows his sewage', it is wise to make ample allowance in digestion capacity.

The total effective depth of the digestion tank usu-

*From a paper read before sanitary section of Arizona Public Health Association, Prescott, Arizona, April 17, 1929.
†Member, American Society of Civil Engineers.

ally ranges from 15 to 25 ft., depending upon local conditions, type of design, and use or omission of mechanical agitation and heating.

In addition to the effective sludge storage capacity, allowance must be made for floating or submerged scum formation, especially in open tanks without covers and without mechanical agitation or scum-breaking apparatus. Also, a space of 2 to 4 ft. should be allowed for partially clear liquor between the scum and sludge zones.

The type of bottom depends upon whether or not the tank is equipped with mechanical agitation or stirring devices. With mechanical devices, the shape is similar to that of the settling tank. Without them, the bottom is hopper-shaped or has multiple hoppers, with outlet pipes connected to the apex of each hopper for withdrawal of digested sludge. A submerged outlet for the liquor should be provided between the scum and sludge zones, to allow the withdrawal of liquor displaced by the addition of sludge. This liquor is usually returned to the settling tank.

In larger installations, provision should be made for uniform distribution of fresh sludge, and also for seeding or mixing well digested sludge with fresh sludge, to hasten digestion and adjust the reaction.

The sludge drying beds are constructed similar to those for other processes. The area should not be less than one-third square foot per connected capita; one-half square foot is more desirable. The area required for separate sludge digestion in a well designed and operated plant is really less, as a more uniformly digested sludge (hence smaller volume) may be obtained than with other types of sludge digestion tanks.

Advantages—The advantages of separate sludge digestion may be summed up as follows:

1. Less initial construction cost, particularly where deep tanks of the Imhoff type must be built in wet excavation or solid rock. The settling tank may be shallow, the digestor tank may be placed at any desirable or economical elevation and, likewise, the sludge drying beds constructed with minimum excavation and in some cases above flood-water lines. Occasionally it might be advisable to place the settling tank in a constricted or non-isolated area and the digestor tanks at some distant and more advantageous or more isolated point. Sludge would then be pumped to these tanks.

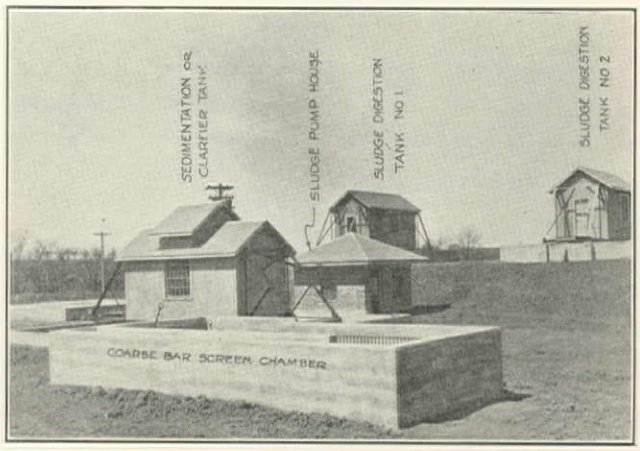
2. The mechanism of the clarifiers and the digestors (if so equipped) and the general arrangement will tend to secure more efficient operation by relieving the operator of the unpleasant duties of breaking scum, scraping down hopper walls, and other manpower labor. The mechanism requires certain daily attention, which again insures better operation by the daily inspection of the plant.

3. Easier and more economical expansion or revision of the plant is possible, as either the settling or digestion capacity may be increased, independent of the other.

4. More accurate control for seeding, mixing, hydrogen-ion (pH) control by the use of lime, heating, and other operations to secure a more rapid and uniform rate of digestion, are permitted.

5. It is more adaptable for collecting gases of decomposition. Such gases can be burned to eliminate odors, or utilized, if necessary, for heat about the plant, to raise the temperature in the digestor, or to drive small power units.

Cost—The first construction cost of separate sludge digestion plants designed for cities of 3000 to 5000 population and larger, will average about the same as well designed Imhoff tank installations. In smaller installations, the clarifier mechanism costs may make this process cost more than other types of plants. For large installations, particularly in cold climates, where greater sludge storage capacities are required, separate sludge digestion tanks with gas collection and heating have the least first cost.



Separate Sludge Digestion Plant for 12,000 Population, Showing Layout of Units. Sedalia, Missouri

The estimated cost of the preliminary treatment plant (separate sludge digestion) for Phoenix, Arizona, was $26,000 per m.g. capacity, including land, engineering, water supply, chlorination equipment, screen and screen housing complete; or $22,000 per m.g. capacity exclusive of land, engineering and miscellaneous incidentals. Operating costs for power and labor are approximately $2.00 per million gallons of sewage treated.

Power costs for operating the clarifier mechanism, pumping sludge to the digestor, and operating a stirring mechanism in the digestor, should not exceed $1.50 per m.g. under average conditions and power rates. For Phoenix, the power is estimated to cost slightly less than $1.00 per m.g. of treated sewage.

Recent Research and Developments—In the past three to five years there has been extensive study and research on sludge digestion in the United States, England, and Germany. Special studies on the effect of age of sewage solids upon their digestibility by Fair and Klein at Harvard University; the relative effect of the quicker and slower settling particles on the rates of sludge digestion, at the New Jersey sewage experiment station; effects of seeding and mixing by Imhoff; experiments with digestion of screenings and activated sludge at Milwaukee, and also by Mohlman for the Chicago Sanitary District; effects of heating, mixing, and pH control, by Fischer of The Dorr Company and others; have solved a number of former troubles. The results of these experiments as well as the operating results of some recently constructed separate sludge digestion plants have given the engi-

neer definite facts and a basis upon which to design such a plant.

The character of sewage, and likewise the sludge, differs to some extent in each city as compared with other cities; and even in an individual case where, by the addition of industrial wastes, the character of the sewage may be greatly changed from that upon which the plant was designed. Therefore, no hard and fast rule or design can apply to all conditions. Recent investigations and studies have given data whereby, if the plant is designed with a certain amount of flexibility, rapid adjustments or readjustments may be made to meet the changed conditions. The necessity for maintaining the proper hydrogen-ion control to prevent foaming and bulking and to maintain uniform digestion is one of the more important items. When the pH drops below 7.0, lime should be added. It is better to add small doses to maintain the pH between 7.3 and 7.8, rather than allow the tank to drop below 7.0 and then attempt to adjust the reaction by adding a large amount of lime.

The results of experiments by Imhoff and others on the proper seeding and mixing of digested alkaline sludge with fresh sludge undergoing preliminary acid fermentation in order to maintain the proper reaction or pH, is a valuable discovery. The digestion tanks should be equipped with mechanical stirring devices, or there should be duplicate tanks with pumps and piping arrangements for mixing or transfering sludge from one tank to the other for seeding and mixing.

Heating of digestion tanks has demonstrated that the period of digestion can be reduced in the average case from 4 or 6 months to 1½ or 2 months, with apparently better results in digestion. Heating the digestor tank reduces the required capacity and cost of construction. It is claimed that with heating, one cubic foot per capita is sufficient for sludge digestion capacity. Experiments show that gasification due to digestion starts with temperatures about 45°F., and is most active between 75 and 80°F. Above these temperatures the rate of gas production falls.

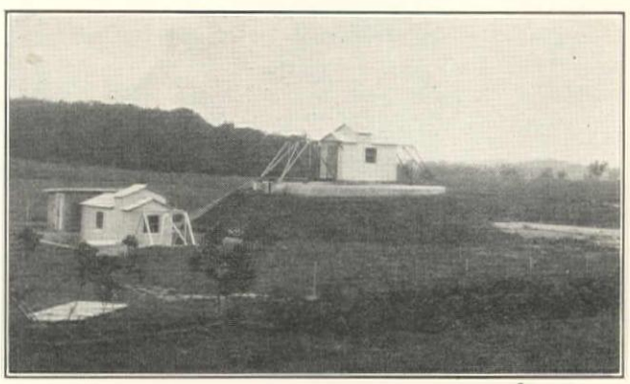
Fischer, in a paper presented before the North Carolina sewage treatment conference, sums up various experiments, together with his own observations and experiences with the operation of several separate sludge digestion plants, as follows: That the most economical digestion can be secured by maintaining the following conditions: (1) a sludge temperature of 80°F.; (2) an amount of ripe sludge equal to 20 times the weight of raw sludge added daily on the basis of dry solids; (3) a pH value of 7.3 to 7.6; (4) the addition of raw sludge in the freshest possible condition; (5) the addition of a thick raw sludge containing about 15% solids; (6) provision for adequate mixing or stirring.

Precautions—The sizes, capacities, and other general statements made by me are based upon average conditions; and it must be borne in mind that sewage varies greatly in amount and strength in different localities, and that each case is usually a separate and individual problem. Industrial wastes from meat packing plants, fruit canneries, and other similar institutions, carrying heavy organic wastes, may require several times the digestion capacity and sludge bed area than average domestic sewage. Some trade wastes may even require special treatment before being permitted to enter a sewage disposal plant.

To produce the proper results from any type of plant, it must receive intelligent operation and care. That 'an ounce of prevention is worth a pound of cure', can be illustrated in the operation of sludge digestion. A little care in proper seeding, mixing, and the addition of small amounts of lime to maintain the correct reaction, will prove more economical than allowing the tank to become acid, to foam, and to cause obnoxious odors. Otherwise, considerable expense may be required to bring it back to the proper balance and operating conditions.

Settling and separate sludge digestion is only an imperfect or preliminary treatment. This statement is made in order to warn the city official or the non-technical citizen against over-confidence in results. In the past, with the introduction of the septic tank, many were led to believe that septic tank effluent was of a drinking water standard.

Separate sludge digestion is a comparatively new term or name, and past history in sewage treatment has demonstrated that in a number of instances the



Separate Sludge Digestion Plant with Clarifier on Left, Digester in Center, and Sludge Beds at Right. Hartford, Wisconsin

city officials and public 'have fallen for' new names for new processes or old processes under new names, as 'So and So's' process. The name alone seems to carry the 'Hocus-Pocus' that will eradicate all sewage treatment problems, and that the plant will produce an aromatic, clear, and sparkling effluent without any operating attention.

Sanitarians are making rapid advancement in sewage treatment, and the knowledge acquired on the principles of sludge digestion has been a big advance in the art. Care should be exercised in order to take advantage of these principles in the design of the sewage treatment plant. Thereafter the city or community must be properly informed or educated, as a sewage treatment plant requires attention and intelligent operation.

S. O. Co. to Reclaim Los Angeles Sewage for Boiler Feed Water

The Standard Oil Co. of California has employed Clyde F. Smith, sanitary engineer, to design a sewage purification plant for the purpose of reclaiming 6,500,000 gal. per day of the sewage effluent at the Hyperion screening plant of the Los Angeles main outfall sewer, for use as boiler feed water in its refinery at Hyperion.

Oiled Roads in Nevada

State Uses Roadmix Treatment of Old Gravel Surface for Maintenance of Federal Aid Highways

Historical—On December 1, 1928, Nevada had 1308 miles of federal aid highways and 254 miles of state roads, either completed or under construction. Systematic development of Nevada roads dates from 1917 when the state highway law was passed. However, the first important construction under this law was not made until the biennium of 1921-1922.

The federal aid act was passed in November, 1921, and shortly afterwards the state highway department made a survey and estimate of road mileage, 22,000 miles being included in the study. For the 7% federal aid roads, 1540 miles were designated in the approved state highway system. The state's 1921-1922 program included 263 miles of road and 434 lin.ft. of bridges, this mileage being doubled in 1923-1924. At the beginning of the 1925-1926 biennium, there were 915 miles of completed road, or highways under contract, 3436 lin.ft. of bridges, and 7 grade separations in the state improvements. During the 1925-1926 period, the completed system was extended to 1240 miles and in the next biennium 556 miles of road was added.

Present Status—Of the 1562 miles of road completed or under construction on December 1, 1928, the mileage by types was divided as follows:

Miles	Type
240.18	Graded but not surfaced
1126.35	Graded and surfaced with crushed rock
20.56	Graded and surfaced with asphaltic conc.
50.99	Graded and paved with cement concrete
18.00	Gravel surfaced, road previously graded

Fig. 1. Distributing Application of Oil Over Gravel Surface

3.92	Surfaced with cement concrete
104.91	Reconstructed by widening
121.66	Surface bituminous treated

During the last biennium, 496 miles of new construction and 113 miles of reconstruction were planned. The 1929-1930 program provides for completion of the Lincoln highway, further work on the North & South highway, and reconstruction on the Victory highway, Arrowhead trail, Goldfield-Beatty

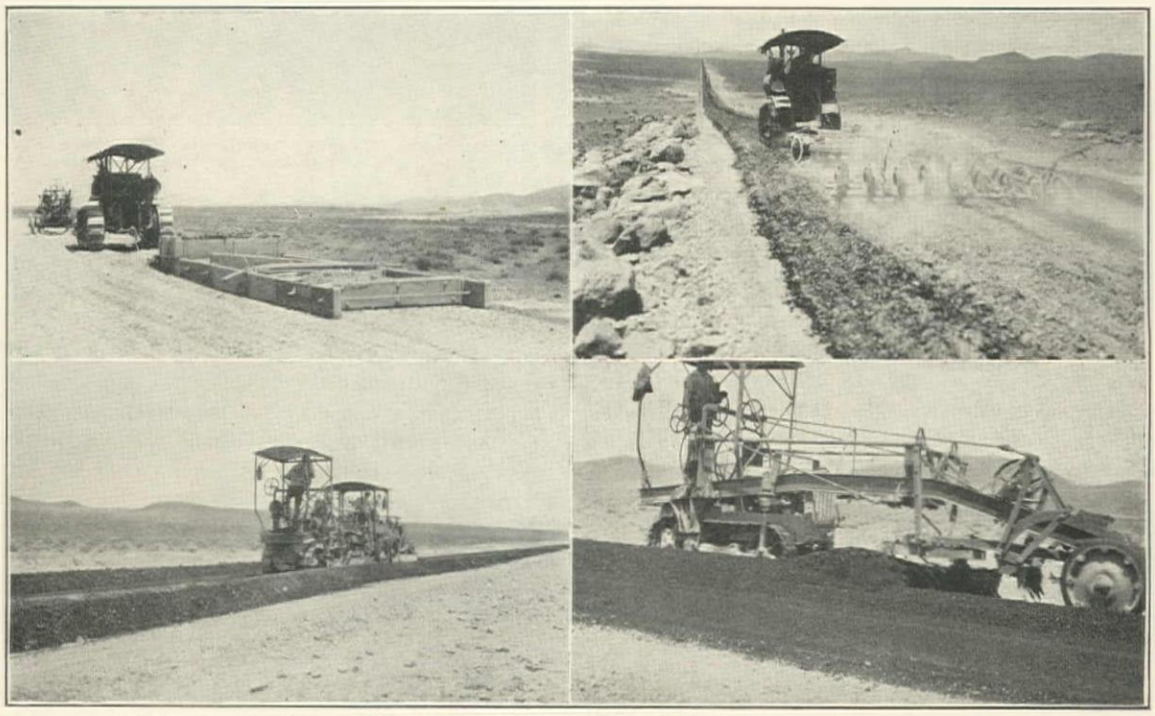


Fig. 2. (Upper Left) Combination Scarifier and Planer Loosening Gravel and Shaping Surface Prior to Oiling. (Upper Right) Mixing Oil and Loose Material by Disc and Spring-Tooth Harrow in Tandem. (Lower Left) Quartering and Turning Mixed Material with Blade. (Lower Right) Finishing Mixing Operation

section, and Wells-Contact section. For the present year, 143 miles of the Victory highway will be resurfaced and oiled. New construction includes 54 miles from Wendover to the south Elko county line, 17 miles from McGill to Magnusson's in White Pine county, 14 miles near Hawthorne in Mineral county, and 41 miles between Humboldt House and Winnemucca in Pershing and Humboldt counties.

Maintenance—As the state must maintain its federal aid highways, the considerable mileage of low-type roads increases the problems of maintenance. On east-west transcontinental roads, such as the Victory highway, the graded and gravelled surface is not efficient under the present volume of traffic and in 1927 the major highways were found to be fast deteriorating. The state highway engineer estimates that an average of ⅜-in. of compacted gravel, or 120 cu.yd. per mile of 18-ft. roadway, is lost annually from this type of surface. Most of the loss occurs within two years after the road is opened to traffic, and corrugations result. Replacement of lost material is estimated to cost $1.25 per cu.yd.

Nevada cannot finance cement concrete or asphaltic concrete roads, and the lower standard type must be adapted as the foundation for a more permanent reconstruction. For the first improvement, it was decided to use asphaltic fuel oil applied to the gravel surface, mixing the two on the road by a method similar to California, Oregon, and Idaho practice. A 5-mile experimental section of this type of road, constructed in 1927, is giving good results.

Roadmix Treatment—In 1928, Nevada built 107 miles of bituminous-treated gravel surface roads and in 1929 the total was raised to 216 miles. The state has tentatively outlined 150 miles for treatment in 1930, but may increase this mileage if finances permit. The cost of treatment averages $1500 to $1700 per mile, in which the mixing cost is $450 to $600. Asphaltic fuel oil is furnished and applied by contract but is mixed on the road by state forces, using state-owned equipment.

Mixing equipment includes a scarifier and a planer, pulled by a 60-hp. tractor; two 30-hp. tractors; a disc and spring-tooth harrow; a large blade; two No. 10-20 motor patrols; a large truck; and a light roller. Three complete units are now in operation and the highway department proposes to organize a fourth unit for the 1930 program. Two state-owned oil distributors are used to recondition sections of the oil-surfaced road placed under maintenance.

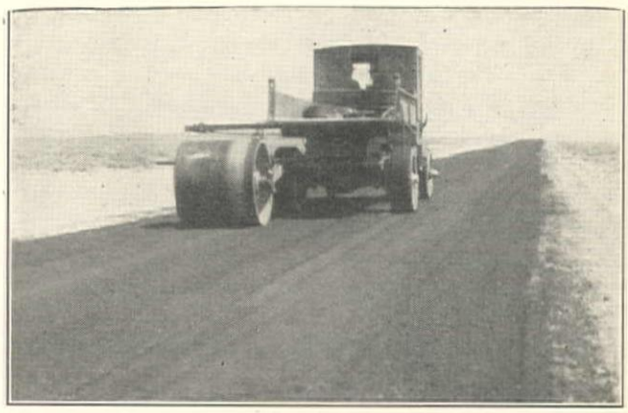


Fig. 3. Compacting Shoulders with Light Roller Where Traffic Holds to Center of Road

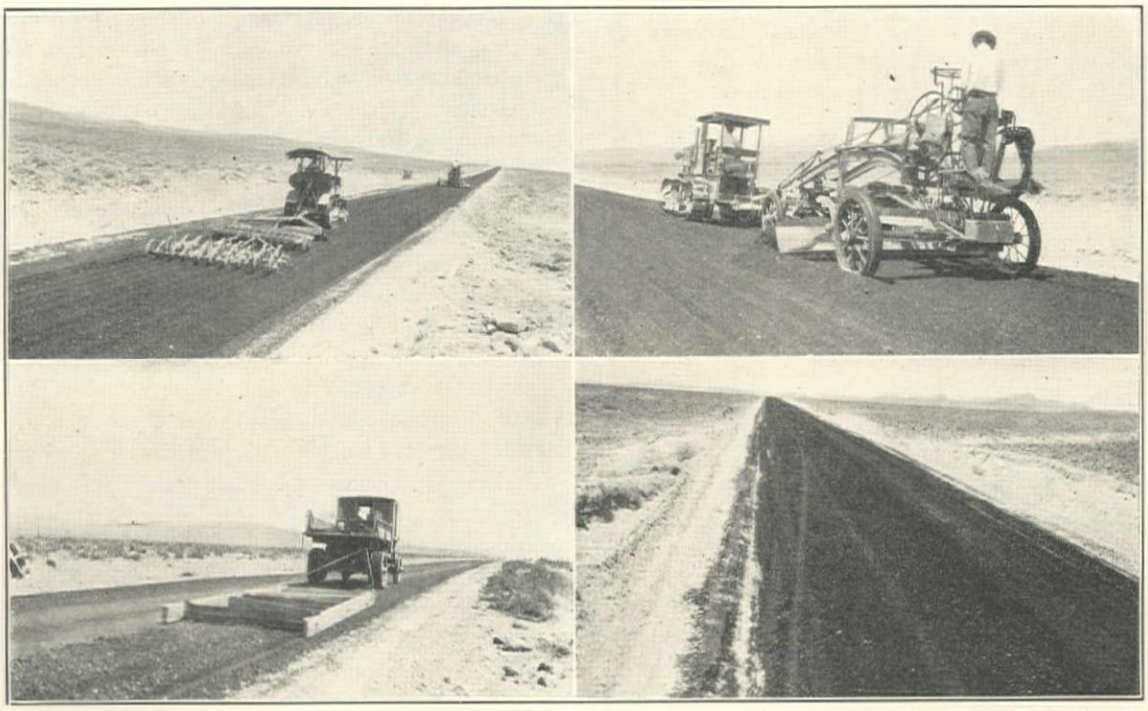


Fig. 4. (Upper Left and Upper Right) Mixing and Spreading Top Inch of Surface. (Lower Left) Light Drag Removing Irregularities During First Stage of Compaction. (Lower Right) Completed Oil Surface Ready for Compaction by Traffic

Oiling Operations—The method of oiling is as follows: A combination scarifier and planer, designed and built by the department, shapes the roadway surface prior to oiling. Heated asphaltic fuel oil is then applied in three applications, each of ½-gal. per sq.yd. of surface. After every application, the oil is thoroughly mixed with the loose material by a disc and

harrow, working in tandem. The oil-treated material is then bladed from the sides of the road to the center. After it has been windrowed in the center of the road, it is again thoroughly mixed with the disc and spring-toothed harrow. It is then ready for quartering and turning back towards the side of the road. The process of turning material from the sides of the road towards the center and quartering and blading back to the sides, is repeated until the mixture has attained a uniform color. When mixing has been satisfactorily completed, the material is bladed back and forth across the road until a smooth surface is obtained. To eliminate the possibility of having unmixed material on the surface, the top inch is again thoroughly mixed and spread.

During the first stage of compaction, a light drag or blade is used to remove irregularities in the surface. This drag or blade is at least 16 ft. long and is pulled by truck. Wherever traffic is inclined to hold the center of the road during compaction, a light roller is used on the shoulders.

The compacted oil surface is finished by traffic. It is 18 ft. wide and is compacted to a depth of 3 in. Within the past two years, this surface has suffered few failures and those were caused by capillarity, improper drainage, or insufficient mixing.

Personnel—S. C. Durkee is state highway engineer, W. A. Young is assistant state highway engineer, and H. D. Mills is office engineer for the Nevada highway department. The state is divided into four maintenance divisions, each in charge of a division engineer who reports to the state highway engineer.

BRINGING MEN AND JOBS TOGETHER

By NEWTON D. COOK †

A big engineering project is under way and it attracts attention because of its size and importance. Someone stops to ask a worker what he is doing. The answer is "Digging a ditch". "What for?" "To earn money to buy me food to give me strength to dig the ditch."

Men, money, and materials are constantly being utilized to accomplish results which may be acclaimed as important achievements in social progress by some, or as merely a job by others. It's all in your point of view whether you see the men, the money, the machinery, or the product. I see the men, on both sides of the fence, employers and employees, as I handle the constant stream of requests for information regarding employment opportunities and men to fill them, which flows through the office of the Engineering Societies Employment Service in San Francisco.

This professional bureau is set up to assist employers in finding men for engineering or technical positions all over the world. It is sponsored by the four founder societies, American Society of Civil Engineers, American Institute of Electrical Engineers, American Institute of Mining and Metallurgical Engineers, and American Society of Mechanical Engineers, and members of these societies are naturally given preference in filling the positions.* However, it is recognized that all of the members of the engineering profession are not enrolled in the founder societies, and a limited registration of non-members is permitted in the offices of the Employment Service.

Because of the high standing of the supporting societies and the extensive registration carried by the bureau, it is possible on short notice to obtain men who would be qualified to manage a city, build a water supply or a cement plant, operate a mine or power plant, design a bridge or a paper mill, and from the same source secure all the necessary technical assistants for a working organization.

Employers find it to their advantage to use the Service because it saves their time when they need a man quickly; it saves the trouble of setting up and maintaining an application filing system; and it affords them a selected list of candidates from the entire available field. A clear statement from the employer regarding his job specifications and working conditions is sufficient to secure prompt service. A weekly bulletin listing positions open, which is sent to subscribing members and co-operating institutions, serves to advertise positions when there are no applicants on the available list.

During the first ten months of 1929 there was an average monthly registration of 127 and 455 positions were filled by the San Francisco office. About 50% of the members register from points outside of California in hopes of securing positions in the western states and occasionally they are successful. Securing a position by correspondence is difficult unless there are very good reasons to influence the employer in deciding to take on a man from outside of his own territory.

Applicants for employment should realize that the same principles govern in the matter of securing a job as in merchandising a commodity, and no sale is made unless the buyer thinks he has what he wants. We can give an applicant a clear idea of the job and a good introduction to the employer, but he must use intelligent salesmanship to get the order. Much more could be said on this subject, because engineers as a class are poor salesmen, but if they will remember and apply the following simple formula it will help considerably in bringing the man and the job together. If **P** is the effective **pulling power** of one's application, **I** is the **intelligence** shown in making the application, **S** is the applicant's **approximation** to the employer's **job specifications**, and **D** is the **distance** between the two parties, then $P \propto \frac{IxS}{D^2}$

This formula appears in no handbook and slide rules are barred, but it is worthy of careful analysis by any one who is trying to get ahead in the game, whether he is unemployed or not. From the employer's point of view, **P** might well stand for **progress**, and the formula still holds true without changing the other factors.

†Manager, Engineering Societies Employment Service, San Francisco.

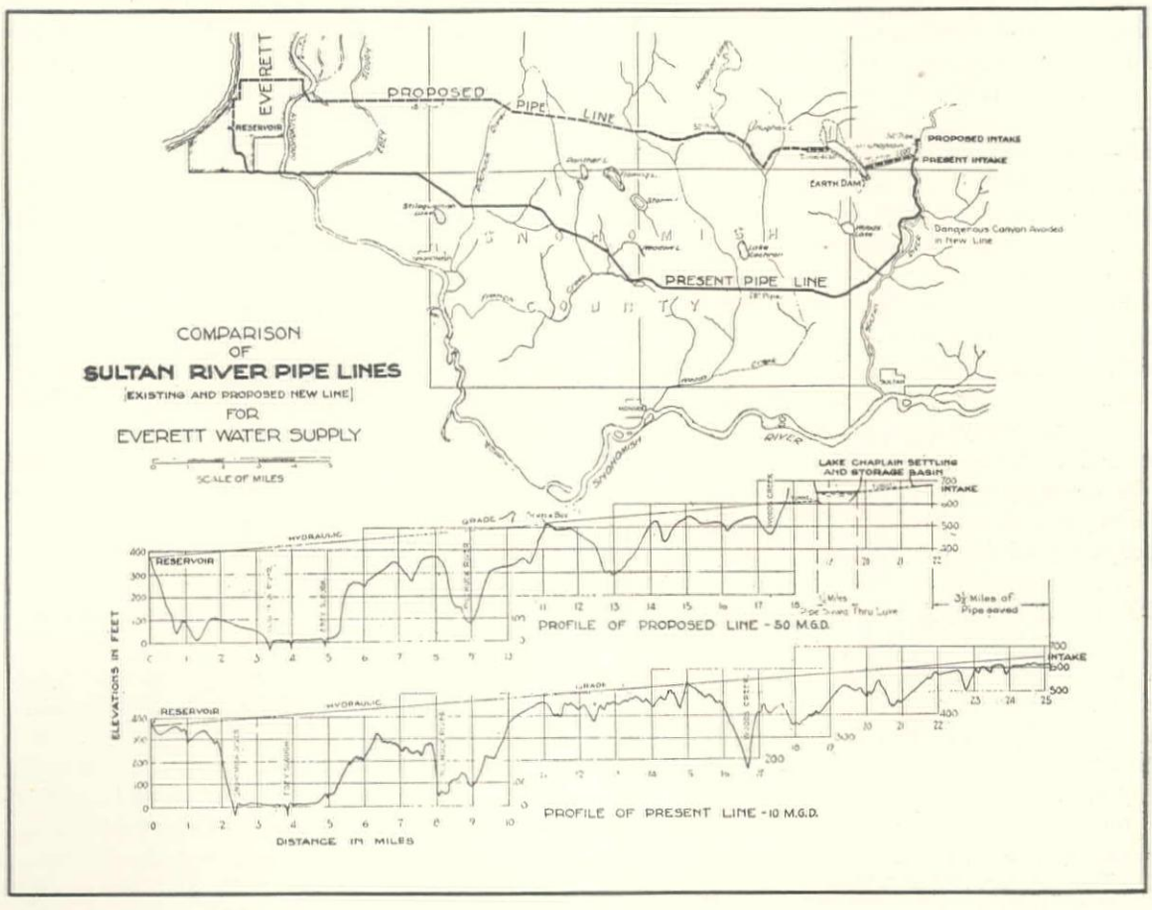
*Members of the Western Society of Engineers, Engineers' Club of San Francisco, and California Section of the American Chemical Society, are also on the preferred list.

New Water Supply for Everett, Washington

By J. W. CUNNINGHAM*
Baar & Cunningham, Consulting Engineers, Portland, Oregon

Everett, with a population of 38,000, is the fourth city in the state of Washington. Its location on navigable tide water, with large tributary resources in timber, minerals, agriculture, and fishing, has given it a rapid growth since incorporation as a municipality in 1893. The city is considered an excellent site for industrial developments, and future growth, at least as rapid as that in the past, is anticipated. This development places heavy demands upon the municipal water supply.

Historical—The original privately owned water system was purchased by the city in 1919, and was improved by constructing a 25-mile, 10 m.g.d. gravity pipe-line from a mountain stream, the Sultan river, to the east of Everett. This line consisted mainly of 28-in. untreated continuous wood-stave pipe, with steel pipe for the high heads near the river crossings. In ten years of service, it has proven rather unsatisfactory and expensive to maintain, from reasons that may be attributed to location and construction rather than the inherent qualities of materials used. Trouble with the old pipe-line, together with the growth of the city, created a need for additional supply which has found expression in various engineering studies and reports over several years. Matters were brought to a head by the requirements of two large pulp and paper mills which sought sites and water supplies in Everett. Comprehensive studies and comparisons of various sources of supply were made and the results were embodied in a report by Baar & Cunningham, submitted in March, 1929. This report recommended further development of the same source of supply, the Sultan river, with a first unit of 50 m.g.d., to cost $2,000,000, and future enlargement to 100 m.g.d., or greater capacity as required. The recommendation for this enlarged water supply met the approval of the city commission, and various civic organizations. After a short, but intensive, campaign a bond issue of $2,000,000 was approved by a vote of 8601 to 153.



Outline of Project—The new Sultan river project is shown in comparison with the old pipe-line by the map and profiles above. The source of supply is the Sultan river, with a diversion point about one-half mile above the old intake, at elev. 655 ft. above sea

*Member, American Society of Civil Engineers.

level. The point of delivery is reservoir No. 2, in Everett, at elev. 361 ft. The old line follows the Sultan river canyon for several miles below the diversion point, and its maintenance on steep and treacherous slopes has always been a serious problem. The new line parallels the river for only 2000 ft., then turns westward in a tunnel through the ridge to Lake Chaplain. The lake serves an important requirement as a settling basin and storage reservoir. From the lake, an outlet tunnel takes the line into the Woods creek valley, and from here a pipe-line follows an almost direct course to Everett. The notable feature of the entire project is the short and direct route, crossing at right angles to the main drainage courses.

The Sultan river diversion dam will be a low, massive, concrete structure with an ogee spillway section to pass the floods which occasionally occur on this river. The stream carries much sand and gravel and, to prevent accumulations above the dam and headworks, a 24-ft. span caterpillar-type sluice gate has been provided in the section adjoining the intake. The intake itself is of conventional design with coarse racks, cast-iron gates, and auxiliary spillway. No attempt is made to fine-screen the water at the intake, since this structure merely secures delivery to Lake Chaplain.

Conduit—The pipe between the diversion dam and the tunnel is a 54-in. steel line of 65 m.g.d. capacity. It is buried in a bench, which also serves as a road to the dam, and space is provided for a second parallel line. The tunnel from the Sultan river to Lake Chaplain is 9 by 9½ ft. in section, with vertical walls and arched roof, and is 7064 ft. long. Solid rock is anticipated for practically the entire length, and lining is not planned for the initial construction. Subsequently, for an enlarged supply, the tunnel will be lined and the improved coefficient of roughness will practically double the capacity.

Lake Chaplain is capable of development up to a storage capacity of 4000 m.g., and approximately this storage will be required to equalize the flow for the future 100 m.g.d. supply. For the present, sufficient capacity for storage and settling will be given by an earth-fill dam, of 22 ft. maximum height, requiring about 15,000 cu.yd. of material. The outlet, at the opposite end of the lake from the dam, will be a concrete tower with gates at various elevations and means of destroying the static head so as to avoid pressure on the outlet tunnel. To provide against algae troubles, a by-pass line around the lake is also planned. Tunnel No. 2, which will be concrete lined throughout, is 4414 ft. long. The section is similar to the other tunnel, an arch with vertical walls, 6 by 6½ ft. in the clear, with a flowline capacity of 100 m.g.d.

Beyond the tunnel the country is of an elevation which will support a pipe-line grade the entire distance to Everett. The line will include the following types and sizes of pipe:

Size	Lin.ft.
52-in.—¼-in. plate arc welded steel	9,920
52-in.—$\frac{5}{16}$-in. plate arc welded steel	960
52-in.—creosoted continuous wood stave	27,470
48-in.—¼-in. plate arc welded steel	24,280
48-in.—$\frac{5}{16}$-in. plate arc welded steel	2,277
48-in.—⅜-in. plate arc welded steel	15,586
40-in.—¼-in. plate arc welded steel	7,753
36-in.—½-in. plate arc welded steel	1,852

Competitive bids were received on steel, concrete, and wood-stave pipe, and contracts as awarded provide for the use of the creosoted continuous wood stave pipe up to 80-ft. head, where the steel pipe becomes less costly. The steel pipe will have a minimum shell thickness of ¼ in. and will be protected by a hot-dip asphaltic coating. All pipe will be buried.

The outlet tower at Lake Chaplain does not lend itself to an installation of fine screens, and a screening plant will be built at an intermediate point on the line, about half way to Everett. The water will be chlorinated and it will be measured by a venturi meter below the screen box. The only special features of the pipe-line section are the crossings of Ebey slough and the Snohomish river. Twin submerged 36-in. lines, supported on piling, and with special protection, are used at these crossings. Valves allow the closing of either line for inspection or repairs.

Stage of Construction—The city will have a large industrial water customer in the Puget Sound Pulp and Timber Co., which is building a 150-ton sulphite pulp mill on the water front. This plant will require delivery of 7½ to 10 m.g.d. of water by July 31, 1930. As this equals the entire present supply, it is essential that the new line be ready for operation on this date and contracts have been let accordingly. The controlling elements in construction are the tunnels, and these sections were awarded on September 9, 1929. At the present time (November 15) construction is under way on all of the principal sections, from the diversion to the pulp mill. Contracts have been let as follows:

Section 1—Coyle Construction Co., of Seattle
Tunnel No. 1, with bench and pipe-line from diversion dam to tunnel $209,335

Section 2—Rumsey & Jordan, of Seattle
Tunnel No. 2 lined $186,360

Section 3—Coluccio & Arcorace, of Seattle
Pipe-line from outlet to Tunnel No. 2 to Ebey slough $616,805

Section 4—Parker Schram Co., of Portland
Diversion dam on Sultan river ..... $ 85,890

Section 5—Pacific Bridge Co., of Portland
Pipe-line from Ebey slough to pulp mill site, including river and slough crossings $345,616

In addition to these principal contracts, the caterpillar gate for the diversion dam has been awarded to Philips & Davies, the sluice gates to the Chapman Valve Manufacturing Co., and gate valves to Crane Co. and the Rensselaer Valve Co. Additional contracts for the Lake Chaplain storage, for the line to the reservoir, and for various structures, will be advertised in the near future.

The Everett water improvement is under the direction of the city commission; N. D. Martin—mayor; Richard Reinertsen—commissioner of public works, and L. F. Rasmussen—commissioner of safety. All of the engineering on design and construction is under the direction of Baar & Cunningham, consulting engineers, of Portland, Oregon.

Easement and Banking of Highway Curves

By N. B. PUTNAM

Civil Engineer, Salt Lake City, Utah

Editor's Note—N. B. Putnam received his engineering education at Massachusetts Institute of Technology and the University of Glasgow, Scotland; also taking a course in mathematics at Cambridge University, England. He has had more than forty years' experience in the construction and maintenance of public works in various parts of the United States, being in charge of construction on more than 1200 miles of railroad. During summer vacations he was employed in railroad work in England and Scotland and in dredge work upon the Clyde. He was on the raising of the masonry dam across the Savannah river above Augusta, Ga. From there he went to the Pennsylvania Central Railroad to learn the methods of replacing wooden Howe truss bridges under traffic with steel truss and stone arch bridges. He was on dredge work for the United States government on the Dutch Gap canal, east of Richmond, Va. Putnam's later experience includes: ten years with the U. P. system; five years as engineer for the track, bridge, building, and water service department of the A.T. & S.F.; six years as engineer of maintenance of way on the B. & M.R. (now the C.B. & Q.) in Nebraska, for five years of this period being assistant chief engineer in charge of new lines.

He is the author of 'Arcs of Adjustment' in the January, 1876, number of Van Nostrand's 'Eclectic Engineering Magazine' and in this article suggested using a number of circular arcs, varying by one or two degrees of curvature, as a transition between the tangent and the main curve. This is believed to antedate the Searles spiral by one or two years.

Historical—In the early days of railroading when trains were operated at low speeds, the curved portions of a line of road consisted of simple circular arcs without spiral or transition curves and the super-elevation of the outer rail was attained by starting the elevation of the rail at a point on the tangent and increasing it at uniform rate, usually an inch to the rail length, until the full super-elevation was reached at the beginning of the curve. As the super-elevation was small, this makeshift answered its purpose, although it caused bad track at the ends of the curves.

Better and more stable roadbeds allowed increased speed of trains which called for greater super-elevation of the rail. As heavier trains were run, the track at the ends of curves became more difficult to maintain and was often a menace to safety. These conditions were corrected by the introduction of easement curves between the tangents and the circular arcs, and the 'Searles spiral' came into common use.

Public highways are now in a condition similar to that of railways before the introduction of transition curves. The speed at which cars are being driven is increasing from day to day and calls for higher banking toward the outside of the roadbed upon curves. Tapering this down upon the adjacent tangents makes the roadbed difficult to maintain and introduces an element of danger when the road surface is wet or icy, and it is believed the time has come for the consideration of transition curves in the alignment and construction of public roads.

Curve Easement—Safe construction directs that there shall be no transverse grade or slope given the roadbed at any point, except it be required by the curvature of the line at that point. This means that the transition curve shall have no slope where it joins the tangent and shall have the same slope and curvature as the circular or main curve where they connect and have a common tangent, with varying slopes between these two points. The simplest law for establishing these intermediate slopes and the one which first suggests itself, is that they shall vary uniformly along with the radii of the connecting or easement curve. The most satisfactory solution of the problem will result in a curve which shall at its point of origin at the tangent have an infinite radius of curvature, or curvature=0. Further, it shall acquire at any subsequent point a curvature directly, or a radius of curvature inversely proportional to the distance, measured along the curve, of this point from the point of origin.

The cubic parabola is a close approximation to such a curve and within certain limits may be used in its place.

The equation to the cubic parabola is: $y = cx^3$ (1)

The first and second differentials of this equation are respectively

$$\frac{dy}{dx} = 3cx^2 \quad (2) \quad \text{and} \quad \frac{d^2y}{dx^2} = 6cx \quad (3).$$

The differential of an arc (s) of this curve is:

$$ds = \sqrt{dy^2 + dx^2} \quad (4).$$

From the theory of plane curves, we obtain for the distance (x") from the axis of Y to the center of the osculatory circle at any point (x,y)

$$x'' = x - \frac{dy}{dx}\left(\frac{1 + \frac{dy^2}{dx^2}}{\frac{d^2y}{dx^2}}\right) \quad (5);$$

and for the radius (r) of the circle of curvature

$$r = \frac{ds^3}{dxd^2y} = \frac{\left(1 + \frac{dy^2}{dx^2}\right)^{3/2}}{\frac{d^2y}{dx^2}} \quad (6).$$

When we consider Eq. 1, it is evident, if the value of the constant c be made very small, that the value of y will increase slowly for quite a distance along the axis of X; then, within a certain limit, the length of the arc up to a given point will not vary materially from the abscissa of that point. Consequently, within this limit we may say

$$ds = dx; \text{ whence} \left(1 + \frac{dy^2}{dx^2}\right) = 1.$$

Applying this value to Eq. 5, we obtain

$$x'' = x - \frac{dy}{dx}\left(\frac{1}{6cx}\right) = x - \frac{3cx^2}{6cx} = \tfrac{1}{2}x \quad (5A).$$

The vertex of the circle of curvature is then midway

between the point of origin and the ordinate of the given point.

Treating Eq. 6 in like manner, we have

$$r = \frac{1}{6cx} \quad (6A).$$

That is, the radii of curvature vary inversely with the value of x.

In Fig. 1, X'ODX represents the straight center line of a road which is to be connected with an intersecting tangent by means of two transition curves or cubic parabolas of which OBp is one, and a circular arc or main curve, of which PP' is a part. The parabola and the main curve arc have a common tangent at the

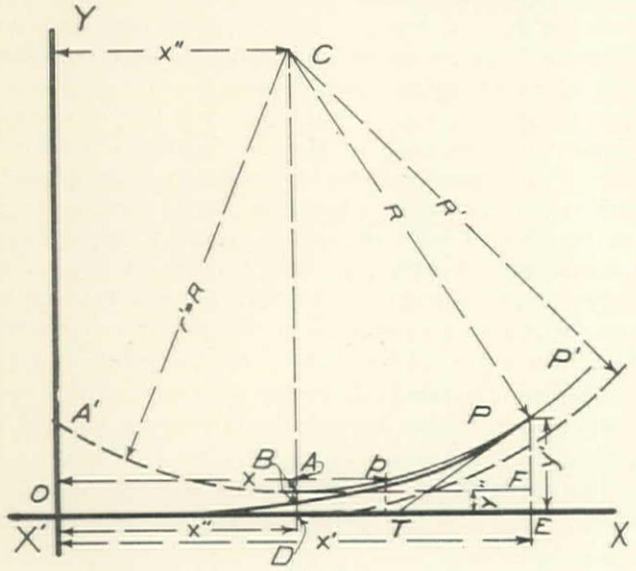


Fig. 1

point of contact P and the radius of curvature of the parabola at this point is to be equal to the radius of the main curve; i.e. $r' = R$, so that the circular arc or main curve PP' is coincident with the osculatory circle A'APP' for the point P.

The tangent X'OX is taken as the axis of X and the beginning of the parabola, O, as the point of origin. Let x' and y' be the coordinates of the point of contact, P.

To locate the curve OBP. We have given the radius R of the shifted main curve APP', the abscissa x' of the point of contact P of the main curve and the cubic parabola, and the radius of curvature $r' = R$ of the parabola at the point of contact P.

By Eq. (6A)

$$r' = \frac{1}{6cx'}, \text{ or } c = \frac{1}{6r'x'};$$

$$\text{also, } y' = cx'^3 = \frac{x'^2}{6r'};$$

and, for the first differential we have

$$\frac{dy}{dx} = 3cx'^2 = \frac{x'}{2r'} = \frac{x'}{2R}$$

It has already been shown that the abscissa of the center of the circle of curvature for the point P, which is also the abscissa of the vertex A of the same circle, is $x'' = \frac{1}{2}x'$. Let its ordinate AD = y''. Draw AE tangent to the circle at its vertex A, then the tangent deflection of the arc AP, is

$$PF = t = R - \sqrt{R^2 - (\tfrac{1}{2}x')^2} = \frac{x'^2}{8R} \text{(approx.)} \quad (7).$$

Then $t = \frac{3}{4}y'$, whence AD = y'' = shift $= \frac{1}{3}t = \frac{1}{4}y'$ (8). Since the ordinate of the point B of the parabola whose abscissa is $\frac{1}{2}x'$ is $\frac{1}{8}y'$, the parabola bisects the line of shift AD.

Draw PT, the tangent common to both curves; then

$$PT = \frac{y'}{\sin PTE}$$; now the $\angle PTE = \angle ACP$, whose sine is $\frac{x'}{2R}$, whence $PT = \frac{x'^2}{6R} \div \frac{x'}{2R} = \frac{x'}{3}$ (9).

The distance TF may then be determined and the point T established. The main curve PP' may next be run from its tangent PT, or from the shifted tangent AE.

The following method may be used to determine the limiting lengths of the cubic parabola that may be applied as an easement to any curve. In the general formula for the tangent deflection,

$$t = R - \left[R^2 - \left(\frac{x}{2}\right)^2\right]^{\frac{1}{2}} = \frac{x^2}{8R} \text{(approx.)} \quad (10).$$

Any value of X which gives an approximate value of t, varying so little from the true value that the difference may be ignored in field work, may be taken as the abscissa of the point of contact of the two curves.

Example: The radius of the circular or main curve, R, = 800 ft.; the abscissa of the point of contact, which is also a close approximation to the length of the parabolic arc, is 120 ft.

$$t = R - \left(\frac{R^2 - x^2}{4}\right)^{\frac{1}{2}} = 2.254 \text{ ft.}$$

$$t = \frac{x^2}{8R} = 2.25 \text{ ft.}$$

Shift $= y'' = 0.75$ ft. and $y' = 4/3t = 3.0$ ft.

In assuming the radius of curvature of the parabola at the point of contact to be the same as the radius of main curve, i. e. $r' = R = \frac{1}{6cx}$, we fix the value of the constant 'c' in Eq. 1 as $c = \frac{6Rx'}{1} = \frac{1}{576{,}000}$; then

$$\frac{dy'}{dx'} = \frac{x'}{2R} = 0.075$$

$$\text{and } \frac{d^2y'}{dx'^2} = 6cx' = \frac{1}{R} = \frac{1}{800}$$

Substituting these values in Eq. 6, we obtain

$$r' = \left[\frac{1 + (0.075)^2}{\frac{1}{800}}\right]^{3/2} = 806.7 \text{ ft.}$$

Table I needs no explanation except, perhaps, that the items in the column 'Errors in t' are the differences between the approximate values of t, upon which the values of the shift are based, and the true value of t given in Eq. 7.

Table I

R	r' Assumed	x'	Shift $= \frac{1}{3}t$	Error in t	$\frac{dy'}{dx'}$	r' (ft.) Eq. 6
200	200	50	0.52	0.007	0.125	204.6
200	200	60	0.75	0.013	0.15	206.8
500	500	80	0.53	0.003	0.08	504.8
500	500	100	0.83	0.007	0.10	507.5
500	500	120	1.20	0.013	0.12	511.0
1000	1000	100	0.417	0.001	0.05	1004.0
1000	1000	150	0.93	0.004	0.075	1008.0
2000	2000	150	0.47	0.000+	0.0375	2004.0
2000	2000	200	0.83	0.002	0.05	2007.0
3000	3000	200	0.555	0.000+	0.033	3005.0

Remarks—From these examples, it is seen that generally the difference in curvature between the circular arc and the parabola at the point of contact is much less than that between the main curve and the adjacent segment of a Searles spiral and, in railroad work, it is often less than the variations of curvature that may be found in the main curve track after it has been lined.

It has been claimed that highway traffic, since it is not rigidly confined to tracks like railroad traffic, will develop its own easement curvature to suit the need of the individual unit, if sufficient width of paved surface is provided. This is a very comforting illusion. It is obvious that, as the roadway is narrowed, the more nearly will traffic follow the line of the road. It is difficult to understand how widening the roadway, which encourages erratic driving, will cause traffic to not only adopt and follow a shifted line but also to adjust transition curves to its ends.

A careful examination of a number of widened curves shows that where the curve departs from the tangent there is often a short stretch of excessive curvature and, generally, there is another where the line merges into the main curve. The same condition was found in railroad work before the introduction of the 'spiral', when track men were accustomed to 'spin the curve out' upon the tangent.

When so little time and trouble is required to locate the shifted curve with its easements, there is no excuse for squandering money in widening curves.

Banking of Curves—The banking of the roadbed upon a curve consists of giving that roadbed a transverse uniform slope such that the action of gravity along the slope shall equal the centrifugal force due to a given velocity. The inner edge of the roadbed, or a line in the roadbed parallel to and a foot or two from it, being placed at the profile grade line.

If S be the slope or rise per foot width of the roadbed, 32.2 ft./sec.^{2} the acceleration of gravity, v the velocity in feet per second, and R, the radius of the curve in feet, then $S = \frac{v^2}{32.2R}$ (11).

If V be the velocity in miles per hour,

$$S = \frac{V^2}{15R} \text{ (approx.)} \quad (12).$$

When the roadbed is banked for a given slope, the velocity adapted to that slope is

$$V = \sqrt{15sR} \text{ (approx.)} \quad (13).$$

Then, with a slope of 0.06 ft. per foot width, a velocity of 36.7 miles per hour will create a centrifugal force equal to the action of gravity in forcing a body towards the center of a curve of 1500 ft. radius.

Present Practice—From a reliable source, it is learned that the highway departments of different states receiving federal aid are permitted to establish their own standards for the banking of curves and there is such a diversity in the treatment of the road surface that it is quite possible for an experienced and observant driver to determine between which curves a state line lies.

The following are some of the deviations from good construction not infrequently met:

(a) Curves with radii not to exceed 1200 ft., and without appreciable banking, upon roads carrying high-speed traffic.

(b) The center line of the roadway taking the profile grade and the plane of the roadbed tilted about this line so that the outside half of the road is banked while the inside half is cut down to conform to the plane of the slope.

(c) Making the slope for the maximum speed 1% per degree of curvature. This gives a velocity upon all curves of less than 30 miles per hour, which is, upon many roads so treated, nearer the minimum than the maximum velocity.

(d) The runoff upon the tangent made so short and steep as to render the road unsafe in bad weather.

These are among the contributing causes of 'death curves' which are too frequently met in some districts and which seem to be regarded as necessary and unavoidable evils, since the attempts to correct the faulty construction are feeble and few.

It is the general, if not the universal custom, to regard the roadbed as a unit—whatever the width may be—and this may satisfy conditions upon very light grades where the speed is practically the same for traffic in both directions. But, upon other grades, and especially those near the maximum, and where the range of vision is short upon one side of the road, the difference in the velocities ascending and descending will vary ten or more miles per hour. This should be considered in the banking. Thus, for a speed of 50 miles per hour, the slope should be 50% greater than one adapted to 40 miles and nearly three times the slope for 30 miles. If the work is to be consistently done, the slope should break in the middle of the roadbed and 'markers' showing the speed for which the slope is built should be placed near the beginning of each ascending and descending grade. The banking, of course, should be placed upon the subgrade in order that the paving may have a uniform thickness.

Where the center line of the roadbed is clearly defined and the edges properly maintained, cars will track very nearly true to line.

In the operation of railroads, the speed of trains can be strictly regulated by time card rules and train orders, but upon public highways with a go-as-you-please traffic and lacking rigid police surveillance, signs and markers must be relied upon to guide and instruct. While this may be sufficient for those who are willing to comply with all regulations, who wish to travel in safety, and give some attention to tire wear and strain, those whose desire is to 'burn up the road' will continue on their present course and trust to a watchful Providence and—luck.

California Gas Tax Upheld

Two recent rulings by the United States supreme court have upheld the constitutionality of the California motor bus and gasoline tax measures. The 3-cent gasoline tax and 5% tax on gross receipts of commercial vans and trucks and 4½% on passenger buses operating on regular routes, will produce revenues of $34,000,000 net during 1929. Safeguarding these sources of revenue assures continuance of the California program of high-standard road construction.

Status of Natural Gas in California

Historical—The first distribution of straight natural gas in California occurred in 1901, when a portion of the gas produced from the old Salt Lake field near Los Angeles was piped to that city for use in the Southern California Gas Co. system. Since that date the production and utilization of natural gas has steadily grown until at present 80% of all gas consumed in the state is straight natural gas. There are now under construction a number of projects which will be finished within the next twelve months. Their completion will greatly enlarge the area served with straight natural gas and will increase its consumption to 98% of the state requirement.

Until August, 1929, all gas used north of Bakersfield was manufactured oil gas of 550 b.t.u. quality. On August 16, the first straight natural gas was delivered into the San Francisco bay area from the first P.G.&E.Co. pipe-line from Kettleman Hills. Since that date straight natural gas service of 1175 b.t.u. quality has been instituted along the line from San Jose to the San Francisco county line on the west side of the bay and from San Jose as far north as Hayward on the east side of the bay. San Francisco and the East Bay cities are now being served with reformed gas of about 585 b.t.u. quality. This service will be changed to straight natural gas when the second P.G.&E.Co. pipe-line from Kettleman Hills is completed in the spring of 1930.

Soon after completion of this second line, the service of straight natural gas will also be instituted in the area along the route of that line—the west side of the San Joaquin valley and those cities and towns around and near Modesto, Oakdale, Stockton, Lodi, Sacramento, Roseville, Woodland, Davis, Antioch to Richmond, Vallejo, Napa, and Marin and Sonoma counties as far north as Santa Rosa. After completion of this project and the one in southern California to carry natural gas from Huntington Beach to San Diego, an interconnected transmission system will exist, extending from Roseville on the North to San Diego on the south, a distance of over 600 miles by pipe-line. This completed system will serve natural gas to an estimated two million consumers.

Southern California Transmission—Contracts aggregating $2,250,000 were recently awarded by the Southern California Gas Co. for constructing a 20-in. natural gas pipe-line from Kettleman Hills to Buena Vista Hills terminal on the company's system near Taft, a distance of 70 miles. This transmission line will have a capacity of 85 million cubic feet of gas per day, with an initial pressure of 400 lb. per sq.in. It will make available a new source of supply of natural gas for Los Angeles and other southern California cities now served by the company's high-pressure line.

Work on this pipe-line will be commenced as soon as material arrives; it is to be completed in January, 1930. The Macco Construction Co., of Clearwater, has been awarded the general contract exclusive of hauling and welding. The Ashbury Transportation Co., of South Alameda, will unload, haul, and string the pipe, and the A. O. Smith Co. will furnish the pipe and do the field welding.

This line will not only aid in the present extensive conservation program in the state by utilizing natural gas produced as a byproduct of crude oil, but it also will assure an additional natural gas supply for southern California. Under the present program of scientific production, natural gas in large quantities should be available from the Kettleman Hills gas and oil field for many years. Long-term contracts, covering large areas, have been made between the Southern California Gas Co. and the oil producers in the Kettleman Hills field.

Northern California Transmission—The Pacific Gas & Electric Co. has ordered 55,000 tons, 312 miles, of 16 to 22-in. steel pipe for its second natural gas transmission line from the Kettleman Hills to the San Francisco bay area and for branches serving Modesto, Stockton, Sacramento, Roseville, Woodland, and intermediate points.

The pipe order will require 1700 cars. Delivery, at the rate of 35 carloads per day, began October 21. The company will use 40-ft. instead of 30-ft. lengths of pipe, thus reducing the number of joints as in the first line by one-fourth. Excavation will be done by P.G.&E.Co. forces and the furnishing and welding of pipe will be done by the A. O. Smith Co. The hauling contract has been let to Robert A. Conyes Co., of Oakland. The delivered cost of the pipe is estimated at $5,500,000.

The P.G.&E.Co. plans a third unit of the natural gas transmission and distribution system by means of a line across Carquinez straits bridge into Vallejo and thence to Napa, San Rafael, Petaluma, Santa Rosa, and Healdsburg. Surveys are in progress for a possible extension from Roseville to the Marysville network, thus bringing natural gas to Oroville, Marysville, and Chico. The maximum transmission distance in the company's completed network will be 360 miles.

Great Northern-Western Pacific Extension

Believing that it would be in the public interest for the Interstate Commerce Commission to grant a certificate of public convenience and necessity to the Great Northern Railway Co. to construct its proposed railroad line in Klamath county, Oregon, and Siskiyou and Modoc counties, California, and for the Western Pacific Railroad Co. to be strengthened by being permitted to construct its proposed line from Paxton or Keddie in Plumas county to Lookout, linking the former railroad with Niles and San Francisco, the California Railroad Commission has instructed its attorneys to file a petition of intervention in behalf of those applications, with the Interstate Commerce Commission.

Reminiscences of the Pioneer Engineers of California*

By OTTO VON GELDERN†
Consulting Engineer, San Francisco

Part IV

Another army engineer of a very practical mind; also a man of keen judgment and logical thought, a contemporary of Colonel Mendell, was the late Colonel W. H. Heuer‡, one of the officers who came to California during the early post pioneer period, and who made it his permanent home later on. I knew him intimately well and have a fond recollection of him. He was nine years older than I. He was a very active man and an honest administrator. He knew no fear and asked no favors. With the courage of his conviction he did not hesitate to defend what he thought just and right,

W. H. HEUER

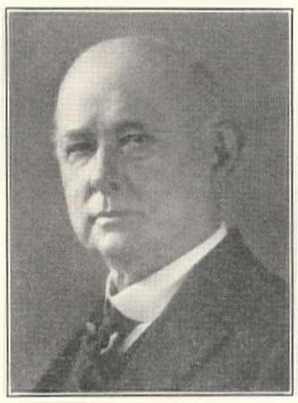
regardless of the opinions of the political powers that were.

It was he who, during the time of the so-called Paine break in the levees of the Sacramento river, now over a quarter of a century ago, by his personal courage and keen judgment, made an examination of the conditions when the river was pouring its water through a narrow crevasse with a terrific speed, and based upon this dangerous examination suggested a method of immediate relief. He died four years ago in his eighty-third year.

One of the post pioneer engineers still alive, who has reached ripe old age with honor, is Marsden Manson‡. He is a Southerner who came to California when a young man, full of energy and ambition. He associated himself with Colonel Mendell's office, and during the early investigations of the damages wrought by hydraulic mining, forty-seven years ago, he, too, was connected with this work and wrote a number of valuable reports on what was then a very vital problem difficult of physical investigation.

He has filled several important public positions since that time. For one or more terms he was the chief engineer of the State Harbor Commission, and later on he became the president of the first highway commission which the state of California ever had. He was a commissioner of public works of the city of San Francisco, and after the great catastrophe in 1906 he became its city engineer.

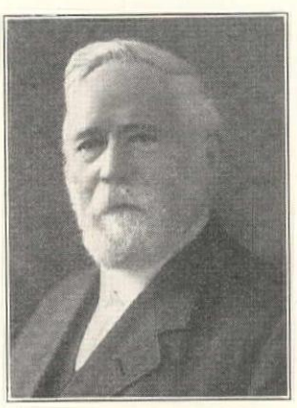
He, also, represents one of the type of the oldtime engineers. Scrupulously honest in his dealings, he had



MARSDEN MANSON

virility and activity, and the power to express himself vigorously and intelligently in good English. He lives more or less in retirement now, but is as courteous and interesting in his manner as ever. It is always a pleasure to meet him.

Mechanical engineering of the early post pioneer period is well represented by a number of engineers of



GEORGE W. DICKIE

the old type. We had quite a number of them, but the time at my disposal will permit me to refer to a few only. Two of them I recall well, George W. Dickie§ and W. R. Eckart‡¶. The former, a practical shipbuilder and machine expert, who came from Scotland in the early days, became the chief engineer of the Union Iron Works in San Francisco. In the early part of his

* Part III was published in the November 10th issue.

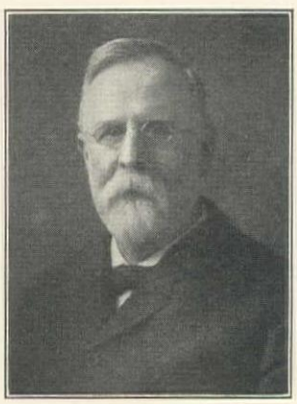
† Otto von Geldern is a Life Member of the American Society of Civil Engineers; Past President of the Astronomical Society of the Pacific; a Vice-President of the California Academy of Sciences; President of the Mechanics Institute of San Francisco; and a Regent of the University of California.

‡ Member, American Society of Civil Engineers.

§ Member, American Society of Mechanical Engineers; and father of A. J. Dickie, M.Am.Soc.M.E., and Editor of Pacific Marine Review.

¶ Father of Nelson Andrew Eckart, chief assistant engineer, City and County of San Francisco, in charge of Hetch Hetchy water supply project (M.Am.Soc.C.E.)

career he developed unique pumping systems for the drainage of the Comstock mines; later on he was known everywhere as the shipbuilder of the Pacific Coast, who carried on this great industry of shipbuilding from the humble coast liner to the great battle ship. He was a straightforward and lovable character; very popular in his day; with a host of devoted personal friends. For many years he held the office of



W. R. ECKART

president of the Technical Society of the Pacific Coast, the first association of engineers founded in San Francisco in 1887.

W. R. Eckart was more of a consulting engineer, active in similar lines. He combined practical ability and experience with a vast store of theoretical knowledge. I doubt whether we ever had a more highly qualified mechanical engineer in California than Mr. Eckart, who was constantly consulted for his superior theoretical knowledge by men of affairs. It was a pleasure to follow him when he was explaining some problem in which he happened to be interested. It was like listening to the profound discourse of a college professor who knew his subject well. He died in 1914 in his seventy-third year. I hold him in my memory as a dear friend of the olden days.

One important work of Mr. Eckart's professional career deserves special mention. I refer to the construction of the high-pressure pipe-line brought from the hills below Lake Tahoe to Virginia City, a pipe system known to you all, which was planned and built by the cooperation of Mr. Eckart and Mr. Schussler. I agree with my friend M. M. O'Shaughnessy, the city engineer of San Francisco, who reminded me of this incident by the statement that this work of the post pioneer days was the greatest advance in high-head hydraulic engineering ever made, and that it should remind the engineers of this age that the names of these two men should not be forgotten in connection with this unique system, which has stirred up the admiration of every engineer since that time.

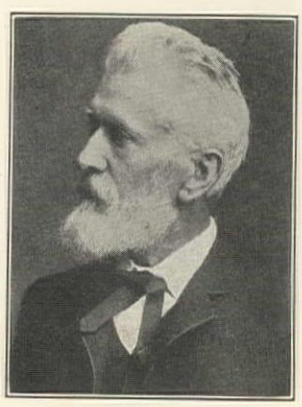
In connection with mechanical engineering we should not forget to mention John Richards and Byron Jackson, two pump experts who did more to develop centrifugal pumping in California than any one else. Agriculturally this has been of great importance. Both of them are well known and highly respected professional men.

One of the best known university teachers, the dean of the college of mechanical engineering in the University of California, was the late Professor F. G. Hesse. As a German scholar, he was a noted mathematician, who had been a Commander or Captain in the Corps of Mathematicians, United States Navy, prior to his coming to California in the very early history of our state university.

He was one of the most learned men in the profession whom it has been my privilege to know, and also one of the most erratic and unsophisticated. In the application of higher mathematics to practical engineering he had no equal. But with all his knowledge of mathematical and physical science, and with his inborn astuteness of intellect to apply them successfully to intricate mechanical problems and to complicated mechanical devices, he was as innocent and guileless as a child in the common affairs of life, that is, in its business relations. He appeared to have no conception of the value of money as a necessity of life, nor did he seem to care enough about it to give such matters a thought.

Characters of this type are not rare; perhaps we do not take them seriously enough; if we did, we would probably regard them very highly because intuitively they seem to have nobler impulses of life, and higher ethical principles than the average member of humanity. At all events, they are usually, as in the case of Hesse, very lovable and delightful men.

The great difference between the deep student and the practical man of logical thought, was brought out very forcibly on a festive occasion, when the engineers of San Francisco, in combination with the college men, gave a dinner in honor of Hesse, who had reached the twenty-fifth anniversary of his professorship at Berke-



F. G. HESSE

ley. This was at the end of the last decade of the nineteenth century.

The banquet was given at the California hotel on Bush street, just west of Kearny street, and it was well attended. The treasurer of the Technical Society of the Pacific Coast, the late Edward T. Schild, furnished the golden wine of California. Several hundred men attended this function, many of them students. A famous German glee club sang the old student songs with which we were all familiar. Benjamin Ide Wheeler, president of the University of California, made the opening address. He sat next to the presiding chairman of the banquet, the late Irving M. Scott, the then president of the Union Iron Works.

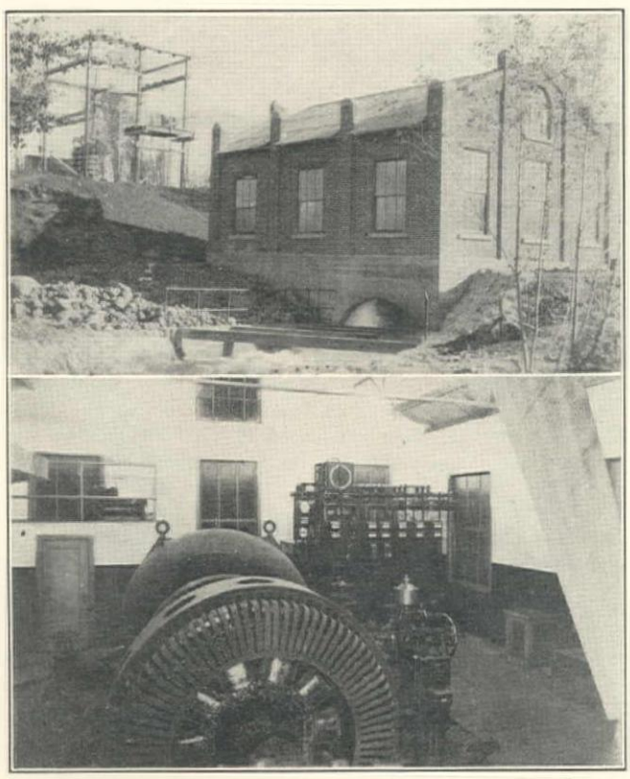
(To be continued)

JOSEPH HYDROELECTRIC DEVELOPMENT, OREGON

By E. V. LORENZ
Construction Engineer, Pacific Power & Light Co.

The Pacific Power & Light Co., of Portland, has completed the Joseph development, a small standby hydroelectric plant on the Wallowa river in northeastern Oregon. This plant will serve the company's local territory, which is somewhat isolated from the main transmission network. Construction began in July, 1929, and the complete plant was turned over to the operating department on November 2.

Water Supply—The Associated Ditch Companies have built a dam at the lower end of Wallowa lake, creating 50,000 ac.ft. of storage for irrigation. The power company has purchased 700 ac.ft. of that storage and has a prior right to 50 c.f.s. diversion below the lake. This prior right exceeds the minimum flow during six months of the normal year. By operating the Joseph development to generate auxiliary power with storage, the company can use 100 c.f.s. for short periods. During the remainder of the time water will



(Upper) Exterior View of Power-House for Joseph Development, Showing Concrete Trim and Corrugated Transite Roof. (Lower) 1450-hp. Pelton Water-Wheel Direct-Connected to Generator

be stored for irrigation and power purposes. Thus, by proper regulation and cooperation, both companies should benefit by the arrangement.

Control Works and Conduit—The water level in Wallowa lake will vary between elev. 4360 ft. and 4385 ft., tailwater at the power-house being at elev. 4188 ft. The power company installed a gate, racks and supports at the dam of the Associated Ditch Companies and constructed a 48-in. continuous wood stave pipe, 6100 ft. long, from the dam to the power-house. Near the dam the pipe is supported on and protected by rock-filled timber cribs. Only light grading was required along the flow line.

Power House and Equipment—The power-house, 32 by 40 ft., is constructed of brick, with a corrugated 'Transite' roofing supported on steel trusses. The building is trimmed with concrete.

The power-house equipment includes a 1450-hp., Pelton reaction turbine, installed and mounted on a horizontal shaft, with a 1000-kw., 1250-kva., 2200-volt Westinghouse generator, and a Pelton synchronous relief valve and governor.

Personnel—The plant was built by the Pacific Power & Light Co. construction organization under the direction of E. V. Lorenz, construction engineer. Earl Eby was the general foreman and L. P. Mattoon had charge of purchasing and accounting. H. H. Schoolfield is chief engineer and J. E. Yates is assistant chief engineer of the Pacific Power & Light Co.

SAN GABRIEL DAM

The board of consulting engineers and geologists appointed by Edward Hyatt, Jr., state engineer of California, to examine the San Gabriel dam under construction by the Los Angeles County Flood Control District, has reported unfavorably on the site and the present dam has been condemned by Hyatt. A review of foundation movements and investigations at San Gabriel damsite to that date was given in the November 10th issue, p. 598-599. Recent developments in the case are: the application of the flood control district to construct the dam has been denied, as the site is considered unsafe for a high concrete dam; the county supervisors have retained six engineers, at salaries of $100 per day and expenses, to make a survey of other damsites in the watershed; the district's chief engineer has recommended a series of small dams in the upper watershed and a large rock-fill dam utilizing the present excavation and native materials at 'the forks' site (this dam the consulting board believes can be built if it is an hydraulic earth and rock-fill structure, of conservative proportions, with a concrete core wall).

The recommended substitute dam should, in the opinion of the consulting board, have a limited height, adequate cutoff, large freeboard, flat slopes, and an ample embankment on the downstream toe. The spillway should have a capacity designed for maximum flood occurrence. The width of dam up and downstream should provide a percolation distance of at least eight times the maximum depth of water against the structure. The concrete core wall should extend into bedrock at all points so as to increase percolation resistance, and a sluiced mat in open cut should also extend to bedrock on both sides of the core wall. The upstream mat would constitute an impervious core and the downstream mat would be of sand. The abutment surfaces above the crest of this dam should be sloped so that slides will not occur.

E. C. Eaton is chief engineer of the Los Angeles County Flood Control District.

BOOK REVIEWS

Note—All books reviewed in these columns are stocked, and orders can be filled promptly by the book department of **Western Construction News.**

SEVEN PLACE NATURAL TABLES

By HOWARD CHAPIN IVES, C. E.

Engineers and contractors have long felt the need of a compact set of tables of natural trigonometrical functions, arranged for convenient use with calculating machines. These tables are especially valuable when computed to seven places, and are preferable to logarithms except for solving exponential equations or in long operations of multiplication.

In a flexible, pocket-size, 220-page, 1929 Wiley book, 'Seven Place Natural Trigonometrical Functions', Howard Chapin Ives has arranged the following tables: natural sines and cosines; natural tangents and cotangents; natural versines and exsecants; natural secants and cosecants; natural chords and co-chords; lengths of circular arcs to radius unity; degrees to radians; inches in decimals of a foot; reduction of stadia readings; minutes in decimals of a degree; squares, cubes, roots and reciprocals; mean refractions in declination; times of culmination and elongation; azimuth of Polaris at elongation; trigonometric formulas, solution of right and oblique triangles; areas of plane figures; volumes of solids; useful numbers and formulas; simple curve formulas; units; explanation of tables. Also, in five appendices, the following subjects are covered: adjustment of the engineer's transit and level; area computations; simple curves; vertical curves; astronomy—determination of latitude, azimuth and longitude. Price $2.50.

WATER PURIFICATION

By JOSEPH W. ELLMS

The second edition of this well-known McGraw-Hill book was published in 1928 to meet the advance in the art of water purification. As a knowledge of the physical, chemical and biological characteristics of natural waters is a prerequisite to the proper understanding of purification processes, a consideration of the properties of various classes of waters is offered. The relation of polluted public water supplies to water-borne diseases has received special attention in this 584-page text.

The chapter headings include: introduction; clarification of natural waters; transmission of disease through drinking water; effect of improved water supplies upon health; objects and methods of water purification; sedimentation; types of settling reservoirs and coagulating basins; practical efficiencies of settling and coagulation basins; filtration of water; preliminary treatment of water for slow sand filters; system of slow sand filtration; efficiency and cost of operation of slow sand filters; rapid sand filtration; general arrangement of rapid sand filter plants; details of rapid sand filter plant construction; regulating, measuring and indicating devices for rapid sand filter plants; equipment for handling and storing of chemicals and for the preparation of solutions; apparatus and methods for applying chemicals and the preparation of solutions; power plant, pumping machinery, air compressors, air tanks, wash water tank and miscellaneous equipment; cost of constructing rapid sand filters; rates of filtration, loss of head and washing of rapid sand filters; efficiency and cost of operation of rapid sand filters; physical and chemical changes produced by the application of chemical coagulants, and by the subsequent filtration of the treated water; effect of the hydrogen-ion concentration of natural waters; disinfection of water supplies; removal of dissolved mineral matter from water; control of water purification processes; appendices. Price $7.00.

CONSTRUCTION JOB MANAGEMENT

By CHARLES F. DINGMAN

To place before the builder a knowledge of the most effective means to be employed in handling the several branches of building construction and of co-ordinating the work of the men in the different trades employed, the author of 'Construction Job Management' has prepared a compact and elementary pocket-sized text of 211 pages.

The chapter headings of this McGraw-Hill book follow: preparing to start the job; equipping the job; getting the work done; organizing the job; handling masonry and concrete operations; handling fireproof construction; handling plaster and stucco work; handling carpenter work; relations with subcontractors; appendix on recommended readings. Price $2.50.

HIGHWAY CURVES

By HOWARD CHAPIN IVES, C. E.

In this book the author aims to present the theory and practice of highway curves, as followed in the United States. It is intended that the book shall apply reasonably well to the work of all the state highway commissions. In many instances the curve practice of various highway departments is widely different, and in some of these cases Ives gives several different methods of procedure, of which one is then recommended. For example: he describes the three common methods for defining degree of curve and then recommends the arc definition, with the exact value for the radius.

'Highway Curves' is a flexible, one-volume, Wiley pocketbook, divided into two parts, as follows: text—155 pages and tables—241 pages. It was first published in the fall of 1929. Chapter headings for part 1 include: highway location; simple curves; compound and reversed curves; grades and vertical curves; spiral curves; superelevating or banking; widening of curves; cross-sections, setting slope stakes; calculation of earthwork; haul and the mass diagram; observations for determination of true North; care and adjustments of instruments; miscellaneous. There are 36 useful tables in part 2. Price $3.50.

PERSONAL MENTION

R. K. Tiffany, state supervisor of hydraulics, Washington, has resigned to enter private consulting practice with Lars Langloe. Charles R. Bartholet, former assistant supervisor of hydraulics, succeeds Tiffany and J. F. R. Appleby, an engineer with the hydraulic division for the past four years, succeeds Bartholet.

C. R. Harding, engineer of standards for the Southern Pacific Co., San Francisco, has been promoted to assistant to the president. Harding graduated in civil engineering from Cornell, class of 1910. He has been with the Southern Pacific Co. since 1913 and at present is supervising construction of the Suisun bay bridge.

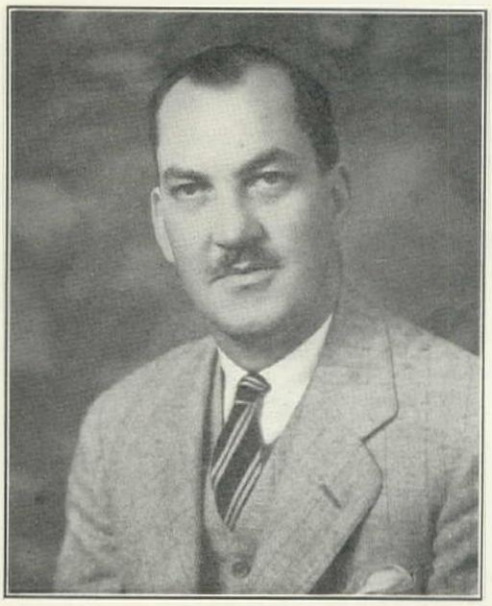
L. V. Murrow has been appointed district engineer for district 6, Spokane, of the Washington state highway department, succeeding the late L. A. McLeod. Murrow is a graduate of Washington State College and has been with the department since 1919. He was formerly assistant engineer of the Seattle district, in charge of construction in King, Snohomish, Skagit, Whatcom, San Juan and Island counties and, since January 1, 1929, has been assistant office engineer at Olympia.

Harry N. Jenks, for the past three years professor of sanitary engineering, Iowa State College, Ames, Iowa, has become associated in partnership with Clyde C. Kennedy, consulting civil engineer of San Francisco, specializing in municipal work. This firm will remain in the name of Clyde C. Kennedy. Jenks and Kennedy have collaborated in the design and construction of an iron removal-water softening plant for the city of Fort Dodge, Iowa, recently completed. Jenks was superintendent of the municipal filtration plant at Sacramento, California, during the first 2½ years of operation. While at Ames he was sanitary engineer of the Engineering Experiment Station, in charge of research projects on the treatment of sewage and industrial wastes and water purification. He attended the University of London, England, during 1912-13; McGill University, Canada, 1913-14; and University of California, 1914-16, graduating with the degree of B.S. in civil engineering.

New Equipment and Trade Notes

THEW SHOVEL COMPANY ANNOUNCES NEW SALES MANAGER AND SERVICE ENGINEER FOR THE PACIFIC COAST

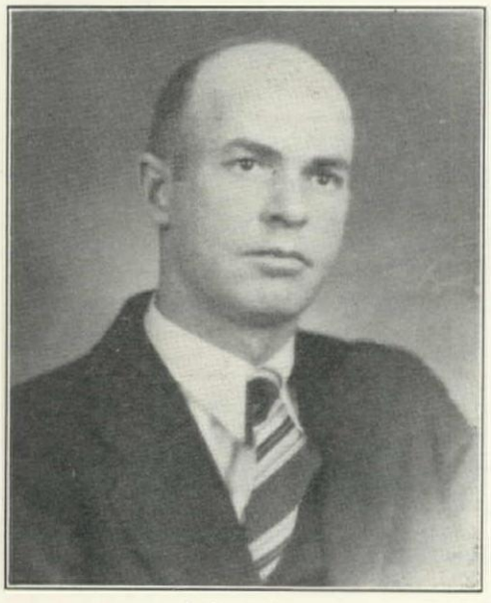
R. F. Deane, formerly district sales manager for the Thew Shovel Co. in Philadelphia, has been transferred to the west coast and has recently arrived to take charge of his new territory. He will maintain an office in San Francisco and



R. F. DEANE

have complete charge of all Thew sales and service in the states of California, Oregon, Washington, British Columbia, Idaho, and Nevada.

Deane's experience of seven years with the Thew Shovel



J. C. LYONS

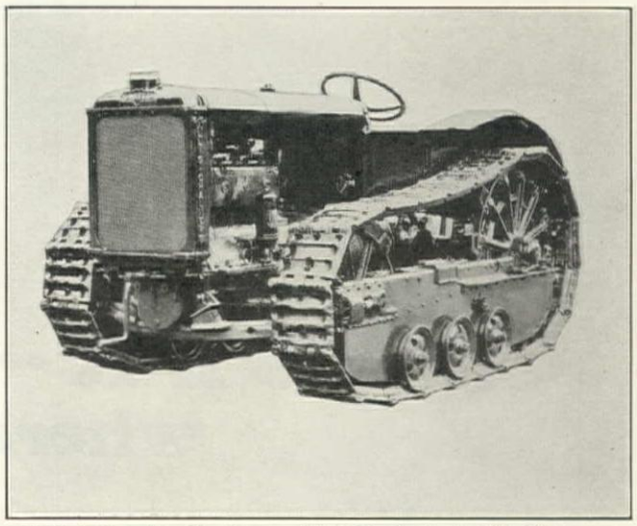
Co. in New York and Philadelphia territories, as sales engineer and district manager, has given him a broad experience that should be of real service to the contractors on the west coast.

He has brought with him J. C. Lyons, as his service engineer, who has had ten years' experience with the service department of the Thew Shovel Co. over the entire country. Lyons has been stationed at the factory for the past two years on erection and testing work. Complete stocks of repair parts will be stocked at all sales points on the Pacific coast by the following distributors: Jenison Machinery Co., San Francisco; Smith Booth Usher, Los Angeles; Hall-Perry Machinery Co., Butte; Feenaughty Machinery Co., Portland, Seattle, and Spokane; and Paragon Supplies, Vancouver, B. C. Thew owners can count on regular inspection and prompt service.

UNITED ANNOUNCES TRACTOR-POWERED EQUIPMENT

A complete line of tractor-powered road building and construction equipment has been announced by the United Tractor & Equipment Corp., of Chicago. This organization was formed over a year ago by a number of well-known equipment manufacturers and distributors who have since been engaged in the development of their equipment lines.

Included in the United line are: rubber-tired industrial trac-



United Crawler Tractor, a Joint Product of Allis-Chalmers and Trackson Co.

tors, crawler tractors, road graders and rollers, snow plows, power shovels, 'iron mules', scrapers, bulldozers, backfillers, loaders, hoists, arc welders, cranes, pipe-handling booms, locomotives, stump-pullers, trailers and street sweepers. A representative showing of the line will be made for the first time at the Atlantic City Road Show in January, 1930. Several thousand United tractors are in use in various fields, including a number in the service of state highway departments. The design of all operating equipment for the tractor embodies proven features developed by the individual manufacturers of the corporation.

The United tractor combines unusual power with light weight and sturdy, compact construction. Among the features claimed for it are: great power at all engine speeds, ease of handling and economy in operation. Frameless, single-unit construction, with 3-point suspension, is employed, all gears and working parts being enclosed.

The power plant is a heavy-duty 4-cylinder engine, with a 4½-in. bore and 5-in. stroke. For full load the engine speed is 1200 r.p.m. and is under built-in governor control. A gear-driven oil pump with leads to all main bearings, connecting rod bearings and piston pins, provides full pressure lubrication. The engine is protected against dust by a double-acting

air cleaner and an oil purolator. The transmission is of the automotive unit power plant type, and provides four normal engine speeds forward (2⅓, 3⅓, 5 and 10 m.p.h.) and reverse.

The United industrial tractor, around which all the operating equipment is designed, is built by the Allis-Chalmers Mfg. Co. at its Milwaukee plant. To make the tractor available for the widest range of work, it is furnished either as a rubber-tired or crawler unit.

The list of corporation members manufacturing United industrial equipment follows: Allis-Chalmers Mfg. Co., Milwaukee, Wis.; Brookville Locomotive Co., Brookville, Pa.; Detroit

United Center-Control Grader, a 1-man Unit for Grading and Maintenance, Built by Wehr Co. and Powered with United Tractor

Harvester Co., Detroit; Dorsey Bros., Elba, Ala.; Maine Steel Products Co., South Portland, Me.; Muskogee Iron Works, Muskogee, Okla.; Northwestern Mfg. Co., Milwaukee; Perry Co., Sidney, Ohio; The Hughes-Keenan Co., Mansfield, Ohio; Trackson Co., Milwaukee; Universal Power Shovel Co., Milwaukee; Wehr Co., Milwaukee. The sale and service of United tractors and equipment are handled through distributing members of the corporation and their affiliated dealers.

KOEHRING BRINGS OUT 10-S WEIGH-MIX

The Koehring Co., Milwaukee, manufacturers of pavers, mixers, gas shovels, pull shovels, cranes and draglines, has combined the 10-S Dandie mixer with a weighing device to bring out the Koehring 10-S Weigh-Mix. Designed for jobs

Koehring 10-S Weigh-Mix

requiring concrete of pre-determined strength, the Koehring 10-S Dandie Weigh-Mix accurately proportions aggregates by weight and water by volume. It meets every requirement of accuracy in proportioning and speed in operation, together with extreme portability.

The weighing device consists of a 2500-lb. all metal platform scale, a cradle to carry the scale and receive the skip; a saddle to protect the scale from the possibility of a dropped skip; a vibrator for cleaning the skip quickly and thoroughly; and a trailer providing easy, quick transportation. Each material —cement, sand and stone—is weighed separately on the 3-beam scale. Water is accurately measured by volume in a tank. The desired weight of stone is set on the stone beam and the weight of sand and cement on their beams, all materials being weighed in the skip. An indicator dial registers when the material being measured is near the desired weight on the beam.

The mixer operator controls charging as well as mixing and discharging. Speed in weighing is aided by use of the double-faced indicator dial, with a pointer in full view of the shovelers, inspector and operator.

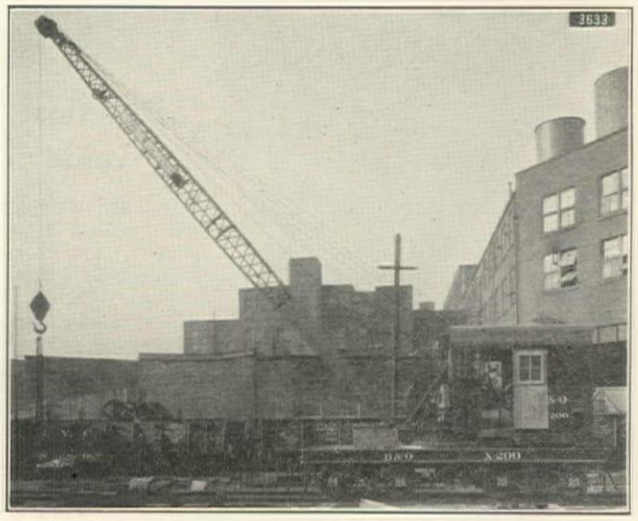
The skip is automatically cleaned by a vibrator as the materials are being shot into the drum during charging. With this device, the charging action is speeded up and a clean skip is provided for each batch.

When moving the 10-S Weigh-Mix, a two-wheel rubber-tired trailer is attached to the mixer for carrying the scale and cradle. After arriving on the job the trailer can be quickly detached, the scale and cradle lowered to the ground, and the machine properly leveled.

INDUSTRIAL BROWNHOIST ANNOUNCES 25-TON DIESEL-OPERATED LOCOMOTIVE CRANE

A diesel-operated, 25-ton locomotive crane has recently been announced by the Industrial Brownhoist Corp., of Cleveland. This model, the first of its capacity to be powered by diesel engine, has been fully demonstrated before groups of engineers from a number of the leading railroads, steel mills, and industrial plants and in every case the performance has proven highly satisfactory.

The diesel engine on this crane is of the 6-cylinder, 2-cycle, solid injection type and burns any ordinary grade of fuel oil.



Industrial Brownhoist 25-Ton Diesel-Operated Locomotive Crane in B & O Yards

The entire operating mechanism is mounted on a one-piece, cast steel rotating bed and the side frames are also made of steel castings. The power takeoff from the engine is fully enclosed, runs in oil, and is equipped with Timken roller bearings to minimize friction and make the crane quiet in operation.

Ten of these cranes were recently purchased by an eastern railroad and are now being placed in operation. Because of their low operating costs and ability to start and stop quickly, it is expected that these Industrial Brownhoists will effect marked economies for their owners.

DIAMOND HEAVY-DUTY MAGNETIC SWITCH

The Diamond Electrical Manufacturing Co., Los Angeles, announces Series KYR, a newly designed heavy-duty magnetic switch. This switch is said to have the following features: adjustable thermal overload relay from 80 to 120% load; interchangeable thermal elements; removable bakelite panel assembly; no control wires to disconnect; ample wiring space (concentric knockouts on four sides and back). Blowout coils can be furnished for higher ratings.

UNIT BID SUMMARY

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

BRIDGES AND CULVERTS

SACRAMENTO, CALIF.—STATE—MARIN COUNTY—STEEL, TIMBER AND CONCRETE

Butte Construction Co., 2014 Folsom St., S. F., $157,339, low bid to California Division of Highways for steel, concrete and timber bridge over Corte Madera Creek at Greenbrae. Bids from:

(1) Butte Const. Co., S. F. $157,339
(2) C. J. Nystedt, Sacramento 166,554
(3) Duncanson & Harrelson, S. F. 166,806
(4) Rocca & Caletti, San Rafael 167,958
(5) Lord & Bishop, Oroville 168,838
(6) Fredrickson & Watson, Oakland 171,855
(7) Fred J. Maurer & Sons, Eureka $176,123
(8) Healy-Tibbitts Const. Co., S. F. 176,735
(9) Pan-Pacific Piling & Construction Co. 179,061
(10) M. B. McGowan, San Francisco 188,202
(11) Average bid 171,947

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
2,000 cu.yd. channel excavation	.867	.50	.75	1.00	1.00	1.00	1.50	1.00	.853	.50	.897
1,300 cu.yd. structure excavation	3.00	8.25	6.20	7.20	8.00	8.00	7.00	1.00	2.36	19.00	7.00
7,300 lin.ft. furnish Douglas fir piles	.42	.27	.29	.28	.25	.26	.327	.25	.278	.30	.293
27,500 lin.ft. furnish Redwood piles	.72	.67	.65	.65	.65	.67	.76	.50	.742	.70	.671
605 each drive piles	10.00	10.75	12.00	18.50	12.00	18.00	12.50	20.00	8.57	20.00	14.23
120 tons gravel backfill	2.50	1.75	1.90	3.50	2.00	4.00	2.30	2.00	3.07	4.00	2.70
300 cu.yd. "A" concrete (tremie)	12.50	14.25	10.60	13.30	16.00	12.00	15.36	18.00	17.24	21.00	15.03
750 cu.yd. "A" concrete (bridge)	15.00	19.25	16.65	14.56	18.00	18.00	17.91	35.00	26.20	20.00	20.06
806 cu.yd. "A" concrete (paving)	11.00	12.60	12.00	12.00	12.00	12.00	14.00	15.00	11.78	12.00	12.44
235 cu.yd. "B" concrete (bridge)	12.00	18.00	15.50	14.60	18.00	16.00	17.25	30.00	24.37	18.00	18.37
140,000 lb. reinforcing steel	.046	.045	.0505	.045	.045	.05	.043	.05	.0443	.05	.0469
335,000 lb. structural steel	.073	.068	.075	.069	.07	.07	.074	.065	.0752	.06	.07
3,250 lb. cast steel	.15	.14	.13	.15	.12	.135	.15	.20	.14	.14	.146
308 M dense sel. all ht. str. redwood	83.00	88.00	81.00	86.60	85.00	84.00	84.50	90.00	86.18	90.00	85.83
29 M kiln-dry sel. all ht. str. redwd.	85.00	101.25	100.00	100.00	100.00	90.00	75.45	100.00	144.00	100.00	99.57
150 M sel. all ht. structural redwood	78.00	86.00	81.00	86.60	85.00	78.00	73.00	90.00	89.74	95.00	84.23
11 M BM select str. Douglas fir	89.00	65.25	60.00	60.00	60.00	70.00	61.00	80.00	110.55	83.00	73.88
335 sq.yd. elastite wearing surface	3.60	3.43	3.40	4.15	3.60	4.00	3.80	3.00	3.56	3.00	3.55
1 operating machinery complete	$17,250	$15,330	$17,900	$17,000	$15,700	$16,500	$18,875	$15,000	$18,192	$13,979	$16,573
1 unit electrical equipment complete	3,543	3,200	3,070	3,038	3,000	3,300	3,250	2,500	3,091	2,718	3,071
1 existing bridge remove	985	600	4,000	2,000	2,500	2,750	3,000	1,000	4,740	1,000	2,257
1 miscellaneous items	729	1,150	1,400	500	2,000	1,500	1,989	800	1,795	1,240	1,310

OLYMPIA, WASH.—STATE—PIERS—LAKE UNION BRIDGE

Contract awarded to Pacific Bridge Co., E. Water and Salmon Sts., Portland, Ore., $502,274, on Proposition 1, using timber piling for piers for Lake Union Bridge in City of Seattle for State Highway Commission. Bids received from:

(1) Pacific Bridge Co., Portland $502,274
(2) General Construction Co., Seattle $588,551

SOUTH ANCHOR PIER

	(1)	(2)
Lump sum clearing and grubbing	$ 200	$ 200
2,000 cu.yd. structure excavation	2.75	5.00
200 ft. drain pipe, 4-in.	.50	1.00
60 cu.yd. gravel backfill	2.00	3.00
1,100 cu.yd. special backfill	1.75	2.00
1,089 cu.yd. 'B' concrete (dry)	10.00	15.00
648 cu.yd. 'C' concrete	9.00	15.00
146,000 lb. reinforcing steel	.045	.05
59,000 lb. anchorage steel	.075	.08

SOUTH MAIN PIER

	(1)	(2)
Lump sum clearing and grubbing	$ 1000	$1000
12,800 cu.yd. structure excavation	7.80	8.00
5,000 cu.yd. special backfill	1.00	2.00
6,870 cu.yd. 'B' concrete (in water)	9.00	9.00
2,070 cu.yd. 'B' concrete (dry)	10.00	14.00
894 cu.yd. 'C' concrete	9.20	14.00
67,000 lb. reinforcing steel	.045	.05
2,800 lb. anchorage steel	.07	.08
930,000 lb. steel sheet piling	.005	.005
100,000 ft. timber bearing piles	.32	.40
828 each drive above piles	20.00	25.00
23,000 lb. steel rails	.02	.04
10 each drive test piles	50.00	50.00
10 each pull test piles	150.00	100.00

NORTH MAIN PIER

	(1)	(2)
Lump sum clearing and grubbing	$1000	$500
5,540 cu.yd. structure excavation	12.00	14.00
6,185 cu.yd. 'B' concrete (in water)	9.00	10.00
1,769 cu.yd. 'B' concrete (dry)	10.00	14.00
438 cu.yd. 'C' concrete	9.20	14.00
56,000 lb. reinforcing steel	.045	.05
2,800 lb. anchorage steel	.07	.08
41,000 ft. timber bearing piling	.18	.25
684 each drive above piles	21.00	20.00
22,000 lb. steel rails	.02	.04
6 drive test piles	50.00	50.00
6 pull test piles	150.00	100.00

NORTH ANCHOR PIER

	(1)	(2)
Lump sum clearing and grubbing	$ 500	$500
1,700 cu.yd. structure excavation	5.30	6.00
800 cu.yd. 'B' concrete (in water)	10.00	10.00
1,320 cu.yd. 'B' concrete (dry)	11.00	15.00
80,000 lb. reinforcing steel	.045	.05
6,800 lb. anchorage steel	.075	.08
9,200 ft. timber bearing piles	.16	.20
230 each drive above piles	10.00	20.00
4 each drive test piles	20.00	50.00
4 each pull test piles	70.00	100.00

Sam J. Humes is Director of Highways for the State of Washington.

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

Whipple Engineering Co., 183 N. Madison St., Monrovia, $31,419, low bid to California Division of Highways for reinforced concrete bridge over La Canada Canyon, 1½ miles from La Canada, LOS ANGELES COUNTY. Bids from:

(1) Whipple Engineering Co., Monrovia $31,419
(2) Oberg Bros., Los Angeles 32,061
(3) E. S. Johnson, Pasadena 33,933
(4) Carpenter Bros., Beverly Hills 34,717
(5) John Simpson & Co., Los Angeles 35,951
(6) Sidney Smith, Los Angeles 37,182
(7) Wm. J. Shirley, Los Angeles $38,182
(8) DeWaard & Sons, San Diego 40,608
(9) A. R. & C. O. Bodenhamer, Hemet 42,828
(10) Geo. J. Ulrich, Modesto 43,788
(11) Sharp & Fellows, Los Angeles 46,388

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1,720 yd. structure excavation	1.00	1.00	1.50	1.25	2.48	3.00	2.50	1.50	1.75	2.25	2.00
1,220 yd. 'A' concrete	16.15	16.00	17.00	17.80	16.50	16.50	18.00	21.40	23.00	22.42	25.00
165 yd. 'F' concrete	16.15	16.60	20.00	18.25	19.60	17.50	19.00	22.50	25.60	23.00	25.00
14 yd. 'E' concrete	50.00	50.00	50.00	41.00	71.50	85.00	75.00	70.00	50.00	70.00	70.00
173,000 lb. reinforcing steel	.037	.04	.036	.04	.04	.0425	.0425	.04	.0375	.0425	.04
770 lb. bronze	.30	.60	.50	.45	.52	.60	.50	.40	.45	.57	.55

STREET AND ROAD WORK

HELENA, MONTANA—STATE—GRADING—LINCOLN COUNTY

Contract awarded to Morrison-Knudsen Co., Boise, Idaho, who bid $217,136, using reinforced concrete culverts for 6.99 miles grading Section A, Libby-Troy Road in LINCOLN COUNTY for Montana State Highway Commission. Bids received on (A) Reinforced concrete culverts, and (B) Cast-iron culverts, from:

	(A)	(B)
(1) Morrison-Knudsen Co., Boise	$217,136	$221,686
(2) Crick & Kuney, Spokane, Wash.	239,060	247,182
(3) L. T. Lawler, Butte, Mont.	249,013	264,868
(4) Sam Orino, Spokane, Wash.	256,801	264,733
(5) Siems-Helmers, Inc., Spokane	$268,352	$275,263
(6) Colonial Building Co., Spokane	281,678	286,460
(7) Engineer's estimate	221,729	

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
141,670	cu.yd. special excavation and borrow	.38	.33	.40	.40	.40	.37	.30
53,116	cu.yd. rock excavation	1.10	1.25	1.25	1.35	1.34	1.33	1.25
496	cu.yd. structure excavation	1.00	1.00	1.50	1.00	1.00	2.00	1.00
3,110	cu.yd. earth cushion material	.70	.50	.75	.75	.60	.50	.40
2,000	cu.yd. sub-base material	.60	.50	.75	1.00	1.10	2.00	1.00
56,416	cu.yd. random rip rap	1.15	1.25	1.25	1.30	1.70	1.53	1.25
100	cu.yd. hand laid rip rap	2.50	3.00	4.00	4.00	4.00	4.00	3.00
1,219,610	sta.yd. overhaul	.01	.00½	.01	.01	.01	.02½	.01
12,240	lin.ft. double wire cable guard rail	.80	.65	.90	.90	.80	1.00	.75
1.52	cu.yd. Class 'B' concrete	30.00	30.00	28.00	40.00	35.00	50.00	25.00
99.94	cu.yd. Class 'A' concrete	30.00	30.00	26.00	30.00	25.00	30.00	25.00
11,330	lb. reinforcing steel	.07	.10	.10	.11	.08	.07	.08
5	cast-iron rings and covers for catchbasins	20.00	15.00	25.00	10.00	20.00	50.00	20.00
308	lin.ft. laying cast-iron and concrete pipe culvert (State fur.)	1.00	2.00	1.50	1.50	1.00	1.30	1.00
64	lin.ft. 12-in. reinforced concrete pipe culvert	2.00	2.00	2.00	2.00	2.00	1.75	1.50
328	lin.ft. 15-in. reinforced concrete pipe culvert	2.00	3.00	2.50	2.50	2.20	2.00	2.00
1,260	lin.ft. 18-in. reinforced concrete pipe culvert	2.50	3.50	3.25	3.00	2.50	2.15	2.50
80	lin.ft. 24-in. reinforced concrete pipe culvert	3.50	5.00	3.50	5.50	4.00	3.50	3.75
204	lin.ft. 36-in. reinforced concrete pipe culvert	6.50	10.00	4.50	7.50	6.50	7.00	6.00
40	lin.ft. 18-in. reinforced concrete pipe syphon	2.50	4.00	3.50	3.25	3.50	3.00	3.00
	ALTERNATE BID—							
64	lin.ft. 12-in. cast-iron pipe culvert	3.50	4.00	5.00	5.00	3.00	2.75	
328	lin.ft. 15-in. cast-iron pipe culvert	3.50	6.00	7.00	6.00	4.60	3.67	
1,260	lin.ft. 18-in. cast-iron pipe culvert	4.50	7.00	12.00	7.00	5.60	4.25	
80	lin.ft. 24-in. cast-iron pipe culvert	6.50	10.00	12.00	9.00	8.00	6.50	
204	lin.ft. 36-in. cast-iron pipe culvert	12.00	20.00	15.00	13.00	15.00	13.00	
40	lin.ft. 18-in. cast-iron pipe syphon	4.50	8.00	12.00	7.00	6.00	4.50	

SAN FRANCISCO, CALIF.—GOVT.—YOSEMITE VALLEY—GRADING

Award of contract recommended to Contoules Construction Co., 46 Collins St., San Francisco, who bid $89,900, using corrugated metal pipe for grading project 2A4, from Grouse Creek to Turtleback Dome on Valley to southern boundary section of Wawona Road, Route 2, Yosemite National Park, 2.19 miles, for Bureau of Public Roads, 461 Market St., San Francisco. Bids from: (1) Using concrete pipe and (2) Using corrugated pipe:

	PROP. 1	PROP. 2
(1) Contoules Const. Co., San Francisco	$ 94,112	$ 89,900
(2) W. A. Bechtel, San Francisco	118,078	116,425
(3) T. E. Connolly, San Francisco	128,248	123,941
(4) Haas, Doughty & Jones, San Francisco	$136,935	$132,955
(5) Engineer's estimate	112,009	108,384

		(1)	(2)	(3)	(4)	(5)
57,640	cu.yd. excavation, unclassified	.84	1.10	1.17	1.10	.95
27,360	cu.yd. excavation, Type B.	1.05	1.50	1.60	2.00	1.50
100	cu.yd. structure excavation	2.00	1.50	4.00	2.00	2.00
38,000	sta.yd. overhaul	.05	.04	.05	.05	.04
2.19	miles finish earth graded road	300.00	350.00	350.00	450.00	300.00
65	cu.yd. cement rubble masonry	20.00	15.00	14.00	20.00	16.00
230	ft. 18-in. reinf. concrete pipe	4.00	3.25	3.50	4.05	3.75
1,006	ft. 24-in. reinf. concrete pipe	6.50	4.00	5.75	6.25	5.50
278	ft. 24-in. reinf. concrete pipe, extra strong	4.50	4.50	6.00	6.50	5.75
230	ft. 18-in. corr. pipe	2.25	2.25	2.10	2.40	2.25
1,284	ft. 24-in. corr. pipe	3.10	3.00	2.70	3.50	3.00
1,200	cu.yd. hand-laid rock embankment	3.50	3.50	4.00	4.50	4.00

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

Contract awarded to Hartman Construction Co., 1804 M St., Bakersfield, $41,993, by California Division of Highways, Sacramento, for 2 miles grading and bituminized macadam surface from 5 miles to 7 miles east of Lost Hills, KERN COUNTY. Bids from:

(1) Hartman Construction Co., Bakersfield	$41,993
(2) J. F. Shepardson, Bakersfield	43,846
(3) M. J. Bevanda, Stockton	47,073
(4) A. Teichert & Sons, Sacramento	$47,641
(5) Pacific Pavement Co., San Francisco	48,516
(6) Grier & Taylor, Oakland	54,689
(7) Tieslau Bros., Berkeley	55,925

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
17.5	acres clearing and grubbing	15.00	50.00	50.00	50.00	25.00	50.00	20.00
9,900	cu.yd. roadway excavation	.40	.33	.45	.42	.60	.40	.40
18,000	sta.yd. overhaul	.02	.01	.02	.02	.01	.02	.02
350	cu.yd. structure excavation	1.00	.75	1.00	1.00	1.00	1.00	1.25
4,920	tons crusher run base	3.80	4.09	4.35	4.20	4.85	5.10	5.50
2,990	tons bituminized macadam (surface)	4.20	4.95	4.45	4.72	3.65	5.10	5.50
142	tons asphalt, Grade E	22.00	11.36	22.00	26.00	30.00	30.00	26.50
11	cu.yd. 'A' concrete (structures)	30.00	28.00	30.00	27.00	25.00	25.00	30.00
450	lb. reinforcing steel	.05	.05	.06	.06	.05	.08	.07
484	ft. corrugated pipe, 18-in., place	.60	.60	1.00	.75	.75	1.00	.75
480	bbl. fuel oil	1.65	1.90	1.85	2.68	2.00	4.00	2.65
0.5	mile move and reset property fence	$200	$250	$300	$250	$250	$500	$300
1.6	mile new property fence	$450	$400	$500	$500	$250	$600	$550
95	sta. finishing roadway	4.00	4.00	5.00	5.00	4.00	6.00	5.00
16	monuments	3.00	3.00	3.00	3.50	3.00	3.00	3.00

HONOLULU, T. H.—GOVT.—GRADING AND PAVING

E. C. Mellor, 1427 Whitney St., Honolulu, T. H., $514,984 low bid to Territorial Highway Dept., Honolulu, T. H., for improving 16.6 miles of Haleakala Road. Bids received from following concerns:

(1) E. C. Mellor, Honolulu, T. H. $514,984
(2) Hawaiian Contracting Co., Ltd. 548,845
(3) Ralph E. Woolley 565,305
(4) C. H. Will $623,812
(5) H. J. Lord, Ltd., Honolulu 670,149
(6) L. L. McCandless 745,838

		(1)	(2)	(3)	(4)	(5)	(6)
240,000	cu.yd. roadway excavation	.60	.635	.79	1.08	1.25	1.25
500	cu.yd. structure bridge excav.	2.50	5.00	4.00	2.50	4.00	2.50
1,025	cu.yd. structure exc. not bridge	2.00	2.50	4.00	2.00	2.50	2.50
1,000	cu.yd. borrow	.60	.65	1.00	.50	.70	1.25
844	cu.yd. 'A' concrete (bridges)	32.50	31.50	32.25	30.00	26.50	33.50
852	cu.yd. 'A' concrete (structures)	30.00	26.75	24.00	30.00	22.75	27.30
485	cu.yd. 'B' concrete	25.00	27.60	29.50	25.00	23.00	22.75
485	cu.yd. cement rubble masonry	12.50	13.00	12.50	7.50	12.50	13.00
133,900	lb. reinf. steel (bridges)	.04	.05	.05	.0525	.05	.0625
86,778	lb. reinf. steel (other struct.)	.035	.05	.05	.0525	.045	.065
1,114	cu.yd. cement rubble mas. (paving)	12.50	11.00	12.50	7.50	15.00	12.50
1,181	cu.yd. hand-laid riprap	4.00	6.25	8.50	7.00	10.00	9.00
100	ft. 12-in. corr. pipe	2.05	2.00	2.00	2.35	2.10	3.10
1,689	ft. 18-in. corr. pipe	3.00	3.15	3.00	3.22	3.10	3.80
762	ft. 24-in. corr. pipe	4.50	4.75	4.40	4.87	4.60	5.25
620	ft. 36-in. corr. pipe	8.15	8.75	8.25	8.87	8.50	9.00
584	ft. 48-in. corr. pipe	10.75	11.50	12.75	12.28	11.20	12.00
80	cu.yd. dry rubble masonry	5.00	7.50	9.00	4.00	7.50	8.00
19,600	sq.yd. hand-laid rock shoulders	.80	1.07	1.57	.95	2.50	4.10
114,300	sq.yd. crushed rock base course	.85	.91	.61	.82	.68	.85
114,300	sq.yd. asphalt macadam surface	.85	.855	.85	.80	.765	.68
114,300	sq.yd. seal coat	.15	.15	.14	.11	.05	.17
8,346	ft. wood guard rail	.90	.80	.95	1.00	.75	1.10
14,000	ft. wire fence (wood posts)	.15	.25	.16	.17	.10	.22
65,000	ft. reconstruct fence	.075	.18	.14	.10	.075	.15
15	cattle gates	30.00	40.00	50.00	34.00	40.00	28.50
4	cattle guards	85.00	$125	$450	90.00	$150	$325
1	lowering Kula pipe-line	$250	66.00	$180	$400	25.00	75.00
200	ft. move existing pipe-lines	.10	.26	1.00	.20	.25	.30
58	highway signs	11.25	10.00	10.00	14.00	20.00	14.50
	Expansion units, except reinf. steel	$1500	$1773	$2500	$1400	$2500	$2500

SAN DIEGO, CALIF.—CITY—ASPHALT—CABLE ST. AND CORONADO AVE.

Griffith Co., 2104 Main St., San Diego, $149,379 low bid to City for improving Cable St., Coronado Ave., and other streets for City. Bids received from:

(1) Griffith Co., San Diego $149,379
(2) Daley Corporation, San Diego 154,538
(3) V. R. Dennis Const. Co., San Diego $169,392
(4) R. E. Hazard Contr. Co., San Diego 169,576

		(1)	(2)	(3)	(4)
32,947	cu.yd. excavation	.25	.30	.30	.32
5,197	cu.yd. embankment	.05	.05	.01	.05
683,244	sq.ft. 6-in. asphalt paving	.113	.116	.132	.12
683,244	sq.ft. prepare subgrade	.08	.05	.01	.01
144,271	sq.ft. cement sidewalk	.13	.14	.14	.1575
25,496	ft. concrete curb	.38	.40	.45	.50
5,657	ft. 6-in. concrete sewer	.75	.713	.60	.86
16	concrete manholes	60.00	60.38	65.00	70.00
140	4-in. concrete sewer laterals	17.00	18.88	20.00	21.00
933	ft. 4-in. 'C' cast-iron pipe	1.00	.97	.95	1.15
8	6-in. concrete sewer laterals	20.00	21.22	22.00	23.00
12,278	ft. 6-in. 'C' cast-iron main	1.10	1.18	1.15	1.25
16	fire hydrants	110.00	113.47	115.00	125.00
444	¾-in. water services	13.00	14.00	14.00	15.50

SAN DIEGO, CALIF.—CITY—39th ST.—CONCRETE

Contract awarded to Butterfield Construction Co., P.O. Box 157, San Diego, who bid $113,173 to City of San Diego for the improvement of 39th and other streets. Bids received from:

(1) Butterfield Const. Co., San Diego $113,173
(2) R. E. Hazard Contr. Co., San Diego 114,314
(3) Miracle Const. Co., San Diego $120,196
(4) Bert Noble, San Diego 120,499

		(1)	(2)	(3)	(4)
29,538	cu.yd. excavation	.63	.54	.45	.76
10,634	cu.yd. embankment	.10	.05	.01	.04
287,293	sq.ft. 6-in. concrete paving	.172	.19	.195	.179
287,293	sq.ft. mono-felt damp course sub-grade	.025	.02	.04	.026
13,838	lin.ft. special curb	.55	.50	.52	.479
1,697	lin.ft. 8-in. concrete sewer	1.50	1.75	1.50	1.40
2,594	lin.ft. 6-in. concrete sewer	1.35	1.55	1.40	1.34
19	manholes	80.00	75.00	85.00	78.00
4	deadends	10.00	7.50	10.00	.....
30	4-in. conc. sewer laterals	25.00	22.00	30.00	28.00
18	6-in. conc. sewer laterals	27.00	25.00	30.00	29.00
7725	lin.ft. 6-in. cast-iron main	1.60	1.70	1.50	1.80
8	fire hydrants	$135	$140	$150	$130
2	hydrants with shackle	$145	$155	$155	$145
156	water services	19.00	17.00	22.00	18.00
100	ft. 18-in. reinf. conc. culvert	3.50	4.00	4.25	5.00
4	curb inlets	$150	$110	$200	$130
	Junction box No. 1	$100	75.00	60.00	$175
	Junction box No. 2	$100	60.00	50.00	$175
246	ft. wire link guard fence	1.50	1.25	1.40	2.00
	Lower existing water main	$2200	$2500	$4500	$3400
141	ft. earth ditch	.25	.20	.75	.70

BERKELEY, CALIFORNIA—CITY—ASPHALT AND WARRENITE—SAN PABLO AVE.

Contract awarded to Western Roads Co., 1305 Twenty-eighth St., Oakland, $110,372, for improving San Pablo Ave. work for the city of Berkeley, Alameda County. Bids received from:

(1) Western Roads Co., Oakland $110,372
(2) Heafey-Moore Co., Oakland 116,907
(3) Bowersmith, Tuttle & John $119,623
(4) Hutchinson Co., Oakland 123,197

		(1)	(2)	(3)	(4)
163,500	sq.ft. grading	.065	.067	.068	.085
150	cu.yd. grading, below subgrade	1.15	1.10	1.50	1.50
163,500	sq.ft. 6-in. rock cushion	.065	.07	.08	.07
150	cu.yd. rock in subgrade	3.10	3.50	3.00	2.50
104,000	sq.ft. 3-in. asphalt base with 2-in. Warrenite Bit. surface	.185	.189	.20	.2025
190,000	sq.ft. Warrenite resurfacing	.09	.095	.10	.102
20	tons extra material, resurfacing	8.00	8.50	9.00	8.10
23,700	lin.ft. concrete curb and gutter	1.00	1.15	1.15	1.15
38,500	sq.ft. cement sidewalk	.185	.18	.20	.18
10,000	sq.ft. concrete driveway	.25	.25	.25	.26
766	ft. 27-in. concrete sewer	4.75	4.80	4.40	4.80
712	ft. 24-in. concrete sewer	4.00	4.20	3.50	4.40
445	ft. 21-in. concrete sewer	3.10	3.25	3.00	4.00
282	ft. 18-in. vitrified sewer	2.65	2.60	2.50	3.10
845	ft. 15-in. vitrified sewer	2.00	1.90	1.90	2.65
240	ft. 12-in. vitrified sewer	1.40	1.50	1.50	1.75
460	ft. 10-in. vitrified sewer	1.10	1.05	1.00	1.50
310	ft. 8-in. vitrified sewer	1.10	1.20	1.15	1.25
7	manhole tops on 24-in. catchbasins	19.50	20.00	20.00	20.00
14	manhole tops on 36-in. catchbasins	35.00	37.50	40.00	35.00
1	water seal, 24-in. catchbasin	15.00	10.00	25.00	11.50
8	water seals, 34-in. catchbasins	17.50	10.00	30.00	14.50
43	catchbasins	70.00	75.00	68.00	65.00
8	manholes	70.00	75.00	70.00	75.00
23	curb inlets	20.00	26.00	18.50	22.50
5	sewer traps, remove	6.00	7.50	5.00	4.00
26	electroliers, reset	$2,250	$2,400	$1,500	$2,000

Work under 1911-15 Acts. H. Goodridge is the City Engineer of Berkeley.

CONSTRUCTION NEWS SUMMARY

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

TABULATION OF AWARDS

Awards for the month of November, 1929, for construction projects in the Far Western States total $59,830,752, of which $23,051,752 was for *Building Construction, balance of $36,779,000 for Engineering Construction, as follows:

Paving	$ 6,375,000
Grading, highways	7,675,000
Bridges	3,050,000
Sewers	1,015,000
Water supply systems	1,370,000
Power development	10,250,000
River and harbor work	1,175,000
Railroad construction	5,000,000
Lighting systems	869,000
	$36,779,000
Building construction	23,051,752
	$59,830,752

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

LARGE WESTERN PROJECTS

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

WORK CONTEMPLATED

Concrete pipe-lines, pumping plants for Riverside County Water Works District 1, California; $690,000.

Seawall in Railroad Ave. for City of Seattle, Wash.; $1,172,000.

Canals, wells, pumps, distributing systems for Gila Bend Water Conservation District, Gila Bend, Ariz.; $365,000.

Pier addition for Neptune Pier Co., Long Beach, Calif.; $2,000,000.

Addition to Zion Hospital, San Francisco; $500,000.

Clinic building for University of Oregon at Eugene, Ore.; $400,000.

Textile tower building at Seattle, Wash.; $600,000.

Levee, timber piling, etc., Santa Clara River Project for City of Los Angeles; $400,000.

Tunnels, 10 miles in length at Owyhee damsite, Oregon, for U. S. Bureau of Reclamation.

Soap manufacturing plant at Long Beach for Procter & Gamble; $5,000,000.

Station at Los Angeles for Atchison, Topeka & Santa Fe RR.; $1,500,000.

Theatre on 20th and Broadway, Oakland, Calif., for Warner Bros.; $1,500,000.

Hotel at Sacramento, Calif., for Pickwick Auto Stage Corp.; $500,000.

Concrete and asphalt paving with Warrenite Bit. surface, Sepulveda Blvd., for City of Culver City; $350,000.

Warrenite paving, sewer, water and lighting systems, bridges, piers, etc. on Lido Island for City of Newport Beach, Calif.; $1,100,000.

Storm and sanitary sewer system for City of Tacoma, Wash.; $3,000,000.

Reinforced concrete pipe-lines, wells and pumps for Riverside County Water Works District No. 1, Riverside, Calif.; $690,000.

Terminal yard on Seventh St., Oakland, for Southern Pacific Co.; $200,000.

BIDS BEING RECEIVED

Concrete paving, 8½ miles, from Tunnel Station to Santa Clara River, for California Division of Highways; bids to Dec. 18.

Second Otay pipe-line for City of San Diego, Calif.; $1,500,000; bids to Dec. 23.

Concrete paving streets in Dickens St. and Kester St. District for City of Los Angeles; bids to Dec. 18.

Concrete paving, etc., Santa Ana Blvd, etc., for City of Santa Ana, Calif.; bids to Dec. 16; $360,000.

School, James Monroe Intermediate School, for City of Seattle; $600,000; bids to Dec. 18.

BIDS RECEIVED

Grading and asphalt macadam surfacing, 16 miles of Haleakala Road, for Territorial Highway Department, Honolulu, T. H.; E. C. Mellor, Honolulu, $514,984, low.

Concrete paving and grading in IMPERIAL COUNTY for California Division of Highways; A. M. Peck, Los Angeles, $312,057, low.

CONTRACTS AWARDED

Grain elevator and shipping gallery for Port of Tacoma, Wash., to Albertson-Cornell Bros., Tacoma, Wash., $520,956.

Piers for Lake Union Bridge at Seattle for Washington Highway Commission to Pacific Bridge Co., Portland, Ore., $502,274.

Steel and concrete, 14th Ave. South Bridge, for County, Seattle, Wash., to Puget Sound Bridge & Dredging Co., Seattle, $482,181.

Dam, tunnel, power house, power line, etc. for Powell River Co. to Stuart, Cameron & Co., Vancouver, B. C., $2,000,000.

Reinforced concrete, Section 5 Jefferson St. Storm Drain System, for City of Los Angeles, to J. Artukovich, Los Angeles, $323,271.

STREET and ROAD WORK

WORK CONTEMPLATED

CULVER CITY, CALIF.—Plans by City Engineer, Geo. Lee, Culver City, Los Angeles County, for improving Sepulveda Blvd. from Venice Blvd. to Centinela Blvd., work involving 472,000 sq.ft. 6-in. asphalt base with 2-in. Warrenite Bit. surface, 450,000 sq.ft. 6-in. concrete base with 2-in. Warrenite Bit. surface, 34,000 sq.ft. cement sidewalk, 24,000 sq.ft. concrete gutter, 24 catchbasins, 475 ft. 42-in. reinforced concrete paving; 470 ft. 15-in. 35 ft. 30-in., 290 ft. 18-in. reinforced concrete pipe; 89 ft. 24-in. corrugated iron pipe, 1,620,000 sq.ft. grading, 8400 lin.ft. concrete curb; $350,000. 12-3

HOLLISTER, CALIF.—City is considering the paving of South St. from San Benito St. to the city limits. A. M. McCray is City Engineer of Hollister. 11-30

LOS ANGELES, CALIF.—Plans by County Surveyor, J. E. Rockhold, protests Dec. 18, for improving Jefferson Blvd. from P. E. RR northwest, and other streets, work involving 83,800 cu.yd. excavation, 241,050 sq.ft. 9-7-in. Vibrolithic concrete paving, 259,950 sq.ft. 4½-in. disintegrated granite subbase, 58,800 sq.ft. 4½-in. disintegrated rock shoulders with oil and rock surfacing; Constructing headwalls and culverts: 645 ft. 18-in., 275 ft. 24-in., 130 ft. 30-in. corrugated iron pipe, and 131 ft. 22-in. reinforced concrete pipe; $132,500. 12-3

NEWPORT BEACH, CALIF.—Plans by City Engineer, R. L. Patterson, for improving streets at Lido Island, involving 36,100 cu.yd. excavation, 737,509 sq.ft. 6-in. and 271,755 sq.ft. 4-in. Warrenite Bit. paving, 29,000 ft. 6-in. to 15-in. vitrified sewers, 2571 ft. 8-in. cast-iron sewer, 5 pleasure piers, 38,000 ft. 4-in to 6-in. cast-iron mains, valves, hydrants, steel bridge, lighting system, etc.; $1,100,000. 11-26

SAN DIEGO, CALIF.—Plans by H. W. Jorgensen, City Engr., for improving Cooper St., involving 79,730 sq.ft. 6-in. asphalt paving, 1693 ft. 6-in., 614 ft. 8-in., and 395 ft. 10-in. cast-iron mains, 4 hydrants, reinf. conc. and concrete sewers, corr. culverts. Bids after Dec. 16. 11-22

SAN LUIS OBISPO, CALIF.—Plans made, protests by County Dec. 16, for: (1) County Improvement Dist. 9, portions of various streets in and adjacent to subdivision No. 2 of Oceano Beach and No. 3 of Oceano Beach, work consisting of grading, paving with Warrenite Bitulithic with gravel subbase, gravel paving, pine header boards, constructing concrete gutters and sidewalks, wooden pile bulkheads, welded steel pipe, valves, fire hydrants, corrugated culverts, ornamental street lighting system, etc.; and (2) County Improvement District No. 17, improvement of portions of Pier Ave. Boulevard, Grand Pacific Boulevard, First St., Strand Ave., McCarthy Ave., Juanita Ave., etc., located near the town of Oceano. Work consists of grading, paving with Warrenite Bitulithic, constructing concrete gutters, sidewalks and curbs, timber bulkheads, corrugated pipe, etc. 1921 Act. 11-30

SANTA CRUZ, CALIF.—Plans by City Engr., R. Fowler, protests December 16, with reference to improvement of portions of Rathburn Ave., work consisting of grading, paving with 5-in. concrete, constructing concrete curbs, concrete sidewalks, concrete driveways, approaches, vitrified pipe sewers, corporation cocks, stop cocks, etc. Work under 1911 Improvement Act. 11-30

SOUTH SAN FRANCISCO, CALIF.—Plans by Engr., Geo. A. Kneese, Court House, Redwood City, protests to be heard by City of South San Francisco, San Mateo County, on December 16, with reference to improving Linden Ave. from Railroad Ave. to San Bruno Road, work consisting of paving with 6-in. concrete base with 2-in. asphalt surface, grading, curbs, gutters, sidewalks, 2 reinf. concrete walls, concrete pipe storm sewers, vitrified pipe sewers, and installation of 86 electroliers, etc. Work is to be done under the 1911-15 Acts. 11-30

TUJUNGA, CALIF.—Plans by E. M. Lynch, Engr., Central Bdg., L. A., for improving Michigan Ave., involving 313,936 sq.ft. grading, 137,013 sq.ft. 9-6-in. and 17,500 sq.ft. 8-in. concrete paving, curbs, lighting system, corr. culverts, retaining walls, etc. $92,000. Bids after Dec. 18. 11-25

BIDS BEING RECEIVED

LOS ANGELES, CALIF.—Bids to 2 p.m., Dec. 30, by County for improving Virginia Ave. near Lynwood, involving 5000 cu.yd. excavation, 23,000 ft. curb, and 99,000 sq.ft. sidewalks; $28,500.

LOS ANGELES, CALIF.—Bids to 10 a.m., Dec. 18, by City for improving streets in Dickens St. and Kester Ave. District, involving: grading (lump sum bid), 1,091,599 sq.ft. 6-in. concrete paving, 1760 ft. lighting concrete curb, concrete curtain wall complete, storm drain system, sanitary sewer system, 27,500 ft. house sewers, water system complete, 473 water services, ornamental lighting system complete. 12-2

LOS ANGELES, CALIF.—Bids to 2 p.m., Dec. 16, by County for improving Floral Drive, Brannick St., etc., near Belvedere, a distance of 1.5 miles, work involving: 14,500 cu.yd. roadway excavation, 208,600 sq.ft. 8-6-8-in. concrete paving, 37,675 sq.ft. 8-in. concrete paving, 250,080 sq.ft. 5-in. macadam and disint. dock subbase, 54 ft. 18-in. reinf. concrete pipe. 12-2

NEWPORT BEACH, CALIF.—Bids to Dec. 16 by City for improving Seville Ave., involving 80,555 sq.ft. 6-in. concrete paving, 2555 ft. 8-in. vitrified sewers, 1507 ft. 6-in. and 1453 ft. 4-in. cast-iron pipe, gate valves, fire hydrants, lighting system, etc.

SACRAMENTO, CALIF.—Bids to 2 p.m., Dec. 26, by California Division of Highways for 5 miles from Dixieland to Seeley, IMPERIAL COUNTY, involving 32,600 cu.yd. roadway excavation, 17,500 tons asphalt paving. 11-27

SACRAMENTO, CALIF.—Bids to 2 p.m., Dec. 18, by California Division of Highways for 8.5 miles concrete paving in LOS ANGELES COUNTY from Tunnel Station to Santa Clara River, involving 30,800 cu.yd. 'A' concrete paving, 712,000 lb. reinf. steel, etc. 11-20

SACRAMENTO, CALIF.—Bids to 2 p.m., Jan. 2, by California Division of Highways for: (1) KERN COUNTY—15 miles grading and surfacing, from Cinco to 7 miles north of Ricardo, involving 228,000 cu.yd. roadway excavation, 33,400 tons crusher-run base, 24,600 tons oil-treated gravel or stone surfacing, corrugated pipe; (2) TULARE COUNTY—8.6 miles grading and asphalt paving from Pixley to Tipton, involving 29,100 cu.yd. roadway excavation, 34,500 tons asphalt paving, 69,800 cu.yd. imported borrow, corrugated pipe, etc.; and (3) LOS ANGELES COUNTY—1.2 miles grading and concrete paving at Liberty Grade, 5 miles west of Calabassas, involving 95,000 cu.yd. roadway excavation, 2840 cu.yd. concrete paving, 83,500 lb. reinforcing steel, etc. 12-4

SAN DIEGO, CALIF.—Bids to Dec. 16 by City Clerk for: (1) Improving Castle Ave., involving 20,801 sq.ft. 6-in. asphalt paving, 681 ft. 6-in. cast-iron main, 2 hydrants, concrete sewers; and (2) Improving Coronado Ave., involving 51,330 sq.ft. 6-in. asphalt paving, 1267 ft. 6-in. cast-iron pipe, 2 hydrants. 11-30

SAN DIEGO, CALIF.—Bids to 11:15 a.m., Dec. 16, by County Clerk for: (1) Grading 5.58 miles of Murphy Canyon Road from City of San Diego north, involving 125,800 cu.yd. roadway excavation, 1 90-ft. reinf. conc. bridge, 2 triple 6 by 10-ft. reinf. conc. culv., 2 double 6 by 10-ft. reinf. conc. culv., 3 ft. corrugated culvert; and (2) Paving 3 miles from Escondido toward Valley Center, involving 7693 cu.yd. excavation, 285,120 sq.ft. paving with 5-8-in. concrete or 6-in. asphalt. These are cash jobs. Plans from E. R. Childs, County Surveyor, Court House, San Diego. 11-29

SAN FRANCISCO, CALIF.—Bids to 2 p.m., Dec. 18, by Board of Public Works for improving Prospect Ave., from Coso Ave. to Esmeralda, involving paving with 6-in. concrete base with 1½-in. asphalt surface; $800. 12-3

SANTA ANA, CALIF.—Bids to 7 30 p.m., Dec. 16, by City for improving Santa Ana Blvd., Broadway, Flower St., etc., involving: 14,360 cu.yd. cut, 14,900 cu.yd. fill, 649,800 sq.ft. concrete paving, 22,300 lin.ft. concrete curb, 26,000 sq.ft. cement sidewalk, 534 ft. 6-in. vitr. sewer, 1740 ft. 8-in. vitrified sewer, 780 ft. 10-in. vitrified sewer, 660 ft. 6-in. cast-iron sewer, 8 manholes, 5205 ft. 6-in. cast-iron water main, 1135 ft. 4-in. cast-iron water main, 32 7-ft. copper water services, 36 51-ft. copper water services, 6 fire hydrants, lighting system using King standards, culverts and storm drains, 124 Douglas Fir piles, 2535 ft. dry rubble walls; Santa Ana Blvd. Bridge, involving: 1245 cu.yd. concrete, 268,500 lb. reinforcing steel; Flower St. Bridge, involving: 1737 cu.yd. concrete, 265,000 lb. reinforcing steel, 5260 cu.yd. excavation, 40 ft. 10-in., 107 ft. 12-in., 875 ft. 16-in., and 70 ft. 24-in. concrete pipe. Estimated cost $360,000. 12-2

SANTA CLARA, CALIF.—Bids to 8 p.m., Dec. 18, by City Clerk for: (1) Improving Lafayette St., involving 170,200 sq.ft. 2-in. asphalt surface on 4-in. asphalt base with 3-in. quarry waste foundations, vitrified sewers, curbs, gutters, etc.; (2) Madison, Jefferson, University Sts., etc., involving 491,295 sq.ft. 1½-in. asphalt surface on 3½-in. asphalt base with 3-in. quarry waste foundation, 85,892 sq.ft. 2-in. asphalt surface on 4-in. asphalt base with 3-in. quarry waste foundations, vitrified sewers, curbs, gutters, etc.; and (3) Sherman, Lexington, Fremont Sts., etc., involving 390,016 sq.ft. 5-in. and 283,463 sq.ft. 6-in. concrete paving, vitrified sewers, curbs, gutters, sidewalks, etc. 1911-15 Acts. 12-3

SOUTH SAN FRANCISCO, CALIF.—Bids to 7:30 p.m., Dec. 16, by City Clerk for improving 3rd St., involving 12,500 sq.ft. 6-in. water-bound macadam paving, 37,000 sq.ft. 3-in. asphalt surface, vitr. sewers. 11-23

STOCKTON, CALIF.—Bids to 11 a.m., Dec. 23, by County Clerk for embankment across Whiskey Slough, shaping roadbed and installing culverts. 11-29

PORTLAND, ORE.—Bids to 10 a.m., December 12, by Oregon State Highway Commission, Multnomah County Courthouse, Portland, Oregon, for the following work: BAKER COUNTY—12.4 miles regrading and resurfacing Pleasant Valley-Durkee Section of the Old Oregon Trail, work involving 100,000 cu.yd. excavation, production of 54,000 cu.yd. of broken stone; BENTON COUNTY—18.7 miles resurfacing and furnishing of broken stone for maintenance on Lincoln County Line-Alsea Mountain Section of the Alsea Highway, work involving 13,000 cu.yd. of broken stone; LAKE COUNTY—19.8 miles grading East Forest Boundary-Silver Lake Section of Fremont Highway, work involving 165,000 cu.yd. of roadway excavation; LANE COUNTY—21 miles resurfacing and furnishing materials for maintenance purposes on Nimrod-Belknap Springs Section of the McKenzie Highway, work involving 41,000 cu.yd. of broken stone and crushed gravel; LINCOLN COUNTY—2.85 miles grading Yachats-Lane County Line Section of the Roosevelt Coast Highway, work involving 123,000 cu.yd. of roadway excavation; LINN COUNTY—1.9 miles grading Ranger Station-Bryant Hill Sect. of Santion Highway, work involving 79,000 cu.yd. of roadway excavation. 11-30

PORTLAND, ORE.—Bids to 10 a.m., Jan. 3, by Bureau of Public Works for improving Siuslaw National Forest, LANE COUNTY, Oregon: (1) 2.4 miles Section 7C, involving 105,200 cu.yd. excavation, timber bridge, corrugated pipe; (2) 2.8 miles Section 7D, involving 164,150 cu.yd. excavation, timber bridge, culverts, and (3) Section 7E, involving 133,300 cu.yd. roadway excavation, timber bridge, corrugated pipe, etc. 12-4

BIDS RECEIVED

PHOENIX, ARIZ.—Southwest Paving Co., Washington Bdg., Los Angeles, $57,452, low bid for oil processing 12.5 miles Douglas-Rodeo Highway, from Douglas northeast, for State. 12-4

SACRAMENTO, CALIF.—Low bids as follows by California Division of Highways: IMPERIAL COUNTY—A. M. Peck, 2966 Allesandro St., Los Angeles, $312,057, low for 10.4 miles grading and concrete paving from Brawley to 4 miles west of Westmorland; and TEHAMA and PLUMAS COUNTIES—E. B. Bishop, Regis Hotel, Sacramento, $59,265, only bid for 21.7 miles grading and surfacing with untreated gravel or stone from Morgan Springs to Lake Almanor. 12-4

STOCKTON, CALIF.—W. H. Hauser, 3129 E. Seventh St., Oakland, $11,750, low bid to City for grading and bridge work on mountain road to Calaveras Dam. 12-3

HELENA, MONT.—Bids as follows by State: (1) Morrison-Knudsen Co., Boise, Ida., $97,768 low for 5 miles grading Wolf Creek-Cascade Highway; (2) B. Helean, Missoula, Mont., $39,874 low for grading 5 miles Knowles-Weeksville Highway; (3) Morrison-Knudsen Co., Boise, Ida., $217,136 low for 6 miles grading Libby-Troy Highway; and (4) C. & F. Teaming & Trucking Co., Butte, Mont., $89,786 low for 15 miles grading Georgetown-Lake Highway.

HONOLULU, T. H.—E. C. Mellor, 1427 Whitney St., Honolulu, T. H., $514,984 low bid to Territorial Highway Dept., Honolulu, for 16.6 miles grading, bridges, and rock base with asphalt macadam surface paving on 16 miles of Haleakala Road. (See Unit Bid Summary.) 11-27

CONTRACTS AWARDED

HOLBROOK, ARIZ.—To Southwest Paving Co., Washington Bdg., Los Angeles, who bid $52,206 for improvement of portions of Porter, Montana, Oakland, Santiago and South Central Aves., work consisting of paving with 6-in. Bitumuls, work for the City. 11-25

PHOENIX, ARIZ.—Awards as follows by Arizona State Highway Comm.: (1) Contract awarded to Henry Galbraith, Jerome, Arizona, who bid $82,635 for grading and constructing bridges on the Ashfork-Kingman Highway beginning at Ashfork and extending west from 6 miles toward Creeokton; and (2) Contract awarded to Hodgman & MacVicar, 714 Plymouth Road, Pasadena, who bid $103,204 for 17 miles grading of the Florence-Tucson Highway from Coolidge south toward Pichaco. (See Unit Bid Summary, November 25th issue.) 11-25

BERKELEY, CALIF.—To Western Roads Co., 1305 28th St., Oakland, $110,372 for paving with asphalt base and Warrenite Bit. surface, curbs, concrete and vitrified sewers, etc., on San Pablo Ave. for City. (See Unit Bid Summary.) 12-3

BURBANK, CALIF.—Awards as follows by City: (1) To Gibbons & Reed, 221 E. San Fernando Blvd., Burbank, $39,737 for Sunset Canyon Drive, concrete paving, water mains, etc.; (2) To Geo. H. Oswald, 366 E. 58th St., L. A., $32,713 for improving Glenoaks Blvd., concrete paving, culverts and water mains; and (3) To Gibbons & Reed, $32,761 for Flower St., asphalt paving, water mains, etc. Bids issue of Nov. 21. 11-29

FRESNO, CALIF.—Awards as follows by City: (1) To Thompson Bros., Fresno, $2064 for concrete paving Alley Block 36; and (2) To California Street & Road Impr. Co., Fresno, $1919 for asphalt paving Alley Block 9. 11-30

LONG BEACH, CALIF.—Awards as follows by City: (1) To P. P. Janich, Pacific Southwest Bank Bdg., Long Beach, $37,256 for improving 31st St., Cedar St., etc., grading, disint, granite paving, curbs, gutters, water mains, gas mains, etc.; and (2) To P. P. Janich, Pacific Southwest Bank Bdg., Long Beach, $13,258 for the improvement of portions of 53rd St. from Long Beach Blvd. to Linden Ave., involving curb, sidewalk, cast-iron water mains, etc. 11-21

LOS ANGELES, CALIF.—To Will F. Peck Co., 1120 Las Palmas St., Los Angeles, $30,852 for improving Nordhoff St., from Balboa to Lindley Ave., for City, grading, concrete paving, water system, etc.

LOS ANGELES, CALIF.—To John Papac, 726 N. Hill St., Los Angeles, who bid $135,540 for improving Devonshire St. from Zelzah Ave. to Santa Susanna Ave., work consisting of grading, concrete paving, oiled roadway, culverts, water mains, etc., work for the City. 11-21

PALO ALTO, CALIF.—To W. A. Dontanville, Box 65, Salinas, $8534

for improving Middlefield and Embarcadero Roads for City, concrete paving. 11-26

SACRAMENTO, CALIF.—Awards as follows by California Division of Highways: ORANGE COUNTY—To Macco Construction Co., Clearwater, who bid $201,545 for 6.4 miles grading and concrete paving from Sunset Beach to Newport Beach; SANTA BARBARA COUNTY—To Cornwall Const. Co., Santa Barbara, who bid $17,483 for 5.5 miles widening with oil-treated crusher-run base from Eagle Creek to El Capitan Creek. (See Unit Bid Summary, Nov. 25th issue.) 11-27

SACRAMENTO, CALIF.—To Griffith Co., Los Angeles Railway Bdg., Los Angeles, $38,288 for 2.3 miles grading and paving with asphalt concrete from Conejo Creek to Camarillo, VENTURA COUNTY, work for the California Division of Highways. 11-25

SACRAMENTO, CALIF.—To H. H. Boomer, 284 Mills Bdg., S. F., who bid $74,977 for grading and surfacing with untreated crushed gravel or stone in HUMBOLDT COUNTY from Garberville to Bluff Creek, for the California Division of Highways. (See Unit Bid Summary, Nov. 25th issue.) 11-20

SALINAS, CALIF.—To M. Rosenberg, 12 Oak Grove Ave., San Francisco, $4828 for hauling and dumping 19,314 cu.yd. gravel on San Lucas-Lockwood Road for County. 12-3

SAN DIEGO, CALIF.—Awards as follows by City: (1) To Butterfield Const. Co., P.O. Box 157, San Diego, $113,173 for improving 39th and other streets, concrete paving, grading, concrete sewers, cast-iron mains, etc.; and (2) To B. G. Carroll, 4396 Maryland St., San Diego, $22,389 for improving Florida St., grading, concrete paving, cast-iron mains, concrete sewers, fire hydrants, etc. (See Unit Bid Summary.) 11-27

SAN DIEGO, CALIF.—Awards as follows by City: (1) To Griffith Co., 2014 Main St., San Diego, $149,379 for improving Coronado Ave., etc., asphalt paving, concrete sewers, cast-iron mains, etc., and (2) To Daley Corp., 4430 Boundary St., San Diego, $56,373 for improving Newton Ave., asphalt paving, cast-iron mains, concrete sewers. (See Unit Bid Summary.) 12-4

SAN FRANCISCO, CALIF.—Awards as follows by City: (1) To E. J. Treacy, Call Bdg., S. F., $656 for improving Faxon Ave. from Thrift to Montana, curbs and concrete paving; (2) To M. J. Lynch, 478 38th St., S. F., $675 for Balboa St. at 42nd Ave., bituminous rock or artificial stone sidewalks; (3) To Municipal Const. Co., Call Bdg., S. F., $1494 for crossing of Sargent and Victoria Sts., stone sidewalks, curbs, vitr. culverts and sewers, 6-in. concrete base with 1½-in. asphalt surface; (4) To M. Bertolino, 32 Shotwell St., S. F., $1662 for Josiah Ave. from Lakeview to Summit, concrete curbs, vitr. sewers, sidewalks, and concrete paving; and (5) To Fay Improvement Co., Phelan Bdg., S. F., $501 for improving Belle Ave. from St. Charles Ave. to Chester Ave., curbs, side sewers, 6-in. concrete base with 1½-in. asphalt surface. 11-27

SAN FRANCISCO, CALIF.—Award recommended to Contoules Const. Co., 46 Collins St., S. F., $89,900, using corr. pipe, for grading Project 2A4 from Grouse Creek to Turtleback Dome on Valley to southern boundary section of Wawona Road, Yosemite National Park, 2.19 miles, for Bureau of Public Roads. (See Unit Bid Summary.) 11-26

SAN FRANCISCO, CALIF.—Award recommended to Pearson & Dickerson, 1451 Cypress Ave., Riverside, $22,154 using corrugated pipe for grading 1.9 miles Idyllwild National Forest Highway, RIVERSIDE COUNTY, for Bureau of Public Roads. 12-3

SAN JOSE, CALIF.—To San Jose Paving Co., San Carlos and Dupont Sts., San Jose, who bid $9320 for improving Vestal Ave. from 17th St. to 13th St., consisting of grading, paving with 2½-in. asphalt base with 1½-in. asphalt surface, curbs, gutters, vitrified sewers. 11-27

SANTA MARIA, CALIF.—To Santa Maria Construction Co., Santa Maria, $28,301 for asphalt paving E. Main, E. Tunnel St., etc., for City. 12-4

SONORA, CALIF.—To W. C. Colley, Mark West Springs Hotel, Santa Rosa, $14,500 for 3.51 miles grading, corrugated culverts on Yankee Hill Road for County. 12-3

VENTURA, CALIF.—To Chas. G. Willis & Sons, 2119 E. 25th St., Los Angeles, $271,030 for 6 miles grading Section C of the Cuyama Division of the Maricopa-Carpinteria Road, from near Cuyama River to the summit of Pine Mountain, work for Joint Highway District No. 6. (See Unit Bid Summary, November 25th issue.) 11-20

LAS VEGAS, NEV.—Awards as follows by City for improvement of portions of Main St., First St., Second, and other streets: (1) Contract awarded to General Construction Co., Las Vegas, Nevada, who bid $82,200 for Durite asphalt paving; and (2) Contract awarded to R. E. Hazard Contracting Co., 2548 Kettner Blvd., San Diego, who bid $52,000 for grading, constructing curbs, concrete gutters, sidewalks, etc. 12-2

OLYMPIA, WASH.—Awards as follows by State Highway Comm.: (1) To Moran Const. Co., Seattle, $33,558 for 2.2 miles grading and surfacing Ilwaco-North Head Highway, PACIFIC COUNTY; and (2) To Joplin & Eldon, Portland, $60,312 for 19.3 miles surfacing Olympic Highway from Tyee to Hoh River, CLALLAM AND JEFFERSON COUNTIES.

BRIDGES and CULVERTS

WORK CONTEMPLATED

FRESNO, CALIF.—Plans to be prepared for constructing Belmont Ave. subway under Southern Pacific tracks for the City of Fresno, to cost $200,000. A. M. Jensen is City Engineer of Fresno. 11-30

BIDS BEING RECEIVED

SACRAMENTO, CALIF.—Bids to 2 p.m., Dec. 18, by California Division of Highways for 6 timber bridges, TEHAMA COUNTY, east of Red Bluff, involving 275 M ft. BM Douglas Fir timber, 170 cu.yd. 'B' concrete, etc. 11-20

STOCKTON, CALIF.—Bids to 11 a.m., Dec. 23, by County Clerk for timber bridge over North Fork of Calaveras River on Tully Road. 11-29

PORTLAND, ORE.—Bids to 10 a.m., Dec. 12, by State Highway Comm. for bridge over Rogue River on Pacific Highway at Grants Pass. Work involves: 2400 cu.yd. excavation, 3510 cu.yd. concrete, 411,000 lb. reinforcing steel, 1186 ft. concrete handrail, 8000 ft. piling. 11-29

BIDS RECEIVED

SACRAMENTO, CALIF.—Low bids as follows by California Division of Highways: (1) MARIN COUNTY—Butte Cons. Co., 2014 Folsom St., S. F., $157,339 low for steel, concrete, and timber bridge over Corte Madera Creek at Greenbrae; (2) SHASTA COUNTY—R. B. McKenzie, Red Bluff, $18,563 low for timber bridges on Redding to Alturas Lateral; and (3) LOS ANGELES COUNTY—Whipple Engr. Co., 183 N. Madison St., Monrovia, $31,419 low for reinf. conc. bridge over La Canada Canyon, near La Canada. (See Unit Bid Summary.) 11-29

CONTRACTS AWARDED

BAKERSFIELD, CALIF.—To V. J. Stoll, Bakersfield, $3421 for reinforced concrete siphon at Stine Canal for City. 12-4

BERKELEY, CALIF.—To Triberti & Massero, 957 38th St., Oakland, $451 for conc. retaining wall on Hawthorne Terrace for City. 11-26

MERCED, CALIF.—Awards as follows by County: (1) To Roy Kruger, Gustine, $3260 for timber bridge 205 over Mud Slough on Fremont Rancho. C. C. Gildersleeve, Felton, $3981, next lowest bidder. (2) To Roy Kruger, Gustine, $1600 for timber bridge 206 over Deep Slough on the Fremont Road. C. C. Gildersleeve, Felton, $1980, next low. 12-4

SACRAMENTO, CALIF.—To M. A. Jenkins, 36th and Y Sts., Sacramento, $3638 for 96-ft. redwood bridge over Dry Creek near Rio Linda for County. 11-29

SACRAMENTO, CALIF.—To Smith Bros. Co., Eureka, who bid $25,245 for suspension bridge over the north fork of the American River, 2½ miles east of Auburn, PLACER AND EL DORADO COUNTIES, work for the California Division of Highways, consisting of 322-ft. suspension span with timber trusses and deck of timber. 11-25

SACRAMENTO, CALIF.—Awards as follows by California Division of Highways: IMPERIAL COUNTY—To deWaard & Sons, Granger Bdg., San Diego, $14,659 for concrete undergrade crossing under San Diego & Arizona RR. near Coyote Wells; SAN BERNARDINO COUNTY—To Pittman & Hippenstiel, Riverside, $13,087 for reinf. conc. bridge near Tajon Station. 11-27

TULARE, CALIF.—To Earl Bowan, Strathmore, $753 for reinf. conc. bridge No. 88 over Travers Canal for County. 11-21

OLYMPIA, WASH.—To Pacific Bridge Co., E. Water and Salmon Sts., Portland, $502,274, Prop. 1, using timber piling for piers, for Lake Union Bridge, Seattle, for State Highway Commission. (See Unit Bid Summary.) 11-27

SEATTLE, WASH.—To Puget Sound Bridge & Dredging Co., Central Bdg., Seattle, who bid $482,181 for constructing 1356-ft. steel and concrete bridge on 14th Ave. South over Duwamish Waterway, work for County Commissioners of King County. 11-29

SEWER CONSTRUCTION

WORK CONTEMPLATED

OJAI, CALIF.—Plans by Engrs., Black & Veatch, Ferguson Bdg., L. A., for enlargements to sewage plant, involving sludge tanks, sprinkling filter beds, chlorination plant, and sludge drying beds. $20,000. Work for City. 12-2

OJAI, CALIF.—Bonds voted, $20,000, by City for enlargements to sewage treatment plant, involving sludge tanks, sprinkling filter beds, chlorination plant, and sludge drying beds. H. B. Waud, 428 Oak St., Ventura, is Engr. 11-25

REDWOOD CITY, CALIF.—Plans by County Surveyor, Geo. A. Kneese, Court House, Redwood City, San Mateo County, and protests will probably be heard the latter part of December (resolution of intention to be introduced December 9) with reference to the construction of a complete sewer system in portions of town of Atherton and North Fairoaks. Work involves the following approximate quantities: 200,000 lin.ft. 6-in., 8-in., 10-in., 12-in., 15-in., 18-in., and 30-in. pipe sewer, part vitrified and part concrete. Work is to be done under the 1921 and 1911 Acts. 12-3

SAN JACINTO, CALIF.—Plans by Engrs., Koebig & Koebig, Rowan Bdg., L. A., for sewer improvements as follows for City: Imhoff tank, sewer farm, chlorination control; main line sewers and lateral sewers, involving 34,571 lin.ft. 8-in., 5473 lin.ft. 10-in., and 1345 lin.ft. 12-in. pipe sewer. $90,000. 1925 Act. Bids soon. 11-22

SEBASTOPOL, CALIF.—Bonds voted, $22,000, by City for sewage disposal plant. C. E. Mueller is City Engineer. 11-27

TACOMA, WASH.—Plans by City Engineer, C. E. Putnam, protests Dec. 9, for sanitary and storm water trunk sewer system as follows: Unit A, Dock St. Interceptor, involving construction of 96-in. to 66-in. sewers. Unit B, South Tacoma Trunk Sewer Main Line, involving 84-in. to 24-in. sewers. Unit C, Wapato Branch, involving construction of 48-in. to 15-in. sewers. Unit D, Fern Hill Branch, involving construction of 36-in. to 18-in. sewers. Unit E, Manito Branch, involving construction of 24-in. to 12-in. sewers. Unit F, Oakland Branch, involving construction of 39-in. to 18-in. sewers. Unit G, Cedar St. Branch, involving construction of 30-in. to 18-in. sewers. Unit H, Wilkerson Branch, involving construction of 24-in. to 10-in. sewers. Unit I, Tacoma Eastern and Pacific Ave. Trunk Gulch Sewer, involving construction of 42-in. to 18-in. sewers. Unit J, McKinley Park Trunk Sewer, involving construction of 42-in. to 12-in. sewers and dredging and sheet piling banks of creek north of Puyallup Ave. Unit K, East B St. Pumping Station, involving pump house and sewage pumping equipment on East B St. from S. 23rd St. to City Waterway. Unit L, Bay St. pumping Station—A pump house and sewage pumping equipment complete in the vicinity of the intersection of Puyallup Ave. and Bay St. with discharge line from this point to E. 25th St., etc. 11-26

CONTRACTS AWARDED

BERKELEY, CALIF.—To J. M. Heafey, 1707 Cedar St., Berkeley, $730 for manholes and catchbasins on Jaynes St. for City. 11-26

LOS ANGELES, CALIF.—To J. Artukovich, 4928 West Blvd., Los Angeles, $323,271 for Section 5, reinforced concrete Jefferson St. Storm Drain System for City. 12-4

LOS ANGELES, CALIF.—To P. J. Akmadzich, Wilcox Bdg., L. A., $34,146 for cement sewers in Deane Ave. and other streets for County.

WATER SUPPLY SYSTEMS

WORK CONTEMPLATED

DOWNEY, CALIF.—Bonds voted by Downey County Water District, Downey, Los Angeles County, in amount of $195,000, for the construction of water system improvements, involving the construction of a 2,000,000-gallon storage tank, installation of water mains, and two wells and pumping plants. Burns, McDonnell, Smith Engineering Co., Western Pacific Bdg., Los Angeles, are the Consulting Engineers. 12-2

FRESNO, CALIF.—Petitions will be heard Dec. 16 by County for formation of County Water Works Dist. 1, planning deep wells and pumping plants to cost $65,000. 11-25

RIVERSIDE, CALIF.—Bonds voted, $690,000, by Riverside County Water Works District No. 1 for: 24 deep wells, of which 22 are to be equipped with motors, pumps, casing, valves; 3300 lin.ft. 20-in., 7900 ft. 16-in., 39,000 ft. 14-in., 29,000 ft. 12-in., 3000 ft. 10-in. reinforced concrete pipe, D.S., and valves, and 105,000 ft. high-pressure reinforced concrete pipe and valves, 210,000 ft. low-pressure concrete pipe and valves, and 75 miles of right-of-way. 12-4

RIVERSIDE, CALIF.—Bond election Dec. 2 by County to vote $690,000 for improvements in Riverside County Water Works Dist. No. 1, involving: 24 deep wells, of which 22 are to be equipped with motors, pumps, casing, valves, etc.; 3300 lin.ft. 20-in., 7900 lin.ft. 16-in., 39,000 lin.ft. 14-in., 29,000 lin.ft. 12-in., and 3000 lin.ft. 10-in. reinforced concrete double-strength pipe and valves, etc.; 105,000 lin.ft. high-pressure reinforced concrete pipe and valves, etc.; 210,000 lin.ft. low-pressure concrete pipe and 75 miles of right-of-way. A. C. Fulmor is County Surveyor. 11-22

STOCKTON, CALIF.—City is considering purchase of 20 hydrants to cost $4000. 11-27

STRATFORD, CALIF.—Petitions circulated with reference to the formation of the Stratford Water District to furnish water and construct works in the City of Stratford, Kings County. 11-22

WATSONVILLE, CALIF.—Bonds voted, $125,000, by City for: Improving Ford St. wells, including two deep-well pumping plants, pump house, piping, water measuring and recording device, $5000; improving main reservoir, grading, concrete work, wooden roof with concrete piers, installing Venturi meter, etc., $32,300; filter plant at Corralitos, including grading, filter plant structures, underdrains and sand, piping and equipment, by-pass, water measuring and recording devices, $69,900; filtered water reservoir at Corralitos, $12,000; elevated reservoir at Corralitos, including necessary excavation and structures, main pipe and pressure control, $7800. H. B. Kitchen is City Engineer and Chas. Gilman Hyde, Berkeley, is Consulting Engineer. 11-20

WHITTIER, CALIF.—At election held Nov. 19 City defeated proposition to vote $310,000 for wells, pumps, pipe-lines, reservoirs, etc. 11-22

BIDS BEING RECEIVED

LOS ANGELES, CALIF.—Bids to 10 a.m., Dec. 12, by Purchasing Agent, Los Angeles Water & Power Bureau, 207 S. Broadway, Los Angeles, for furnishing and erecting one 500,000-gallon elevated steel water tank on Ways St. and Terminal Way. 11-29

LOS ANGELES, CALIF.—Bids to 2 p.m., Dec. 16, by County for steel work at water tower, County Farm, near Hondo. 11-30

LOS ANGELES, CALIF.—Bids to 10 a.m., Dec. 18, by Purchasing Agent, City Water & Power Bureau, for two 30-in., one 26-in., one 24-in., and one 42-in. gate valve. 11-30

SAN DIEGO, CALIF.—Bids to 10 a.m., Dec. 23, by City Clerk, San Diego, for constructing 19-mile Otay Reservoir-San Diego second main pipe-line, involving: 43,150 ft. 40-in. and 43,000 ft. 36-in. pipe-line, Diego, who bid $30,957, low bid to City for cast-iron pipe system in La Mesa and Metropolitan Center. 12-4

EVERETT, WASH.—Bids to 10:30 a.m., Dec. 12, by City for Lake Chaplain Reservoir, Sultan River water project, involving: SECTION 6, involving 210 acres clearing; SECTION 7—Construction of a storage dam, work involving the following approximate quantities: 5300 cu.yd. excavation, 24,000 cu.yd. embankment, 247 lin.ft. of tunnel to be 4 by 6 ft.; SECTION 8—Construction of a pipe-line, work involving the following approximate quantities: 8400 cu.yd. trench excavation, 8000 lin.ft. pipe-line, to be 36 in. diameter, alternative bids on reinforced concrete or welded steel pipe. Baar & Cunningham, Spalding Bdg., Portland, and Wisconsin Bdg., Everett, Wash., are Engrs. 12-2

BIDS RECEIVED

NOGALES, ARIZ.—Bids as follows by City: (1) Pratt & Gilbert, Phoenix, $32,163 low for Diesel engine and pump; and (2) F. Lown, Nogales, $5735 low for pumping building. 12-2

OAKLAND, CALIF.—Cement Gun Const. Co., 58 Sutter St., S. F., $1875 only bid to East Bay Municipal Dist. for gunite coating 3000 ft. 16-in. welded steel pipe. 11-29

CONTRACTS AWARDED

BEVERLY HILLS, CALIF.—To Carpenter Bros.,, 457 Canyon Drive, Beverly Hills, who bid $13,600 for constructing reinforced concrete settling basin, sand trap, etc., work for the City of Beverly Hills. 12-2

EL SEGUNDO, CALIF.—To Chutuk, Cordich & Vukojevich, Los Angeles, who bid 9½¢ per lin.ft. for 9300 lin.ft. of trench, to be 4 ft. deep, for a 10-in. water pipe-line, work for the City. 11-25

EUREKA, CALIF.—To Halsey & Lax, Eureka, $3574 for 166,000-gallon wooden tank on Myrtle St. for City. 11-29

LOS ANGELES, CALIF.—Awards as follows by County for water system at County Water Works District No. 16, Miramonte: (1) To Chicago Bridge & Iron Works, Rialto Bdg., San Francisco, $14,300 for steel tank and tower. (2) To National Cast Iron Pipe Co., 417 S. Hill St., Los Angeles, $19,071 for cast-iron pipe system. (3) To Ducommum Corp., Los Angeles, $1989 for gate valves and fittings. 12-4

LOS ANGELES, CALIF.—Work started by H. A. Van Norman, General Manager of City Dept. of Water & Power, City Hall, Los Angeles, by day labor in connection with raising present lower San Fernando earth-fill dam 12 ft., increasing the capacity from 14,000 to 18,000 ac.ft. $250,000. 12-2

MONROVIA, CALIF.—To American Cast Iron Pipe Co., L. A., 58.8¢ ft. for 2200 ft. 6-in. Class 150 cast-iron pipe for City. 11-20

OAKLAND, CALIF.—To National Cast Iron Pipe Co., S. F., who bid as follows for furnishing cast-iron pipe to the East Bay Municipal Utility District: 119 tons of 'B' 16-in. cast-iron pipe at $37.60 a ton; 1200 ft. 8-in. cast-iron pipe at 75½¢ ft. 11-20

OAKLAND, CALIF.—Awards as follows by East Bay Municipal Utility District for furnishing f.o.b. 22nd and Adeline Sts., Oakland, equipment for El Cerrito Booster Plant: SCHEDULE NO. ONE (PUMPING UNITS)—To United Iron Works, Oakland, $7200; SCHEDULE NO. TWO (VALVES)—To Rensselaer Valve Co., S. F., $779; SCHEDULE NO. THREE (TRANSFORMERS)—To C. F. Henderson, $2535. 11-20

SEATTLE, WASH.—To Beall Tank & Pipe Co., Portland, $25,652 for furnishing 3300 ft. 51½-in. steel pipe for Cedar River Pipe-Line No. 2 for City. 11-25

POWER DEVELOPMENT

WORK CONTEMPLATED

HOOD RIVER, ORE.—Engineers, Stevens & Koon, Spalding Bdg., Portland, Ore., have recommended that the City of Hood River, Ore., construct (1) Lighting system on 12th St., involving 24 lighting standards, and lighting system in business district involving 124 lighting standards. Work will cost $36,310, and will be done under the Assessment Act. (2) Power plant to have capacity of 100-hp., to cost $14,000, and to be paid for by proposed bond issue. 12-3

CONTRACTS AWARDED

TACOMA, WASH.—To Ward Const. Co., Perkins Bdg., Tacoma, Washington, who bid $219,940 for Cushman Power House No. 2 for City. Work consists of excavation, steel sheet piling, timber piling, concrete drainage pipe, concrete work, copper water steels, reinforcing steel, metal work, cast-iron drains, timber work, substructures, oil storage tank, and highway bridge, etc. (See Unit Bid Summary, issue of Nov. 25.) 11-20

RIVER AND HARBOR WORK

WORK CONTEMPLATED

VANCOUVER, B. C.—To Stuart Cameron & Co., Ltd., 543 Granville St., Vancouver, B. C., at about $2,000,000 for the construction of works for the Powell River Co., Ltd., of Vancouver, B. C. Work involves storage dam on Lois River, tunnel to be 1 mile in length, power house at Stillwater and penstock, power line from Stillwater to Powell River, reinf. concrete buildings for manufacture of paper at the Powell River Co. plant at Powell River. 11-29

LONG BEACH, CALIF.—Plans by Engr., R. D. Van Alstine, Heartwell Bdg., Long Beach, for 665-ft. addition to Silver Spray Pier for Neptune Pier Co., to cost $2,000,000. 11-25

NEWPORT BEACH, CALIF.—Plans by City Engr., R. L. Patterson, for: (1) Two rock groins, $50,000; and (2) Dredging a channel 250 ft. wide and 15 ft. deep at low water extending from harbor entrance at Corona del Mar beyond the end of the west jetty in open water, $150,000. Bonds voted, $200,000, for above. 11-25

SEATTLE, WASH.—Plans by W. D. Barkhuff, City Engr., bids in March, 1930, for 6040 ft. seawall, 25 to 50 ft. high, in Railroad Ave. from Madison St. to Bay St., involving: 20,500 cu.yd. precast rein. concrete, 2550 cu.yd. reinf. concrete, 2556 tons of reinf. steel in precast concrete, 398 tons of reinf. steel in concrete, 948 tons of steel tie rods, nuts, 330,000 cu.yd. earthwork fill. $1,172,000. 11-22

BIDS BEING RECEIVED

SAN DIEGO, CALIF.—Bids to 11 a.m., December 27, by Public Works Officer, 11th Naval District, Ft. of Broadway, San Diego, for constructing landing floats and moorings at the Naval Operating Base, San 15,270 ft. 36-in. pipe under streets, 89,000 ft. trenching and backfilling, piers and trestles for support of 1500 ft. of pipe, 7200 ft. tunnel excavation and lining, furnishing and installing valves, connections, etc. Plans from H. N. Savage, Hydraulic Engr., 525 F St., San Diego, $25 deposit. 11-26

BIDS RECEIVED

SAN DIEGO, CALIF.—Miracle Construction Co., 4751 Monroe St., San Diego. Work consists of furnishing and installing: (A) Two timber floats; (B) Creosoted piles and framing required for mooring of the two floats; and (C) One new brow and reinforcing of one existing brow. Each of the timber floats will be 14 ft. wide and 40 ft. long and the new brow will be approximately 28 ft. long. 11-30

CONTRACTS AWARDED

SAN FRANCISCO, CALIF.—Awards as follows by State Harbor Comm. for cold storage plant at Pier 48: CONTRACT A—To W. W. Williamson, 320 Market St., San Francisco, who bid $16,450 for reconstructing and making additions to building; CONTRACT B—To York Ice Mchy. Co., 234 9th St., S. F., $37,572 for cork board insulation and cooler room doors; CONTRACT D—To Otis Elevator Co., 1 Beach St., S. F., $13,960 for elevators. 11-20

TACOMA, WASH.—Awards as follows by Port of Tacoma: (1) To Albertson-Cornell Bros., 1113½ A St., Tacoma, $520,956 for grain elevator and shipping gallery; and (2) To the Tacoma Dredging Company, Tacoma, $108,507 for grain dock and approach. 11-20

MACHINERY and SUPPLIES

WORK CONTEMPLATED

SAN FRANCISCO, CALIF.—Bids soon by the U. S. Supt of Lighthouses, Custom House, San Francisco, for furnishing one 5 and one 4-ton stiffleg derrick, operated by 40 and 30-hp. 4-cylinder gasoline engines, for use at Anasapa Island Light Station, California. 11-25

BIDS BEING RECEIVED

PHOENIX, ARIZ.—Bids to 1:30 p.m., Dec. 16, by Secretary, State Institutions, Phoenix, Ariz., for furnishing and delivering following for cell house at Arizona State Prison, Florence, Ariz.: 238,000 lb. reinforcing bars, ⅜ to ⅞-in. sq., 6000 lb, annealed tie-wire, 10,000 sq.ft. welded-steel wire fabric.

LOS ANGELES, CALIF.—Bids to 2 p.m., Dec. 16, by Los Angeles County Flood Control District, Hall of Records, Los Angeles, for furnishing 102,000 bbl. cement for Hansen Dam in Big Tujunga Wash. 12-4

OAKLAND, CALIF.—Bids to 2 p.m., Dec. 12, by East Bay Municipal Utility District, 512 16th St., Oakland, for one 110-cu.ft. capacity portable air-compressor, direct connected to 4-cylinder motor. 12-4

SAN FRANCISCO, CALIF.—Bids to 2 p.m., Dec. 18, by Superintendent of Lighthouses, Custom House, San Francisco, for furnishing one 5 and one 4-ton stiff-leg derricks, operated by 40 and 30-hp., 4-cylinder gasoline engines for use at Anasapa Island Light Station, California. 12-4

WATERFORD, CALIF.—Bids to 10 a.m., Dec. 14, by Waterford Irrigation Dist., Box 187, Waterford, for: 300 cu.yd. washed rock, 1½ to ¼-in., 170 cu.yd. sand, 550 bbl. portland cement, 200 bars ⅜-in. square reinf. steel. 11-22

CONTRACTS AWARDED

COALINGA, CALIF.—Awards as follows by City: (1) To Ingersoll-Rand Co., S. F., $976 for gas compressor; and (2) To Boiler Tank & Pipe Co., Berkeley, $1025 for gas receiver tank. 11-20

LONG BEACH, CALIF.—To Steel, Inc., Chamber of Commerce Bdg., L. A., $18,750 for 400 tons of steel sheet piling for Berth 42 for City. 12-2

LOS ANGELES, CALIF.—To Union Tank & Pipe Co., L. A., $6780 for 2000 joints 8-ga. double stovepipe well casing for L. A. City Water & Power Bureau. 12-2

LOS ANGELES, CALIF.—Awards as follows by Water & Power Bureau for 12-in. cast-iron pipe: (1) Contract awarded to American Cast Iron Pipe Co., Los Angeles, who bid $1.575 per lin.ft. for furnishing and delivering 22,000 ft. 12-in. cast-iron pipe f.o.b. Ducommun and Alameda Sts.; (2) Contract awarded to Pacific States Cast Iron Pipe Co., Los Angeles, who bid $1.545 per lin.ft. for furnishing and delivering 6000 ft. 12-in. cast-iron pipe f.o.b. Slauson and Compton Aves.; and (3) Contract awarded to National Cast Iron Pipe Co., Los Angeles, who bid $1.548 ft. for furnishing 1800 ft. 12-in. cast-iron pipe f.o.b. First and Myler Sts., San Pedro. 12-2

LOS MOLINOS, CALIF.—To R. B. McKenzie, Red Bluff, $392 for removing present oil tank from pit, and furnishing and installing new ⅜-in. ga. riveted steel and welded tank, 12 ft. diameter and 8 ft. high, painted on outside with metallic paint, for Los Molinos Mosquito Abatement Dist. 11-21

SACRAMENTO, CALIF.—To Tay-Holbrook Co., Sacramento, $2242 for 150 gate valves for City. 12-2

SACRAMENTO, CALIF.—To Sacramento Pipe Works, Sacramento, $42.80 each for 50 fire hydrants for City. 11-23

IRRIGATION and RECLAMATION

WORK CONTEMPLATED

GILA BEND, ARIZ.—Bonds voted by Gila Bend Water Conservation District, Gila Bend, Arizona, $365,000 for the acquisition of lands and the construction of irrigation system, involving canals, wells, pumping plants, and distributing systems. Edwin D. Green is Secretary. 11-25

ELSINORE, CALIF.—Plans by Consulting Engineer, H. Hawgood, 722 H. W. Hellman Bdg., Los Angeles, for system to supply 1700 acres of Orchard lands for the Ladera Irrigation District, Elsinore, Riverside County. Work will involve wells, pumping plants, and pipe distribution system. Bonds voted, $200,000. 11-25

LOS ANGELES, CALIF.—Plans by Engr., H. L. Jacques, Water and Power Bdg., Los Angeles, and bids will be called for shortly for the Santa Clara River Protection project, made necessary by the failure of the St. Francis Dam. Work involves the following approximate quantities: 70,000 lin.ft. of earth, gravel, and sand levee, involving about 5 cu.yd. of material to the lin.ft.; 7500 lin.ft. double row 'A' creosoted timber piles, and 15,000 ft. of electric welded steel wire mesh fence; 2300 ft. rail type tetrahedron jetties, using old 60-lb. rails; 38,000 ft. double row pipe piling, using 4-in. to 6-in. pipe and 76,000 ft. wire fencing. Estimated cost of work is $400,000, funds having been appropriated to cover the cost by the City of Los Angeles. 11-30

NYSSA, ORE.—Plans by Engr., F. A. Banks, Bureau of Reclamation, Owyhee Project, Nyssa, Oregon, and bids will be called for soon for the construction of ten miles of tunnel, etc., at the Owyhee damsite: (1) One tunnel to be 3.6 miles in length, 15 ft. diameter, running from reservoir northeasterly; and (2) One tunnel to be 6.3 miles in length, running from the reservoir east, to be 10½ ft. diameter. 11-29

BIDS BEING RECEIVED

SACRAMENTO, CALIF.—Bids to 11 a.m., December 12, by the U. S. Engineer's Office, California Fruit Bdg., Sacramento, for: (1) Levee to be 5700 ft. in length at Starr Bend, on left bank of Feather River, 10 miles below the town of Marysville; and (2) Levee to be 5300 ft. in length on the Feather River near the 'Lake of the Woods' just above the mouth of Bear River, 2 miles from town of Nicolaus. 11-25

CONTRACTS AWARDED

TURLOCK, CALIF.—To Ed. Erickson, Route 4, Box 284, Modesto, $13,608 for concrete lining Lateral 5½ and 6 for Turlock Irrigation District. Alldrin & Anderson, Turlock, $14,232, only other bidder. Work involves 215,000 sq.ft. 2-in. concrete lining. 12-4

LIGHTING SYSTEMS

WORK CONTEMPLATED

SAN LEANDRO, CALIF.—Plans by W. A. Richmond, City Engr., pro-

SURETY BOND AND CASUALTY INSURANCE DIRECTORY

SURETY BONDS
AMERICAN SURETY COMPANY
R. D. WELDON, Manager
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Phone DAvenport 5770

Great American Indemnity Company
New York
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Phone DAvenport 3680
548 S. SPRING STREET LOS ANGELES
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PACIFIC COAST DEPARTMENT:
R. W. FORSYTH,
Manager
206 SANSOME STREET SAN FRANCISCO
San Francisco Branch Office: 204 Sansome Street
R. L. HOLBROOK, *Manager*
Los Angeles Branch Office: E. F. HOLMES, *Manager*
SERVICE IN ALL PARTS OF THE COUNTRY

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

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

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GUY LEROY STEVICK
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tests Dec. 18, with reference to installing 58 Union Metal Mfg. Co. electroliers, etc., on Dutton St. from E. 14th St. to city limits. 1911-15 Acts. 12-2

RAILROAD CONSTRUCTION

BIDS RECEIVED

SAN FRANCISCO, CALIF.—Meyer Rosenberg, 12 Oak Grove Ave., San Francisco, $34,975, low for reconstructing Taraval St. tracks from 20th Ave. to 33rd Ave. for City. 12-4

BUILDING CONSTRUCTION

WORK CONTEMPLATED

BAKERSFIELD, CALIF.—Plans by Architect, S. C. Lee, 531 Petroleum Securities Bdg., Los Angeles, and Supervising Architect, Chas. H. Biggar, Bank of Italy Bdg., Bakersfield, Kern County, for the construction of a Class 'A' reinforced concrete and steel theatre building for the Fox West Coast Theatres, to be constructed on H and 20th Sts., Bakersfield, Kern County. Bids will be called soon. Cost $250,000. 12-3

BERKELEY, CALIF.—Plans by W. H. Ratcliff, Architect, Chamber of Commerce Bdg., Berkeley, for 1-story 'C' steel and concrete auto sales building for Langhorne-Thomas Co. on Oxford and Addison Sts. $50,000. 11-25

LONG BEACH, CALIF.—Procter & Gamble, 300 Avery St., Los Angeles, will construct a factory and soap manufacturing plant on W. Seventh St., Long Beach Harbor, Long Beach, to cost about $5,000,000. Work will include two main buildings, to be 100 by 700 ft. and 100 by 500 ft.; ten or more elevated steel tanks; and a 500-ft. wharf. Contract awarded to Stone & Webster, Laughlin Bdg., Los Angeles, for driving test piles. 12-2

LOS ANGELES, CALIF.—Plans by Engr. Dept., Atchison, Topeka & Santa Fe RR., Kerckhoff Bdg., L. A., for railway station at First and Santa Fe Ave., Los Angeles, to cost $1,500,000. 11-27

OAKLAND, CALIF.—Plans by Architect, H. H. Meyers, Kohl Bdg., San Francisco, for constructing addition to the Highland Hospital for Alameda County, located on 14th Ave. and Vallecito Place, Oakland, Alameda County. $150,000. 12-2

OAKLAND, CALIF.—Plans by Architect, G. A. Lansburgh, 140 Montgomery St., S. F., for 'A' theatre on 20th and Broadway for Warner Bros. $1,500,000. 11-27

OAKLAND, CALIF.—Plans by Engineering Department of the Southern Pacific Co., Southern Pacific Bdg., San Francisco, for the construction of terminal yard on Seventh St., Oakland, near the Key Route Station. Estimated cost of work is $500,000. 12-3

OAKLAND, CALIF.—Plans by Architect, J. J. Donovan, Tapscott Bdg., Oakland, for brick addition to the Maxwell Park School for the Board of Education. $125,000. 11-26

SACRAMENTO, CALIF.—Plans by Architects, O'Brien & Peugh, 315 Montgomery St., San Francisco, for the construction of a hotel building to be constructed at Sacramento for the Pickwick Auto Stage Corporation of San Francisco. $500,000. 11-29

SACRAMENTO, CALIF.—Plans by State Architect, Geo. B. McDougall, Public Works Bdg., Sacramento, for the construction of a reinforced concrete livestock building, to be constructed at the State Fair Grounds at Sacramento; $200,000. 12-3

SAN FRANCISCO, CALIF.—Plans by City Bureau of Architecture, City Hall, San Francisco, for constructing firehouse, 2-story brick construction, on Eighth Ave. and Revere St., San Francisco. Estimated cost, $50,000. 12-3

SAN FRANCISCO, CALIF.—Plans by Architects, S. L. Hyman & A. Appleton, 68 Post St., San Francisco, for the construction of an addition to the Hebrew Home for Aged and Disabled, located on Mission St. and Silver Ave., San Francisco. Estimated cost of work, $125,000. 12-3

SAN FRANCISCO, CALIF.—Plans by Architect, Arthur Brown, Jr., 251 Kearny St., San Francisco, for 6-story 'A' hospital addition on Post and Scott Sts. for the Mt. Zion Hospital. $500,000. 11-26

SAN FRANCISCO, CALIF.—Plans by State Architect, Geo. B. McDougall, Public Works Bdg., Sacramento, for 'A' addition to the State building located on Larkin and McAllister Sts. $350,000. 11-26

UKIAH, CALIF.—Plans by State Architect, Geo. B. McDougall, Public Works Bdg., Sacramento, for the construction of additions to the ward buildings at the Mendocino State Hospital, Ukiah, Mendocino County, to cost $125,000. 12-2

WILLOW GLEN, CALIF.—Plans by Architects, Wolfe & Higgins, 19 N. 2nd St., San Jose, for frame and stucco school for Willow Glen School Dist. $40,000. 11-26

RENO, NEV.—Plans by Architect, Carl Werner, 605 Market St., San Francisco, for 3-story Class 'C' steel, concrete, and brick building at Reno, Nevada, for the Scottish Rite Masonic Temple Association. $100,000. 11-25

EUGENE, ORE.—Plans by Architects, Lawrence, Holford, Allyn & Bean, Failing Bdg., Portland, Ore., for clinic building for University of Oregon, to cost $400,000.

SEATTLE, WASH.—Plans by Architect, E. W. Morrison, Seattle, for constructing Textile Tower building at Seattle, to cost $650,000.

BIDS BEING RECEIVED

PHOENIX, ARIZ.—Bids to 10 a.m., December 10, by Board of Directors of State Institutions, Phoenix, Arizona, for concrete, brick, and terra cotta office building for the State. $275,000. Plans from Architects, Lescher & Mahoney, Phoenix, Arizona. 11-26

SAN DIEGO, CALIF.—Bids to 2 p.m., Dec. 24, by State Architect, Sacramento, for reinf. concrete training school and power house at State Teachers College, San Diego. 11-27

SEATTLE, WASH.—Bids to 11:30 a.m., Dec. 18, by Board of Education for reinf. conc. and brick James Monroe Intermediate School, to cost $600,000. F. A. Naramore, Seattle, is Architect.

BIDS RECEIVED

ALAMEDA, CALIF.—J. J. Grodem, 1208 San Antonio Ave., Alameda, $19,300 low for municipal bathhouse at Washington Park for City. 11-21

EUREKA, CALIF.—Mercer-Fraser Co., Eureka, $125,000 low for 'A' theatre building for the Fox Theatres, Inc., on 7th and G Sts. Balch & Stanberry, Film Exchange Bdg., Los Angeles, are Architects. 11-26

OAKLAND, CALIF.—J. B. Bishop, 587 Athol Ave., Oakland, $12,031 low bid to the State Architect's Office, Public Works Bdg., Sacramento, for construction and completion of reinf. concrete sales building and office and addition to warehouse, broom factory, etc., at the Industrial Home of Adult Blind at Oakland, Calif. 11-27

SAN JOSE, CALIF.—Low bids as follows for steel and concrete hotel for San Jose Community Hotel on W. Santa Clara and Notre Dame Ave., San Jose: GENERAL—Carl N. Swenson, 1395 Shasta St., San Jose, $164,500, low. STRUCTURAL STEEL—Herrick Iron Works, Oakland, $39,500, low. TILE—Rigney Tile Co., San Francisco, $9265, low. LATHING and PLASTERING—J. F. Smith, 271 Minna St., San Francisco, $47,725, low. PAINTING—J. B. Huber, $13,080, low. PLUMBING—H. J. Pascoe, San Jose, $36,650, low. HEATING—Scott Co., 243 Minna St., San Francisco, $26,970, low. ELECTRICAL WORK—T. E. Baker, 239 W. San Carlos, San Jose, $11,850, low. W. H. Weeks is the Architect. 12-4

YOUNTVILLE, CALIF.—Low bids as follows by State Architect's Office, Sacramento, for barracks building at Veterans' Home, Yountville, Napa County: (1) GENERAL—J. F. Shepherd, First National Bank Bdg., Stockton, $274,324 low; and (2) MECHANICAL EQUIPMENT—Latourrette-Fical Co., 907 Front St., Sacramento, $55,570 low. 11-20

CONTRACTS AWARDED

BEL-AIR, CALIF.—To J. P. Brennan, Rives-Strong Bdg., Los Angeles, at $250,000 for the construction of a 3-story Class 'B' dormitory and classroom building to be constructed on Chalon Road, Bel-Air, Los Angeles County, for the Mt. St. Mary's College. I. E. Loveless, Robertson Bdg., Los Angeles, is the Architect. Other buildings will be erected as needed. 12-2

BENICIA, CALIF.—Awards as follows by Constructing Quartermaster, Benicia Arsenal: (1) To T. Pringle and Fred Turner, $94,724 for magazine buildings; and (2) To R. E. Burgund, 806 Rodeo Drive, Beverly Hills, California, $7000 for bituminous roads. 11-23

OAKLAND, CALIF.—To R. W. Littlefield, 337 17th St., Oakland, who bid $108,115 on Proposition A for the construction of Transit Shed No. 2 at the Outer Harbor, Oakland (all work except structural steel), work for the Oakland Port Commission. 12-3

SAN DIEGO, CALIF.—Awards as follows by State Architect's Office, Sacramento, for steel and concrete library and science building at State Teachers College, San Diego: GENERAL—To Pettifer Hunt Co., P.O. Box 146, East San Diego, $182,930; MECHANICAL EQUIPMENT—To Pemberton Heating & Ventilating Co., 105 Macy St., Los Angeles, $33,500; ELECTRICAL—American Electric Const. Co., 757 E. 9th St., L. A., $13,498. 11-20

YOUNTVILLE, CALIF.—Awards as follows by State Architect's Office, Public Works Bdg., Sacramento, for constructing concrete barrack buildings at Veterans' Home, Yountville, Napa County: GENERAL CONTRACT—To J. F. Shepherd, First National Bank Bdg., Stockton, $274,324. MECHANICAL EQUIPMENT—To Latourrette-Fical Co., 907 Front St., Sacramento, who bid $55,570. 12-4

OPPORTUNITY PAGE

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

THE BUYERS' GUIDE

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

Acetylene Welding Generators
Oxweld Acetylene Co.

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

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

Asphalt, Emulsified
American Bitumuls Co.

Asphalt Plants and Equipment
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Jenison Machinery Co.
Link-Belt Meese & Gottfried Co.
Madsen Iron Works
Peerless Mchy. & Mfg. Co.
Spears-Wells Mchy. Co., Inc.

Asphalt Paving
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Back Fillers
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Cleveland Tractor Co., The
Garfield & Co.
Harnischfeger Sales Corp.
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Industrial Brownhoist Corp.
Jenison Machinery Co.
Link-Belt Meese & Gottfried Co.
Northwest Engineering Co.
Orton Crane & Shovel Co.
Spears-Wells Machy. Co., Inc.
Speeder Machinery Corp.
Thew Shovel Co., The
Universal Crane Co., The

Bars, Steel
Pacific Coast Steel Co.

Beams, Channels, and Angles
Pacific Coast Steel Co.

Bins, Storage and Hopper
Bacon Co., Edward R.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Link-Belt Meese & Gottfried Co.
Madsen Iron Works

Blacksmithing—Drop Forgings
Payne's Bolt Works

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

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

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

Bonds, Street and Road Improvement
Pacific Co.

Bonds, Surety
American Surety Co.
Associated Indemnity Corp.
Commerce Casualty Co.
Detroit Fidelity & Surety Co.
Fidelity & Casualty Co. of N. Y., The
Fidelity & Deposit Co. of Maryland

Bonds, Surety (Continued)
Glens Falls Indemnity Co.
Globe Indemnity Co.
Great American Indemnity Co.
Indemnity Insurance Co. of North America
Maryland Casualty Co.
New Amsterdam Casualty Co.
Rolph, James Jr., Landis & Ellis

Brick, Common
Kartschoke Clay Products Co.

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

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

Buckets, Dredging
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Slick, R. R.

Buckets, Excavating
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Owen Bucket Co.
Slick, R. R.
Williams Co., G. H.

Buckets, Rehandling
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Garfield & Co.
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Jenison Machinery Co.
Lakewood Engr. Co.
Orton Crane & Shovel Co.
Owen Bucket Co.
Slick, R. R.
Williams Co., G. H.

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

Camp Supplies
Thomson-Diggs Company

Cars, Industrial
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Jenison Machinery Co.
Lakewood Engr. Co.

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

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

Castings, Iron and Steel
American Cast Iron Pipe Co.
Industrial Brownhoist Corp.
Link-Belt Meese & Gottfried Co.
U. S. Cast Iron Pipe & Fdy. Co.

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

Cement
Portland Cement Association

Cement Guns
Cement Gun Const. Co.

Chemicals
Great Western Electro-Chemical Co.

Chlorinators
Wallace & Tiernan
Water Works Supply Co.

Chlorine
Great Western Electro-Chemical Co.

Chutes, Concrete
Bacon Co., Edward R.
Garfield & Co.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Lakewood Engr. Co.

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

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

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

Concrete Curing
Concrete Curing Co.
McEverlast, Inc.

Concrete Forms
Harron, Rickard & McCone Co.

Concrete Roads
Portland Cement Association

Conveyors, Portable
Harron, Rickard & McCone Co.
Jenison Machinery Co.

Conveyors, Elevating and Conveying
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Bodinson Mfg. Co.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Link-Belt Meese & Gottfried Co.

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Hackley Equipment Co., P. B.
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Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.
Jenison Machinery Co.
Link-Belt Meese & Gottfried Co.
Marion Steam Shovel Co.
Northwest Engineering Co.
Ohio Power Shovel Co., The
Orton Crane & Shovel Co.
Speeder Machinery Corp.
Thew Shovel Co., The
Universal Crane Co., The
Willamette-Ersted Co.

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

Crushers
Bacon Co., Edward R.
Garfield & Co.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Smith Engineering Works
Young Machy. Co., A. L.

Culverts, Concrete
Portland Cement Association

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

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

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

Curing—Concrete
Concrete Curing Co.
McEverlast, Inc.

Dams
Ambursen Dam Co., Inc.

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

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

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

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

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

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Jenison Machinery Co.
United Commercial Co.

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Burns-McDonnell-Smith Engr. Co.
Hunt, R. W., Co.

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Engines, Gasoline and Steam
Bacon Co., Edward R.
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Hercules Motors Corp.
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Cleveland Tractor Co., The
Garfield & Co.
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Industrial Brownhoist Corp.
Jenison Machinery Co.
Link-Belt Meese & Gottfried Co.
Marion Steam Shovel Co.
Northwest Engineering Co.
Ohio Power Shovel Co.
Orton Crane & Shovel Co.
Owen Bucket Co.
Sauerman Bros., Inc.
Speeder Machinery Corp., The
Thew Shovel Co., The
Universal Crane Co., The

(Continued on page 66)

OPPORTUNITY PAGE

CONTINUED

SITUATIONS WANTED

SUPERINTENDENT, bridges, docks, steel, and machinery erection. Piling, rigging, and water works a specialty. 34 years old, engineer. A good pusher. Wide experience. Box E.W.S., Western Construction News.

HELP WANTED

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

DRAFTSMAN, mechanical or structural, preferably college graduate with about two years' experience on the drafting board, for detail work in connection with design and layout of oil refinery equipment. $175 month to start. Location, San Francisco. R-2866-S.

MINING ENGINEER, graduate, 25-30, single, as technical adviser and salesman of explosives. Should preferably have had technical sales or mining experience in South America or Mexico. Must have good strong sales personality with ability to speak Spanish fluently. Work will be in the United States for about a year, and then later will be transferred to South America or Mexico. Apply by letter. Headquarters, East. X-9881.

ENGINEER, preferably young civil engineer, to develop into sales engineer for bituminous road products. Highway experience and sales personality are important assets. Permanent opportunity. Salary open. Apply by letter with recent photo. Location, Northwest. R-2749-S.

EXPERT WELDER, for position as service department operator. Must be thoroughly familiar with oxy-acetylene welding and capable of developing sales by demonstrating up-to-date welding methods. Salary $150-$250 month, depending on experience. Location, San Francisco. R-2697-S.

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DRAFTSMAN, experienced on layout of electrical or steam equipment for sub-stations and power plants. Must be good draftsman. Salary depends upon experience. Location, San Francisco. R-2819-S.

STRUCTURAL ENGINEER, with considerable experience on detailing and checking steel. Prefer a man with experience on pulp mill jobs. Salary $50 a week and overtime. Permanent position for satisfactory man. Apply by letter. Location, Seattle. No transportation. R-2861-S.

THE BUYERS' GUIDE—*Continued from Page 64*

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Water Works Supply Co.

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

Equipment—Rental
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Water Works Supply Co.

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Oxweld Acetylene Co.

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Wailes Dove-Hermiston Corp.

Flumes, Concrete
Portland Cement Association

Flumes, Metal
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Gates, Radial
California Corrugated Culvert Co.

Gates, Sheet Metal
California Corrugated Culvert Co.

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Young Machy. Co., A. L.

Governors, Turbine
Pelton Water Wheel Co., The

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Smith Engineering Works
Young Mach. Co., A. L.

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Harnischfeger Sales Corp.
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Industrial Brownhoist Corp.

Hoists, Hand and Power (Continued)
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Sullivan Machinery Co.
Willamette-Ersted Co.
Young Machy. Co., A. L.

Hoppers, Steel
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Detroit Fidelity & Surety Co.
Fidelity & Casualty Co. of N. Y., The
Fidelity & Deposit Co. of Maryland
Glens Falls Indemnity Co.
Great American Indemnity Co.
Indemnity Insurance Co. of North America
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New Amsterdam Casualty Co.
Rolph, James Jr., Landis & Ellis

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Peerless Mchy. & Mfg. Co.
Spears-Wells Machy. Co.
Young Machy. Co., A. L.

Leadite
Water Works Supply Co.

Lighting Standards
United Iron Works

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

Locomotives (Electric, Gas and Steam)
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Garfield & Co.
Hackley Equipment Co., P. B.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Plymouth Locomotive Works
United Commercial Co.

Meters, Venturi
Water Works Supply Co.

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

Mixers, Chemical
Dorr Co., The

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

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

Motors, Gasoline
Continental Motors Corp.
Hercules Motors Corp.
Harron, Rickard & McCone Co.
Jenison Machinery Co.

Paints, Acid Resisting
General Paint Corp.
Wailes Dove-Hermiston Corp.

Paints, Metal Protective
General Paint Corp.
McEverlast, Inc.
Wailes Dove-Hermiston Corp.

Paints, Technical
American Bitumuls Co.
General Paint Corp.
Wailes Dove-Hermiston Corp.

Paints, Waterproofing
General Paint Corp.
McEverlast, Inc.
Wailes Dove-Hermiston Corp.

Pavers, Concrete
Chain Belt Co.
Foote Company, Inc.
Harron, Rickard & McCone Co.
Koehring Company
Smith Co., T. L.

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Rix Company, Inc., The
Schramm, Inc.
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Madsen Iron Works

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Lacy Manufacturing Co.
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Water Works Supply Co.
Western Pipe & Steel Co.

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Industrial Brownhoist Corp.
Ingersoll-Rand Co.
Jenison Machinery Co.
Northwest Engineering Co.
Orton Crane & Shovel Co.
Thew Shovel Co., The

Piles, Concrete
Raymond Concrete Pile Co.

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

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

Pipe Clamps and Hangers
Kortick Mfg. Co.

Pipe Coatings
McEverlast, Inc.
Wailes Dove-Hermiston Corp.

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

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

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

Pipe Line Machinery
Bacon Co., Edward R.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Jenison Machinery Co.

Pipe, Lock-Bar
Western Pipe & Steel Co.

Pipe, Preservative
Columbia Wood & Metal Preservative Co.

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

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

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

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

Pipe, Vitrified
Gladding, McBean & Co.
Kartschoke Clay Products Co.
Pacific Clay Products

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

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Galion Iron Works & Mfg. Co.
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Jenison Machinery Co.
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Gardner-Denver Co.
Ingersoll-Rand Co.
Leitch & Co.
Schramm, Inc.

Portable Lights
Oxweld Acetylene Co.

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

Power Units
Continental Motors Corp.
Harron, Rickard & McCone Co.
Hercules Motors Corp.
Jenison Machinery Co.

Preservative—Wood, Metal, etc.
Columbia Wood & Metal Preservative Co.

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

Pumps, Deep Well
American Well Works, The
Byron Jackson Pump Mfg. Co.
Industrial & Municipal Supply Co.
Jenison Machinery Co.
Pelton Water Wheel Co., The
Woodin & Little

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OPPORTUNITY PAGE

CONTINUED

OFFICIAL BIDS

UNITED STATES DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

Grading—Arizona

San Francisco, Calif., November 15, 1929

Sealed bids, in single copy only subject to the conditions contained herein, will be received until 2 o'clock p.m. on the 12th day of December, 1929, and then publicly opened, for furnishing all labor and materials and performing all work for grading project 4 grading, Bright Angel Springs-North Entrance, on the North Rim of the Grand Canyon National Park, Arizona.

The length of the project to be graded is 9.97 miles and the principal items of work are approximately as follows:

Clearing, 17.5 acres.
Excavation unclassified, 83,450 cu.yd.
Excavation for structures, 580 cu.yd.
Borrow, 3200 cu.yd.
Overhaul, 17,700 sta.yd.
Dry rubble masonry, 150 cu.yd.
Pipe culverts, 2830 lin.ft.

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

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

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

Performance bond will be required as follows: In the amount of one hundred (100) per cent of the total contract price. Performance shall begin within ten (10) calendar days after date of receipt of notice to proceed and shall be completed within one hundred and forty (140) calendar days from that date exclusive of any time that may intervene between the effective date of orders of the Government to suspend operations on account of weather conditions and the effective date of orders to resume work.

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

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

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

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

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

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

Bid for Road Construction. To be opened 2:00 p.m., December 12, 1929.
Project 4 (Grading), Bright Angel Springs-North Entrance, Grand Canyon National Park, 807 Sheldon Bldg., 461 Market St., San Francisco, California.

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

OFFICIAL BIDS

NOTICE TO CONTRACTORS

Sealed proposals will be received at the office of the State Highway Engineer, Public Works Building, Sacramento, California, until 2 o'clock p.m. on December 26, 1929, at which time they will be publicly opened and read, for construction in accordance with the specifications therefor, to which special reference is made, of portions of State highway, as follows:

Imperial County, between Dixieland and Seeley (VIII-Imp-12-C), about five (5.0) miles in length, to be graded and paved with asphalt concrete.

Plans may be seen, and forms of proposal, bonds, contract and specifications may be obtained at the said office, and they may be seen at the offices of the District Engineers at Los Angeles and San Francisco, and at the office of the District Engineer of the district in which the work is situated. The District Engineers' offices are located at Eureka, Redding, Sacramento, San Francisco, San Luis Obispo, Fresno, Los Angeles, San Bernardino and Bishop.

A representative from the district office will be available to accompany prospective bidders for an inspection of the work herein contemplated, and Contractors are urged to investigate the location, character and quantity of work to be done, with a representative of the Division of Highways. It is requested that arrangements for joint field inspection be made as far in advance as possible. Detailed information concerning the proposed work may be obtained from the district office.

No bid will be received unless it is made on a blank form furnished by the State Highway Engineer. The special attention of prospective bidders is called to the "Proposal Requirements and Conditions" annexed to the blank form of proposal, for full directions as to bidding, etc.

The Department of Public Works reserves the right to reject any or all bids or to accept the bid deemed for the best interests of the State.

DEPARTMENT OF PUBLIC WORKS,
DIVISION OF HIGHWAYS.
C. H. PURCELL, State Highway Engineer.
Dated November 27, 1929.

NOTICE TO CONTRACTORS

Sealed proposals will be received at the office of the State Highway Engineer, Public Works Building, Sacramento, California, until 2 o'clock p.m. on December 18, 1929, at which time they will be publicly opened and read, for construction in accordance with the specifications therefor, to which special reference is made, of portions of State Highway, as follows:

Tehama County (II-Teh-29-A) six timber bridges at various points east of Red Bluff having a total length of approximately 665 feet, the bridge decks to be surfaced with bituminous macadam.

Los Angeles County, between Tunnel Station and Santa Clara River (VII-L.A.-4-F), about eight and five-tenths (8.5) miles in length, to be paved with Portland cement concrete.

Plans may be seen, and forms of proposal, bonds, contract and specifications may be obtained at the said office, and they may be seen at the offices of the District Engineers at Los Angeles and San Francisco, and at the office of the District Engineer of the district in which the work is situated. The District Engineers' offices are located at Eureka, Redding, Sacramento, San Francisco, San Luis Obispo, Fresno, Los Angeles, San Bernardino and Bishop.

A representative from the District Office will be available to accompany prospective bidders for an inspection of the work herein contemplated, and contractors are urged to investigate the location, character and quantity of work to be done, with a representative of the Division of Highways. It is requested that arrangements for joint field inspection be made as far in advance as possible. Detailed information concerning the proposed work may be obtained from the District Office.

No bid will be received unless it is made on a blank form furnished by the State Highway Engineer. The special attention of prospective bidders is called to the "Proposal Requirements and Conditions" annexed to the blank form of proposal, for full directions as to bidding, etc.

The Department of Public Works reserves the right to reject any or all bids or to accept the bid deemed for the best interests of the State.

DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS.
C. H. PURCELL, State Highway Engineer.
Dated November 20, 1929.

NOTICE TO CONTRACTORS

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

Tulare County, between Pixley and Tipton (VI-Tul-4-A & B), about eight and six-tenths (8.6) miles in length, to be graded and paved with asphalt concrete.

Los Angeles County, at Liberty Grade, about five miles west of Calabasas (VII-L.A.-2-C), about one and two-tenths (1.2) miles in length, to be graded and paved with Portland cement concrete.

Kern County, between Cinco and 7 miles north of Ricardo (IX-Ker-23-C, D), about fifteen (15.0) miles in length, to be graded and surfaced with oil-treated crushed gravel or stone.

Plans may be seen, and forms of proposal, bonds, contract and specifications may be obtained at the said office, and they may be seen at the offices of the District Engineers at Los Angeles and San Francisco, and at the office of the District Engineer of the district in which the work is situated. The District Engineers' offices are located at Eureka, Redding, Sacramento, San Francisco, San Luis Obispo, Fresno, Los Angeles, San Bernardino and Bishop.

A representative from the district office will be available to accompany prospective bidders for an inspection of the work herein contemplated, and Contractors are urged to investigate the location, character and quantity of work to be done, with a representative of the Division of Highways. It is requested that arrangements for joint field inspection be made as far in advance as possible. Detailed information concerning the proposed work may be obtained from the district office.

No bid will be received unless it is made on a blank form furnished by the State Highway Engineer. The special attention of prospective bidders is called to the "Proposal Requirements and Conditions" annexed to the blank form of proposal, for full directions as to bidding, etc.

The Department of Public Works reserves the right to reject any or all bids or to accept the bid deemed for the best interests of the State.

DEPARTMENT OF PUBLIC WORKS,
DIVISION OF HIGHWAYS.
C. H. PURCELL, State Highway Engineer.
Dated December 4, 1929.

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Jenison Machinery Co.
United Iron Works

Pumps, Hydraulic
Jenison Machinery Co.

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

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American Well Works, The
Dorr Co., The
Fairbanks, Morse & Co.
Industrial & Municipal Supply Co.

Pumps, Sewage Ejector
Industrial & Municipal Supply Co.
United Iron Works

Pumps, Sludge
Dorr Co., The

Pumps, Water Works
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Water Works Supply Co.

Valves, Hose Gate
Greenberg's Sons, M.
United Iron Works

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

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Industrial & Municipal Supply Co.
Wallace & Tiernan
Water Works Supply Co.

Water Supply Installations
Industrial & Municipal Supply Co.
Wallace & Tiernan
Water Works Supply Co.

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United Iron Works
Water Works Supply Co.

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