WESTERN CONSTRUCTION NEWS

CIVIL ENGINEERING AND CONSTRUCTION IN THE FAR WEST

PUBLISHED SEMI-MONTHLY
VOLUME V NUMBER 6

SAN FRANCISCO, MARCH 25, 1930

25 CENTS A COPY
$3.00 PER YEAR

BATTERY OF THREE GREEN APPROACH LIGHTS ILLUMINATING ONE END OF MAIN RUNWAY AT FRESNO CHANDLER AIRPORT, FRESNO, CALIFORNIA

The DIESEL GIANT SWELLS PRODUCTION

DIESEL Power is a giant. All factors considered, no other power equals it for shovel operation.

Diesel Power swells production . . . increases yardage output, especially in hard digging. Over a period of nearly four years, P & H Diesel Shovels have proved that they turn out 10 to 15% more yardage than gasoline machines. And they do it with fuel savings of 75 to 85%!

P & H Shovels are built to withstand the tremendous torque of Diesel engines. All main frames are single-piece steel castings. Gears are of heat-treated alloy steel. Heavy duty shafts are made from heat-treated hammered steel.

P & H Diesel Shovels are built in capacities from ¾ to 3½ cu. yds. Send for special Diesel information.

Harnischfeger Sales Corporation

Established 1884

3890 National Avenue, Milwaukee, Wis.

32 Beale Street, San Francisco

2025 Santa Fe Avenue, Los Angeles

ROBERT M. TAYLOR,

Pacific Coast Manager

Complete Repair Part Stocks and Excavators at San Francisco, Los Angeles and Seattle

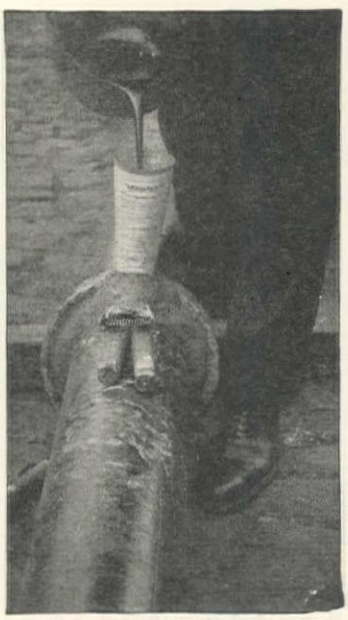
P&H *Diesel* SHOVELS

LEADITE

Trade Mark Registered U.S. Pat. Office

Melting *Leadite* prior to pouring joint.

"Yarning" joint with Braided Hemp.



Pouring the *Leadite* joint.

237.41 Miles of Water Mains in Flint, Mich. Jointed with LEADITE

Another example of the widespread use and effectiveness of *Leadite* is the City of Flint, Michigan, of which Mr. E. L. Holloway is Superintendent, Board of Water Commissioners. This City has used *Leadite* for jointing 237.41 miles of cast iron water mains, ranging in sizes from 4" to 30" in diameter. The average working pressure is 75 pounds per square inch, but they have tested *Leadite* joints as high as 150 pounds pressure.

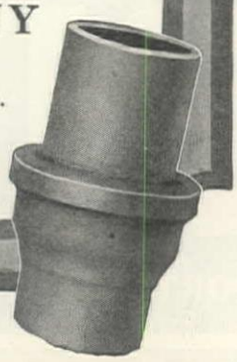
The tightness of their water system is indicated by their accounting for more than 90% of water delivered through Master Meter, which they feel is "very satisfactory."

The pioneer self-caulking material for c. i. pipe.
Tested and used for over 30 years.
Saves at least 75%

WATER WORKS SUPPLY COMPANY

501 Howard Street, San Francisco 2326 E. 8th St., Los Angeles
Water Works & Power Equipment Co., White Building, Seattle
THE LEADITE COMPANY—LAND TITLE BLDG., PHILADELPHIA, PA.

No Caulking



Cutting Cliffs ... and costs

THIS million dollar organization does both with RIX "6" *Super-charged* Air Power

ONE company of whose road building and construction engineering the West may well be proud is the GRIFFITH COMPANY of Los Angeles. This progressive organization has found that it *does* cut costs, increase business, and earn extra profit by making an occasional investment in efficient modern machinery. Above is a photograph of such equipment owned and operated by the *Griffith Company*—a RIX "6" cutting cliffs on road construction near Laguna Beach, (Cal.). Because of a patented *Super-charger* and other exclusive features, a size smaller RIX "6" actually does as much work as other compressors a size larger. Don't be without this marvelous modern money-saver. Write now for Bulletin 3-A.

RIX COMPANY, INC.
San Francisco - 400 4th Street
Los Angeles - 684 Santa Fe Ave.
Portland - - 312 E. Madison St.
Seattle - - - 1729 First Ave. So.

RIX "6"
PORTABLE AIR COMPRESSORS

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

. . . . SINCE 1877

COMPRESSED AIR MACHINERY — RIX — SAN FRANCISCO LOS ANGELES

The Compressor with the SUPER-CHARGER

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DEVOTED TO CIVIL ENGINEERING AND CONSTRUCTION IN THE FAR WEST

VOLUME V MARCH 25, 1930 NUMBER 6

CONTENTS

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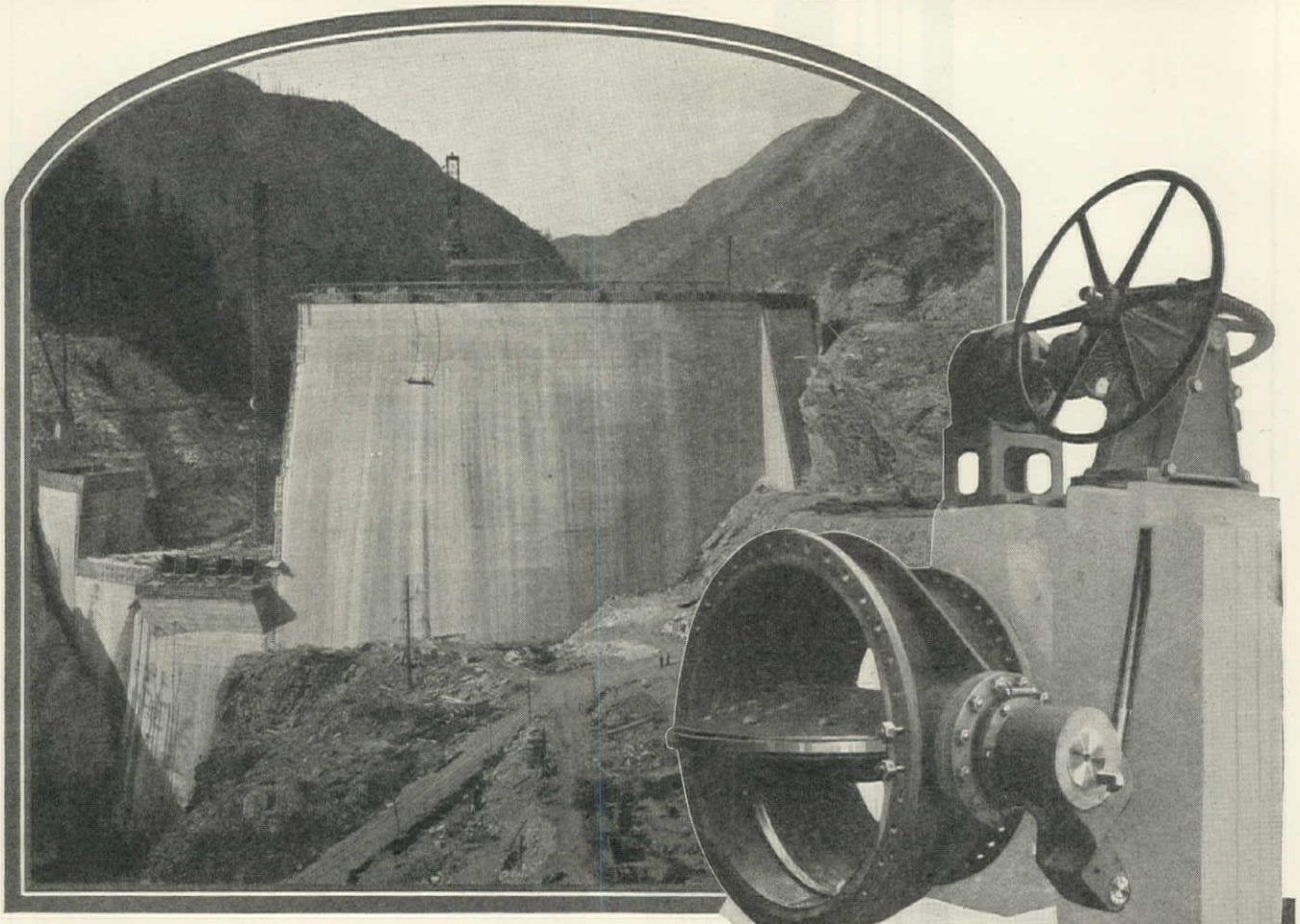
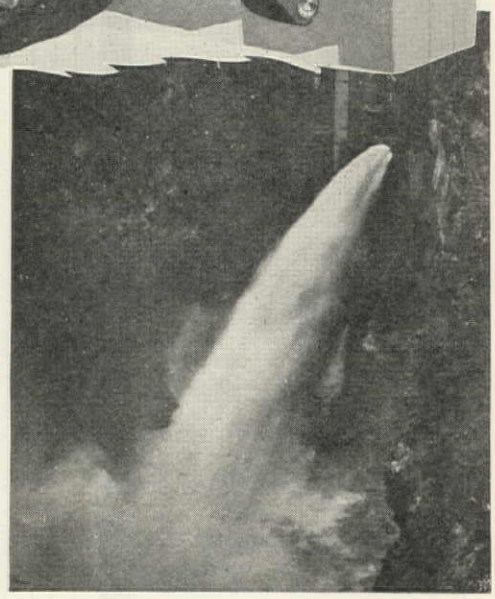


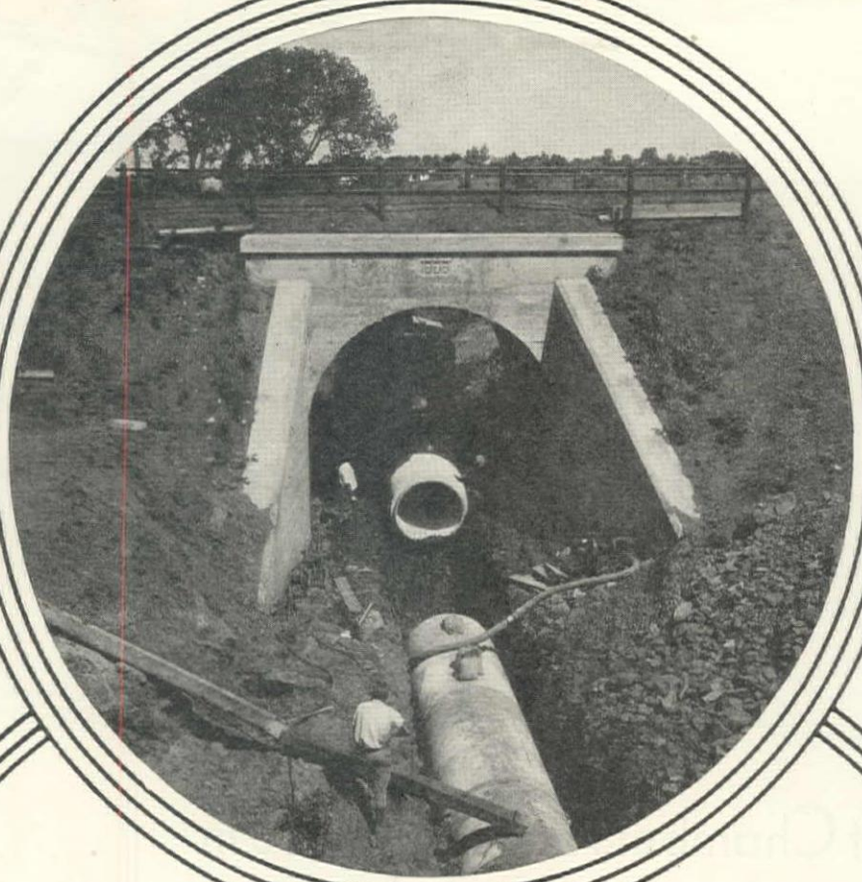
Butterfly Valves as Reservoir Outlets

THREE Pelton 78″ butterfly valves are installed in Diablo Dam in conjunction with a 96″x72″ Larner-Johnson valve for free discharge service under 155 ft. static head. This installation typifies the broader application of butterfly valves in water handling problems and such an arrangement meets the exacting requirements of close regulation with equipment costs reduced to a minimum. For such installations the butterfly valves are used in full open or closed position, and the regulating is accomplished with the Larner-Johnson valve.

Pelton butterfly valves are usually provided with bronze sectionalized seat rings which permit minute adjustment about the disc periphery for elimination of leakage when closed against full head. Hand, electric motor or hydraulic cylinder operation can be provided, the valves being readily adapted for remote control.



Upper view: Diablo Dam under construction, showing discharge conduits for Pelton valves in the left foreground. Center: Shop assembly of Pelton butterfly valve with hand and motor-operated mechanism. Below: Free discharge from 60″ Pelton butterfly valve in Glines Canyon Dam.



High Potentiality!

THE ease with which we can lay Lock Joint Pressure Pipe, even under difficult conditions such as in the highway underpass depicted above, is nothing as compared with the ease with which Lock Joint Pressure Pipe lines demonstrate their capabilities to squarely and successfully meet every exacting operating condition, with undiminished mastery, as the decades add up.

Their Strength, their Water-Tightness, their remarkable Joints all help insure this highly desirable result.

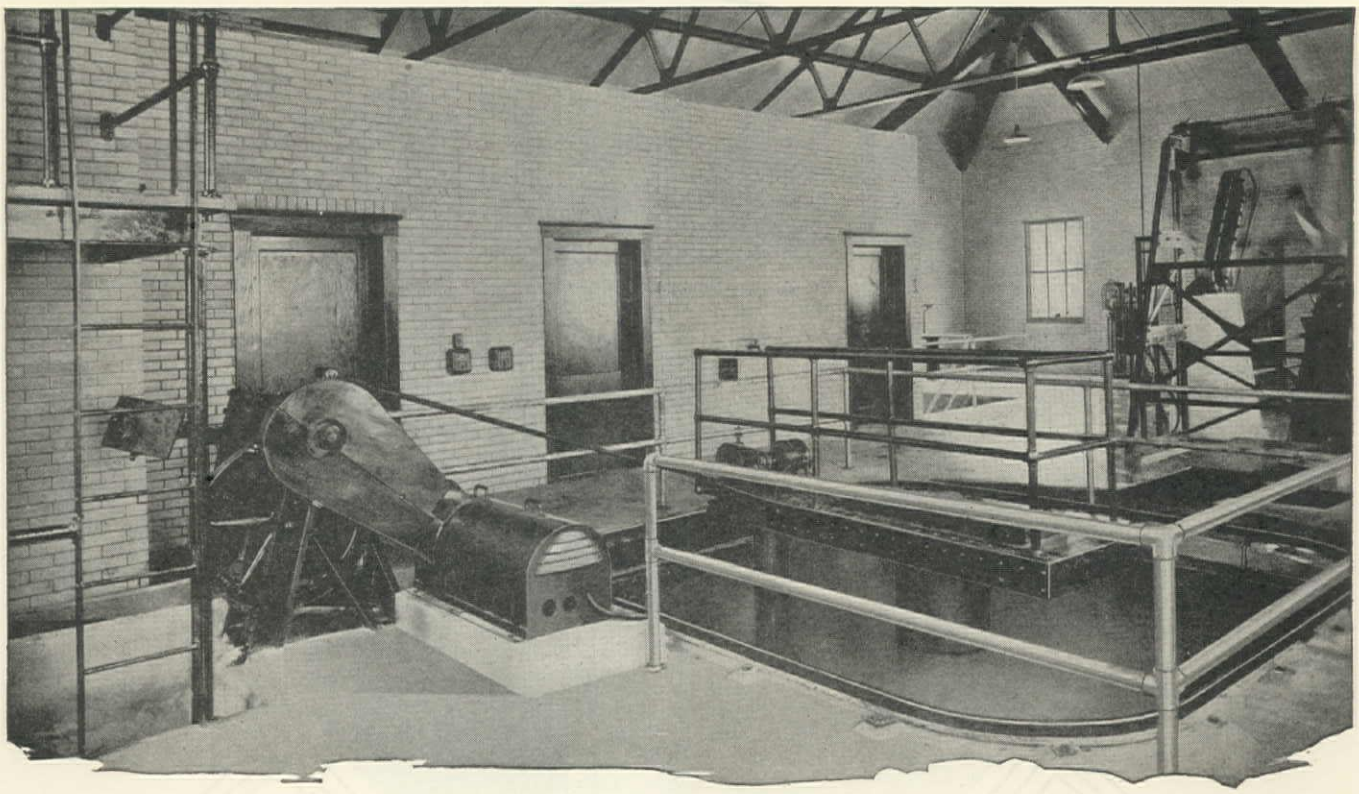
Summed up, these capabilities spell Lock Joint High Potentiality.

LOCK JOINT PIPE CO., *Est'd 1905* Ampere, N. J.

Pressure, Sewer, Subaqueous, Culvert

LOCK JOINT
Reinforced Concrete
PRESSURE-PIPE

When writing to LOCK JOINT PIPE CO., *please mention Western Construction News*



Plain Grit Chambers have no Place in the Modern Sewage Treatment Plant

Just as old-fashioned, plain settling tanks have been superseded by Dorr Clarifiers, so are plain grit chambers giving way to Dorr Detritors in up-to-date sewage treatment plants.

Dorr Detritors solve the grit removal problem by continuously collecting the grit in the flow, *washing* it, and discharging it in a clean, drained condition. The grit as discharged is practically free from organic material and it can be used on roadways or as fill around the plant, without causing offensive odors.

The illustration shows the Dorr Detritor in the recently-completed sewage treatment plant at Middletown, N.Y., designed by Fuller & McClintock.

DORRCO

The operation of the Dorr Detritor is described in Bulletin No. 6481. Our nearest office will gladly send you a copy.

DENVER, COLO.
1009 17th Street

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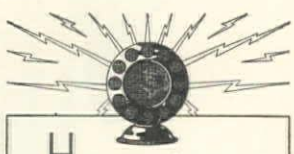
the plant covering of low cost per year

FOR buildings that require more than temporary covering, specify rust-resisting Armco INGOT IRON . . . . and be assured that the structure and its contents will long be shielded from the elements.

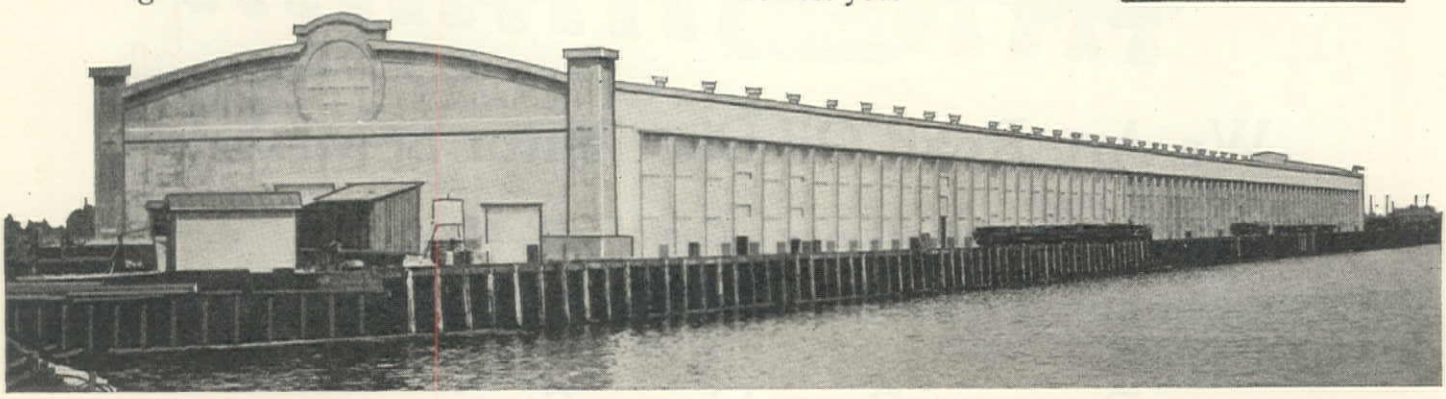
Whatever the conditions—variable atmospheric, industrial, or saline—Armco INGOT IRON provides adequate and long-time weather protection. Twenty-three years of exacting service has brought to this durable iron the longest record of *actual service* of any low-cost, rust-resisting sheet metal.

Among the several types of Armco INGOT IRON roofing are galvanized corrugated roofing and siding, pressed standing seam roofing, V-crimp roofing, and roof-deck ("Ferrobord" and "Rigideck").

An Armco Development Engineer will be glad to work with you in selecting materials, and estimating quantities needed. Call on the office nearest you.



Hear the famous
ARMCO CONCERT BAND
every Tuesday night
WLW-700K.-Cincinnati
Ten to eleven E.S.T.



The siding, skylights, and ventilators of this Los Angeles Municipal Wharf building were constructed of rust-resisting Armco INGOT IRON, in 1915. Fifteen years' exposure to a corrosive salt and smoke-laden air has proved its durability.

BACK of this familiar symbol is nearly thirty years' experience in the manufacture of special analysis iron and steel sheets and plates. When you seek a rust-resisting, low-cost metal be sure to see this triangle and the words "Armco INGOT IRON." It is your assurance of dependable economical service.

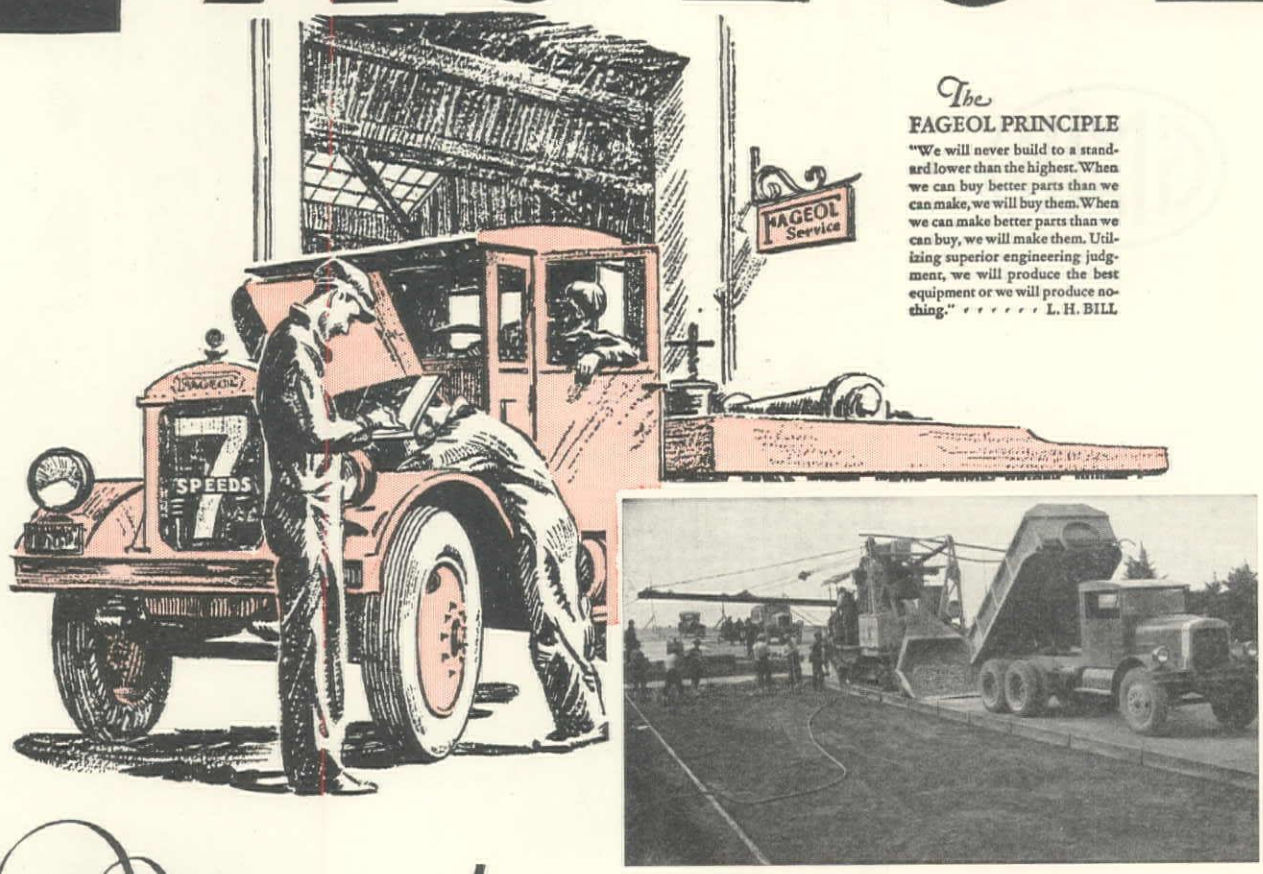
ARMCO

The
AMERICAN ROLLING MILL CO.
OF CALIFORNIA
540 Tenth Street, San Francisco
32 West Connecticut Street, Seattle

"BE SURE IT'S MADE OF ARMCO INGOT IRON"

When writing to THE AMERICAN ROLLING MILL CO., *please mention Western Construction News*

FAGEOL



The
FAGEOL PRINCIPLE

"We will never build to a standard lower than the highest. When we can buy better parts than we can make, we will buy them. When we can make better parts than we can buy, we will make them. Utilizing superior engineering judgment, we will produce the best equipment or we will produce nothing." . . . . . L. H. BILL

WHAT *they* CONTRIBUTE...

WHEREVER hangs out a Fageol service sign . . . whether along the Pacific Coast or as far inland as the Rocky Mountains, there are men carrying out the L. H. Bill principle of service.

Fageol Trucks and Safety Coaches require minimum shop attention . . . they are built that way . . . but even a Fageol cannot be constantly neglected and live out its full years of usefulness.

Fageol service men are all factory trained. They realize the importance of keeping a Fageol on the job. Every possible convenience is afforded the owner, and service work is reduced to a minimum consistent with good workmanship. Divisional branches, centrally located distributors and dealers, and a western factory afford immediate accessibility of factory parts.

And most important of all, there's a spirit of pride which each man feels who services a Fageol. He likes to see how long a hard-working, weather-beaten old Fageol can be kept profitably on the job. The first Fageol is still carrying on; and thousands of others have been in service for many years.

Yes, these men contribute much to the value of a Fageol. There's a "follow-through" that starts at the factory and extends all along the line to the farthest dealer . . . exemplified by conscientious service.

FAGEOL MOTORS COMPANY . . . OAKLAND, CALIFORNIA

Factory Branches

SEATTLE . . . . 717 Dexter Avenue
BELLINGHAM . . . 1417 State Street
SAN FRANCISCO . 180 Twelfth Street
LOS ANGELES . 770 East Ninth Street
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FAGEOL
TRUCKS AND SAFETY COACHES
BILL-BUILT

Factory Branches

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DENVER, COLORADO; SALT LAKE CITY, UTAH; CASPER, WYOMING; SANTA FE, NEW MEXICO; PUEBLO, COLORADO: Mountain Truck Corporation; VANCOUVER, B.C., Fageol Motors Sales Canada, Ltd., 2781 Fourth Avenue West; VICTORIA, B.C., L. H. Campbell, 921 Wharf Street; HONOLULU, T. H., Chester R. Clarke, 620-622 Beretania Street

A monkey may cut off his tail—but he is still a monkey

A machine may be dolled-up with paint—and still be designed wrong

IT PAYS TO BUY PROVEN EQUIPMENT

We don't monkey with experiments. Every piece of equipment we carry in stock has EARNED its right to be there. Every piece has PROVED its earning power in the field.

GET IT FROM BACON

EDWARD R. BACON COMPANY, Construction Equipment
17th and Folsom Streets, San Francisco, Phone HEmlock 3700

We have branches at Fresno, Sacramento, San Jose, Oakland, Reno, Honolulu

On a shallow cut

Byers *always* heaps *the* dipper Full

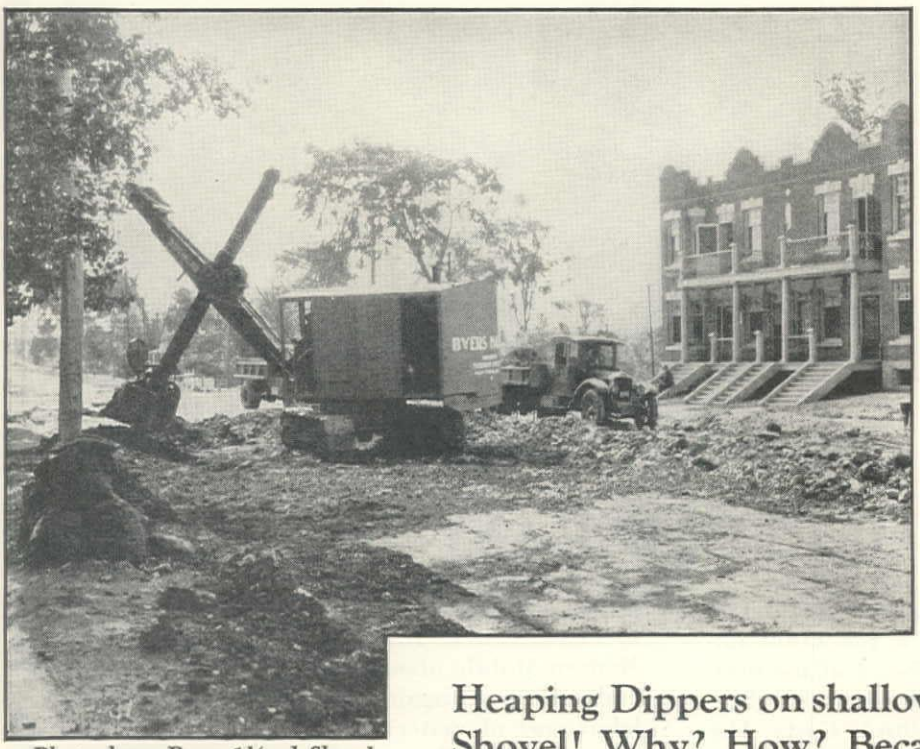

Photo shows Byers 1¼ yd. Shovel

Long Reach

Just like the big league fielder stretches out to reach that hot liner —*and always gets it*—

—so do Byers shovels have a long reach that always get more full dippers without having to move up closer to the job after every other cut.

Heaping Dippers on shallow cuts with Byers 1¼ yd. Shovel! Why? How? Because Byers 1¼ yd. Shovel holds to a grade line 43 ft. 2 in. wide before nosing up into its "bank cut." This wide flat grade line means that the 1¼ yd. Byers can travel down any ordinary width street or highway to be graded and cut away the whole width in one trip. The flat grading range of 21 ft. 7 in. on each side of the center of the machine is wide enough to insure a full dipper on even a 6 inch cut.

Byers 1¼ yd. *full circle Master Shovel, Crane, Dragline, Trencher*

Byers ¾ yd. *full circle Shovel, Crane, Dragline, Trencher, Skimmer*

Byers ½ yd. *full circle Bulldog Shovel, Crane, Dragline, Trencher, Skimmer.*

Byers ½ yd. *half circle Bear Cat Shovel, Crane, Trencher, Skimmer.*

It's the Byers CROWD that does it

BYERS 1¼ yd.

THE BYERS MACHINE CO., Ravenna, Ohio

SALES AND SERVICE THROUGHOUT THE COUNTRY

THE EDWARD R. BACON CO.

Folsom at 17th Street, San Francisco

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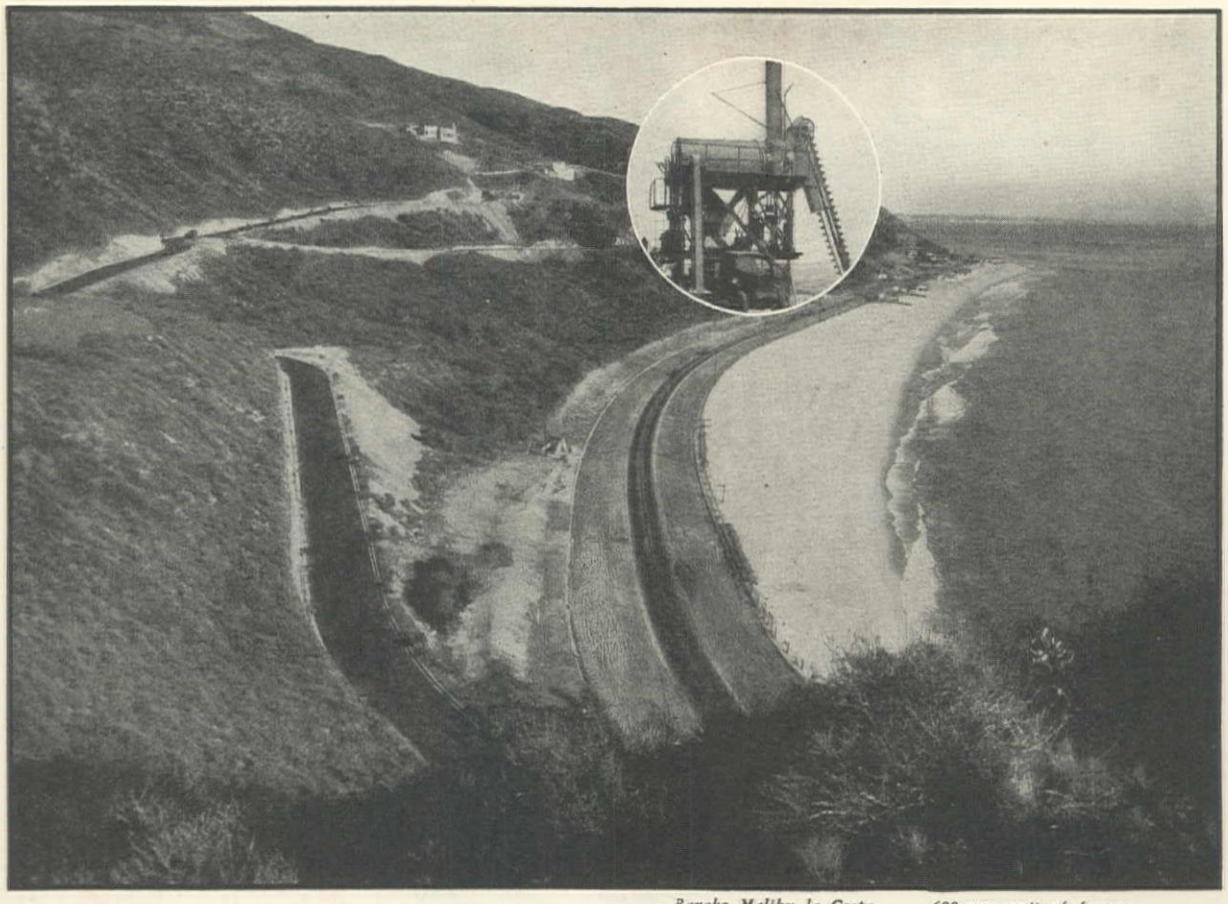


Rancho Malibu la Costa . . . 600-acre unit of famous Malibu Ranch which extends 23 miles along Pacific Ocean

A MADSEN
PAVES HISTORIC OLD RANCHO MALIBU

The Harold G. Ferguson Corporation of Los Angeles has just completed a $250,000 improvement program in Unit No. 1 of the 600-acre hillside section of the historic old Malibu Ranch known as Rancho Malibu la Costa. The program included the laying of 201,000 square feet of asphaltic concrete on permanent 26-foot roadways.

A total of approximately 6,750 tons of material was used. It was mixed on the job with a Madsen 1,000-lb. 2-Unit Mobile Paving Plant. Rancho Malibu la Costa is on the Roosevelt Highway, north of Santa Monica, about twenty miles from the paving contractor's home base in Los Angeles. The cost of dismantling the Madsen Mobile plant, moving it twenty miles, and setting up again, totaled $234. The total labor cost of material mixed averaged 25.84 cents per ton. The overall cost of finished material delivered into trucks averaged 29.38 cents per ton.

Commenting on this job, *"California Constructor"* says:

"Whether or not California is to have a real estate 'boom' in the near future, realtors will obtain better-satisfied customers if they make sure that new streets and improvements are well and permanently built."

Madsen Mobile Paving Plant economies will help good contractors to turn out good jobs at a good profit. May we send complete catalog and specifications?

MADSEN IRON WORKS

Established 1910

P. O. BOX 601, HUNTINGTON PARK, CALIFORNIA
(Suburb of Los Angeles)

EDWARD R. BACON CO.

Distributor
Folsom and 17th Streets, San Francisco, Calif.

IF YOU HAVE NOT RECEIVED YOUR COPY OF OUR NEW CATALOG WRITE FOR IT TODAY

When writing to MADSEN IRON WORKS, *please mention Western Construction News*

IN SAN FRANCISCO IT'S BACON

Performance–
Profits–

THE 1930 MULTI FOOTE PAVER

for Speed-Service-Success

Greater Speed–

Greater Reliability–

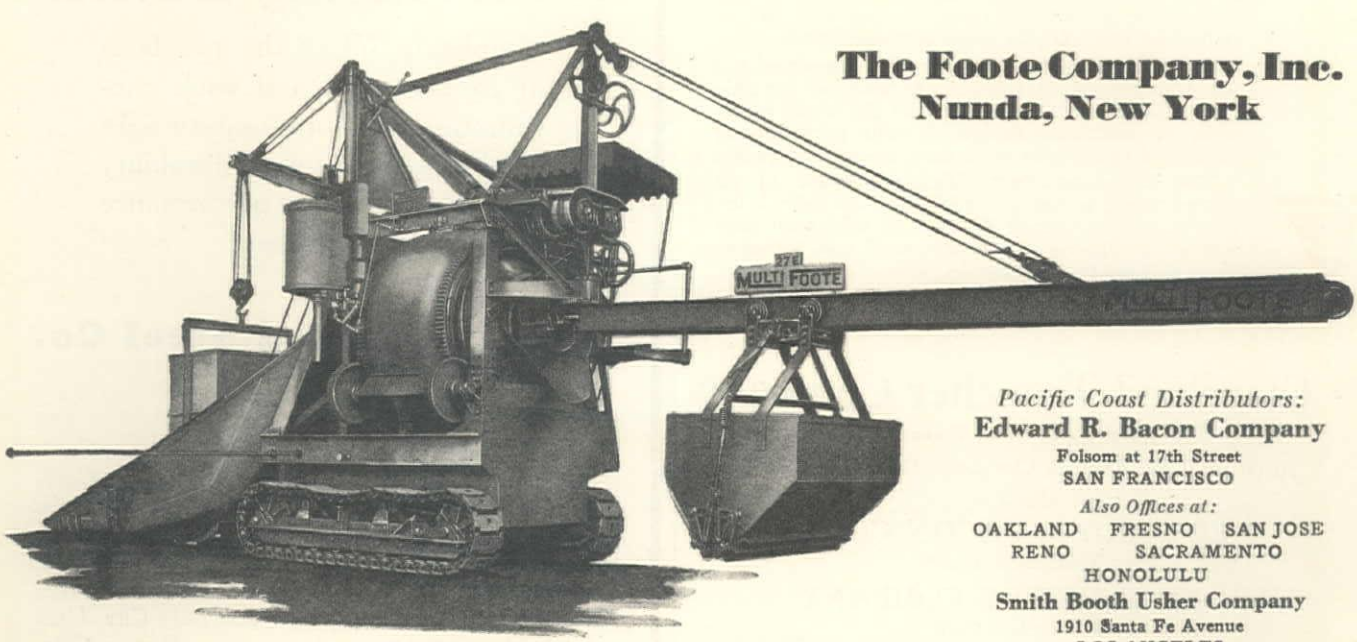
Fast, Steep Discharge–

Tried, Proven Dependable

A Paver refined to the last degree and backed by twenty-five years experience in building Road Pavers. The Best Standard Equipment throughout.

TIMKEN BEARINGS HERCULES HEAVY DUTY GASOLINE MOTORS NO-PRESSURE WATER TANK

The Record of the Multi-Foote Paver for years assures you of that steady, daily performance which means Speed and Profits. The 1930 Improvements automatically save you every possible minute.



The Foote Company, Inc.
Nunda, New York

Pacific Coast Distributors:
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Also Offices at:
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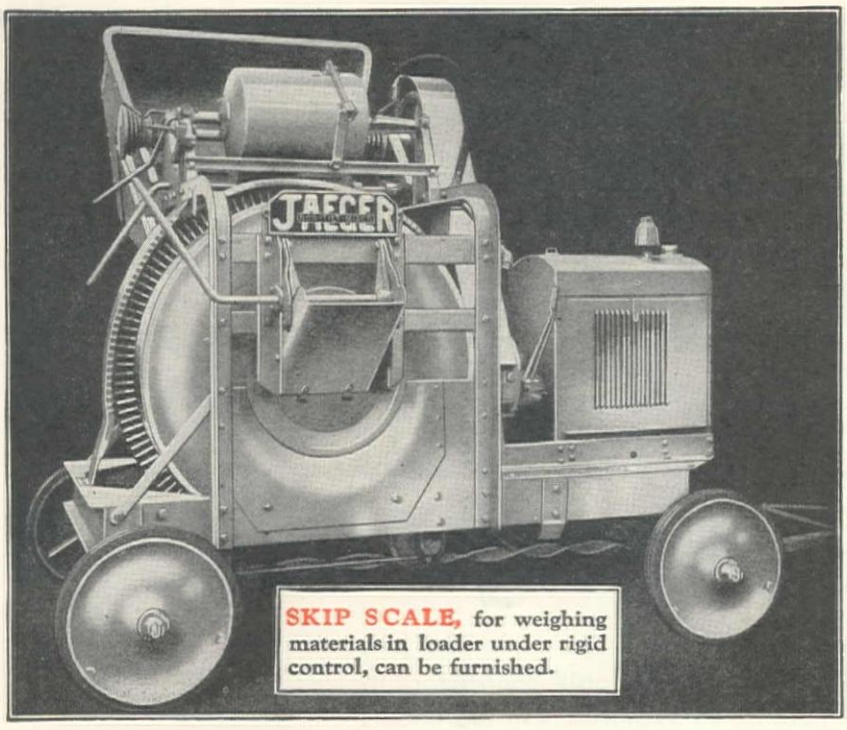
World's Largest Exclusive Builders of Road Pavers

When writing to THE FOOTE COMPANY, INC., *please mention Western Construction News*

IT'S BACON IN SAN FRANCISCO

1 and 2 Bag Mixers

.... Again Stepped Up in the Features that mean SPEED and EASY HANDLING ... to Make You Money on 1930's Jobs!



SKIP SCALE, for weighing materials in loader under rigid control, can be furnished.

10S Handles like a 7...

50% extra strength...1000 lbs. less weight...all-steel,

Short coupled, direct driven, 100% ball bearing,

Dual tire wheels, roller bearings, springs,

Patented Skip Shaker loading, faster discharge, rigid water control with fast tilt and pour tank,

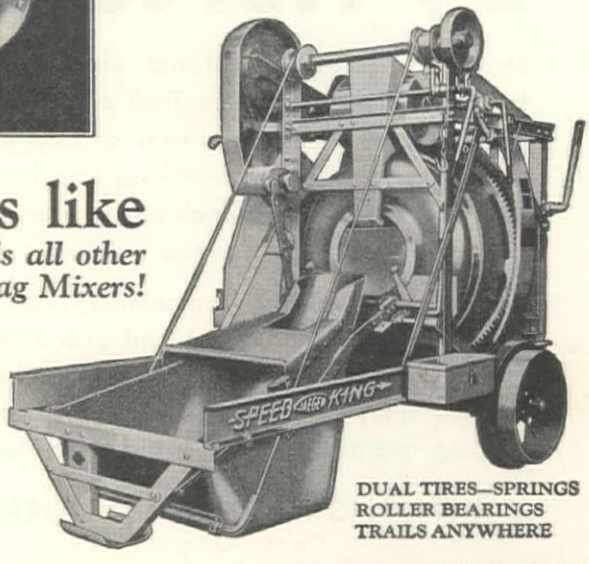
One man end control.

7S SPEED KING Handles like Any TRAILER ....

Outsells all other One Bag Mixers!

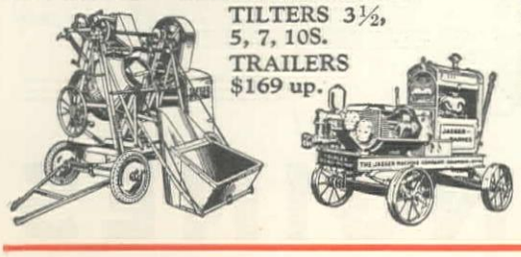
STOUTER, faster than ever, this sensational mixer is ready to hang up new 1930 records. Finest construction with all Jaeger features (Skip Shaker, Accurate Water Tank, ball bearings, one man control) plus advantage of end discharge and many new improvements.

Contractors have proved it out...buy more Speed Kings than any other 7S mixer built.



DUAL TIRES—SPRINGS
ROLLER BEARINGS
TRAILS ANYWHERE

OTHER NON-TILTS 14, 21, 28, 56S.
TILTERS 3½, 5, 7, 10S.
TRAILERS $169 up.



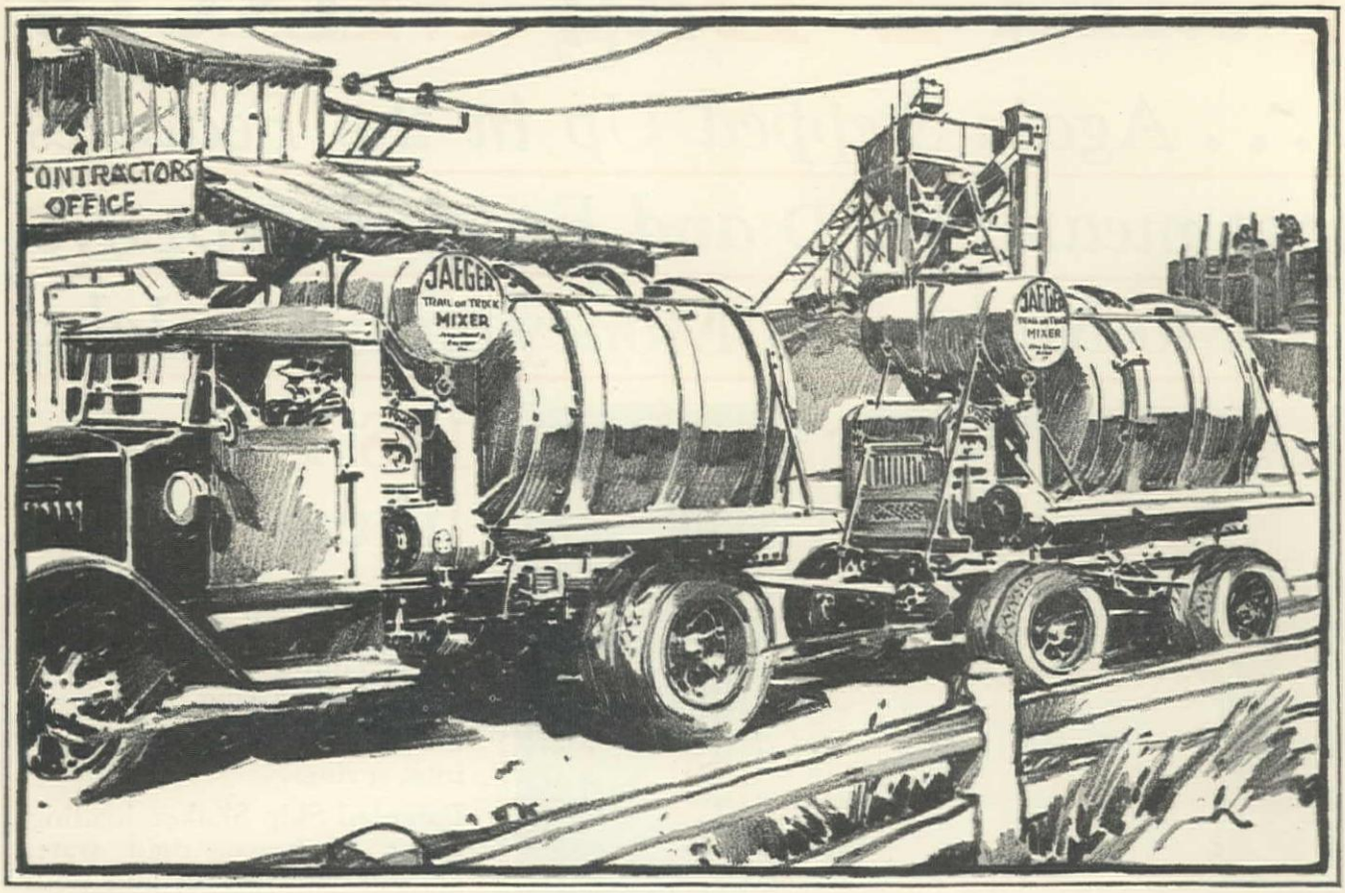
JAEGER-BARNES PUMPS
Self-Priming Centrifugals
—
Triplex Road Pumps
—
All other types

JAEGER MIXERS...PUMPS ...HOISTS...

Carried in stock by

Edward R. Bacon Co., San Francisco
Smith Booth Usher Co., Los Angeles
The C. H. Jones Co., Salt Lake City
Clyde Equipment Co., Portland—Seattle
General Machinery Co., Spokane
Neil B. McGinnis, Phoenix, Ariz.

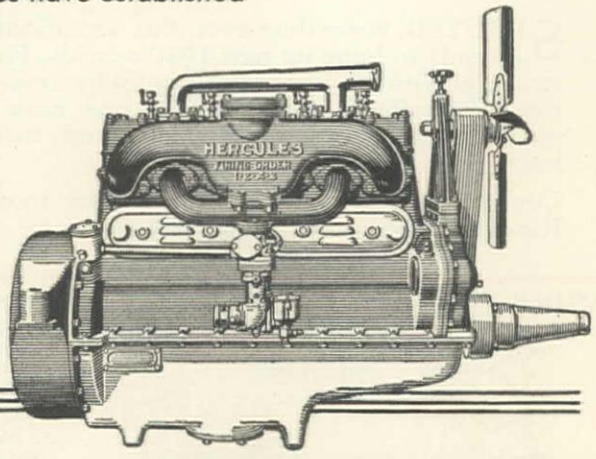
Concrete Mixed in Transit



by Hercules Engines

Mixing 5 yards of material enroute from the batcher to the job, Hercules-Powered Jaeger Trail or Truck Mixers enable contractors to rush concrete construction work and cut down expenses. On short hauls —even with a dry mix—the reliable Hercules Engines respond unfailingly with the added punch and power needed to speed up the drums and insure thoroughly mixed batches.

On all types of industrial machinery, Hercules Engines have established a reputation for reliability and economy. Simple and rugged—expressly designed for heavy-duty service—they are used as standard power by leading manufacturers of industrial equipment.



HERCULES MOTORS CORPORATION
Canton, Ohio, U. S. A.

West Coast Branch: Los Angeles, Cal. Mid-Continent Branch: Tulsa, Okla.
Western Representatives: Edward R. Bacon Co., San Francisco, Cal.; Smith Booth Usher Co., Los Angeles, Cal.; General Machinery Co., Spokane, Wash.; H. W. Moore Equipment Co., Denver, Col.; Nickerson Machinery Co., Salt Lake City, Utah

HERCULES ENGINES

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

An economical combination—three S-49 "Jackhamers" operating from a single I-R Portable

The Best Drilling Combination

The I-R Portable Compressor is an exceptionally fine unit for road-building work.

It is designed and constructed to withstand the rigors of the open country. Inclement weather does not affect its uniformly good performance. Skilled mechanical attendance is not required; in fact, its operation and maintenance are comparatively simple items.

The same may be said of I-R rock drills, which are usually operated from these portable compressors. Regardless of the rock encountered, you can select an efficient drilling combination from the Ingersoll-Rand line. Write our nearest Branch Office for detailed literature.

INGERSOLL-RAND COMPANY of Cal.

San Francisco Los Angeles Seattle New York

230-PC

Ingersoll-Rand

Age-Old Inca Post Road

Proves Moisture-resistance of Asphalt

CENTURIES ago, the Incas constructed a 2000 mile post road from Quito, Ecuador, to Cuzco, in Southern Peru. Most of it was more than two miles above sea level, along the lofty peaks of the Andes.

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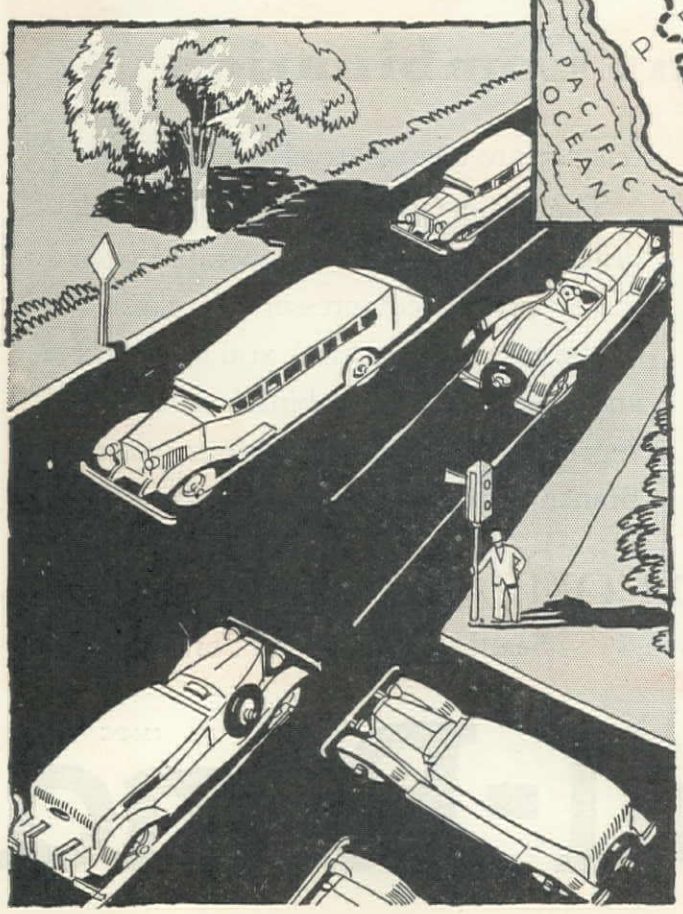

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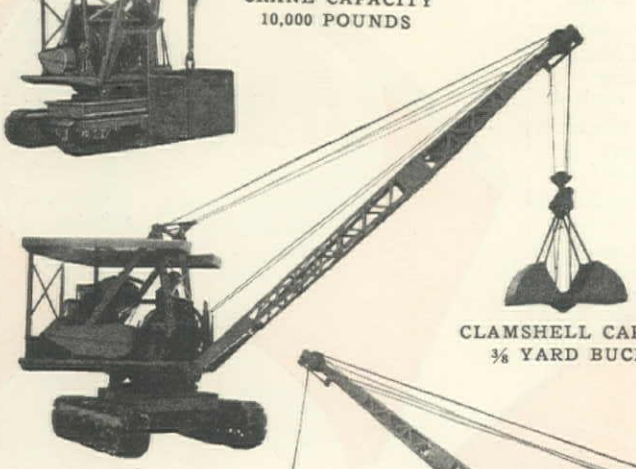

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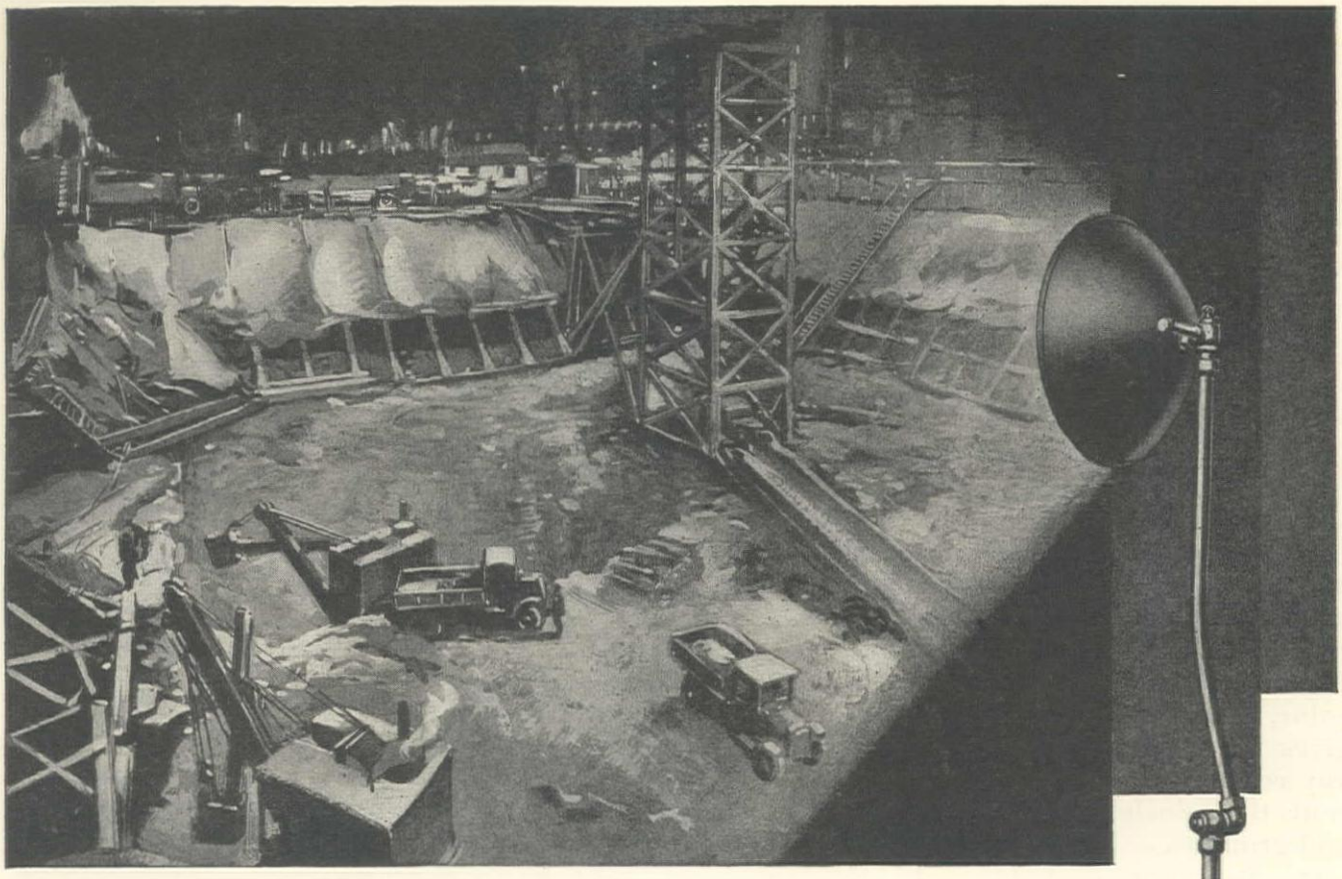

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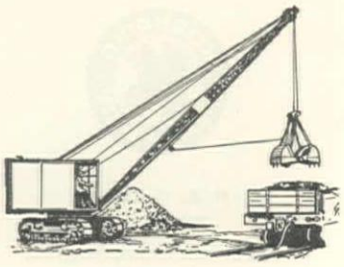

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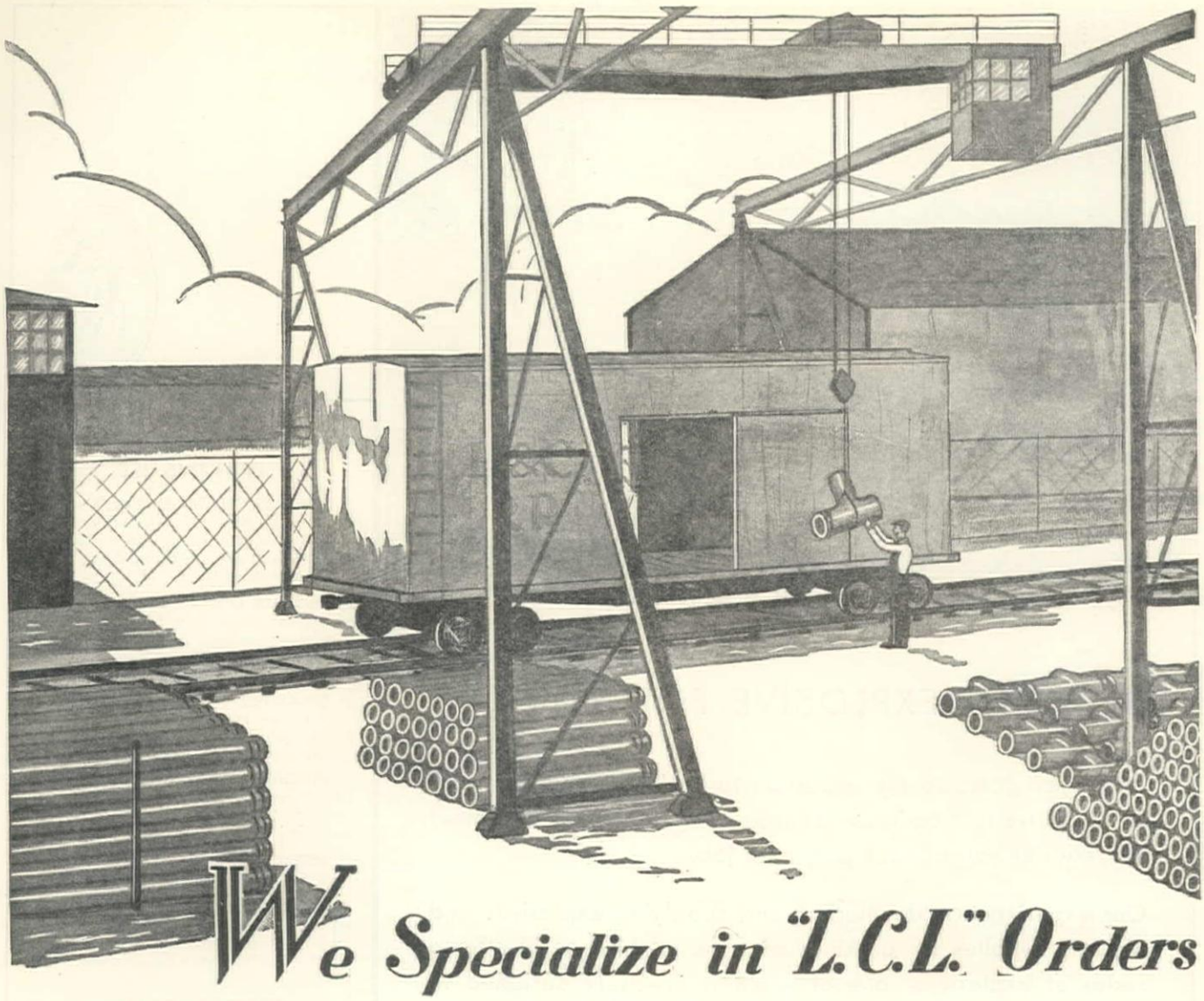

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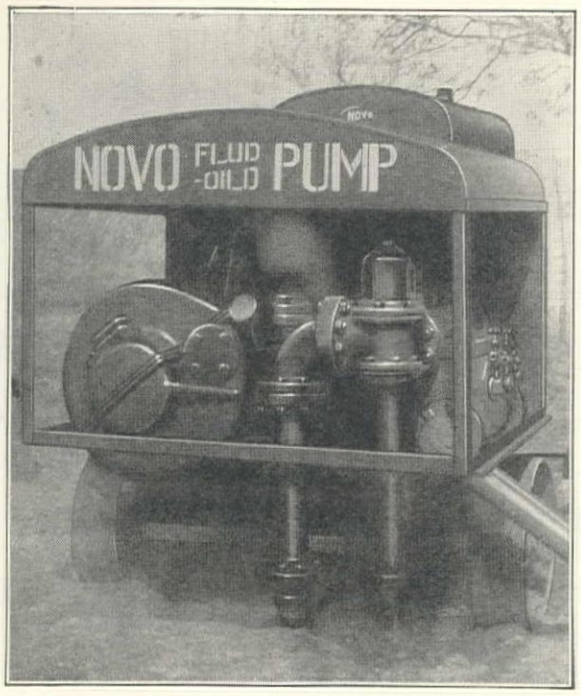

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Even greater performance and lower operating costs are now assured to users of Novo Flud-Oild Triplex Road Pumps.

For these pumps are now powered by the famous four-cylinder Novo "Rollr" Bearing Engine.

The crankshaft of this new engine is completely mounted on anti-friction bearings. Wear is reduced to an absolute minimum. Gas consumption is less. Timkens hold the coupling in perfect alignment always. And because of the increased bore of the cylinders, the engine produces about 10% more horsepower. In addition, the engine cranks on a quarter, right-hand turn.

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Destructive water hammer that wrecks pipe lines and pumps, long before their time, is completely licked by the high speed operation of the Novo Triplex. Operating at 200 r.p.m. instead of the customary 65, this Novo produces *600 water strokes per minute*. The flow of water is smooth and even. Pressures are steadier and stronger. And vibration is eliminated.

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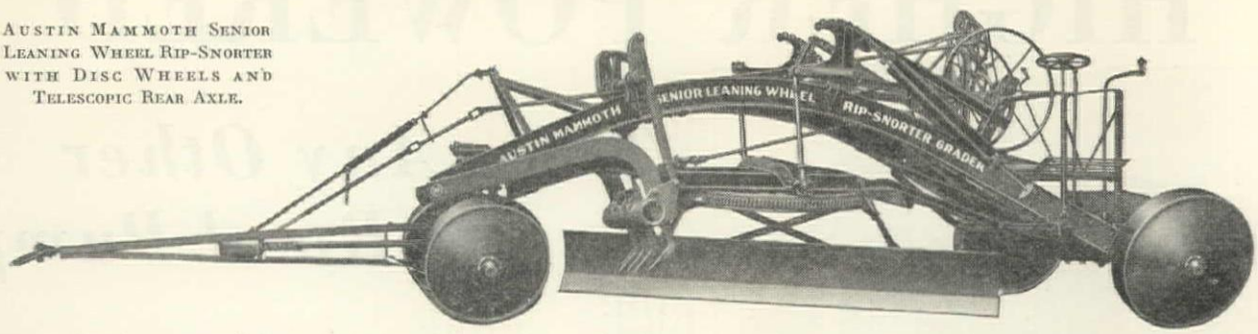


More work per horse power!

This dual purpose Austin Rip-Snorter is typical of the exceptional values in the entire Austin-Western line .....

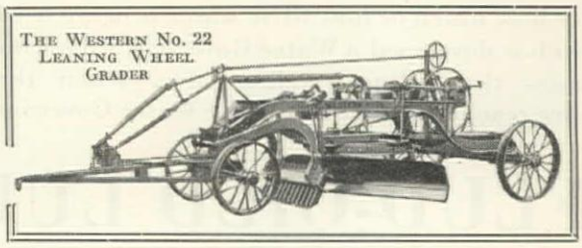
GRADER and scarifier in one—a sturdy and well-balanced outfit that bites into the hardest soil and keeps it rolling before the blade. A machine that tears up worn-out roads or rough sub-grades and regrades in one operation, thus eliminating several slow and expensive operations.

The Austin Mammoth Senior Leaning Wheel Grader, equipped with the Rip-Snorter scarifier as shown above, was the first combination grader-scarifier ever designed and is still the leader in its field. These machines are made in five sizes, ranging in weight from 5300 to 11,200 pounds. Leaning or straight wheels may be had with all sizes, spoke or disc in the 12′ and 10′ models; spoke wheels only, in the three smaller sizes.

The famous and exclusive Austin Telescopic Axle may be had in all Austin leaning wheel graders. This valuable feature enables work to be done under difficult conditions with much greater efficiency than would be possible with graders having one-piece axles. This is just one of the many improvements to be found in Austin-Western Road Machinery—features which result in better, faster work and at less cost per mile, whatever the operation.

Write for complete information about the equipment you are most interested in. Special bulletins are available which provide much data of interest and value.

THE WESTERN NO. 22 LEANING WHEEL GRADER



A strong, easily handled patrol grader that is also ideal for finishing shoulders, smoothing rough sub-grades, light grading and ditching. Has leaning wheels, shiftable rear axle and Timken bearings. Six horses or a light tractor can handle it. Can be supplied with a steerable offset engine hitch if desired. Write for details.

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Over 200,000 Yards... Oversize Bucket

A Link-Belt Dragline with 45 ft. boom and 1¼ cu. yd. bucket at work on lake front improvement in Chicago

THE above are the features of the story of service rendered by the Link-Belt K-30 Dragline belonging to Peterson & Simmons, drainage contractors of Fairfax, Missouri.

Under date of January 9, Mr. S. J. Peterson of the above company wrote the following unsolicited testimonial:

"We expect to get through with the job at Elmo, Mo. in about a week if the weather does not get too bad on us. That will make 165,000 yards since October 18.

"This K-30 has dug considerably over 200,000 yards since we got it. It has caused *less trouble than any machine we have had anything to do with.* Nothing has been spent on it except for brake lining."

It should be noted that this 1 cu. yd. machine had been equipped by the owner with a 1¼ yard bucket. This is the fourth Link-Belt machine that Mr. Peterson has purchased.

The range of sizes in Link-Belt Crawlers is up to two full yards capacity, heavy duty units, gasoline, Diesel or electric power.

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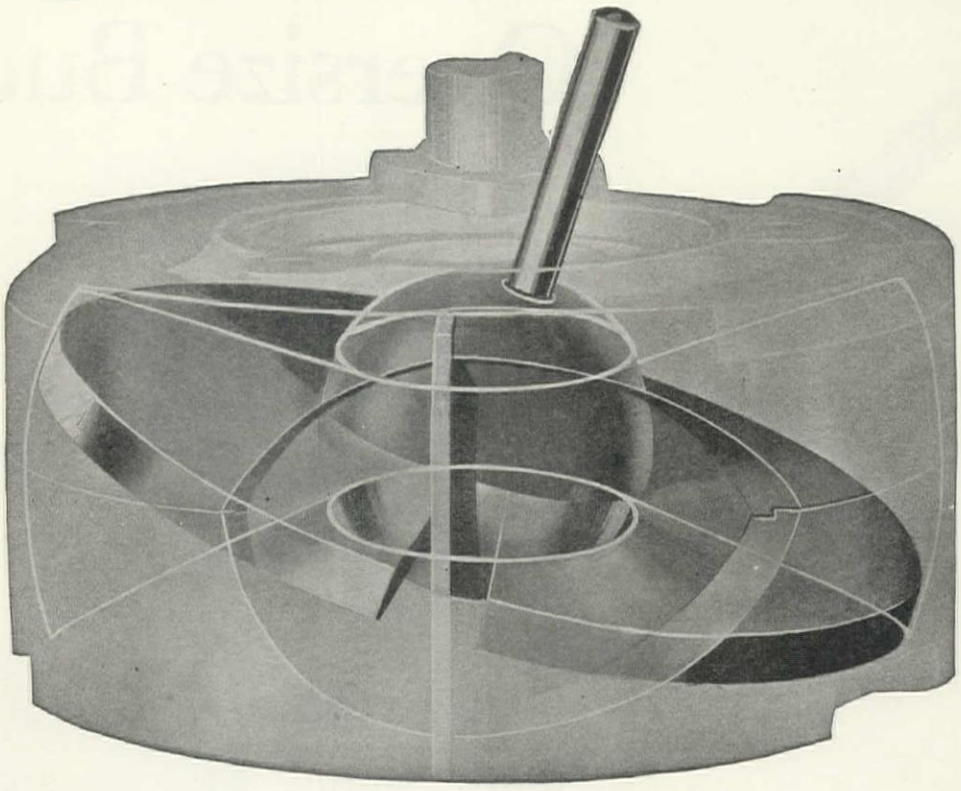

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Water enters disc measuring chamber on inlet side of a radial partition, its passage thru chamber causing disc to move positively and projecting spindle to revolve.

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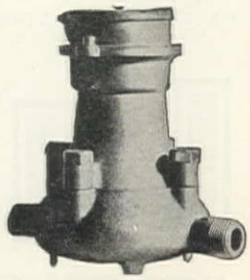

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VOLUME V | MARCH 25, 1930 | NUMBER 6

For several weeks the grand jury of Alameda county, California, has been delving into a sordid mess of political corruption and graft, starting with an alleged street paving ring centering in Oakland and spreading, as the inquiry continues, to a veritable chaos of graft involving garbage disposal, bootlegging, and gambling.

Oakland Paving Scandal

Several times during the past two years, the city officials of Oakland have been forced into an inquiry following charges of graft in the disposal of garbage and in street paving; each time the 'official' inquiries resulting in neither indictments nor any specific facts, but leaving suspicion in the minds of everyone.

This inquiry, which has the earmarks of an attempt to discredit the present political administration, is being conducted by the district attorney, and has already resulted in the indictment and dismissal of the sheriff and two deputies, and the indictment of a number of others including the commissioner of streets—since transferred to another department—and a prominent contractor.

The accusations include payments by contractors to inspectors of street paving contracts, payments to city officials for patented pavement rights, 'closed shop' regulations against certain materials, such as gravel; discrimination against contractors not in the 'ring'.

We have altogether too many of these political upheavals, which seldom uncover the true facts in the case, but result in the besmirching of many an innocent engineer and contractor—the guilty in most instances escaping punishment.

If engineers and contractors would take a firm stand against participation in construction contracts subject to political 'favor', both would be better off in the long run.

Only those who have been obliged to use hard water for a long period and then have moved to a soft-water city, or the other way around, can appreciate the value and convenience of real soft water. Likewise, only those who have a water softener in their residences realize that it is a paying investment—a necessity and not merely a luxury.

Value of Soft Water

A water softener is a sound investment for any family wherever the water supply is at all hard—even waters as low in hardness as 3 grains per gallon.

I reside in the East Bay Cities on San Francisco bay, where the water supply until recently averaged 12 to 14 grains of hardness per gallon (Los Angeles and San Francisco water supplies average a few grains less). Waters of this hardness are hard on the skin, hard on clothes; leave an adhesive scum to bath tubs and wash basins; a lime deposit on cooking utensils; and rapidly deteriorate all plumbing and heating fixtures. Needless to say, I have a water softener, which I consider one of the most important pieces of equipment in the house.

Recently a new mountain supply was added to the water supply of the East Bay Cities, reducing the average hardness to 6 grains, or one-half. The water softener is just as necessary as before—it merely operates twice as long between regenerations. The cost of operation is so nominal it is hardly noticeable.

Although practically all of the East Bay water supply is carefully filtered and chlorinated, the water picks up some impurities in passage through the distribution system—to be expected in any large water works—and the residential water softener, acting as a pressure filter, gives the consumer the final clarification and purification.

As soft water as well as filtered water is an economic necessity, mass treatment should be a function of the water works. Anyway, soft water in a residence is as important as electricity, gas, and heat. P.S.

As we always welcome constructive criticism, we take pleasure in publishing elsewhere in this issue, a 'Letter to The Editor' by J. E. Jellick, referring to our editorial in the March 10th issue on 'Shrinkage Cracks in Concrete'. We might well have amplified our statement by referring to the success achieved in recent concrete paving, especially in California, in preventing shrinkage cracks by the use of 'dummy joints'. Jellick, who was for many years Pacific Coast manager of the Portland Cement Association and is an engineer of recognized standing, suggests the applicability of the 'dummy joint' to other types of structures. Some engineers have been trying this method or principle in dam design—others are not as yet 'sold' on the idea.

Concrete Control by Dummy Joints

What we meant to convey in the editorial referred to, was that the proper spacing, location, and type of 'dummy joints' in mass concrete or concrete structures other than pavements, have not been accurately determined.

Fresno Chandler Airport, California

By ANDREW M. JENSEN*

Consulting Engineer, San Francisco, and Formerly Commissioner of Public Works, Fresno

Old Airport—About four years ago the Fresno Chamber of Commerce, realizing that this city should have an airport, leased a 300-acre tract eight miles northwest of the city for an airport. The Chamber of Commerce started the development of this airport and soon thereafter the city took over the lease and made further improvements. At best, due to the lack of money, only sufficient development to provide a fair runway and meager lighting for an air mail could be made. On two different occasions, the last of which was in November, 1928, the people of the city voted to bond the city for the purchase and development of this tract of land for an airport. In both instances the bond election failed.

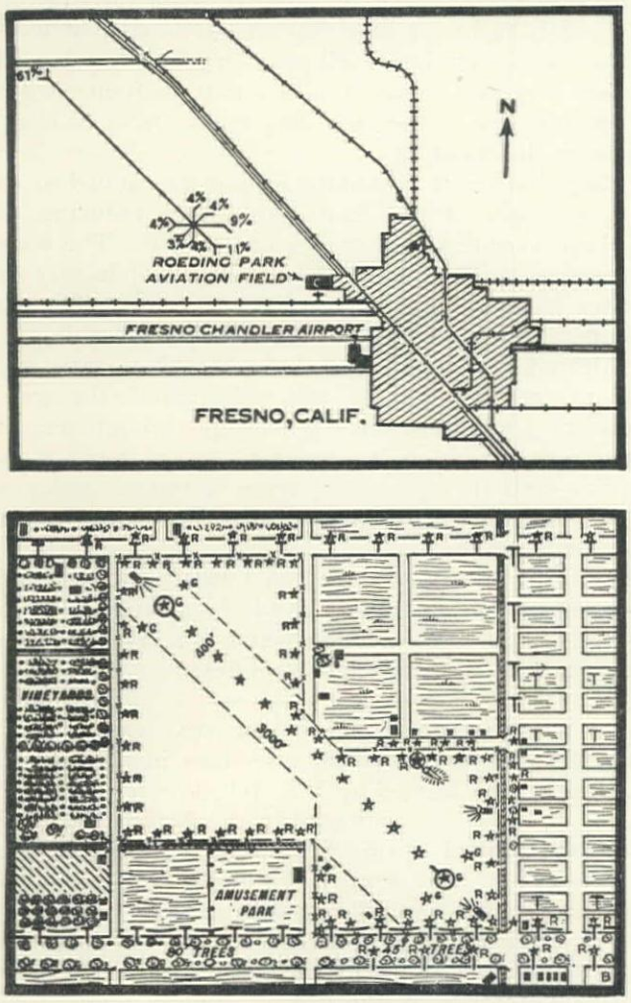


Fig. 1. (Upper) Vicinity Map of Fresno Chandler Airport. (Lower) Plan of Airport Showing Obstructions, Lighting, Graded Area, and Main Runway

Chandler Gift—In December, 1928, W. F. Chandler, former state senator from this district and a public-spirited citizen, and his wife, donated to the city 100 acres of land for airport purposes. This land lies in such a shape that it was practical to develop a real airport on it. Sufficient money was appropriated out of the general tax levy to make the absolutely necessary improvements for a landing field safe for day and night flying.

This tract of land is immediately adjacent to the city limits, and the entrance to the airport is 1.5 miles from the City Hall and 1.8 miles from the Post Office of Fresno city. Although the airport is surrounded by closely built up territory and some obstructions which later will be overcome, it has been pronounced by many authorities and pilots as being entirely safe and one of the best airports in the country.

Amount of Improvements—Realizing that only a comparatively small amount of money was available for the development of this airport, the Department of Public Works made only those improvements which were absolutely necessary to provide a safe and usable landing field, letting the construction of hangars and the installation of facilities go until a later date. Three essential features were first installed, and since then some important facilities have been added. The attitude of the citizens toward the expenditure of money on this airport has changed, so that there will be no trouble in securing the necessary money to complete its development. The three essential features were a runway in the prevailing wind direction and an operations area carefully graded with the surface oiled so as to eliminate dust, a complete lighting system, and a boundary fence entirely surrounding the airport.

Fig. 1 shows the location of the airport, close to the center of the city of Fresno. This fact has stimulated great interest in aviation, and the attendance at the Chandler airport and use of airplanes for flights of all sorts has been many times that of the old airport eight miles from the city.

When additional money is available, land will be purchased with which to enlarge the airport so as to form a full quarter-section, thereby eliminating the constricted condition now existing. However, the present area has proven safe and satisfactory for the airport purposes, but it will not permit sufficient expansion for future hangar and factory sites.

Runways—The main runway has an effective length of 3000 ft., which has proven ample for use by all ordinary sizes of airplanes. In 1931, when more money will be available, an east-west and a north-south runway will be prepared. As 61% of the winds are northwest and southeast, this is the direction of the main runway.

Most of the soil of the airport is a sandy loam, the remainder being an ordinary loam with a little clay;

*Member, American Society of Civil Engineers.

it is ideally suited for runway purposes. The runway and operations area were graded to a surface having no grade or slope greater than 3 in. per 100 ft. After the rough grading was finished, the entire area was settled by flooding with water, and then the finish grading was done. A total of 49 acres was graded at a cost of $91 per acre.

The oil applied to the runway and operations area was a natural crude petroleum containing 65% asphalt. Two hot applications, each of ¾ gal. of oil per sq.yd., were made; the total oiling cost being 4.8 cents per sq.yd. Before the first application, the area to be oiled was disced, and after oiling it was disced, harrowed, and dragged. The drag blades were placed diagonally and slanted backwards toward the top, with openings at the ends so arranged that the earth would be carried from one side to the other of the drag and mixed by rolling. No attempt was made to compact the surface by rolling. The ordinary traffic of planes and the subsequent maintenance dragging soon put the surface in shape. For maintenance purposes, the blades of the drag were tipped forward, the result being that the drag compacted as well as smoothed the oil surface. The oiled area is dragged at regular intervals to cover the tail skid scars. The surface formed in this manner is dustless, not too hard, and yet firm enough to make an ideal runway for the dual purposes of landing and taking off.

The normal rainfall of Fresno is 9 in. per year, and this is spread over a period of five months. Therefore, with this rainfall, the type of soil, and the manner in which the runway and operations area are graded, no artificial drainage is necessary.

Lighting—The lighting system was designed by George M. Bowman, electrical engineer, city of Fresno, who made comprehensive studies of the requirements for night landing, his studies including night flights to some of the best lighted airports in California. The lighting system consists of boundary, obstruction, approach, runway, flood, and beacon lights.

The existence of obstructions around the boundaries of the airport required red obstruction lights installed on poles opposite to them and at sufficient heights to indicate the obstructions. The boundary lights were all made red in order not to have any confusion with street and house lights adjacent to the airport.

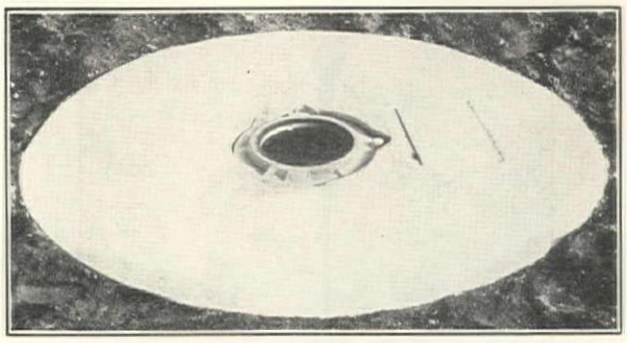


Fig. 3. Crouse Hinds 8-in. Runway and Approach Lights in 4-ft. Concrete Circles, Three Lights at Each End of Runway

Runway and approach lights are 8-in. Crouse Hinds flush type units set in 4-ft. circles of concrete, with the units flush with the runway surface and permitting airplanes to pass freely over them at will. The runway lights are amber and are located 245 ft. apart along the centerline of the runway. The approach lights are green and are three in number at each end of the runway. When other runways are provided, center runway lights and approach lights of the same type will be installed in a similar manner; and the proper runway lights for landing into the wind will be automatically lighted. At the present time, the existing runway is lighted continuously.

The flood lighting system adopted consists of a bank of Crouse Hinds type DCE 24, 3000-watt 32-volt flood lights at each end of each runway. At present there are three banks installed, one of 5 at the southeast end of the main runway, one bank of 4 at the northwest end of the main runway, and one bank of 4 at the east end of what will be the east-west runway. These floodlights are so designed as to have the top rays parallel with the runway surface, and are of such intensity that a newspaper can be read at a distance of 3000 ft.

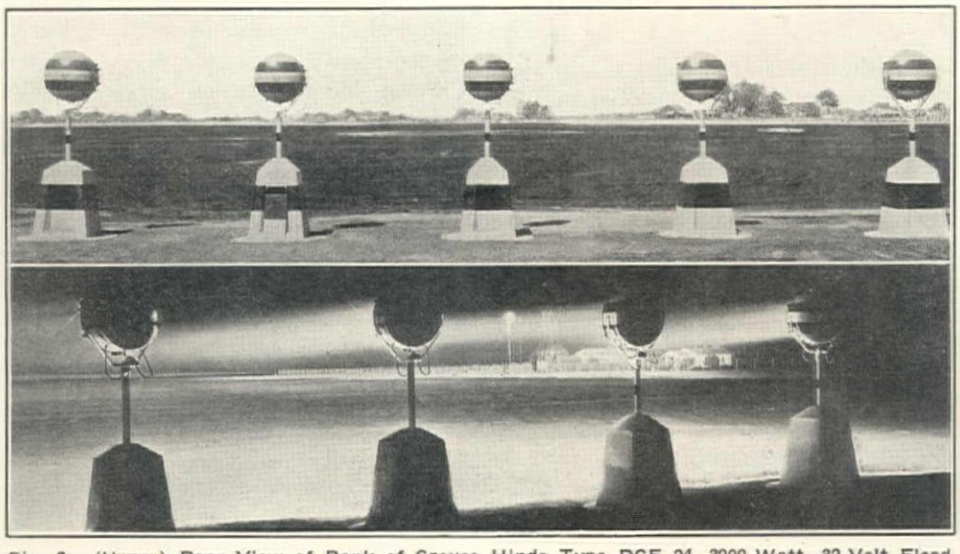


Fig. 2. (Upper) Rear View of Bank of Crouse Hinds Type DCE 24, 3000-Watt, 32-Volt Flood Lights Facing Oiled Operations Area. (Lower) Floodlights Illuminated, Beacon In Right Background

The beacon is mounted on a 57-ft. tower and is a 24-in., 3,000,000 candlepower Sperry revolving Department of Commerce standard beacon, equipped with Zenith lighting panels, automatic lamp changer, and a contactor which automatically flashes the letter 'F' in International code. Thousand-watt flashing course

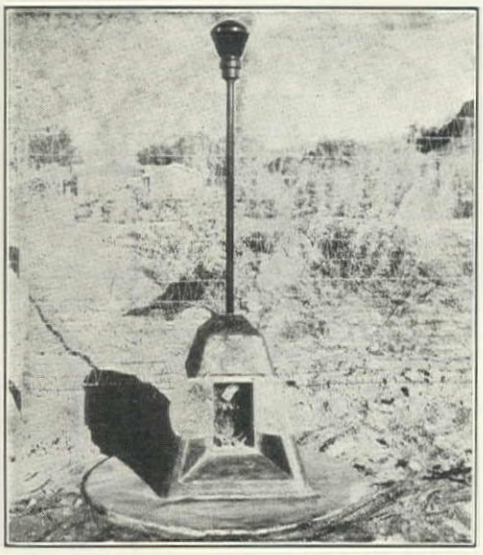


Fig. 4. One of the Red Boundary Lights Defining Location of Fresno Chandler Airport

lights pointing to Los Angeles and San Francisco will be installed soon.

The boundary, obstruction, approach, runway, and beacon lights are controlled by a Type S202 astronomic Tork time clock, and are turned on 15 minutes after sundown and off 30 minutes before sunrise. This clock is operated by electricity, but has spring clockworks mechanism which automatically operates when the electric current is off, and which can operate for a period of 3 days.

The main service to the lighting system is supplied with 3-phase, 440-volt current, and the obstruction, boundary, approach, runway, and beacon lighting units are supplied with single phase, 440-220-volts, with 30% Hazard rubber covered wires, all in iron conduit. The power for the flood lighting banks is transmitted at 3-phase, 440 volts, to a 3-phase bus at each lighting bank. From this bus, a single-phase, 440-volt circuit is carried to a switch in the base of each flood light. From this switch, a 440-volt single phase circuit is run to a 3000-watt, 440-32 volt, lighting transformer which furnishes energy for the 3000-watt, 32-volt flood light. The flood light circuits consist of 30% Hazard rubber covered wire, all in iron conduit.

A central control station was constructed, from which circuits for the present and all future lighting emanate. All circuits now installed are such that they will coordinate with future enlargements or installations. The control of flood lights is had by contactors equipped with remote control buttons, all installed in the control station. When an administration building is constructed, the remote control circuits for all lights will be extended to the administration building. Tests of the voltage at the flood lights prove the system to be accurately designed. The control of flood light banks is such that the lights will always be at the pilot's back when landing and will be changed so as to be on his back while taxiing to position.

The lighting system has been declared by experienced pilots and others as being first class in every respect. The approach and runway lights particularly have been commended and are considered superior to other runway lighting systems. The total cost of the present lighting system complete was $23,000.

Buildings—A residence was constructed for the airport superintendent, who is on duty 24 hours a day. One room of the residence is used as an office. When

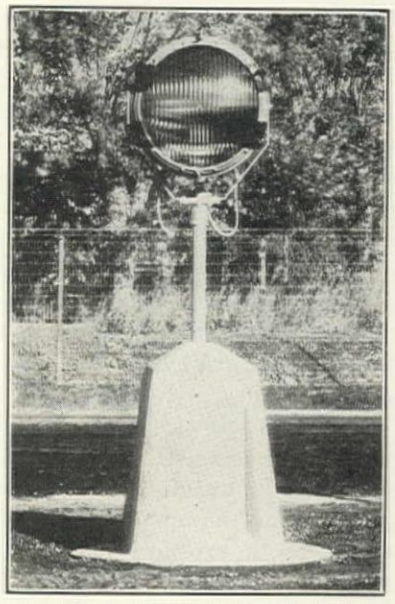


Fig. 5. Front View of Crouse Hinds Floodlight, the Rays from which Parallel Runway Surface and Give Good Visibility at Distance of 3000 ft.

more money is available, an administration building will be erected. A building is now being built to house the Government weather bureau station. Four oil companies (Standard, Associated, Richfield, and Union) have installed service stations of the latest type with field pits flush with the ground surface. One private hangar is now completed, and two more soon will be started. The Pacific Air Transport, which carries air mail through the San Joaquin valley, was established on this airport in February, 1930.

The total expenditures on this airport to January 6 were:

Grading and oiling	$14,100
Fence	2,850
Lighting system	23,000
Residence and garage	3,100
Weather bureau station	1,950
Office furniture	300
Circle markers	900
Miscellaneous	4,800
	$51,000

Personnel—The work was done under my direct supervision and that of W. F. Rantsma, deputy commissioner* of public works, Fresno. Lambert & Wood were the contractors on the grading and oiling work, and the Electrical Construction Co. was the contractor on the lighting system. George T. Johnson is the airport superintendent.

*Now acting commissioner of public works, succeeding Jensen, who resigned to enter private consulting practice.—Editor.

Oil-Processing Roads in New Mexico

By R. W. BENNETT

Office Engineer, New Mexico State Highway Department, Santa Fe

The outstanding phase of highway building in New Mexico at this time seems not to be any spectacular blasting of a road through the mountains, any bridge of unusual design, or other unique construction, but rather the reconstruction of the state's graveled roads by oil-processing.

About three years ago the necessity for 'doing something' to rescue and put New Mexico's Federal Aid gravel roads in condition for modern traffic became apparent. A study was made of conditions in other western states confronted with the same situation. The result was the adoption of California's method of handling the same problem.

Light-Traffic Road Construction—Because of lack of finances, New Mexico has not been able to construct any imposing mileage of paved highways. The availability and low cost of gravel and stone has led to the building of a large distance of gravel-surfaced roads. This type, which includes crushed gravel, stone, malpais, caliche, and other native materials, stood up fairly well and was reasonably economical to maintain so long as traffic remained comparatively light.

With material increases in volume of traffic on the main arteries, however, the gravel-surfaced roads became inadequate. Heavy losses in surfacing material became the rule. The federal aid gravel-surfaced roads sustained losses of one inch or more of surfacing material annually as a result of traffic and high winds. Dust became not only a nuisance but a menace to traffic. Corrugations were virtually impossible of correction, particularly in long periods of dry weather such as are frequently experienced in New Mexico and the Southwest. Maintenance costs became almost prohibitive in even keeping the roads fit for travel, to say nothing of replacement of lost material.

The means of remedying these unsatisfactory conditions was borrowed from California, namely, oil-processing principally by the 'mixed-in-place' or 'turn-over' method.

Oil-Processing—As practiced in New Mexico, the oil-processing results in a surface cake or mat 2½ to 3 in. thick and 20 ft. wide. Earlier projects were processed only 18 ft. in width, but shoulder failures led to the building of 20-ft. roadways.

Because of the large grading of gravel on early built gravel roads (in some instances 2½-in. maximum) and heavy losses in surfacing material sustained on many projects, it has been necessary in most instances to add crushed material in sufficient amount to form the oiled mat. This, of course, has added to the cost of our reconstruction—about doubling it on those projects where such replacement has been necessary.

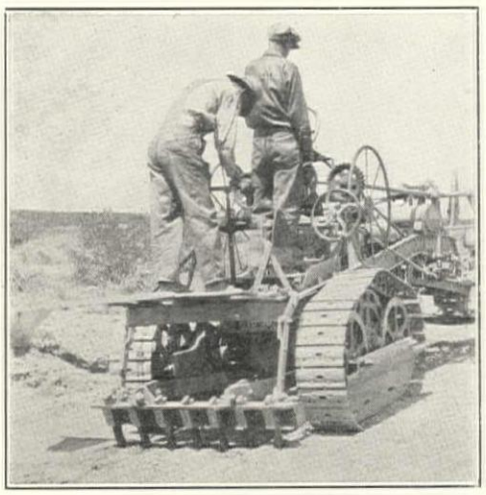
On projects where there remains a sufficient thickness of gravel to form a good base and at the same time yield enough surface material of the proper consistence as regards grading to form the standard 2½-in. oil mat, only scarification and perhaps addition of fines or dust is necessary prior to the oil treatment.

Whether new material is added or old surfacing scarified and oiled, the material to be treated should come within the following limits as regards grading:

Size Screen	% Passing
1-in.	100
½-in.	60–80
10	35–70
100	12–25
Dust	5–15

In New Mexico sandy gravel has been treated, also crushed limestone; but, at least 35% of sand has been added to the limestone roads. An appreciable amount of dust is essential—material so fine that it will remain suspended in water for several minutes.

Where new material is added, its volume is known and the amount of oil to be used is readily computed.



Russell '15' Scarifier Preparing Old Gravel Surface Prior to Oiling

Where old surface is scarified, it is necessary to move the loose scarified material to one side in a windrow for measuring.

The oil employed in processing is a fuel oil, specified as containing 60 to 70% of asphalt varying from 80 to 100 penetration at 77° F. and of 25 to 45 viscosity, Engler. The oil is heated in the tank car by means of steam coils, the heating unit consisting of a 25-hp. steam boiler. The temperature of the oil when pumped from the tank car into the distributor is about 150° F.

The amount of oil required for satisfactory results has varied in this state from 1⅓ to 2 gal. per sq.yd. Gravel having a minimum percentage of sand and dust requires less oil than material carrying high proportions of these ingredients. Mats containing the larger percentage of fines and consequently a greater amount of oil, have been found more impervious to

water and are advantageous in regions of greater rainfall.

In New Mexico practice, samples are carefully screened from the rolled or newly placed material to determine the amount of oil necessary according to the following formula which has been developed in observation of this work:

$P=(a\times0.02)+(b+0.07)+(c\times0.15)+(d\times0.20)$: in which 'P' represents the percentage of oil necessary in pounds; 'a' the percentage of gravel material (in pounds) held on a No. 48 screen; 'b' the percentage of material (in pounds) passing the No. 48 and held on a No. 100 screen; 'c' the percentage of material (in pounds) passing the No. 100 but held on a No. 200 screen; 'd' is the percentage of material passing the No. 200 screen.

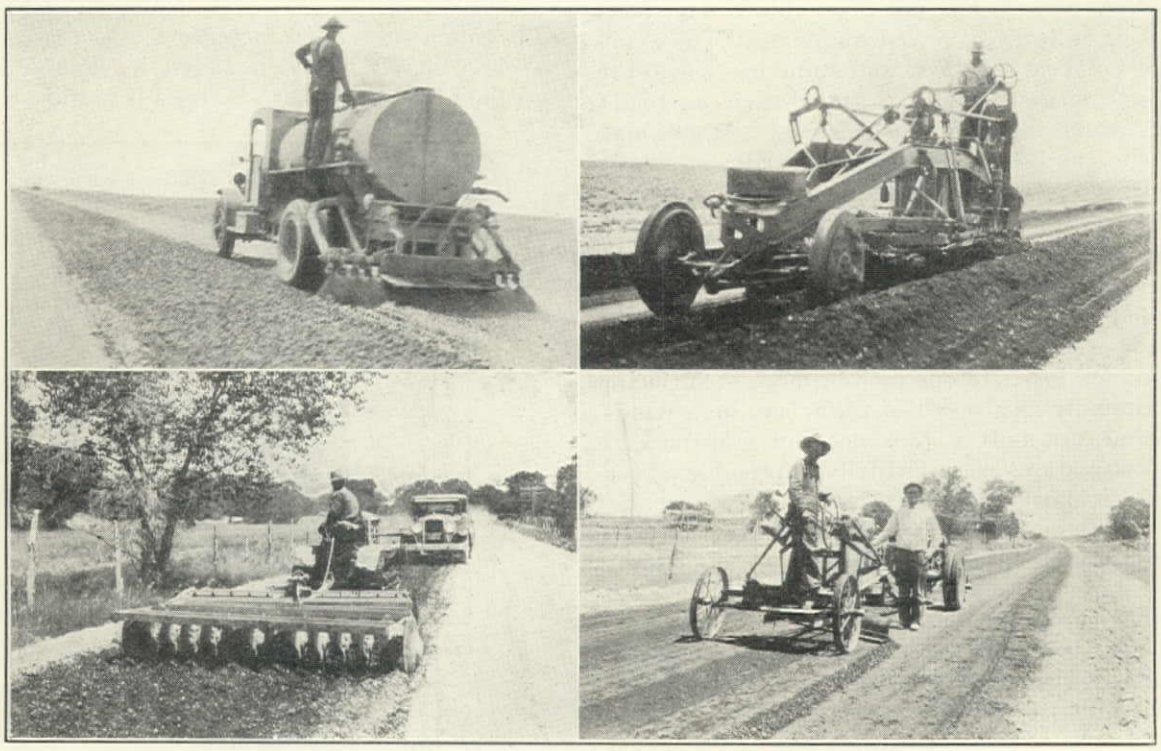
The amount of oil determined, the material (in the case of the scarified road) is spread to uniform thickness and the oil applied, usually in three equal applications.

An expert on the distributor is able to gauge his application of oil so that the required amount is placed on the surfacing for any desired width over a given distance, based on the distributor tank capacity.

Mixing Materials on the Road—Following each application of oil, a disc-harrow drawn by a tractor pulls in behind and immediately starts mixing the oil and gravel. This operation only partly mixes the materials. When the gravel is completely oiled, the real mixing by means of one-man graders is begun. It is this operation which gives the process its name 'turn-over'. The graders take a short section and blade the material all to one side. This is done in successive stages, a small amount at a time. The operation is continued until the treated material is in a windrow at one side—then picked up and moved in the same manner to the opposite side. The number of times which the roll is moved varies from 30 to 40, but is sometimes more.

When the materials have become thoroughly mixed as determined from appearance and by stain tests, the surfacing is spread out uniformly to the width desired and is ready for compaction under traffic. During the time required for thorough compaction, which is usually from four days to one week, a light motor grader is kept moving over the mat to prevent the forming of ruts and inequalities and to insure a smooth surface.

Equipment Needed for Oiling—The equipment required for the oil-processing of a section may be of interest. The following does not take into account machinery necessary for placing additional crushed material—which would include crushing and screening plant, trucks, etc.—but is the equipment used in oil-processing only:



(UPPER LEFT) GILMORE 1000-GAL. OIL DISTRIBUTOR MOUNTED ON WHITE TRUCK APPLYING OIL TO GRAVEL SURFACE. (UPPER RIGHT) CATERPILLAR-SPEARSWELL 15-HP. MOTOR GRADER MIXING GRAVEL AND OIL BY 'TURN-OVER' PROCESS. (LOWER LEFT) TOWNER DISC HARROW ON PRELIMINARY MIXING. (LOWER RIGHT) ADAMS 6-FT. BLADE WORKING NEWLY OILED SURFACE UNTIL COMPLETELY COMPACTED

Four 15-hp. motor graders, crawler type, 8-ft. blade, with scraper attachments, for the oil processing.

Two offset disc-harrows (9 ft. wide) for mixing behind the oil distributor.

Two 15-hp. crawler-type tractors for pulling disc-harrows.

One 6-ft. rubber-tired grader for finishing.

One 10-hp. rubber-tired tractor for pulling 6-ft. grader.

One 25-hp. steam boiler for heating oil in tank cars.

One 1000-gal. capacity oil distributor.

One 1½-ton service truck.

One light auto for foreman.

The approximate cost of the above equipment is $30,600, and according to the A.G.C. schedule, the daily

equipment rental for such a complement of equipment would be $71.80.

Personnel Needed for Oiling—The average working crew necessary to handle this equipment and to properly oil-process a gravel road (exclusive of placing additional surfacing) is as follows:

No.	Duties	Wage—Month	Wage—Day
One	foreman	$200	.....
One	boiler engineer	150	.....
One	oil distributor operator	.....	5.00
One	swamper for oil distributor	.....	5.00
Four	motor grader operators	$150 to 175	.....
Two	tractor operators for disc harrows	.....	4.50
One	tractor operator for light grader	.....	4.50
One	grader operator	150	.....
One	service truck driver	.....	4.50

In addition to the construction crew, an engineer is placed in charge of each project, his duty being to make frequent tests to determine the proper amount of oil, to insure a proper mix, and to secure a finished job.

Status of Oiled Roads—At the beginning of 1930, New Mexico had 300 miles of oil-processed road. This included 69 miles completed in 1928 and 231 miles built in 1929. Not all of this mileage was built by the 'turn-over' method, although most of this distance was so constructed. A few projects were built by the 'pre-mix' method, the new crushed material and the oil being mixed at a central plant and hauled to the road and spread.

During 1928, only one construction crew was in operation. The monthly output of this crew was 9¾ miles of completed road per month. The width of oiled surface on 51 miles was 18 ft., while 16 miles was built 20 ft. wide; the latter width has since been standard practice. The 18-ft. work in 1928 cost an average of $1542 per mile for oil-processing only.

The season of 1929 was an unusually wet one. This condition, added to the increase in width to 20 ft., made per mile costs greater than in 1928. The estimated oiling cost during 1929 was $2000 per mile. The monthly mileage output of the oiling crew was also less for 1929 because of the adverse weather conditions encountered. Dry weather is essential to the success of oil-processing.

Where it is necessary to place additional crushed surfacing prior to oiling, the total cost for the reconstructed road is about doubled. In other words, the additional crushed material plus oil-processing for a 20-ft. road costs about $4000 per mile.

The oiling program for 1930 calls for 250 to 300 miles, estimated to cost about $1,000,000. At the present rate of construction, all gravel surfaced projects on main arteries could be oil-processed in 4 to 5 years.

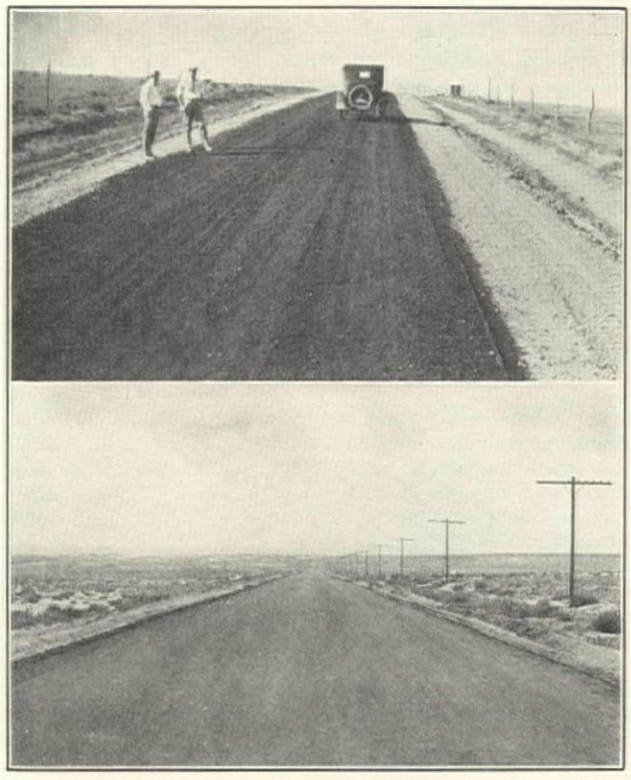
Economics—As to the economic advantages:

On January 1, 1930, an investigation of maintenance costs by types was made. Gravel and similar type roads were costing $230 per mile per year to maintain. Against this, the oiled roads so far constructed show a cost for maintenance of $200 per mile per year, which includes the placing of a seal coat of oil and dust as often as is necessary. This is a direct net gain of $30 per mile per year.

The great economic advantage of the oil-processed road over the gravel-surfaced type, however, is not in the direct saving in maintenance but in the conservation of the road metal. There is virtually no loss in surfacing material in the case of the oil-processed road. With the addition of a seal coat occasionally (once each year at least) it is estimated that an oiled road will need no other re-oiling for an indefinite period.

Investigation of a large number of projects constructed of gravel, crushed stone, caliche and selected material, indicates that the loss of original surfacing is one inch thickness per year.

The average width of the projects under consideration is 16 ft., which means a loss of 260 cu.yd. of surfacing material per mile per year. At an average cost



Oiled Material Spread Out Ready for Compaction Under Traffic. (Lower) Completed Oil-Graveled Highway in New Mexico as It Appears Under Traffic

of $2, the loss per mile on the original investment is $520 per year. Add to this the maintenance cost of $230, and the total annual charge is $750 per mile.

In the case of the oiled road there is an annual maintenance cost of $200, plus interest on the cost of reconstruction (6% of $4000) which is $240, or a total of $440. The net annual saving is, therefore, $310 per mile, which would be sufficient to pay off the extra investment of $4000 per mile in 13 years.

Even this is not all. The New Mexico roads which have been oiled carry conservatively an average daily traffic the year round of 300 vehicles per day. Each mile of road, therefore, handles 109,500 vehicles annually. The estimated saving in motor vehicle operation costs, as between an oil-processed road and a gravel-surfaced road is one to two cents per mile. Using the more conservative figure of one cent per mile, the annual saving to motorists is $1095 for every mile of oil-processed construction. Other advantages are: dustless surface, superior riding, and imperviousness to water.

Western Pacific Railroad Improvements

The Western Pacific Railroad and its subsidiary lines will spend $4,548,000 during 1930 for the upkeep and improvement of properties and for additional facilities and equipment in California, Nevada, and Utah. A large part of this outlay will be for labor. Of this budget, which is additional to the requirements for ordinary maintenance and construction of new lines or extensions, the Western Pacific will spend $3,621,000, the Sacramento Northern $829,000, and the Tidewater Southern $98,000.

Ultimate Program—In budgeting 1930 expenditures for upkeep and improvements, the Western Pacific is carrying forward the program adopted in 1927, involving an ultimate expenditure of $18,000,000 for improvement of road and equipment. The object of this program, on which $6,000,000 has already been spent, is to put the railroad in prime physical condition and to anticipate heavier traffic demands resulting from the construction of new lines and extensions. When this year's work is completed, the railroad will be in excellent condition to meet additional requirements.

Western Pacific Improvements—Among the principal items in the Western Pacific budget are:

Improvements in main line roadway and track	$1,960,000
Passing, interchange, and side tracks	223,000
Other track improvements	48,000
Bridges and trestles	229,000
Concrete lining of tunnels	48,000
Station facilities and tracks	118,000
Yard facilities	122,000
Improvements to locomotives	121,000
Improvements to freight cars	316,000
Machinery and improvements for shops	22,000
Miscellaneous structures	171,000
Improved housing for employes	97,000
Signals and safety devices	30,000
Painting of buildings	35,000

Improvement of main-line roadway and track comprises bank widening, ballasting, and rail renewal. Ballasting of 47 miles of main line between Sacramento and Stockton, which was begun in 1929 will be completed this spring at a cost of $287,000. Ballasting will be done on 21 miles of track in the Feather river canyon at a cost of $168,000, and also on 19 miles between Burmester and Delle, Utah, at a cost of $104,000.

Bank widening, the foundation for subsequent track improvement, will be done on 15 miles between Oroville and Las Plumas, California; on 137 miles between Reno Junction, California, and Winnemucca, Nevada, $307,000; and on 93 miles between Wells, Nevada, and Wendover, Utah, $81,000.

Rail will be renewed on 37 miles between Ellerbeck and Salt Lake City at a cost of $398,000. In the section between Winnemucca and Wells, where the line is used in common with the Southern Pacific Co., 110-lb. rail will be laid on 60 miles of track at a cost of $612,000.

Sacramento Northern Improvements—The Sacramento Northern, which acquired the Sacramento Short Line last year and now operates a through line from San Francisco and Oakland via Sacramento and Marysville to Chico and Oroville, California, has an extensive program for improvements to road and equipment, as is indicated by the following schedule:

Track improvements	$460,000
Additional track facilities	52,000
Bridges and trestles	64,000
New equipment and improvements to equipment	103,000
Station and other buildings	132,000
Signals and safety devices	21,000

Bank widening, ballasting, and laying of 85-lb. rail is to be done on the 18-mile section between Burton and Bay Point. Two additional passing tracks are to be constructed in this section, making the total for these improvements $265,000.

Between Chipps and Sacramento, a distance of 46 miles, bank widening and ballasting will be done, also two additional passing tracks will be constructed, the total cost being $155,000.

Material improvements will be made in motive power and in passenger equipment and a new electric freight locomotive will be purchased.

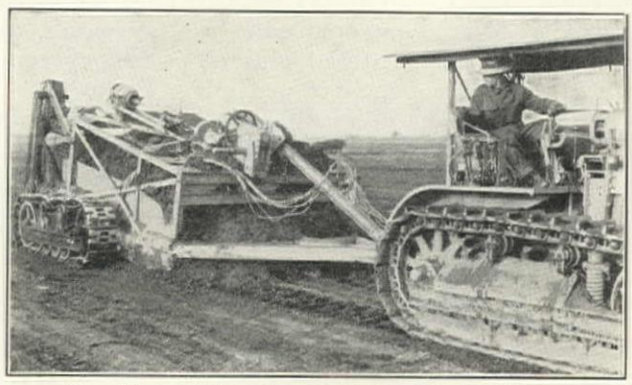
Tidewater Southern Improvements—The Tidewater Southern, which operates from Stockton to Manteca, Escalon, Modesto, Turlock, and Hilmar will expend $48,000 for rail renewal and ballasting; $15,000 for other track improvements; $1700 for passing tracks; $3000 for bridges, and $5000 for fencing right-of-way. Among additional items in the budget are:

Station and other structures	$10,000
Housing for employes	12,000

The schedule provides that improvements in track, roadway, and bridges shall be commenced on March 1 and actively carried forward with a view to completion prior to the heavy fall movement of traffic.

LEVELING WILHOIT TRACT, BYRON, CALIF.

Guy Bros., grading contractors, Stockton, California, built and are using a 12-yd. electrically-operated earth mover and land leveler for destroying Indian mounds on the Wilhoit tract near Byron, California.



Caterpillar '60' Hauling 12-yd. Electrically-Operated Guy Scraper

This equipment is drawn by a Caterpillar '60'. A generator on the tractor supplies electricity with which the driver may operate motors on the scraper.

Gravity Extension Division, Minidoka Project, Idaho

Bureau of Reclamation Constructing 70-Mile Gravity Extension Between Snake River and Wood River Project

By E. B. DARLINGTON*

Superintendent, Minidoka Project, Bureau of Reclamation, Burley, Idaho

Irrigation works of considerable magnitude, by which it is proposed to resurrect agriculture in one of the interior valleys of Idaho where irrigation farming has suffered for a number of years on account of severe water shortages, are now being constructed by the Bureau of Reclamation. These works are features of an undertaking known as the gravity extension division of the Minidoka project, the feasibility of which was largely enhanced by construction of the American Falls reservoir[1] on Snake river. Stored water will be supplied to lands in the Wood river basin, as well as the Snake river slope, through a main canal about 70 miles long and a lateral system covering the irrigable area.

The reclamation plan is to supply Snake river water to about 80,000 acres of irrigable land, of which 45,000 acres have a partial supply from Big Wood river, Little Wood river and the Magic reservoir, which was constructed several years ago by private interests. The remaining area is new land, now entirely without water right.

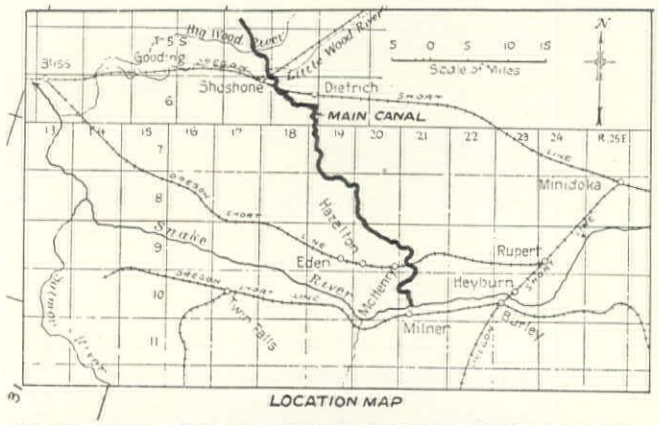
In 1925, an irrigation district was formed embracing 115,500 acres of irrigable land, which includes about

Springing First 'Shot' on Haas, Doughty & Jones Contract Between Sta. 2315 and 3129, Gravity Extension Division, Minidoka Project, Idaho. Contract Involves 1,050,000 Cu.Yd. Excavation

37,000 acres above the canal. This land which cannot be served directly from the new works will be benefited by concentration of the water supply from Wood river sources upon a greatly reduced area. A contract was later entered into between the district and the United States providing for construction of an irrigation system, purchase of storage capacity at American Falls reservoir, and repayment of the costs over a term of years.

Headwaters and Upper Reach—Construction was started on the new project during the summer of 1928, contracts for earthwork and structures on a reach of about 3½ miles at the upper end of the main canal being let to the Derbon Construction Co.,[2] of Seattle, and Winston Bros. Co., of Minneapolis.[3]

Additional schedules have been awarded from time to time since the first letting, and by the middle of



Route of 70-Mile Canal on Gravity Extension Division from Snake River near Milner to North Gooding Canal 10 Miles Beyond Little Wood River

January, 1930, the main canal for a length of 55 miles was either under contract or completed. Excavation of the first 10 miles of canal has been accomplished, and long stretches in other parts of its length have been opened and partly excavated. About 2,500,000 cu.yd. of all classes of material had been handled to the end of January, 1930; over 300,000 cu.yd. of which was basaltic lava.

The canal diverts from Snake river a short distance above Milner dam, which is also a part of the diversion works of the North Side and South Side Twin Falls projects. This dam is 13 miles downstream from Burley, Idaho. An earth cofferdam was used in construction of the headworks, which is a reinforced concrete structure bearing two steel gates of the radial type. The gates, manufactured by the Ogden Iron Works Co., Ogden, Utah, are operated by means of electrically-controlled hoists, manufactured by Foote Bros. Gear and Machine Co., Chicago, Illinois.

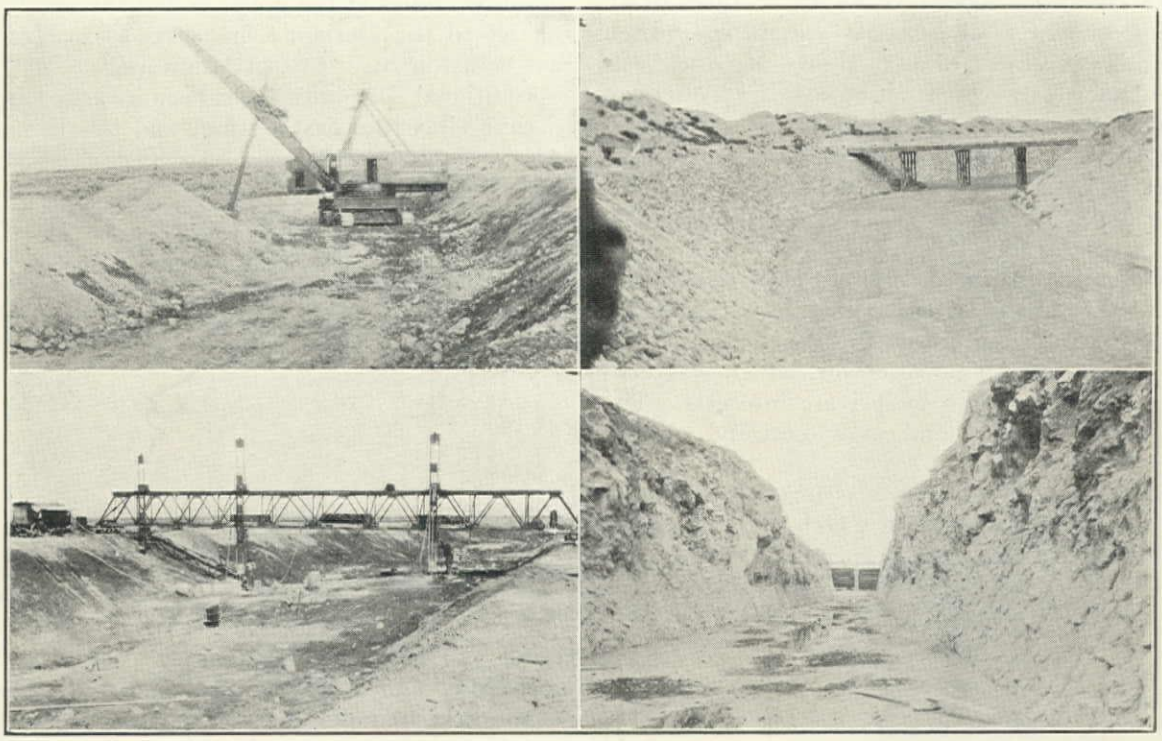
Derbon Construction Co. Contract—The first 1½ miles of canal is largely in lava, cuts up to 45 ft. deep having been encountered. The section used in sound rock has bottom widths from 25 to 34 ft. and side

*Member, American Society of Civil Engineers.

[1] A construction progress article on the American Falls reservoir was published in the April 10th, 1926, issue, p. 41, and a complete design and construction article by Ivan E. Houck in the September 25th, 1929, issue, p. 480.

[2][3] For the unit bid summary on the Derbon Construction Co. and Winston Bros. Co. contracts see June 25th, 1928, issue, p. 26, and for progress articles the July 25th, 1929, issue, p. 383, and the December 25th, 1929, issue, p. 688.

slopes of ¼:1. Slopes of 1¼:1 were adopted for the earth cuts. The base of the section was floored with concrete to a 6-in. average thickness, and all fissures were filled and fractured rock masses consolidated by the use of gunite. An unusual condition was disclosed in the excavation. A seam of soft material from 1 to 12 ft. thick is intercalated between basaltic sheets —doubtless due to lava flows separated by considerable periods of time. As the soft seam was within the water section, it was necessary to protect it from erosion. This was accomplished by excavating into the seam and laying up a dry rock wall, flush with the ¼:1 slope of the rock cut. The wall was backed with gravel and pierced with weep-hole pipes for drainage, and gunite was applied on the water face. The headworks and the canal construction from Sta. 0 to Sta. 80 were completed in December, 1929, by the Derbon Construction Co.*



(UPPER LEFT) TYPE 125 MARION 2½-YD. ELECTRIC SHOVEL WITH FAIRBANKS-MORSE DIESEL-ELECTRIC POWER PLANT ON MITTRY BROS. CONTRACT. (UPPER RIGHT) COMPLETED SECTION OF CANAL ON WINSTON BROS. CONTRACT, SHOWING DRY ROCK PAVING ON LEFT. (LOWER LEFT) STEEL TRUSS DRILLING FRAME SPANNING CANAL ON MITTRY BROS. CONTRACT. FRAME MOUNTS THREE INGERSOLL-RAND R39 LEYNER-TYPE DRILLS. (LOWER RIGHT) ROCK CUT ON DERBON CONTRACT, HEADWORKS IN BACKGROUND, WALL GUNITED TO PROTECT SEAM OF SOFT MATERIAL

Winston Bros. Co. Contract—From sta. 80 to sta. 182+80 the canal is mostly in earth, with a maximum cut of 35 ft. The section has a 50-ft. base with 1¼:1 side slopes. A 3-yd. Monighan semi-diesel Walker dragline, with an 80-ft. boom, was used for excavation. Construction has been completed, under a contract with the Winston Bros. Co.

This reach (and that between sta. 0 and 80) has been constructed with a capacity of 2700 c.f.s., which includes about 1000 c.f.s. for use of the North Side Canal Co. This company operates a canal which runs practically parallel with the new one, but its location and the conditions under which it is operated make enlargement impracticable. The company desired an increase in diversion and conveyance capacity in this part of its irrigation system and, in 1928, entered into a contract with the United States and the District providing for co-operation in construction and use of the first 3½ miles of the gravity extension canal. Connection between the two systems is made by means of a diversion structure at sta. 182+80 and a short reach of earth conduit. The structure is a combined check and turnout, built of reinforced concrete, and carrying four radial-type gates operated by hand hoists. Gates and hoists were furnished by the same manufacturers who were awarded contracts for similar appurtenances in connection with the headworks.

Below the diversion structure, the canal has a capacity of 1550 c.f.s., which is gradually reduced as the irrigable land is traversed and lateral diversions are made. The line swings first to the northeast and then turns northwesterly across a sagebrush desert, in which there are numerous and extensive lava fields. It was found impossible to so locate the canal as to miss all the rock ridges and outcrops, and the construction is therefore expensive.

The John Phillips Co.,[4] of San Francisco, and Mittry Bros. Construction Co.,[5 6] of Los Angeles, have been

*Editor's Note—Equipment on the Derbon contract included one 1¼-yd. P&H No. 700 power shovel; two Ingersoll-Rand R-72 drills on a bar; six Ingersoll-Rand R-12 Jackhamers; one 750-c.f.m. Chicago-Pneumatic stationary electric-driven and two Ingersoll-Rand 210-c.f.m. portable compressors; one Gardner-Denver drill sharpener; one 3-yd. Bucyrus-Erie 14-B diesel-electric dragline; one 2-yd. Bucyrus-Erie 50-B crane; one 2½-yd. Marion '60' railroad steam shovel; one Ransome paving mixer.

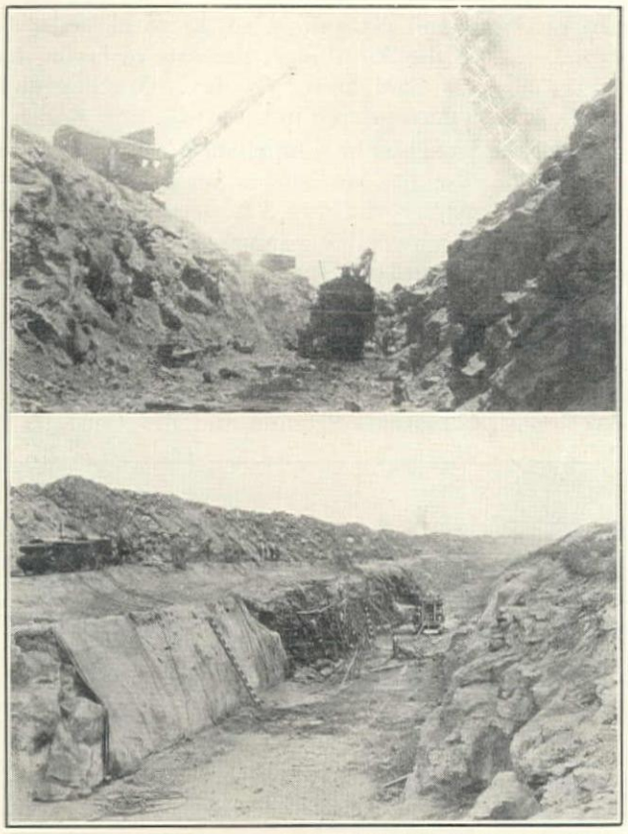
[4] For the unit bid summary on the John Phillips Co. contract see May 25th, 1929, issue, p. 38, and for a progress article the December 25th, 1929, issue, p. 688.

[5 6] For unit bid summaries on the Mittry Bros. Construction Co. contracts see May 25th, 1929, issue, p. 36, and October 10th, 1929, issue, p. 54, and for a progress article the December 25th, 1929, issue, p. 688.

awarded contracts for earthwork and structures on nearly 40 miles of the canal below the North Side Canal Co. diversion, and construction is actively in progress on this part of the work.

The John Phillips Co. has in use two 50-B Bucyrus draglines on excavation, and rock-drilling equipment consisting of two 360 c.f.m. portable compressors and eight R12 Ingersoll-Rand jackhamer drills, using ¾-in. drill steel. The contract involves excavation of 1,000,000 cu.yd., all classes, 75,000 cu.yd. of which is rock; also placing 500 cu.yd. of reinforced concrete.

Mittry Bros. Construction Co. has two contracts, and is operating two camps 17 miles apart. Some large equipment is in use, including one 175-B Bucyrus electric dragline, with 110-ft. boom and 6-yd. bucket; two 2-yd., one 1½-yd., and one 1-yd. Koehring draglines, the last two convertible to shovels; one type-125 Marion 2½-yd. electric shovel, with a Fairbanks-Morse diesel-electric portable power plant; one 750 c.f.m. stationary

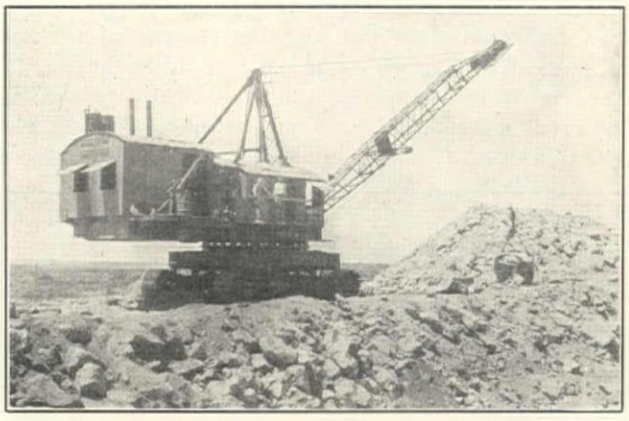


(Upper) Type 50-B Bucyrus-Erie 2-Yd. Diesel-Electric Dragline Hoisting and Dumping Skips on Spoil Bank. Marion '60' Railroad Steam Shovel in Bottom of Cut Cleaning Up and Loading into 5-yd. Skips, Derbon Contract. (Lower) Guniting Rock Section on Derbon Contract. Two 210-c.f.m. Ingersoll-Rand Portable Compressors on Bank; Ransome Paving Mixer in Bottom of Canal

air compressor; two 360 c.f.m. portable air compressors; one 210 c.f.m. truck-mounted compressor; six Ingersoll-Rand R39 Leyner-type drills, three mounted on a steel frame carried by a tractor and three mounted on a steel truss spanning the canal; five tractors hauling Athey wagons or McMillan scrapers, for hauling borrow material; concrete-mixing machinery.

The two contracts require excavation of 2,700,000 cu.yd. of all classes of material, of which 765,000 cu.yd. is estimated to be rock. The contracts also cover the installation of 2800 cu.yd. of reinforced concrete in structures.

Section Ending at Little Wood River—On December 27, 1929, bids were opened on earthwork and structures on the main canal, sta. 2315 to 3129, the last-named station being at Little Wood river. This undertaking requires excavation of 1,050,000 cu.yd., all classes; also 900,000 cu.yd. of overhaul and the placing of 900 cu.yd. of reinforced concrete. A large number of structures are required on this reach of canal, as the



Type 14-B Bucyrus-Erie 3-yd. Diesel-Electric Dragline on Derbon Contract

location intercepts the natural drainage lines of the country traversed, and also crosses numerous roads and irrigation distributaries.

The firm of Haas, Doughty & Jones,[7] of San Francisco, was low bidder on this work and was awarded the contract on a total tender of $537,200. Excavation was started February 22, using a P&H 1-yd. dragline for stripping rock and building embankments. A new model P&H '800' power shovel will also be used.

Remaining 10-Mile Section—The main canal terminates about 10 miles beyond Little Wood river, at a juncture with the North Gooding canal of the Big Wood Canal Co. system, which will be used for supplying Snake river water to part of the lands in the district. The location of the canal line beyond Little Wood river traverses bare lava for 3½ miles, necessitating specially designed forms of construction. It is expected that plans and specifications for the last 10 miles will be prepared and advertisement for bids issued some time during the current year.

Engineering Personnel—I am superintendent of the Minidoka project and am in direct charge of construction of the gravity extension division, with John K. Rohrer and Clyde H. Spencer as associate engineers, at Eden and Shoshone, respectively. Designs for this work are prepared in the Denver office of the Bureau by H. R. McBirney, engineer for canals, under the general supervision of J. L. Savage, chief designing engineer. All engineering and construction is under the supervision of R. F. Walter, chief engineer, with headquarters in Denver. Dr. Elwood Mead is the commissioner of the Bureau with headquarters at Washington, D. C.

[7] For the unit bid summary on the Haas, Doughty & Jones contract see January 10th, 1930, issue, p. 48.

Dallas, Texas, Improves Water System

City Lays 25 Miles of 16 to 36-in. Cast-iron Feeder and Distributing Mains—New Filtration Plant, Pumping Station, and Underground Reservoirs

Dallas, Texas, with a metropolitan population of 280,000, is in the midst of a city-wide improvement program, one of the most important of the projects being a $4,000,000 enlargement and betterment of the municipal water system. The city is adjacent to, and takes its water supply from, the Trinity river, for which reclamation and trafficway projects costing $10,000,000 are now under construction.* Underpasses,

Northwest Power Shovel with Specially Designed Pipe Tongs Lowering 36-in. Cast-Iron Main on Line No. 3, Keating Ave., Dallas. Austin Ditcher in Background. Leadite Joints Being Poured in Foreground by Two-Cone Method

storm and sanitary sewers, and the relocation of public utility services are also included in the general development.

The water works improvements include 25 miles of 16 to 36-in. cast-iron feeder and distribution mains, a new filtration plant and pumping station, and underground reservoirs. Their construction will enable the water department to meet any demand on its system and to supply abundant water for both domestic and industrial use.

A pipe contract was awarded January 7, 1929, to the U. S. Pipe & Foundry Co. for $1,265,295, and was sublet to the Uvalde Construction Co., of Dallas. The subcontractor began excavation April 8, 1929, and the mains will be completed about June 1, 1930. Other bidders were: U. S. Pipe & Foundry Co. (alternate), $1,192,136; Smith Bros., Dallas, $1,255,887; and Uvalde Construction Co., Dallas, $1,176,667.

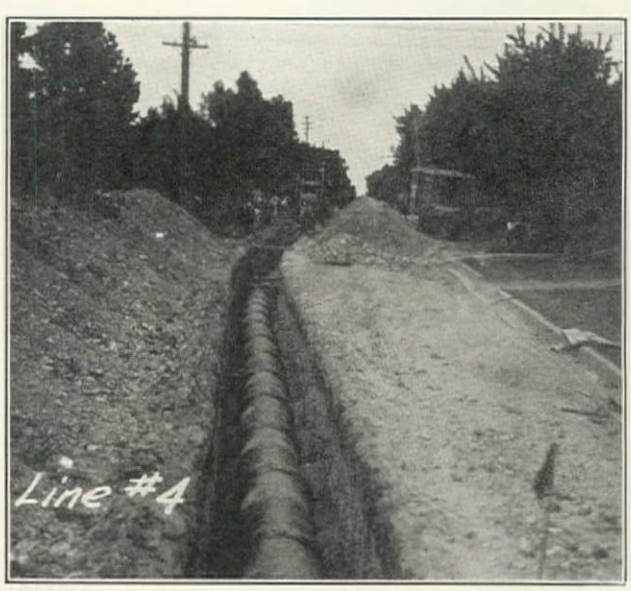
The contract quantities and unit prices for furnishing and installing cast-iron pipe include:

2,500 lin.ft. of 16-in. at $ 3.15
3,600 lin.ft. of 18-in. at $ 3.70
10,200 lin.ft. of 24-in. at $ 5.87
24,990 lin.ft. of 30-in. at $ 8.19
74,360 lin.ft. of 36-in. at $12.06

There was also required the removal and replacing of 7185 sq.yd. of paving at $4.00, and 19,050 cu.yd. of rock excavation at $2.50.

Pipe Laying—To February 8, the work completed included: 2159 lin.ft. of 16-in.; 3378 lin.ft. of 18-in.; 8365 lin.ft. of 24-in.; 17,462 lin.ft. of 30-in.; and 59,630 lin.ft. of 36-in. pipe. At that time there was 13,000 lin.ft. of 36-in. and 3000 lin.ft. of 30-in. mains to be completed. On the 36-in. pipe, the rate of laying has been as high as 1200 lin.ft. per day. Much ground water has been encountered in the work.

Part of the trench is in solid chalk rock. The Uvalde Construction Co. has devised a special air-powered drill with a capacity of 2½ to 3 ft. per min. in shallow holes, a Sullivan portable compressor supplying the air. An Erie steam shovel is used for excavating rock and in the deeper cuts, some of which reach a depth of 20 ft. For ordinary trenching and covering, a specially designed Austin ditcher and a special Austin backfiller are used. Pipe is laid by two Northwest power shovels with combination crane and dragline attach-



Completed Section of 30-in. Cast-Iron Main on Line No. 4, Delmer St., Dallas

ments, and special pipe tongs designed by the subcontractor. 'Leadite' joints are being used on the project.

John M. Fouts is commissioner of water works, and sewage and H. E. Moore is secretary of the Dallas city water works. J. B. Winder is the engineer in charge of construction of the new pipe system.

*See 'Reclamation and Trafficway Projects for Dallas, Texas', July 25th, 1929, issue, p. 374.

Water Works Problems

What is the Relation of Depth to Soil Corrosion on Steel Pipe?

Editor's Note—The engineer of a large industrial company recently asked for a symposium on the question: 'What is the relation of depth to soil corrosion on steel pipe, assuming equal thickness of shell and the same soil conditions at various depths?' Two explanatory questions might be: (1) Assuming a 2-ft. cover, equal thickness of shell, and the same soil conditions at various depths, which will corrode the fastest—a small diameter pipe (6 to 10-in.) or a large diameter pipe (18 to 36-in.)? (2) Assuming a 2-ft. cover, equal thickness of shell, and the same soil conditions at all points around the pipe, will corrosion be greater at the bottom than at the top or on the sides?

A questionnaire was prepared and sent to representative water works engineers and superintendents in the far west. The following replies, received by letter, express their varied experiences and bring out additional practical points.

Ira D. Van Giesen, electrolysis engineer, Department of Water and Power, city of Los Angeles, California:

It has been the experience in the city of Los Angeles that the factor of depth-of-burial, of itself, has no observable effect on the rate of normal soil corrosion. Our Water Bureau's experience is rather limited, as probably 90% of the water mains are at a depth of about 30 in. to the top of the pipe. All other depths of burial are incidental, and the maximum depth is 10 ft.

Regardless of the type of iron or steel pipe used, the rate of corrosion (in the absence of stray-current electrolysis) always is greater on the bottom than at any other position on the periphery of the pipe. The rate of corrosion appears to be slightly higher for large (over 18-in. diam.) pipe than for small (under 8-in. diam.) pipe.

In laboratory tests, McCollum and Logan found that the rate of corrosion increases—between certain limits—as the percentage of moisture increases. Curve A, Fig. 2, is plotted from their data (see Technologic paper No. 25, 'Electrolytic Corrosion of Iron in Soils', by Burton McCollum and K. H. Logan, 1913 publication of the U.S. Bureau of Standards). In making these tests, a quantity of red clay soil was air-dried and then distilled water was added to obtain the desired moisture content. Change of moisture content by evaporation was prevented by maintaining a saturated atmosphere above the test cans.

In a field test, the same observers determined that the rate of corrosion increased with the depth of burial as shown by curve B, Fig. 2. It is evident that this field test is a corrollary of the laboratory test—that is, within the limits of the depth of burial of the test specimens, the moisture content of the soil increased directly with the depth below the surface.

An analysis of the soil conditions about the periphery of a pipe reveals the reason for the more rapid rate of corrosion at the bottom of a pipe than at other positions about its periphery. When the diameter is sustaining greater corrosion disappear, so that normal corrosion becomes constant about the periphery of the pipe. When the diameter exceeds this critical value, the conditions causing more rapid corrosion increase and with the more severe conditions comes a higher corrosion rate.

From a corrosive viewpoint, the soil conditions about the complete periphery of a pipe having a diameter greater than 6 or 8 in. are never constant. This is evident from a consideration of what comprises 'soil conditions' from the viewpoint of corrosion. The major factors, some of which may vary, others of which generally vary, are:

I. Type of soil
  (a) Siliceous

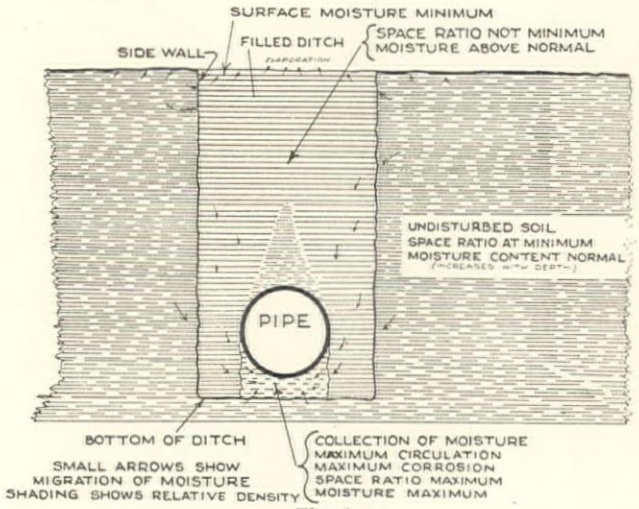


Fig. 1

  (b) Carbonaceous
    1. Inorganic
    2. Organic
  (c) Sulphaceous
  (d) Ferruginous

II. Aggregate
  (a) Homogeneous
    1. Single type as sand, clay, and others
  (b) Heterogeneous
    1. Mixture of two or more types, as sand and clay, gumbo and humus, and others

III. State of matter in aggregate
  (a) Insoluble, as sand
  (b) Solutional, as alkalies
  (c) Suspensoidal, as decomposed granite
  (d) Colloidal, as gumbo, humus, and others

IV. Moisture content

V. Porosity
  (a) Soil
  (b) Aggregate, space ratio $= \frac{\text{density of space aggregate}}{\text{density of soil}}$

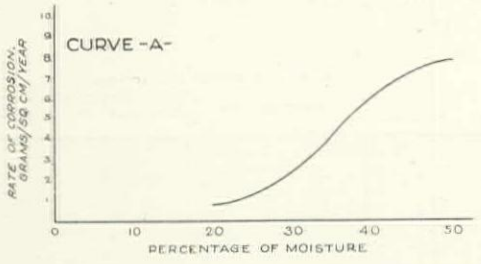
VI. Ionization.

Factors I, II, and III may be constant about the periphery of the pipe, but Factors IV, Vb, and VI usually vary.

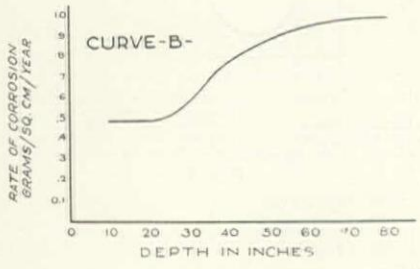
If the pipe is greater in diameter than a few inches, no method of backfilling will insure a constant space

ratio above and below the pipe. The soil is always more loose beneath the pipe than at the sides or above, and in many cases, especially with large pipe (20 in. or more in diameter), numerous air-pockets exist directly beneath the pipe that are not filled—even with watering. In watering, the soil above the pipe is leached and the soluble, colloidal, and suspensoidal substances are carried to the bottom of the ditch. This sets up a vertical ionization gradient in the soil moisture. The greater space factor of the soil under the pipe permits greater circulation of the soil moisture than at the sides or above. Wherever air-pockets exist, the moisture of the air in the voids condenses on the surface of the pipe. This condensate contains a large percentage of oxygen and carbon dioxide.

All these factors are those that increase corrosion and, since they collect at the bottom of the pipe, that is where the highest corrosive rate will be, and is found. These principles and conditions are illustrated in Fig. 1.



EFFECT OF MOISTURE CONTENT ON RATE OF CORROSION



EFFECT OF DEPTH OF BURIAL ON RATE OF CORROSION

Fig. 2

Ben S. Morrow, engineer, Water Bureau, city of Portland, Oregon:

Replying to the question as to whether corrosion will be greater at the top than at the bottom or sides of the pipe, assuming the same soil conditions at all points, I might set forth the experience of our Bureau of Water Works with one of its early steel pipe-lines.

Bull-run conduit No. 1, which is a steel line of 33, 35, and 44-in. diam., with plate thicknesses from 0.203 to 0.375 in., was laid in 1894 and has about a 3-ft. cover. Certain portions of this line were laid through damp, clayey soils, and by 1905 leaks began to appear from pitting action in these sections. Consideration of 392 such pit-holes, which had appeared by 1914, showed that 85% were on the bottom half of the pipe, the remaining 15% about equally on the top and sides.

This condition was to be expected, since the pitting action was caused by the clay backfill made when the soil was excessively damp. When the line was laid, no ditch drainage had been provided in these sections and, naturally, the backfill around the bottom portion of the pipe was damp a greater part of the time than that around the upper portion.

That the pitting was caused by the character and condition of the backfill material is evidenced by the fact that on one 5000-ft. section, on which deterioration was exceedingly rapid, the backfill was removed and the pipe cleaned and repainted, drain tiles installed in the trench, and the pipe backfilled with gravel—well up around the sides—with the result that in the past fifteen years practically no leaks due to pitting have occurred in this section.

While our particular condition may not throw any light on a situation where the surrounding material is of the same character, but is rather due to a combination of surrounding backfill material and water, I mention it because we have largely eliminated damage to two later-constructed conduits in this same section by proper trench drainage.

S. O. Harper, general superintendent of construction, U. S. Bureau of Reclamation, Denver, Colorado:

With a few exceptions, steel pipes installed by the Bureau of Reclamation are placed above ground; therefore the matter of soil corrosion has not been a factor. As the few installations of buried pipes have been of little importance, no records of deterioration have been made. For these reasons we feel that we have not had proper experience upon which to base a discussion of the questions submitted.

S. B. Morris, chief engineer, Water Department, city of Pasadena, California:

The Pasadena Water Department was organized in 1912 and since its organization has acquired fourteen different water companies, each of which used steel pipe exclusively for distribution purposes. We have, therefore, had considerable experience with small-size riveted steel pipe, most of which was laid in depths not exceeding three feet.

In our experience, we have observed no apparent relationship between the depth of cover and soil corrosion. There appears to be a marked preponderance of leaks occurring on the bottom of the mains, which is probably due to greater likelihood of moisture underneath the pipe than above it. In general, mains from 6 to 10-in. diam. have been constructed of No. 14 and 16-gauge riveted steel. We have had substantially more trouble with corrosion and leakage from these small mains than we have had from those of 18 to 30-in. diam., the latter being the maximum size in our water system. These larger mains vary in thickness from No. 14 to 10-gauge and, in general, show less corrosion and leakage than the smaller size pipes. Owing to variations in soil conditions and water pressures, it is rather difficult to generalize concerning the condition of steel pipe of various sizes. It is, however, our opinion from observation that—based upon the same thickness of shell—smaller pipe shows greater corrosion and more frequent leaks than larger

pipe. The prevalence of leaks on the under side of the pipe in comparison to the sides or top, is marked.

Harry C. Jessen, city engineer, Salt Lake City, Utah:

This city recently removed 1000 ft. of 6-in. diam. steel pipe. In that district there were several hot sulphur springs, and soil conditions are most unfavorable. As was expected, the pipe was badly corroded for its entire length.

We have had no other experience with steel pipe and are, therefore, unable to give any information relative to the comparative effects of soil corrosion on varying diameters and depths. However, stress—both internal and external—would affect the rate of corrosion.

Geo. W. Pracy, superintendent, City Distributing Department, Spring Valley Water Co., San Francisco, California:

The question regarding a relation of depth to soil corrosion is one which will probably bring various answers.

From our experience, I would say that the mere depth does not affect corrosive action, that is: a pipe buried 6 ft. deep will not corrode any faster than a pipe under the same condition but only 2 ft. deep.

It is a fact that more leaks come on the lower portion of a pipe than on the upper portions. I would not, however, classify this so much to depth as to relative position of the pipe.

My opinion also would be that equal sizes of pipe corrode equally fast, but inasmuch as the smaller diameter pipes are usually made with a larger factor of safety, they probably appear to corrode less than the larger sizes.

W. A. Kunigk, superintendent, Water Division, city of Tacoma, Washington:

Our experience seems to indicate that the effect of depth of backfill has little bearing on soil corrosion of steel pipe. Our standard practice is to have not less than 3 ft. and preferably 3.5 ft. backfill on top of steel pipe. We have observed that wherever the backfill has been light, say 2 ft. or less, the alternate wet and dry conditions in the soil near the surface has a deteriorating effect on the various pipe coatings used.

We find in uncovering old steel pipe that has been in service for a number of years that the outside top part shows usually more corrosion than any other. This, however, is caused by damage to the protective coating during the backfilling operations, in dropping gravel and small rocks on top of the pipe and not by any variation in the depth of backfill. Likewise the greater corrosion that we usually find on the bottom of the inside of our large steel pipe is the result of abrasions of the coating caused by the men of the laying crew walking through the pipe during laying operations.

Of course, we make a thorough inspection of the pipe coating after the pipe has been laid and assembled in the ditch. But, regardless of the care taken to recoat all abrasions, there is always a certain amount of damage done to the coating during backfilling of the ditch and this, we find, is more pronounced on the outside upper half than elsewhere, hence the more apparent corrosion of this section.

K. H. Logan, electrical engineer in charge of underground corrosion investigations, U. S. Bureau of Standards, Washington, D. C. (Extracted from a paper before the tenth annual convention of the California section, American Water Works Association, Del Monte, October 23 to 26, 1929.):

Until recently, the importance of soil corrosion of underground pipes has not been generally recognized. Most of the older pipes have comparatively thick walls, resulting in a life more than proportional to the wall thickness.

In 1922, the Bureau of Standards buried specimens of commonly used pipe in a variety of soils. As a result of these and further experiments, the following additions to the knowledge of soil corrosion have been made:

'1. While it seems probable that quality of material has an important bearing on rates of corrosion, factors exterior to the pipe appear in many cases to determine the life of the line.

'2. The phenomena connoted by the term 'soil corrosion' includes not only the chemical characteristics of the soil adjacent to the pipe, but also the effects of climate and topography, and soil corrosiveness can not be determined without considering all of these factors.

'3. Under some conditions, pipe-line corrosion is accelerated by the line passing through soils differing in their electrochemical properties with respect to iron; and when this is important, corrosion can be decreased by reducing the tendency of the line to collect and carry electric currents. Among the means of accomplishing this, are the use of low-conductivity pipe material, insulating joints, and surface insulation of the line.

'4. Pitting can be reduced by insuring uniform contact between pipe and soil through backfilling with sand, and by thoroughly tamping the soil around the pipe as it is replaced.

'5. Usually, the rate of penetration of pits decreases as the pipe becomes older. Hence, the depreciation of a pipe-line is not proportional to its age.

'6. In locations where pitting is serious, the life of a pipe can usually be more than doubled by doubling the thickness of the pipe wall. As the cost of the pipe is usually from 50 to 80% of the line, the economy of using thick-walled pipe in corrosive soil should be evident.'

Hydroelectric Development in Washington

The state of Washington has 7,000,000 hp. potential water power, or one-sixth of the United States total. The developed horsepower is now 12% of the potential, a total capacity of 708,438 hp. being provided in 69 plants. Four plants under construction have a total capacity of 254,000 hp.; appropriations have been authorized for 156,000 hp. additional; and other applications on file with the state supervisor of hydraulics as of the first of the year total 3,400,000 hp.

Construction Review

PAVING

By S. J. SANDERS
Editor, Daily Construction News Service

Progress is being made on important projects as follows:

CALIFORNIA STATE HIGHWAYS

Alameda County—Hanrahan Co., San Francisco, has practically completed a contract for 8.7 miles of concrete and asphalt paving from Hayward to Niles. The equipment includes two '60' and one '30' Caterpillar tractors; one Russell mogul grader; one Adams grader; one McMillan scraper; one Barber-Greene trencher; one 15-ton Buffalo-Springfield roller; two

Sterling 6-ton Pneumatic-Tired Truck Dumping Asphaltic Concrete Into Butler Spreader on Valley Paving & Construction Co. Contract, Tulare County, for California Division of Highways

8-ton Buffalo-Springfield tandem rollers; one P&H 1-yd. clamshell; one Erie steam shovel; four 5-ton Mack trucks; four 5-ton Autocar trucks; one Geiger asphalt plant (2500-lb.); two Multifoote pavers; two Galion spreader boxes; one 20-ft. Ord finisher. The contract price, $325,305, includes 20,600 cu.yd. roadway excavation at $0.30; 195,600 sta.yd. overhaul at $0.01; 25,650 cu.yd. imported borrow at $0.28; 74,000 sq.yd. subgrade at $0.09; 9500 tons crusher-run base at $1.40; 16,800 cu.yd. 'A' concrete paving at $8.50; 21,000 tons asphaltic concrete paving at $4.40; 76,000 sq.yd. asphalt paint binder at $0.02; 68,000 sq.yd. remove asphalt skin coat at $0.03; 415,000 lb. reinforcing steel at $0.04; and other items.

J. H. Skeggs is district engineer of district IV, California Division of Highways, at San Francisco.

Los Angeles County—Jahn & Bressi, Los Angeles, are placing 8.51 miles of portland cement concrete pavement between Tunnel Station and the Santa Clara river. Over 2½ miles of 10-ft. strip has been placed since the contract was commenced early in January. The project will be completed about November, 1930. Equipment includes one 1¼-yd. Koehring clamshell crane; two batch trucks; one Koehring 27-E paver; one Ord finisher; one Kelly-Springfield roller; two Best '30' tractors; one Blaw-Knox bunkers and scales. The contract price, $253,126, includes 20,000 cu.yd. slide removal at $0.20; 200,000 sta.yd. overhaul at $0.0075; 150,000 sq.yd. subgrade for paving at $0.08; 30,800 cu.yd. 'A' concrete in pavement at $6.65; 712,000 lb. reinforcing steel at $0.038; 1000 timber guide posts at $1.50; 450 sta. finishing roadway at $5.00.

S. V. Cortelyou is district engineer of district VII, California Division of Highways, Los Angeles, and L. M. Ranson is construction engineer.

Madera County—A. Teichert & Sons, Sacramento, is completing a contract for grading and asphalt paving on 5.6 miles from Califa to the northerly boundary of Madera county. All grading, culverts, and paving had been completed to February 20, excepting a small gap at a spur crossing in the town of Chowchilla, and final grading. The contract price, $135,636, involves in the main: 47,000 cu.yd. roadway excavation at $0.26; 96,000 stat.yd. overhaul at $0.02; 3700 cu.yd. imported borrow at $0.45; 1200 tons crusher-run base at $2.50; 25,000 sq.yd. subgrade at $0.10; 43,000 sq.yd. asphalt paint binder at $0.02; 23,000 tons asphaltic concrete at $4.46. The asphalt paving was placed between November 12, 1929, and January 15, 1930, the highest day's run being 727 tons.

E. E. Wallace is district engineer of district VI, California Division of Highways, Fresno.

Marin County—Granfield, Farrar & Carlin, San Francisco, have completed 62% of the grading and 35% of the entire project on 1.8 miles of grading and

Placing Asphaltic Concrete on Valley Paving & Construction Co. Contract for California Division of Highways, Tulare County

concrete and bituminous macadam paving from Bolinas creek to San Rafael. The equipment includes one Ingersoll-Rand compressor; one Chicago-Pneumatic compressor; two Best '60' and one Best '30' tractors with bulldozers; one 12-ft. Russell grader; one 1¼-yd. Thew-Lorain gas shovel; one 1¼-yd. Erie gas+air shovel; one 1-yd. Erie steam shovel; two Doane 5-yd. trucks; two White 5-yd. trucks; two 1½-ton Dodge trucks; one Fageol water truck. The contract price,

$133,231, includes 181,000 cu.yd. roadway excavation at $0.32; 2,241,000 sta.yd. overhaul at $0.005; 8120 tons crusher-run base at $1.90; 9910 sq.yd. subgrade at $0.08; 2350 cu.yd. 'A' concrete paving at $9.50; 66,500 lb. reinforcing steel at $0.0475; 1880 tons broken stone at $2.00; 102 tons asphaltic oil at $21; 6559 lin.ft. timber guard rail at $0.80.

J. H. Skeggs is district engineer of district IV, California Division of Highways, at San Francisco.

Marin and Sonoma Counties—Hanrahan Co., San Francisco, has completed 90% of the grading, placed all pipe and box culverts and cattle passes, and laid 2 miles of 10-ft. strip portland cement concrete pavement on an 11.9-mile project from Petaluma to Ignacio. The equipment includes six jackhamers; two Ingersoll-Rand compressors; one scarifier; one Hyde scarifier; three 12-ft. blades; one Carr grader; three 12-ton rollers; one 1¼-yd. Bucyrus-Erie gas+air shovel; two 1¼-yd. Northwest gas shovels; one P&H clamshell; three '30' and three '60' Caterpillars; one Johnson bunker and hopper; four Autocar batch trucks; two Kleiber batch trucks; one 5-ton Mack truck; two ¾-ton, two 1-ton, and three 6-yd. International trucks;

Northwest 1-yd. Power Shovel and Northwest 1-yd. Clamshell Crane on Valley Paving & Construction Co. Contract for California Division of Highways, Tulare County

three 7-yd. Fageol trucks; two 5-ton flat trailers; one Multifoote 27-E paver; two Ord tampers. Principal items in the $536,795 contract are: 355,000 cu.yd. roadway excavation at $0.35; 5,591,000 sta.yd. overhaul at $0.004; 5200 cu.yd. structure excavation at $1.50; 28,000 tons crusher-run base at $2.00; 74,000 sq.yd. subgrade at $0.09; 20,200 cu.yd. 'A' concrete paving at $9.25; 1280 cu.yd. 'A' concrete in structures; 569,000 lb. reinforcing steel at $0.05; 8700 sq.yd. reinforcing steel in second-story pavement at $0.30; 5500 tons oil-treated rock borders at $2.40; 5400 tons broken stone at $2.50; 285 tons asphalt oil at $20.

J. H. Skeggs is district engineer of district IV, California Division of Highways, at San Francisco.

Orange County—Macco Construction Co., Clearwater, California, is grading and placing culverts on its contract for 6.4 miles of grading and portland cement concrete paving from Sunset Beach to Newport Beach. No paving had been placed to March 13; the project will be completed about August, 1930. The equipment includes one 120-hp. Hoh 6-cylinder motor-powered floating dredge; one No. 8 dredging pump with 8-in. discharge; one Browning 1-yd. clamshell. Main items in the contract price of $201,545 are: 204,000 cu.yd. roadway embankment at $0.54; 36,000 sq.yd. subgrade for paving at $0.08; 7400 cu.yd. 'A' concrete paving at $9.00; 172,000 lb. reinforcing steel at $0.045.

S. V. Cortelyou is district engineer of district VII, California Division of Highways, and L. M. Ranson is construction engineer.

San Luis Obispo County—Steele Finlay, Santa Ana, will complete his contract for reconstructing 9.6 miles

Oswald Bros. Paving Platt St. Intersection (20,000 sq.ft.) in City of Lynwood, California. Indiana 5-yd. Truck and Lakewood Tampers in Background

of the Coast Highway between Atascadero and Paso Robles about June 1. The roadbed is being made 26 ft. wide and the asphaltic concrete pavement 20 ft. wide. Grading is over 80% complete, structures 90%, and paving 20% complete. Major items of equipment include: one 1¼-yd. Northwest power shovel; one 1¼-yd. Northwest clamshell; one 12-ton Austin roller; two 12-ton Buffalo-Springfield rollers; one 1½-ton asphalt plant; one 20-ft. Ord finisher with rake attachment. The contract price, $268,258, includes the following: 114,000 cu.yd. roadway excavation at $0.35; 4100 cu.yd. structure excavation at $0.75; 39,600 cu.yd. asphaltic concrete at $4.50; 745 cu.yd. class 'A' concrete in structures at $20; 75,000 lb. reinforcing steel at $0.05; and minor items.

M. J. Bevanda, Stockton, is constructing street improvements on the Coast Highway for one-half mile through the town of Atascadero, the work being handled through a local improvement district.

L. H. Gibson is district engineer of district V, California Division of Highways, San Luis Obispo.

Santa Barbara County—Cornwall Construction Co., Santa Barbara, has begun grading of 4 miles of the Coast Highway between Zaca and Wigmore. The contract was awarded February 1 and the project will be completed about October, 1930. The road is being reconstructed with a 36-ft. roadbed and a 20-ft. portland cement concrete pavement. Major items of equipment are: one 1-yd. Link-Belt shovel; one 1-yd. Northwest shovel; one 1-yd. Koehring paver; one Ord finisher; and one 10-ton Austin roller. The contract price, $153,239, includes: 100,000 cu.yd. roadway excavation at $1.00; 44,500 sq.yd. subgrade at $0.08; 1100 cu.yd. cushion course at $1.25; 9650 cu.yd. class 'A' concrete in pavement at $9.00; 237,500 lb. reinforcing steel at $0.0375.

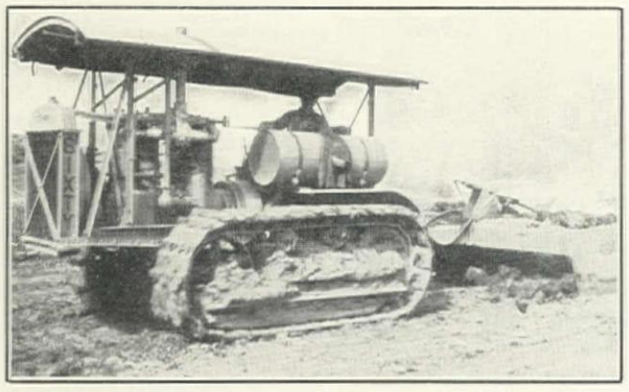
L. H. Gibson is district engineer of district V, California Division of Highways, San Luis Obispo.

Santa Clara County—Hanrahan Co., San Francisco, has started removing trees, placing culverts, and struc-

ture excavation on 4.4 miles grading and concrete and asphalt paving from San Francisquito creek to San Antonio ave., contract price $264,926. The equipment includes one Best '60' tractor; one Fordson tractor; one 1-ton and one 1½-ton truck; one gas shovel. Main contract items are: 10,000 cu.yd. roadway excavation at $0.23; 15,500 cu.yd. imported borrow at $0.70; 96,000 sta.yd. overhaul at $0.009; 18,650 tons crusher-run base at $4.08; 18,450 tons asphalt paving at $4.08; 30,830 sq.yd. asphaltic paint binder at $0.015; 8430 cu.yd. 'A' concrete paving at $9.00; 243,000 lb. reinforcing steel at $0.05.

J. H. Skeggs is district engineer of district IV, California Division of Highways, San Francisco.

Tulare County—Valley Paving & Construction Co., Visalia, is now making good progress on its contract for paving 12.2 miles from the south boundary of Tulare county to Pixley. The work in general consists of regrading and widening and resurfacing the existing 15-ft. portland cement concrete pavement with asphaltic concrete to a width of 20 ft., the new roadbed



Best '60' and McMillan Scraper Grading on County Improvement District 25, Dana Point, Orange County, California, Western Construction Co., Contractor

being 30 ft. wide. The grading and paving account for about 80% of the value of the work.

Plant erection began August 20, grading on August 29, and paving commenced November 1, 1929. Good progress was made during November and December, the north half of the contract being completed. Due to cold and fog, the job was shut down during the month of January—on only about five days of that month could full days' runs have been made. Paving was resumed January 30. During the first half of the job an average daily output of 584 tons was laid, counting all starts. Considerable time was lost due to part-day runs, which considerably lowered the job average. The average tonnage per day during February was close to 900 tons, bringing the total production average to 671 tons. Paving was finished March 15 and the entire contract should be ready for acceptance about May 1.

The grading equipment includes three Caterpillar '30' tractors; one 1-yd. Northwest shovel; two Ball wagon graders; eight head mules; one Galion grader; one Killifer scarifier; one Johnson scarifier; one 30-ton steam traction engine for pulling trees; one Fordson sheeps-foot tamper; two 1-ton roustabout trucks; eight 6-ton pneumatic-tired dump trucks. For asphaltic concrete paving, the equipment includes: one 4000-lb. Pacific portable paving plant; one 1-yd. Northwest clamshell crane; one Ord finisher; two Butler spreaders; twelve 6-ton Sterling pneumatic-tired dump trucks; one Buffalo-Springfield 10-ton tandem rollers; one 8-ton Erie tandem roller; two Kelly-Springfield 8-ton tandem rollers; two 1000-gal. water tank trucks; one 2½-ton truck with hoist for moving finisher; nine head mules.

The contract price was $287,674. Main items in the work are: 55,600 cu.yd. roadway excavation at $0.23; 65,800 cu.yd. imported borrow at $0.39; 49,600 tons asphalt at $4.47; 1100 tons oil-treated gravel or stone surface at $2.93; 98,500 sq.yd. asphalt paint binder at $0.015.

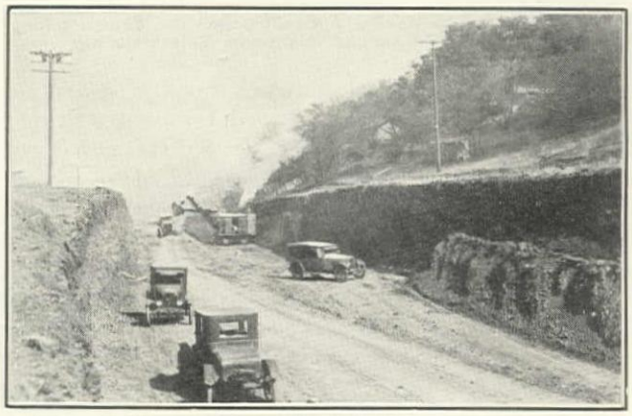
E. E. Wallace is district engineer of district VI, California Division of Highways, Fresno.

Tulare County—California Construction Co., San Francisco, is moving equipment to begin work on 8.6 miles of grading and asphalt paving from Pixley to Tipton, contract price $240,109. The project will be completed about September 1. Major contract items are: 29,100 cu.yd. roadway excavation at $0.22; 69,800 cu.yd. imported borrow at $0.35; 1050 cu.yd. structure excavation at $1.00; 17,900 sq.yd. subgrade at $0.09; 11,400 lb. reinforcing steel at $0.06; 34,500 tons asphalt paving at $4.64; 7100 tons oil-treated gravel or stone borders at $3.00; 64,150 sq.yd. asphalt paint binder at $0.015; 2300 bbl. fuel oil for shoulders and crusher-run base at $2.00.

E. E. Wallace is district engineer of district VI, California Division of Highways, Fresno. C. H. Purcell is state highway engineer at Sacramento.

LOS ANGELES COUNTY HIGHWAYS

Beverly Blvd. West of Montebello—Kovacevich & Price, Long Beach, began grading on 1.63 miles of Beverly blvd., County Improvement No. 859, October 28, 1929. Rough grading and concrete structures are



Marrter & Bock Excavating Cut for Monterey Road, City of Los Angeles, California

practically complete and the job will be finished about May, 1930. The project includes 280,397 sq.ft. of 9-7-9-in. and 199,285 sq.ft. of 8-in. compressed concrete pavement. Much underground construction—water and gas mains, telephone lines, etc.—has slowed down the progress, but paving operations are now scheduled to begin. The improvement extends from the west boundary of Rancha Rapetto easterly to Hendricks st. The contract price, $250,341, involves grading, concrete

paving, concrete pipe and box culverts, and a lighting system.

Compton and Wilmington Ave. at Compton—Geo. H. Oswald, Los Angeles, completed his contract February 17 for 5.62 miles of 40-ft. concrete and asphalt pavement from Main st. to Central ave. at Compton, County Improvement No. 862. Grading was started on this project August 23, 1929, and paving on October 28. During part of the paving period, two 6-sack mixers were used. Difficulty in keeping sufficient grade prepared prevented the continual use of both these mixers. The contract price, $379,198, involved the following principal items: 65,255 cu.yd. excavation at $0.40; 1,162,558 sq.ft. 9-7-9-in. compressed concrete pavement at $0.2425; 1,219,478 sq.ft. 6-in. old macadam and rock sub-base at $0.049; one 8-in. by 4-ft. reinforced concrete culvert at $800; and one 1-ft. by 4-ft. reinforced concrete culvert at $850.

Las Tunas Drive—Francisco & Ellington, Los Angeles, started grading on this project, Acquisition and Improvement District No. 44, on October 1, 1929. Practically all rough grading has been completed, as have all concrete structures, including curbs, gutters, culverts, and concrete intersections, and some concrete paving. The principal work still to be done is the laying of 1,114,606 sq.ft. of Warrenite paving, for which the asphaltic concrete base course was begun early in February. The project, 5.72 miles long between San Gabriel blvd. and Live Oak ave., will be completed about July 1. Rain has so far been beneficial to the work, and fair progress has been made. The contract price, $446,520, includes: 70,288 cu.yd. excavation at $0.54; 5271 lin.ft. 6 by 4 by 12-in. curb

Bucyrus-Erie Power Shovel Loading Into Dump Trucks on County Improvement District 25, Dana Point, Orange County, California, Western Construction Co. Contract

at $0.40; 5417 lin.ft. 6 by 9 by 15-in. curb at $0.42; 14,399 lin.ft. 6 by 10 by 18-in. curb at $0.51; 54,981 sq.ft. 6-in. gutter at $0.20; 60,917 sq.ft. 3½-in. sidewalk at $0.15; 259,768 sq.ft. 7 to 9-in. portland cement concrete pavement at $0.20; 11,040 sq.ft. 6-in. portland cement concrete pavement; 1,114,606 sq.ft. 2-in. Warrenite surface at $0.115; 58,320 sq.ft. 2½-in. Warrenite surface at $0.12; 1,113,575 sq.ft. 4-in. asphaltic concrete base at $0.115; 58,320 sq.ft. asphaltic concrete base at $0.12; bridge over Eaton Wash $19,000; and minor items.

E. A. Burt is county road commissioner and J. E. Rockhold is county engineer of Los Angeles county.

ORANGE COUNTY HIGHWAYS

Dana Point—The Western Construction Co., Maywood, is making satisfactory progress on grading, asphalt and concrete paving, sewer, water, and lighting systems in County Improvement District 25. The grading should be completed by the middle of the present summer, ready for the other improvements. Principal grading equipment includes: two Bucyrus-Erie power shovels and a string of dump trucks and Best '60' tractors with McMillan scrapers on short hauls.

The contract price was $439,606, the items being 183,355 cu.yd. excavation at $0.43; 90,551 sq.ft. portland cement concrete paving at $0.225; 19,828 sq.ft.

18-Sack Central Mixing Plant on Oswald Bros. Contract for Paving Century Blvd., City of Lynwood, California, Showing Discharge and Loading Hoppers and Loading Pit

portland cement concrete paving for alleys at $0.19; 1,006,445 sq.ft. asphalt paving at $0.13; 53,331 lin.ft. concrete curb at $0.50; 24,163 ft. sidewalk at $0.155; 33,515 lin.ft. 6-in. vitrified pipe sewer at $0.87; 3705 lin.ft. 8-in. vitrified pipe sewer at $1.00; and 2365 lin.ft. 6-in. cast-iron sewer.

Nat H. Neff, Santa Ana, is county road commissioner of Orange county.

CITY OF BERKELEY, CALIFORNIA

San Pablo Ave.—Western Roads Co., Oakland, will start paving operations about April 1 for widening and surfacing San Pablo ave. through its entire length in the city of Berkeley. This contract has been delayed while the City Improvement Co. completes installation of electroliers. The total cost of the improvement, including widening, paving, and electroliers, will be about $172,000; the contract price to the Western Roads Co. being $110,372. Main items in the work are: 163,500 sq.ft. grading at $0.065; 163,500 sq.ft. 6-in. rock cushion at $0.065; 104,000 sq.ft. 3-in. asphalt base with 2-in. Warrenite surface at $0.185; 190,000 sq.ft. Warrenite resurface at $0.09; 23,700 lin.ft. concrete curb and gutter at $1.00; 38,500 sq.ft. cement concrete sidewalk at $0.185; 10,000 sq.ft. concrete driveway at $0.25.

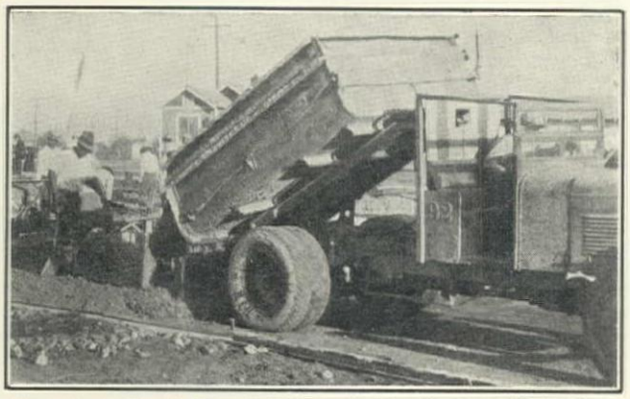
Harry Goodridge is city engineer and superintendent of streets for Berkeley, Chester C. Fisk is assistant city engineer, and C. H. Thomas is assistant superintendent of streets.

CITY OF LOS ANGELES, CALIFORNIA

Alhambra Ave. and Valley Blvd. Improvement District—Hall-Johnson Co., Alhambra, was awarded the contract for this project December 30, 1929, for $587,023, and began work February 7, 1930. The completion date is June 17, 1930. Contract quantities include: grading (lump sum) $35,000; 1,229,931 sq.ft. 2-in. War-

renite surface at $0.11; 44,520 tons asphaltic concrete base at $3.65; 17,017 lin.ft. heavy concrete curb at $0.50; 36,918 sq.ft. concrete gutter at $0.26; three storm drain systems totalling $210,500; sanitary sewer $26,000; water system complete $6900; 425 water service connections at $21. The pavement consists of 20,238 lin.ft. of 6 and 8-in. asphaltic concrete base-Warrenite surface.

Dickens St. and Kester Ave. Improvement District—J. L. McLain, Los Angeles, was awarded the contract for this project December 23, 1929, for $266,250, and began work January 15. The completion date is May 6, 1930. The contract items are: grading (lump sum) $18,000; 1,091,590 sq.ft. of 6-in. portland cement concrete paving at $0.125; storm drain at $260; sanitary sewer system $27,000; 27,400 lin.ft. house sewers at $0.70; water system complete $7750; 475 water services at $19.30; lighting system complete $46,000.



Indiana 5-yd. Truck Dumping Concrete for Century Blvd., City of Lynwood, California, Oswald Bros., Contractors. Lakewood Tamper in Background

Monterey Road—Marrter & Bock, Los Angeles, began work February 5, 1930, for improving Monterey road from Pullman st. to Huntington drive. The completion date is June 5, 1930. Contract price, $259,886, involves: grading (lump sum) $40,000; 316,390 sq.ft. 8-in. portland cement concrete pavement at $0.195; 38,316 sq.ft. 6-in. portland cement concrete pavement at $0.18; 11,359 lin.ft. heavy concrete curb at $0.55; 2170 lin.ft. special concrete curb at $0.45; 19,982 sq.ft. concrete sidewalk at $0.14; storm drain system $3000; sanitary sewer system $7000; water system complete $6000; and concrete retaining walls (including ornamental lighting installation) $115,000.

J. J. Jessup is city engineer of Los Angeles and D. M. True is office engineer.

CITY OF LYNWOOD, CALIFORNIA

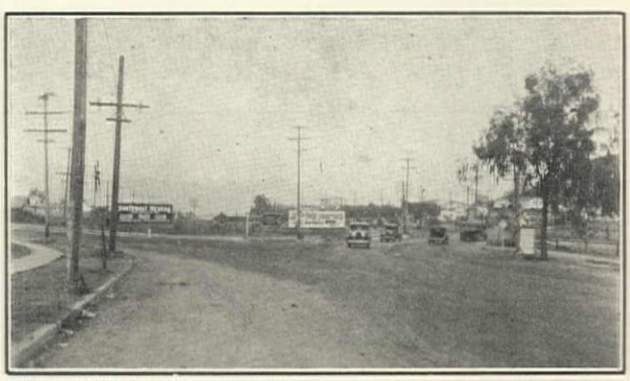
Century Blvd.—Oswald Bros., Los Angeles, completed Acquisition and Improvement District No. 18 for the city of Lynwood on February 18 and the date of protest was March 4. Century blvd. is part of the Los Angeles county major boulevard system and will be an important link in the proposed cut-off of the Coast Highway from Venice to Santa Ana. This cut-off will eventually save 8 miles to north and southbound vehicles wishing to escape traffic congestion of downtown Los Angeles. Construction was under the Mattoon Act of 1925 and required the widening of existing streets and new land to secure a 100-ft. right-of-way. The paved roadway is 70 ft. between curbs, the curbs being 18-in.; there are 5-ft. walks and lights on each side.

The total contract was $504,885, and included: grading (lump sum) $37,000; 1,054,130 sq.ft. disintegrated granite base at $0.06; 895,780 sq.ft. 8-6-8-in. compressed concrete pavement at $0.24; 158,350 sq.ft. 8-in. compressed concrete pavement at $0.2725; 155 lin.ft. special and 22,583 lin.ft. 'B' curb at $0.50; 113,215 sq.ft. 4-in. sidewalk at $0.1425; 2200 sq.ft. 4-in. oil-macadam paving at $0.15; 10,470 sq.ft. oil surfacing at $0.05; lighting system complete $101,790; 3365 lin.ft. 8-in. vitrified pipe sewer at $2.10; 1050 lin.ft. 10-in. vitrified pipe sewer at $2.34; 2550 lin.ft. 6-in. vitrified house connections at $1.10; and 25 'A' manholes at $110. The contractor was required to accept $182,691 of Acquisition bonds.

Sewer construction was begun October 30, 1929, using a P&H trencher. On all main line sewers, a 6-in. rock cradle and Weston gaskets were used.

Grading began November 15, using three 90-hp. Best tractors with elevating graders, two 60-hp. Best tractors with rooters, scarifiers, and blades; two 30-hp. Best tractors; 100 head mules; 50 dump wagons; two tandem and two 12-ton Buffalo-Springfield 3-wheel rollers on rough and finished grade; 10 to 50 dump trucks to haul disintegrated granite, for batching, and in removing dirt. The peak number of men employed was 250, the average being less than 200.

Work on the 18-in. curbing began November 26, using a 6-sack, 27-E Rex paver; a 2-sack Koehring top mixer; and three 5-ton trucks hauling from cars. The cars were equipped with side-dump hoppers for measuring. A total crew of 54 men was used on the curb work.



Section of Finished Asphaltic Concrete and Warrenite Pavement in the Alhambra Ave. and Valley Blvd. Improvement District, City of Los Angeles, Hall-Johnson Co., Contractor

Paving was begun December 13, using an 18-sack central mixing plant designed by Edward Earl of Oswald Bros. The plant was set on a spur near Alameda st. and north of Century blvd., no change in its location being made. As the length of haul increased, the quantity of mixing water was reduced to give a 1 to 2-in. slump, and the mix was slightly richened to prevent segregation. By specifications the mix was a 1:2:4, but it was varied to fit job conditions and the cement yield, an average yield of 5.85 sacks per cu.yd. being obtained. The maximum length of haul was 3.5 miles and the maximum interval between discharge from mixer and depositing of concrete on the grade was 12 min. Most of the time, fifteen 5-yd. Indiana special-body dump trucks kept the crew and plant run-

ning, seven additional trucks being used on the longest haul. In 27 days, Oswald Bros. placed 895,780 sq.ft. of 8-6-8-in. and 158,350 sq.ft. of 8-in. compressed concrete pavement. In this period there were at least 8 days when the actual running time—due to breakdowns and rain—was but 4 to 6 hours. The maximum 8-hour plant production was 971.6 cu.yd. on December 14, 1929; the maximum 8-hour placing of both 8-6-8 and 8-in. pavement being 49,894 sq.ft. on January 2, 1930. Paving was completed January 25 after about two weeks of the paving period had been lost by rain.

The lighting system installed consists of 179 double-arm cast-iron posts made by the Southwest Foundries, of Long Beach, using Westinghouse glass and equipment.

All surveys and construction were in charge of Millard L. Johnson, city engineer of Lynwood.

CITY OF NEWPORT BEACH, CALIFORNIA

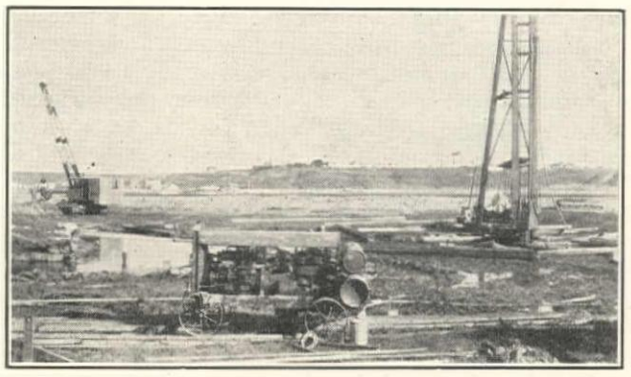
Lido Island—Griffith Co., Los Angeles, general contractor, will complete the improvements on Lido island for the city of Newport Beach about December 1, 1930. The contract price, $1,170,950, involves Warrenite bitulithic pavement, sewer, a water system, an underground system for utilities and street lights, a bridge and approaches, colored sidewalks, rolled curbs, and pleasure piers. A 6000-yd. temporary fill connecting the island and mainland has been completed, as has also a 3-mile dirt-surfaced construction road on the beach sand. Cofferdams for the piers and abutments of the bridge have been completed and foundation piles are now being driven. Over 2500 lin.ft. of 8-in. and 1400 lin.ft. of 15-in. vitrified pipe sewer on the mainland have been completed.

Major items in the contract are: 36,100 cu.yd. excavation at $0.60; 11,700 cu.yd. embankment at $1.00; 737,509 sq.ft. 6-in. Warrenite pavement at $0.28; 271,755 sq.ft. 4½-in. Warrenite pavement at $0.22; 64,000 lin.ft. curb and gutter at $1.20; 199,053 sq.ft. sidewalk at $0.22; 13,433 sq.ft. sidewalk and retaining wall at $0.80; 23,350 lin.ft. 8-in. vitrified pipe sewer at $4.25; 2571 lin.ft. 8-in. cast-iron pipe at $5.00; 94 regular manholes at $140; 16 drop manholes and 23 flushtanks at $200; pumping station complete at $15,000; 9285 lin.ft. 4-in. cast-iron pipe at $1.20; 23,038 lin.ft. 6-in. cast-iron pipe at $1.60; 1911 lin.ft. 8-in. cast-iron pipe at $2.10; 1556 lin.ft. 10-in. cast-iron pipe at $2.75; 2304 lin.ft. 12-in. cast-iron pipe at $3.30; 46,500 lb. pipe fittings at $0.09; 21 'A' fire hydrants at $90; 23 'B' fire hydrants at $70; 40 4-in. valves at $20; 107 6-in. valves at $31.50; steel plate girder bridge complete $59,900; 9200 lin.ft. piling at $0.90; additional concrete, per yd., at $30; 47,710 cu.yd. bridge embankment at $1.00; 13,250 sq.ft. granite pavement at $0.10; 12,250 sq.ft. bitulithic pavement at $0.28; 149 B.11 light posts at $135; 71 S.13 light posts at $119; 64 S.15 light posts at $150; conduit system at $237,294; 5 pleasure piers at $10,000; 772 lin.ft. 10-in. concrete piling at $5.00; 370 lin.ft. 12-in. concrete piling at $5.50.

The Drainage Construction Co., Lynwood, has subcontracted the sewer system. Considerable sewer mains are below the water level. Where sheeting is required, a steel cage is attached to the trenching machine. In wet ground, crushed rock is being placed in the bottom of the trench and Weston gaskets are being used. The equipment on this work includes one No. 40, one No. 30, and one No. 21 Parsons trenchers; two No. 32 Parsons backfillers; eight diaphragm pumps; one Rix compressor mounted on a Ford truck.

Oberg Bros., Los Angeles, subcontractors on the bridge, are using one Link-Belt 25-ton crane equipped with dragline and clamshell; one pile driver with 45-ft. leads and 4000-lb. hammer; one 4-phase Byron-Jackson 4-in. centrifugal pump; one 3-in. Byron-Jackson centrifugal pump connected to a 10-hp. Westinghouse motor.

Installation of the underground conduit and duct



Temporary Fill and Equipment in Vicinity of West Bridge Abutment, Lido Island Improvement for City of Newport Beach, California, Griffith Co. General Contractor, Oberg Bros., Subcontractor. Link-Belt 25-ton Crane in Background

system for electricity, telephone, and ornamental lighting will start early in April. The water system will be begun about May 1 and paving about June 1.

R. L. Patterson is city engineer of Newport Beach.

OREGON STATE HIGHWAYS

Washington County—J. L. Young, Portland, was awarded a contract January 16 for 3.9 miles of 9-7-9-in. portland cement concrete paving on the Multnomah county line-Beaverton section of the Tualatin Highway. This pavement will be 20 ft. wide in two equal strips, with 6-ft. rock shoulders on each side. Construction began during March and will be completed about September 30. The contract price, $104,405, involves 5500 cu.yd. roadway excavation at $0.35; 6000 cu.yd. truck-measure borrow at $0.40; 46,000 sq.yd. subgrade at $0.05; 46,000 sq.yd. concrete paving at $1.67; 7000 lin.ft. expansion joints at $0.20; 14,000 lin.ft. contraction joints at $0.02; 44,000 lb. reinforcing steel at $0.04; 4000 dowels at $0.20; 5000 cu.yd. rock shoulder base course and 1000 cu.yd. rock shoulder top course at $2.25.

W. D. Clarke is division engineer of the Oregon State Highway Commission at Salem. Roy A. Klein is state highway engineer and S. H. Probert is office engineer for the Commission.

CITY OF KLAMATH FALLS, OREGON

Unit 83—This unit, comprising about 7 miles of 30-ft. street paving with 7-in. oil macadam and 2-in. Bitumuls 95, is over 70% complete and will be finished by July 1. Dunn & Baker, Klamath Falls, were awarded the contract for $273,131 in July, 1929.

C. C. Kelly is city engineer and E. A. Thomas is assistant city engineer of Klamath Falls.

Recent Development in Sewage Disposal in the East*

By R. F. GOUDEY†

Resident Engineer, Bureau of Water Works and Supply, City of Los Angeles, and formerly Resident Engineer, State Department of Public Health, at Los Angeles

Part II

Digestion of sludge in open tanks at Baltimore has been very successful during the summer period. The scheme of operation is to leave one-third depth of old sludge for new fillings. Sludge is added, 1 to 2 feet daily, and good gassing continues, and by the time the tank is full its outlet or bottom sludge is ready to be placed on sand beds. Sludge is added under the surface, to prevent release of odors. When full, three soundings are made to determine the clear water zone, which is drawn off prior to the release of sludge. Digestion reduces volatile suspended matter from 75 p.p.m. to 55 p.p.m. in 24 days. About 50% of the sludge is lost through gassification and liquefaction. During the winter, sludge is recirculated to advantage. Heating of sludge, long experimented with at this plant, is in the future program. Further experiments on separate sludge digestion and heating are under way at the Chicago DesPlaines plant.

Digestion of activated sludge in a heated tank with gas collection has been installed at Salem, Ohio. Excess activated sludge pumped to the digestor gave an overflow liquor so bad that it bulked the sludge in the process, and spoiled the effluent. A separate settling tank was then installed in which the excess sludge was first pumped. After settling several hours, the clear water, amounting to three-fourths of the original sludge volume, is drawn off. The concentrated sludge when pumped to the digestor does not upset the clear water zone in it, and the overflow is clear.

Most of the heating coils are placed on the sides of the tanks and held in place by short screws and brackets. A more secure method of fastening should be employed to prevent dropping of the coils, which would interfere with the rotation of the digestion equipment.

Many of the plants are equipped with auxiliary heating units, principally to get the plant started. This is a wise precaution for all new installations to adopt. Temporary steam boilers have been used in some instances.

Activated Sludge

Very definite progress has been made in activated sludge treatment, in obtaining greater efficiency at a less cost.

Advantage of Preliminary Sedimentation — Milwaukee is the only large plant not having sedimentation. Mohlman, a number of years ago, proved from experiments at Calumet, that preliminary sedimentation over screening would effect a 25% reduction in air consumption. Accordingly, the North Side plant was built with preliminary sedimentation. It is interesting to note that this plant is getting excellent aeration and nitrification with only 0.8 cu. ft. of air per gallon of sewage treated. The sewage is rather weak, although its suspended solids run as high as 110, and the B.O.D., 120 p.p.m. The aeration is so successful that good separation of sludge and liquid occurs one-third the way along the tank.

Both Salem, Ohio, and Indianapolis, claim to save air by use of preliminary sedimentation, and I believe now that it can be generally conceded as a necessary adjunct in activated sludge treatment.

Aeration—The Manchester type of aeration has certainly proven its worth. Milwaukee uses a ridge and furrow type, but the large masses of septic sludge which occasionally rise may be caused in part by the inefficiency of that type of aeration, even though the surface aeration looks fair. At Indianapolis the aeration seems to be rather violent. They claim, however, that violent aeration is necessary on account of their very concentrated sewage.

Following Mohlman's leadership, the activated sludge plants are now using the suspended solid test, aiming to keep 4000 p.p.m. of suspended solids in the aeration tanks.

Several of the new plants are using curved top baffles in connection with the Manchester type of aeration, to give the sewage a rotational flow. It does not appear that these specially curved plates are of any material advantage over the conventional designs.

At the Chicago North Side plant, water collects behind the concrete baffles designed to give a spiral flow, and has a very objectionable odor.

Experiments at Calumet, with short aeration periods of one hour with 15% of four-hour reaerated sludge prior to heavy dosing on filters, are not working out well because of the loss of too much poor sludge.

Mohlman has proven the need of reaeration of sludge for total plant efficiency. Neither Milwaukee nor Salem, Ohio, reaerate sludge. It seems to me that reaeration of returned sludge should be provided in new designs. Variable speed return sludge pumps work out well at Chicago.

I was much interested in the progress made with paddle-wheel aeration, as an adjunct to compressed air. This type of aeration originated with the Sanitary District of Chicago, at their Argo experimental plant in 1924, and is now being tested in a 1.8 m.g.d. plant, at Calumet. The sewage is first pre-settled, and then aerated in a wide tank, in which two horizontal paddles revolve downward toward air diffuser plates at each side of the tank. The amount of air now used is 0.2 cu. ft. per gallon of sewage. The total horsepower required per million gallons is 7 for compressed air, and 6 for the paddles, totaling 13; which is about one-half of the horse power if 0.8 cu. ft. of air per gallon of sewage were used alone. The final effluent of this treatment plant shows a final B.O.D. of 8 p.p.m., nitrates of 1 p.p.m., and 60% removal of organic nitrogen. Both Mohlman and Imhoff feel that much less air could be safely used. This is very encouraging, as this will cut

*Reprinted from Vol. II, No. 1, California Sewage Works Association 1929 Journal. Part I was published in the March 10th issue, p. 141.

†Associate Member, American Society of Civil Engineers.

down the present cost of activated sludge $6 to $10 per m.g.

At Salem, Ohio, a large demonstration is being made by the Dorr Co. with a paddle system in a tank which is only 9 ft. in cross section. Already their work indicates a saving at least equivalent to one-half of the present horsepower.

At Calumet, a chain-driven centrifugal blower with motor-gear reduction appears to be very dependable and satisfactory.

The advantages of washing the air used for compressing purposes, and removing oil from it to keep down the friction in the aeration plates, has been thoroughly demonstrated at Chicago and Indianapolis. At Indianapolis, the air is first passed through oil-removal filters prior to washing, which appears to be the logical procedure. At Chicago, the air is washed first, and then oil is removed. In both cases the air friction in the diffusion plates does not build up, as at other plants. At Chicago, the air is heated prior to washing. Just what advantage this gives is not clear.

Final Sedimentation—Two outstanding developments in final sedimentation, have been the invention of the Tow-Brow clarifier at Milwaukee, and the use of double sedimentation at Salem, Ohio. The Tow--Brow clarifier is one in which a revolving arm at the bottom contains outlet nozzles which suck out sludge and some final effluent to the reaeration tanks. Experiments at Milwaukee indicate that for the same size of tank, 50% greater flow can be clarified than in other types of clarifiers. The clarifier was operating at this rate when I saw it, but the effluent was mediocre and contained particles of light sludge. Dorr clarifiers operating alongside were giving a good clarification.

At Salem Ohio, the final effluent, after being settled in a Dorr clarifier, is allowed to resettle in a plain sedimentation tank of the same capacity as the Dorr clarifier. This tank was made available from the old plant, and was put into use by the city engineer, primarily to act as a safeguard in case something happened with the plant proper. It is doing a great deal of work and is in continuous use. The tank has rectangular hopper bottoms which are cleaned every four days. This is done by decanting the top water and discharging the sludge on to sand beds. It is necessary to remove all sludge from the effluent, because of the character of the dry stream bed into which the effluent is discharged. The effluent from the Dorr clarifier looks like all activated sludge effluents, but the effluent from the secondary clarifier is noticeably clearer, and at once shows the advantage of the additional sedimentation. I believe that, in new plants, double sedimentation should be seriously considered.

The need for deep inlet baffles, such as at Pasadena, to prevent short-circuiting in the tank, was observed in all of the clarifiers seen in the east. The Indianapolis and Milwaukee design approaches this type of inlet.

The settling of activated sludge in plain sedimentation tanks is rapidly going out of date. Indianapolis is the only plant which attempts to do this. The tanks are circular and have rather steep hopper bottoms. A revolving arm with chains, presumably sweeps the sludge to the center outlet. Experiments with dyes, and looking down into the tanks through glass tubes, with lights below, show that, with all kinds and types of outlets, they cannot stop the bottom currents, which so defeat good sedimentation. The capacity of the entire plant is seriously limited by this faulty provision for sedimentation.

Indianapolis has devised a good type of clarifier overflow. Everyone notices, on the weirs of clarifiers, that a small difference in head means a great variation in flow, particularly if some of the weirs are out of alignment. This is even more true when the clarifiers operate at full load. By putting in small V-notch outlets, 1½ in. deep, and 4 or 5 in. apart in the outlet weir plates, a little difference in head when the weir notches are out of level makes very little difference in the amounts discharged. I believe all the clarifiers will come to this type of outlet.

Sprinkling Filters, Dosing Tanks and Final Sedimentation

No large installations are being made of sprinkling filters. There has been a tendency in the larger plants in the East in the past to get away from patented equipment in connection with automatic siphons. At Brockton, Massachusetts, an attempt was made to vary the flow at the filters by turning on and off a valve in two separate lines, so that only one line at any one time would contain the flow, but, during the period it was getting the flow, the rate would be gradually increased, and decreased. This design did not work out well, because there is practically no overlap of the nozzle spray, and a large part of the bed is not wetted at all.

At Baltimore, a very good dosing arrangement has been devised. Each filter bed has its own feeder pipe and two are operated in pairs. The feeder pipe of each set lies one over the other, and each pipe has a butterfly valve in the lines, operating opposite each other. They are continually opening and closing as long as there is any flow through them. The operator manually controls the number of pairs in operation during the day, according to the sewage flow. This system certainly has worked out well, and, as it is not patented, it could be used elsewhere.

I was favorably impressed with the Columbus type of nozzle at the Baltimore sprinkling filter plant. It gives a longer distance of spray and much less trouble from cleaning. The spray drops are larger than with the Taylor nozzles.

There appears to be no type of clarifier yet worked out for efficient settling of sprinkling filter effluent. At Baltimore, where they have the largest sprinkling filter plant in the United States, the final tanks do more damage than good. At Brockton, Plainfield, Aurora, Illinois and other plants, the same likewise applies. The effluent in all these cases loses dissolved oxygen and nitrates as it passes through the final settling tanks, and picks up large particles of sludge. It used to be stated that sprinkling filter plants in the east unloaded once or twice a year. They now find, probably due to closer observation, that there is more or less unloading continuously, as we have found in California.

The present type of settling tank was designed on the basis that the filters would unload once or twice a year, and that the sludge could be removed after digestion. With a continuous deposition of sludge in larger amounts than heretofore considered in the design, it is no wonder that these clarifiers do not give adequate removal.

(To be continued)

LETTERS TO THE EDITOR

SAN FRANCISCO, CALIFORNIA, March 11, 1930

THE EDITOR:

DEAR SIR—I read with interest your editorial on 'Shrinkage Cracks in Concrete' in the March 10th issue of WESTERN CONSTRUCTION NEWS. Unfortunately, however, I cannot agree with the first sentence—particularly that part which says, "We have not yet solved the problem of their prevention or their control to predesigned lines"—this referring to expansion and contraction cracks.

In the next sentence, you qualify this statement by stating that it is particularly true in mass concrete, with which I agree. However, I am afraid that the average reader might assume that all concrete structures were included in your editorial.

The particular construction which I have in mind is the concrete road and the recent development on the Pacific coast of dummy joints, which, if properly spaced and constructed, control the cracking in 99% of the cases. Because of the success of the dummy joint in pavement construction on the Coast, it is being adopted in other sections of the country, and I have a notion that the application of this principle might likewise be adopted in various other types of concrete structures.

I know that you are quite familiar with the dummy joint development, and I do not want to appear critical, but it occurred to me that you might want to qualify this statement, making exception of concrete roads as now constructed on the West Coast.

J. E. JELLICK,
Manager, Advertising and Promotion,
Calaveras Cement Co.

GOLDEN GATE BRIDGE ACROSS SAN FRANCISCO BAY

The proposed $30,000,000 Golden Gate highway toll bridge, for which approval by the War Department is being sought, will join Fort point in the Presidio of San Francisco and Lime point in Marin county, California. This crossing, the narrowest at the Golden Gate, has an opening of 6000 ft. It can be made by a suspension bridge with a 4200-ft. center span, having about 225 ft. maximum clearance. With side spans, the bridge will be 6400 ft. long; approaches add 8500 ft.

The Golden Gate is over 300 ft. deep at the bridge crossing, but a shelf extends 1000 ft. out from Fort point, with a maximum depth of 60 ft. One of the main piers will rest on this shelf and will have its base 80 ft. below the water line. The main pier on the opposite side will be in shallow water. Cable towers will extend 700 ft. above the water.

The entire width of the bridge will be 90 ft., in order to provide sufficient stiffness against wind and vibration. To meet current and early traffic demands, only a 30-ft. roadway will be required. No provision will be made for railroad tracks, the bridge being designed only for fast motor traffic. As the traffic demands increase, the floor can be widened and another deck added, if necessary.

PERSONAL MENTION

Ralph Budd, president of the Great Northern railroad, has been asked by the Soviet to spend three months in Russia during the coming summer assisting in the rehabilitation of the railroad system.

J. B. Tyrrell, member A.A.E., for the past 5 years superintendent of streets at Stockton, California, has resigned to enter private practice in engineering or contracting, with headquarters probably at San Francisco.

John F. Partridge, formerly with the Asphalto Concrete Corp., is a civil engineer on hydroelectric power studies for the Emprezas Electricas Brazileiras, S.A. He can be reached at Caipa Postal, 883, Rio de Janeiro, Brazil.

E. P. Callahan, hydraulic construction superintendent, Chicago, has completed the Falls River project for the Power Corporation of Canada and returned to the United States. This project is 65 miles north of Prince Rupert, B.C., in a region which was isolated for two months during the past winter.

Skeels & Graham Co., engineers and contractors, began operation January 1, with a principal office at Roseville, California, and a branch office at Tucson, Arizona. The firm is composed of E. B. Skeels and Robert J. Graham. Graham was for many years connected with Bates & Rogers Construction Co., Chicago, and with D. W. Thurston Co., Detroit.

Joseph B. Strauss, chief engineer for the Golden Gate Bridge & Highway District, San Francisco, and president of the Strauss Engineering Co., Chicago, submitted a report March 14 on engineering developments to date for the proposed Golden Gate bridge across San Francisco Bay. The estimated cost of this bridge is $30,000,000 and it is possible that actual construction may begin late in 1930.

C. E. Grunsky, consulting engineer of San Francisco, has returned from a tour of the Orient which included attendance at the World Engineering Congress, Tokio. At the 50th annual meeting of the A.S.M.E. in New York and Washington during April, he will present a paper on 'Progress in Engineering in America During the Last 50 Years'. Grunsky was recently elected president of the American Engineering Council.

Lynn Crandall, of Mackay, Idaho, has been elected watermaster of Snake river, succeeding G. C. Baldwin, resigned. His duties will include the delivery of stored water from Jackson lake and American falls reservoirs, as well as the delivery of normal flow to about 100 canals, serving 2,000,000 acres of irrigated lands in southern Idaho. Crandall will also act as district engineer of the U. S. Geological Survey at Idaho Falls, a position likewise formerly held by Baldwin.

Burns-McDonnell-Smith Engineering Co., Los Angeles and Kansas City, is appraising the properties of the Elko & La Moil Power Co. for the purpose of rate adjustment, being retained by the city of Elko, Nev. The same firm is now appraising three properties in the state of Sonora, Mexico, the largest one at Hermosia, for the Byllesby interests, and has also been retained to design and construct a municipal filtration plant for the city of Weiser, Idaho, for which the bond issue was recently voted.

Dr. Ing. E. Foerster of Hamburg, one of the foremost German engineers interested in aerodynamics, marine engineering, and naval architecture, visited the San Francisco bay region March 17 to 22. Dr. Foerster delivered two lectures as the guest of the University of California on 'The Effect of Recent Progress in Shipbuilding and Marine Engineering Upon Power, Speed, Accommodation, and Economy' and 'Scientific Experimental Investigations in Hydrodynamics and Aerodynamics, and the Influence Thereof Upon the World's Progress in Shipping'.

E. D. Sulminov, first vice-commissar of the Soviet Commissariat for Transportation and chief engineer of the Russian railways, headed a party of 15 Russian engineers on an inspection of the Suisun bay bridge of the Southern Pacific Co. at Martinez, California, on March 14. Principal members of his party included: J. M. Mironov, general manager of the

central administration of railway transport; S. A. Bogdanov, chief of the traction department; T. S. Shushkov, chief inspector of railways; M. M. Kaganovich, chief efficiency engineer; G. B. Ulanov-Zinovier, president of the Don railways; B. J. Kuritzin, president of the state machine building works. The party is spending some months in the United States studying railway properties, transportation development, and construction projects.

Fred J. Klaus, of Berkeley, has been appointed city engineer of Sacramento, California, at a salary of $6000 a year, succeeding Baylies Clark, resigned. The change is effective April 1. Klaus graduated from Ohio State University in 1904, having one year's experience with the Los Angeles Gas & Electric Corp. prior to his college training. From 1904 to 1905 he was on the engineering staff of the Salt Lake, San Pedro & Los Angeles Railroad, and from 1905 to 1907 was with the Santa Fe and the Northwestern Pacific railways. From 1908 to 1929 he was with the Peoples Water Co. and the East Bay Water Co. in Oakland and Berkeley, California, for the last half of this period being chief engineer of the latter company. Klaus designed and constructed the San Leandro and Upper San Leandro water projects, both consisting of dams, tunnels, rapid sand filtration plants, and distribution lines. One of his first projects at Sacramento will be to rehabilitate the existing filtration plant.

OBITUARY

Fred J. Maurer, 67, for seven years an engineering contractor at Eureka, California, died February 28 after a long illness. Maurer is survived by his widow and five children.

Louis F. Barzelotti, 72, for the past 17 years city engineer of Lodi, California, died of heart disease on March 15. Barzelotti had previously been a surveyor for the Tesla coal mines in Alameda county, California. He is survived by his widow

George Perry Griffith, Jr., 33, for the past two years vice-president and general manager of the Griffith Co., paving contractors of southern California, died at Beverly Hills on March 10. Griffith was born at Scranton, Pennsylvania, and attended the University of California. He is survived by his widow and four children.

Carl Pleasant, president of Carl Pleasant, Inc., an engineering contractor with a wide practice in the United States, died at Phoenix, Arizona, March 15. Among his projects was the $3,000,000 Lake Pleasant (Frogs Tank) dam on the Agua Fria river near Phoenix, which he financed and built for a private citrus irrigation development.

ASSOCIATIONS

Society of Engineers, San Francisco Bay Region—The annual dinner of the society was held at the Mandarin cafe, San Francisco, on March 11.

Pacific Northwest Section, A.W.W.A.—The third annual meeting of this section, embracing the states of Oregon and Washington, will be held at Portland on April 24 to 26. The program will be announced in an early issue.

Arizona Public Health Association—The third annual meeting of the Arizona Public Health Association will be held in Phoenix, April 22 to 23, in connection with the Sanitary Water Works Section of Arizona—an organization similar to the C. S. W. A. The program will be announced in an early issue.

University of California Engineer's Day—The University of California Student Engineers Council sponsored an engineer's day on the Berkeley campus March 14. The program included a barbecue and entertainment, open house and exhibits by all the engineering colleges, and an engineer's day dance.

Western Washington Section, American Society of Civil Engineers—A regular monthly meeting of this section was held at the Engineers Club, Seattle, February 21. The speaker was Ralph Budd, president of the Great Northern Railway Co., on the topic 'Modern Trend in Railway Transportation'.

School of Citizenship and Public Administration, University of Southern California—A short course in water supply and purification will be held at Los Angeles, April 14 to 19, under the Braun Corporation Lectureship. Besides lectures, there will be papers by eminent engineers and roundtable discussions, inspection of exhibits and engineering structures.

Engineers Club of Fresno—This organization holds regular luncheon meetings at the Hotel Fresno each Wednesday, with a musical program and guest speaker. Its progress is interestingly reviewed in the club's 'Modulus of Activity'. W. F. Rantsma, acting commissioner of public works, Fresno, is president and J. A. Hall, vice-president. As of February 28, the membership was 98, of which 20 were non-resident.

At the meeting on February 19, attendance 47, Hubert Phillips spoke on 'Contemporary Europe' and at the one on February 26, Harold K. Fox described the 'San Francisco Steam Plant of the Great Western Power Co.' Officers for the next year were nominated March 3.

A.S.C.E. EXCURSION
(San Francisco Section)

The excursion committee of the San Francisco Section of the American Society of Civil Engineers, composed of George D. Whittle (chairman), D. J. Fee, and C. J. Nobmann, has arranged a 2 and 3-day week-end inspection trip to the Pardee dam, Calaveras flood control dam, and Calaveras Cement Co. plant, all close together east of Stockton.

The Calaveras Cement Co. is sponsoring this trip and the engineers will be its guests at The Kentucky House (the company's club house at the plant).

Engineers have their choice of leaving Oakland by auto from the Oakland hotel either at 2:00 p.m., Friday; 7:20 a.m., Saturday, or 2:00 p.m., Saturday: returning either Saturday or Sunday.

As accommodations are limited, the inquiry cards being mailed by H. B. Hammill, secretary of the Section, should be promptly returned, or J. E. Jellick of the Calaveras Cement Co. notified.

Nevada County Commissioners Association—The sixth annual convention was held in Reno December 12-13, 1929. Papers of interest to engineers were: 'Development of Nevada's Highway system' by S. C. Durkee, state highway engineer, and 'How the counties may benefit through an efficient budget system' by F. N. Fletcher, secretary of the Nevada Taxpayers Association.

AMERICAN SOCIETY OF CIVIL ENGINEERS

Spring Meeting at Sacramento

The tentative program for the national spring meeting at Sacramento, California, April 23 to 25, as guests of the local section, the San Francisco section assisting, includes the following technical sessions:

General (April 23)

'Maximum Conservation of Water Resources'
'State Supervision of the Design and Construction of Dams'

Highway Division (April 24)

'Western Highway Practice'
'Developments in Low-Cost Bituminous Roads'
'Pre-Qualification of Contractors'

Irrigation Division (April 24)

'Proposed Colorado River Aqueduct and Metropolitan Water District of Southern California'
'Foundation Treatment of the Rodriguez Dam'
'Hydroelectric Power as an Aid to Irrigation'
(And other subjects)

Structural Division (April 24)

'Suisun Bay Bridge'
'Structural Features of the Salt Springs Dam'

Surveying and Mapping Division (April 24)

(Program not announced.)

At the close of its 77th year, the society had 14,085 members (of which 16% were juniors), 50 local sections, 96 student chapters, 9 technical divisions, and more than 300 operative committees.

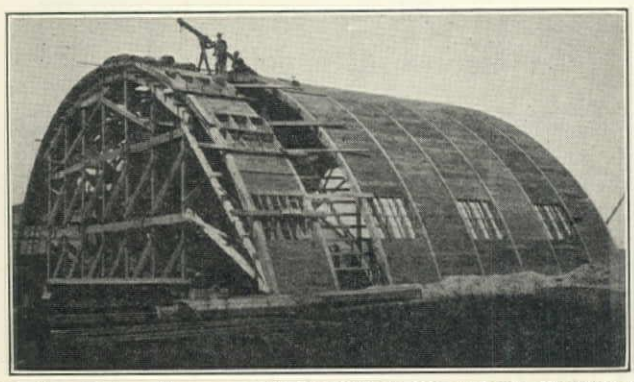
New Equipment and Trade Notes

NOTRUS HANGAR WITH CONTINUOUS WOOD ARCH

During erection of a Notrus hangar at the Great Lakes Aircraft Corp. plant, Cleveland, Ohio, an engineering test for wind and snow loads was requested on the structure by the city engineering department. Wilbur Watson & Associates, Engineers, of Cleveland, designers of the Goodyear Zeppelin hangar at Akron, Ohio, were employed to conduct the test.

The Notrus hangar to be tested was an arch-shaped structure springing from the ground, the distance across the arch being 76 ft. and that around the arch 90 ft.; the arch was 27 ft. high.

The hangar was constructed of standardized factory-built sectional wood units, 6 by 10-ft., shaped to the curve of the arch roof and bolted together. Thus, by using a certain number of these sectional units a structure of any desired size can be constructed. Between each row of panels were bolted three arch ribs, 2 in. by 12 in. by 10 ft., the top edge of these ribs being cut to the radius of the arch. Starting at the end of



Testing Notrus Hangar with Continuous Wood Arch, Cleveland

the hangar, six rows of panels and ribs were erected, the seventh row being omitted. The eighth row which served as the test span was erected, thus causing it to stand detached from the main structure for the test.

For the snow test, the roof of the building was loaded for a distance of 25 ft. on each side of the crown of the arch with bags of sand; a total load of 19,243 lb. being placed on the one row of panels and pair of ribs attached thereto, which was equivalent to a snow load of 30 lb. per sq.ft. Steel wires with targets attached were hung from the center of the arch, also at 10-ft. intervals on each side, and as the load was applied readings were taken at these points. The greatest deflection recorded was 2 in. and upon removal of the test load the structure returned to within ½ in. of its original position.

Wind load tests were conducted by attaching ⅝-in. steel cables to 6 by 6-in. timbers laid horizontally across the roof of the test arch at three equal points on one side of the structure. The steel cables ran horizontally through sheaves attached to a scaffold and then vertically toward the ground and were attached to 8 by 8-ft. platforms suspended above the ground, on which were piled sacks of sand exerting a 30-lb. wind load on the structure. The structure withstood this wind test which represented a 90-mile gale and upon removal of load returned to within ½ in. of its original position.

The patented method of constructing Notrus hangars from standardized units permits the economical erection of any size hangar at minimum cost. As the units are bolted together by a patented method, the length may be increased at any time with 100% salvage, or the hangars can be moved to a new location at low labor cost. The thoroughness of standardization makes possible shipment of a complete hangar five days after receipt of order. The exterior is covered with 85-lb., slate-coated, fire-resistant roofing over the entire exterior, including gables. This slate-coated roofing may be supplanted with asbestos fireproof roofing or Toncan iron if appropriation permits.

Notrus hangars have been erected on airports in Chicago, New York, Cleveland, Houston and other points. The hangar at Cleveland was erected by the Circle A Products Corp., of Newcastle, Indiana, under patents of the parent company, the Notrus Hangar Corp., Esperson bdg., Houston, Texas.

STERLING TRUCKS LAY FALSE SEAWALL

A new use for motor trucks was devised by the Malden Crushed Stone Co. on a contract for placing 700 ft. of false seawall to protect concrete sea-walls from erosion. A fleet of four Sterling dump trucks completed the work in four days, hauling 1800 tons of blasted rock from the quarries to the wall, a round-trip distance of 10 miles. The trucks averaged 112 tons

Three Sterling Trucks Placing False Seawall in 8-Ton Loads

each daily with 8 tons to the load, making 14 trips per day and driving through considerable traffic congestion.

Deliveries were made direct to the beach and to the desired location, eliminating all rehandling. This made it necessary for the trucks to pull through 2 ft. of water at times when the tide was in. The entire job was completed three days under the contract time and has caused much comment among contractors. As the contract price was based on the old method —delivery as close to the beach as possible and then the use of horse-drawn boats and hand labor to place the rock—the job proved quite profitable.

YOUNG RADIATOR CO. INCREASES PLANT CAPACITY

Production of industrial type internal combustion engine cooling radiators for trucks, power units, compressors, industrial machinery, hot water forced draft automobile heaters, and new type forced draft heating units, for factories and buildings, reached its peak in the history of the Young Radiator Co., Racine, Wisconsin, manufacturers of copper heat transfer products.

F. M. Young, president, reports plans under way to double the company's manufacturing possibilities during the coming year, much additional machinery having already been installed in anticipation of increased production. Increase in accounting, purchasing, and engineering department personnel has also been made to promptly take care of, and control the additional work.

This company has purposely withheld accepting certain large contracts, due to its desire to take care of established trade.

LINK-BELT GAS SHOVEL FOR QUARRY WORK

The James Stone Co., Richmond, Texas, uses a 1¼-yd. Link-Belt gas-powered shovel in its quarry. The rock in this

Link-Belt 1¼-yd. Gas Shovel Handling Large Boulder from Quarry of James Stone Co., Richland, Texas

quarry lies in a solid formation and is dynamited to allow for loading into dump cars. Boulders too large to be scooped into the dipper are carried on the dipper teeth to the cars or are laid aside for reblasting.

WESTINGHOUSE SYNCHRONOUS MOTOR

The Westinghouse Electric & Manufacturing Co. has installed the world's largest diameter synchronous motor to drive a 22-in. continuous bar mill at the plant of the Columbia Steel Corp., Pittsburg, Cal. This motor is 25 ft. in diameter, with an output of 5000 hp. at 82 r.p.m. It has 88 poles and

Westinghouse 25-ft. Diam., 5000-hp. Synchronous Motor at Columbia Steel Mills, Pittsburg, Calif.

operates on a 3-phase, 2200-volt, 60-cycle system at 100% p.f. A duplicate motor is being installed at the same plant to drive a continuous billet mill. The steel rolled by these two mills is used for making tin cans.

HEIL CO. APPOINTS DIRECTOR OF HIGHWAY SALES

The Heil Co., Milwaukee, manufacturer of hydraulic hoists and all-steel dump bodies for motor trucks, announces the appointment of C. N. Maurer as director of the highway sales division.

Maurer had been with the Wisconsin State Highway Commission for 10 years. Early in his service with the Commission he secured, reconditioned, and distributed surplus war equipment to the counties. He was then appointed traffic engineer and in this capacity supervised the remarking of all Wisconsin highways, installed a department to handle the weight law enforcement of vehicles, and developed the state highway arterial system. These activities formed a background for preparation of the State traffic code, which he formulated, and which became effective November 4, 1929.

Maurer is a graduate mechanical engineer from the University of Wisconsin. He was a first lieutenant during the war and served 19 months overseas. He is a member of the Society of Automotive Engineers and the Wisconsin Engineering Society; chairman of the board of directors of the Madison, Wisconsin, A. A. A., and also the Wisconsin member to the A. A. A. National Good Roads Committee.

COMPRESSOR SERVICE & TOOL CO. ORGANIZED

H. L. Hill, formerly with the U. S. Machinery & Steel Co., San Francisco, has organized the Compressor Service & Tool Co., 1559 Howard st., San Francisco, for the sharpening of rock drill steel. The company maintains a modern shop, run by expert mechanics, and guarantees high-class work, giving special attention to rush orders. This shop is equipped to bit, shank, and resharpen paving breaker moils, gads, spaders, etc.

PERFEX ENGINE-COOLING RADIATORS

The Perfex Corp. exhibited at the Atlantic City Road Show a complete series of parts, showing each stage in the manufacture of its staggered-tube radiator. These operations, illustrated in the accompanying cut, are:

(1). Section of ribbon stock used in making Perfex lock-seamed tube.

(2). Tube stock partly formed in a series of rolls.

(3). Tube as it is first formed with lock seam.

Stages in Manufacture of Perfex Staggered-Tube Engine Cooling Radiator, Steps 1 to 10 Shown from Right to Left

(4). Tube as it is finally formed after passing through forming rolls.

(5). Tube after it has been tinned or soldered by passing through solder bath.

(6). Section of fin stock used for making Perfex hemmed fins.

(7). Section of finished fin stock—hemming, punching, cutting, and stacking operations all performed on one machine with one operator.

(8). Jig used for assembling tubes and fins to form Perfex all-copper staggered tubular core.

(9). Completed core, with fins soldered uniformly to tubes by baking operation.

(10). Section of Perfex header for tubular core, as formed.

UNIT BID SUMMARY

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

STREET AND ROAD WORK

SACRAMENTO, CALIF.—STATE—SAN BERNARDINO COUNTY—GRADING

H. W. Rohl Co., Roosevelt Bdg., Los Angeles, who bid $100,372, submitted low bid to California Division of Highways, Sacramento, for 1.9 miles grading in SAN BERNARDINO COUNTY, between The Pass and two miles down Waterman Canyon. Bids from:

(1) H. W. Rohl Co., Los Angeles $100,372
(2) J. P. Holland, Inc., San Francisco 101,757
(3) J. G. Donovan & Son, Los Angeles 103,277
(4) Gist & Bell, Arcadia 103,927
(5) C. G. Willis & Son, Los Angeles 106,095
(6) Geo. Pollock Co., Sacramento 108,892
(7) Triangle Rock & Gravel Co., San Bernardino $115,493
(8) O. A. Lindberg, Stockton 115,741
(9) Sander Pearson, Santa Monica 120,789
(10) Isbell Constr. Co., Fresno 127,258
(11) Lewis Constr. Co., Los Angeles 147,808
(12) Pearson & Dickerson, Riverside 174,352

Bids received on the following items for this project:

(A) 26 acres clearing and grubbing right-of-way.
(B) 219,000 cu.yd. roadway excavation.
(C) 241,000 sta.yd. overhaul.
(D) 1,500 cu.yd. structure excavation.
(E) 521 cu.yd. A concrete (structures).
(F) 78,800 lb. reinf. steel (structures).
(G) 464 lin.ft. 18-in. corr. metal pipe.
(H) 530 lin.ft. 24-in. corr. metal pipe.
(I) 434 lin.ft. 30-in. corr. metal pipe.
(J) 116 lin.ft. 48-in. corr. metal pipe.
(K) 60 ft. corr. pipe, clean and relay.
(L) 600 bbl. fuel oil.
(M) 1 mi. new property fence.
(N) 101 sta. finishing roadway.
(O) 95 monuments.

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
(1)	80.00	.36	.005	1.00	18.00	.04	.70	1.00	1.00	1.50	1.00	1.50	$500	10.00	3.00
(2)	75.00	.34	.01	1.00	28.00	.0425	.50	.60	.60	.60	.50	2.00	600	5.00	3.00
(3)	100.00	.345	.0075	1.25	25.00	.05	.50	.75	1.00	1.00	1.50	2.35	500	10.00	3.00
(4)	60.00	.37	.01	1.50	18.00	.04	.50	.75	1.00	1.50	2.00	2.50	500	5.00	3.00
(5)	65.00	.35	.01	1.50	26.00	.06	.75	.75	1.00	1.50	1.25	2.25	700	10.00	3.50
(6)	100.00	.37	.005	1.25	24.00	.05	1.25	1.50	2.00	2.50	1.00	2.25	500	10.00	3.00
(7)	150.00	.40	.01	1.00	24.00	.04	.65	.80	1.00	3.00	.50	2.50	600	5.00	3.00
(8)	150.00	.38	.01	1.25	30.00	.05	.60	.75	1.00	1.50	1.50	3.00	550	7.50	3.00
(9)	80.00	.43	.0125	2.00	19.00	.05	.60	.80	1.00	1.40	1.25	2.70	500	9.00	3.00
(10)	100.00	.46	.01	1.50	22.00	.04	.50	.75	1.00	1.00	2.00	2.50	550	10.00	3.00
(11)	250.00	.52	.01	1.50	25.00	.05	1.00	1.00	1.50	3.00	2.00	3.00	500	10.00	4.00
(12)	75.00	.637	.015	2.00	30.00	.05	1.50	1.75	2.50	3.50	1.00	3.00	350	10.00	4.00

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

Contract awarded to Dodge Bros., Fallon, Nevada, who bid $32,334 for 3.4 miles grading and gravel surfacing in DOUGLAS COUNTY, from Minden north, for Nevada State Highway Commission, Carson City. Bids from:

(1) Dodge Bros., Fallon $32,334
(2) Isbell Construction Co., Carson City, Nevada 34,637
(3) A. D. Drumm, Jr., Fallon 34,761
(4) Nevada Rock & Sand Co., Reno $36,460
(5) Engineer's estimate 35,827

	(1)	(2)	(3)	(4)	(5)
23,500 cu.yd. excavation	.30	.30	.40	.35	.25
48,532 sta.yd. overhaul	.05	.04	.03	.04	.02
3.44 mi. prepare subgrade and shoulders	75.00	150.00	100.00	100.00	100.00
8,000 cu.yd. sel. borrow excavation	.55	.50	.50	.60	.65
8,500 cu.yd. cr. rock or cr. gravel	1.10	1.25	1.25	1.20	1.60
100 cu.yd. cr. rock or gravel (stockp.)	1.10	1.25	1.25	1.00	1.60
205 cu.yd. 'A' concrete	35.00	40.00	35.00	40.00	35.00
3 cu.yd. 'B' concrete	35.00	40.00	35.00	40.00	35.00
74 ft. 10-in. corr. pipe, install	.50	.50	.50	.50	.75
635 ft. 18-in. corr. pipe, install	.50	.75	.50	.50	.75
82 ft. 24-in. corr. pipe, install	.50	1.00	.50	.50	.75
74 ft. 10-in. corr. pipe, remove	.50	.50	.50	.50	.75
132 ft. 15-in. corr. pipe, remove	.50	.75	.50	.50	.75
18 ft. 18-in. corr. pipe, remove	.50	1.00	.50	.50	.75
0.671 M ft. b.m. timber	100.00	150.00	200.00	300.00	120.00
Remove and reconstruct timber bridge	250.00	60.00	150.00	500.00	100.00
13,020 ft. remove and reconstruct fence	.05	.07	.04	.10	.11
3 demolish rein. conc. box culverts	15.00	100.00	100.00	30.00	25.00

ALAMEDA, CALIF.—CITY—ASPHALT—PARK STREET

Contract awarded to Heafey-Moore Co., 344 High St., Oakland, who bid $25,727 for improvement of Park St. from San Antonio Estuary to San Jose Ave., work for the City of Alameda. Bids received on the following items:

(1) 8,454 lin.ft. concrete curb
(2) 7,555 sq.ft. concrete gutter
(3) 2,310 sq.ft. gutter bridges
(4) 48,620 sq.ft. 5-in. asphalt paving
(5) 8,500 sq.ft. 6-in. oil macadam paving
(6) 1,332 ft. 8-in. x 30-in. corr. culvert
(7) 26,500 sq.ft. special grading
(8) Per sq.ft. sidewalk repairs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	TOTALS
Heafey-Moore Co., Oakland	.70	.25	.30	.175	.15	3.60	.10	.25	$25,727
Hutchinson Co., Oakland	.60	.296	.296	.202	.122	4.75	.095	.18	27,694
Western Roads Co., Oakland	.60	.35	.60	.23	.13	4.15	.12	.20	30,097

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

Contract awarded to T. M. Morgan Paving Co., Edwards & Wildey Bdg., Los Angeles, who bid $251,562 to California Division of Highways for 6.9 miles grading and concrete paving from Cherokee Station to Harney Lane, SAN JOAQUIN COUNTY. Bids received from the following concerns:

(1) T. M. Morgan Paving Co., Los Angeles.....$251,562
(2) C. W. Wood, Stockton 259,579
(3) M. J. Bevanda, Stockton 264,808
(4) J. F. Knapp, Oakland 269,845
(5) Isbell Construction Co., Fresno.....$290,120
(6) Heafey-Moore Co., Oakland 314,389
(7) Average bid 275,000

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
436	trees removed and disposed of	2.00	1.00	5.00	1.00	5.00	1.50	2.58
47,800	cu.yd. roadway excavation	.32	.25	.25	.35	.40	.46	.34
33,400	cu.yd. imported borrow	.55	.50	.82	.65	.75	.90	.70
34,500	cu.yd. imported selected material	.57	.75	.82	.65	.75	1.00	.76
44,200	sta.yd. overhaul	.02	.02	.02	.01	.02	.02	.018
3,060	cu.yd. structure excavation	.70	.75	.75	1.00	1.50	1.00	.95
9,200	cu.yd. salvage macadam (subbase and border)	1.10	1.00	1.00	2.00	1.00	1.00	1.18
2,000	tons untreated cracked gravel or stone sur acing	2.25	2.00	2.50	3.00	2.65	2.70	2.51
100M	gal water applied to surface	2.00	1.00	3.00	2.50	2.50	2.00	2.17
19,840	sq.yd. subgrade for pavement	.08	.08	.10	.09	.09	.07	.085
1,610	cu.yd. cushion course	1.00	1.00	1.50	2.00	2.50	1.00	1.50
61	cu.yd. 'A' concrete (structures)	25.00	20.00	20.00	20.00	30.00	20.00	22.50
15,000	cu.yd. 'A' concrete (paving)	9.40	10.00	9.50	9.50	10.25	11.25	10.00
383,000	lb. reinforcing steel (pavement and structures)	.0484	.05	.04	.04	.05	.05	.046
220	ft. 12-in. corrugated metal pipe	.50	.50	.50	.40	.50	.50	.483
2,144	ft. 18-in. corrugated metal pipe	.65	.50	.50	.50	.50	.50	.525
1,003	ft. 24-in. corrugated metal pipe	.75	.50	.50	.60	.50	.75	.60
20	ft. 30-in. corrugated metal pipe	1.25	1.00	2.00	.70	1.00	1.00	1.76
1,339	ft. clean and relay corrugated pipe	.75	1.00	1.00	1.00	.50	1.50	.96
240	ft. solid timber guardrail	.85	1.50	1.00	1.00	1.00	1.00	1.06
4.6	mi. new property fences	$375	$400	$500	$450	$500	$500	$454
9.2	mi. move and reset property fences	$250	$300	$150	$350	$350	$300	$283
21	move and reset concrete headwalls	12.00	8.00	15.00	10.00	20.00	12.50	12.90
2,180	bbl. fuel oil (shoulders)	2.00	2.00	2.25	2.50	2.50	2.20	2.24
362	stations finishing roadway	8.00	5.00	4.00	5.00	8.00	5.00	5.83
77	monuments	3.00	3.00	3.00	3.00	3.00	2.50	2.92

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

Chigris & Sutsos, 2211 18th St., San Francisco, who bid $52,550, low bid to California Division of Highways, Sacramento, for 1.4 miles grading and surfacing, HUMBOLDT COUNTY, from southerly boundary to Richardson's Grove. Bids received from the following concerns:

(1) Chigris & Sutsos, San Francisco.....$52,550
(2) Kennedy-Bayles Construction Co., Oakland..... 57,574
(3) E. C. Coats, Sacramento 58,815
(4) Rocca & Caletti, San Rafael..... 59,491
(5) Engelhart Paving & Construction Co., Eureka..... 61,772
(6) W. H. Hauser, Oakland 62,489
(7) Christie & Allen, San Francisco.....$62,792
(8) J. F. Knapp, Oakland 69,499
(9) Gist & Boll, Arcadia 71,474
(10) J. P. Holland, Inc., San Francisco..... 99,160
(11) Average bid 65,562

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
12	acres clearing anl grubbing	$250	$150	$250	$250	$350	$200	$350	$300	$300	$300	$270
82,000	cu.yd. excavation	.38	.46	.45	.45	.48	.50	.50	.55	.59	.81	.52
119,200	sta.yd. overhaul	.01	.02	.01	.01	.01	.01	.01	.01	.02	.01	.012
4,050	cu.yd. cracked gravel or stone	2.40	2.00	2.40	2.25	2.25	2.25	2.25	2.60	2.00	4.69	2.51
680	cu.yd. structure excavation	1.00	1.25	1.00	2.00	1.50	1.50	1.57	1.50	1.50	1.00	1.38
300M	gal. water for surfacing	2.50	2.00	2.50	3.00	2.25	3.00	1.97	2.50	2.00	3.00	2.47
720	cu.yd. screenings	2.55	2.00	2.40	3.00	2.25	2.50	1.95	3.00	2.00	2.25	2.39
65	cu.yd. 'A' concrete (structures)	25.00	30.00	26.00	25.00	25.00	30.00	20.00	30.00	30.00	35.00	27.60
5,350	lb. reinforcing steel	.06	.06	.06	.07	.07	.05	.07	.10	.05	.07	.066
72	ft. 12-in. corrugated pipe	.50	.65	.75	1.00	.60	.50	.72	.75	1.00	.80	.73
782	ft. 18-in. corrugated pipe	.60	.75	1.00	1.00	.75	.60	.84	1.00	1.25	1.00	.88
84	ft. 30-in. corrugated pipe	1.00	1.00	1.50	2.00	1.50	.90	1.02	1.25	1.50	1.00	1.27
160	ft. 36-in. corrugated pipe	1.50	1.50	2.00	2.00	1.50	1.25	1.08	1.50	1.50	1.25	1.51
1,000	ft. lam. timber guardrail	1.00	1.00	1.10	1.00	1.00	1.25	1.00	1.00	1.50	1.50	1.14
73	sta. finish roadway	5.00	5.00	5.00	6.00	7.00	10.00	7.00	5.00	10.00	5.00	6.50
29	monuments	2.50	3.00	3.00	3.00	3.00	3.00	2.50	4.00	3.00	4.00	3.10

TRACY, CALIF.—CITY—ASPHALT

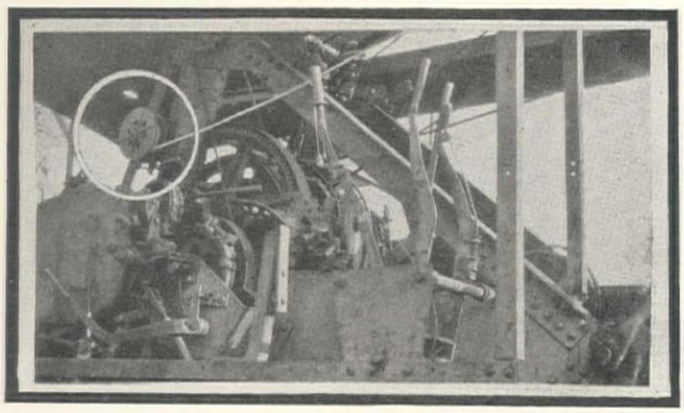
Contract awarded to J. E. Johnston, Weber Ave. and E. St., Stockton, who bid $104,369 for improvement of portions of West Tenth St., East Tenth St., West Ninth St., East Ninth St., etc. Bids received on the following items from the seven lowest bidders:

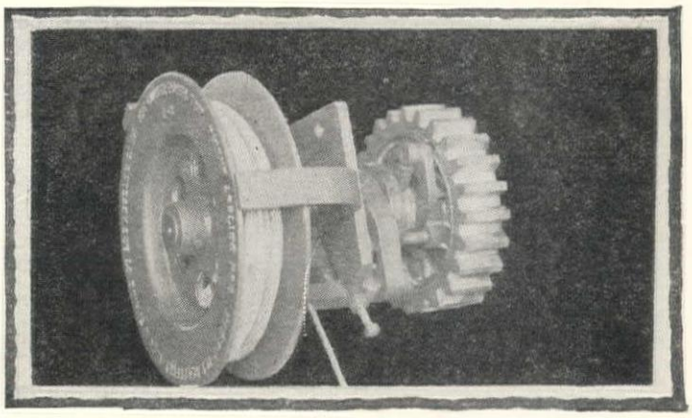
(1) 744,108 sq.ft. 3-in. asphalt pavement
(2) 819,996 sq.ft. grading, including rock foundation
(3) 33,399 ft. integral curb and gutter
(4) 5,905 sq.ft. concrete sidewalk
(5) 1,612 ft. concrete valley gutter
(6) 1,087 ft. concrete single curb
(7) 2,051 ft. concrete single gutter
(8) 1,700 ft. 4-in. vitrified sewer pipe
(9) 1,700 ft. ¾-in. water pipe, including fittings

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	TOTALS
J. E. Johnston, Stockton	.11	.01	.35	.10	.25	.25	.25	.25	.25	$104,369
Peninsula Paving Co., San Francisco	.09	.015	.71	.14	.80	.40	.30	.40	.40	107,509
S. M. McGaw	.08	.032	.62	.15	.60	.50	.35	.65	.70	111,885
Union Paving Co.	.085	.025	.80	.16	.66	.40	.35	.50	.50	111,989
Osborn Company	.09	.03	.75	.16	.50	.40	.30	.70	.50	121,459
Teichert & Son	.108	.017	.70	.175	.60	.40	.30	.47	.56	122,484
Heafey-Moore Co.	.121	.01	.58	.16	.60	.40	.40	.60	.50	122,645

Work will be done under the 1911 Improvement Act and the Bond Act of 1915.

CULVER POWER TRIP





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THE CULVER POWER TRIP is adaptable to any type or make of gasoline, electric, diesel or gas-air shovel. Unquestionably, it is near perfect as far as mechanical construction is concerned and will provide years of uninterrupted satisfactory service.

This device is designed to operate the latch on the bucket door at the touch of a finger and with lightning-like speed. It weighs approximately 85 pounds, therefore, is easily and quickly installed.

THE CULVER POWER TRIP can be installed in an hour by any shovel crew. There are no delicate parts requiring skilled mechanics to keep in adjustment. Simple and effective in operation.

THE CULVER POWER TRIP WILL INCREASE YOUR SHOVEL'S OUTPUT AT LEAST FIFTEEN TO TWENTY PER CENT.

We specialize in the manufacture and repair of dragline buckets, dipper sticks, booms and buckets

Mfgd. and Sold by M. P. McCAFFREY, 1420 No. Spring Street, Los Angeles, Calif.

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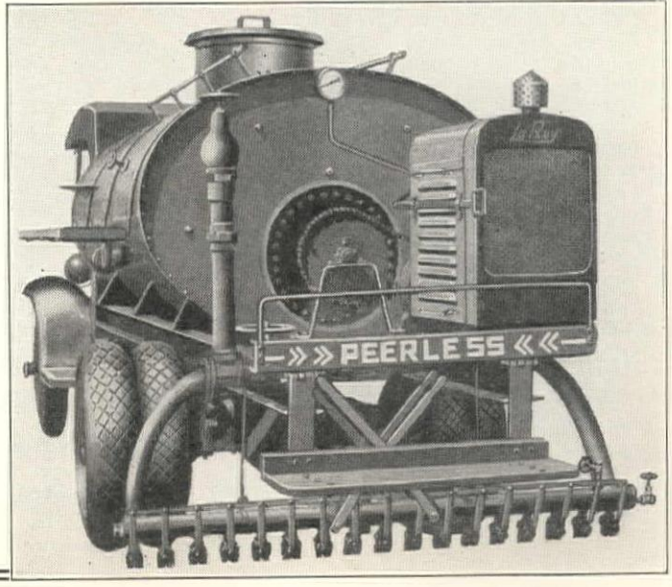

PHOENIX, ARIZ.—STATE—SURFACING AND OIL PROCESSING—PHOENIX-YUMA HIGHWAY

Skeels & Graham, P.O. Box 576, Roseville, California, who bid $145,210, submitted low bid to Arizona State Highway Commission, Phoenix, for oil processing Phoenix-Yuma Highway, 23 miles of roadway. Bids received on the following items:

(1) 70,790 cu.yd. roadway surfacing
(2) 210,530 cu.yd. roadway surf. haul
(3) 262,996 sq.yd. prepare subgrade
(4) 577,927 gal. oil applied to road
(5) 22.414 mi. mix, lay, and finish
(6) 262,996 sq.yd. seal coat

	(1)	(2)	(3)	(4)	(5)	(6)	TOTALS
Skeels & Graham, Roseville	.60	.17	.01	.075	$525	.035	$145,210
Schmidt-Hitchcock, Phoenix	.77	.165	.013	.07	415	.018	147,155
Mulligan & Martin, Tucson	.50	.21	.02	.08	500	.04	152,827
R. E. Hazzard Contracting Co., San Diego	.90	.16	.02	.0625	600	.03	160,114
Pearson & Dickerson, Riverside	.745	.20	.01	.07	550	.05	163,406
Hodgman & MacVicar, Pasadena	.65	.22	.015	.08	500	.045	165.551
Yglesias Bros., Inc., San Diego	.89	.19	.015	.075	600	.035	172,946
Packard & Tanner, Phoenix	.90	.20	.02	.07	550	.04	174,379
T. J. Tobin Construction Co., Albuquerque, N. M.	.95	.21	.015	.0775	600	.05	186,794

TUNNEL CONSTRUCTION

NYSSA, ORE.—GOVT.—CONCRETE LINED TUNNELS

Bids received as follows by Bureau of Reclamation, Nyssa, Oregon, for concrete lined tunnels:

SCHEDULE No. 5—T. E. Connolly, 461 Market St., San Francisco, $982,116, low for Upper portion of Tunnel No. 1 (16 ft. 7 in. diameter), from Sta. 0-50 to Sta. 93-50. Bids from:

(1) T. E. Connolly, San Francisco $ 982,116
(2) J. F. Shea Co., Portland, Ore. 985,725
(3) General Constr. Co., Seattle 1,157,085
(4) Fisher, Ross, McDonald & Kahn $ 995,300
(5) Utah Construction Co., Ogden, Utah 1,039,235
(6) A. Guthrie & Co., Portland 1,562,360
(7) W. S. Mead, Oakland 1,552,560

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1,600 cu.yd. roadway excavation, Class 1	.50	.50	.50	.40	.30	.45	2.00
9,000 cu.yd. roadway excavation, Class 2	.70	1.00	1.00	.70	.50	.75	2.00
3,600 cu.yd. roadway excavation, Class 3	1.40	2.00	1.50	1.25	1.00	1.25	2.00
2,000 cu.yd. excavation, open cut	1.50	1.00	4.00	2.00	.50	.95	1.50
107,000 cu.yd. tunnel excavation	6.12	6.35	8.05	7.00	6.10	10.00	11.18
4,400 ft. constr. 8-in. tunnel drain	.30	1.20	2.00	.50	1.20	1.50	1.00
4,400 ft. constr. 10-in. tunnel drain	.30	1.40	2.50	.60	1.40	1.80	1.00
500 ft. constr. 12-in. tunnel drain	.40	1.60	3.00	.70	1.60	2.00	1.00
53 M. ft. B. M. furn. erect. timber (tunnel)	70.00	60.00	90.00	$110	70.00	$100	50.00
55,000 lb. furn. and erect. steel liner plates	.07	.10	.08	.12	.10	.12	.10
4,000 lb. furn. and erect. I-beam wall plates	.07	.10	.10	.12	.10	.20	.10
26,300 cu.yd. concrete in tunnel lining	11.42	10.00	9.00	8.00	13.25	17.00	11.50
200 ft. drilling grout holes	1.00	1.00	2.00	1.50	1.00	2.00	2.25
300 making grout connections	1.00	1.00	2.00	2.00	2.50	2.50	.75
400 cu.yd. pressure grouting	1.00	1.00	3.00	2.00	1.50	2.00	2.00
1,000 Mil. gal. pump excess water	.10	2.00	2.50	.50	5.00	1.00	3.00

SCHEDULE No. 6—J. F. Shea & Co., Henry Bdg., Portland, Ore., low at $1,025,208 (as they allow deduction of $63,167 if awarded Schedules 6 and 7 together) and low bidder Fisher-Ross-McDonald & Kahn bid to get all Schedules or none for lower portion of Tunnel No. 1 (16 ft. 7 in. diam.) from Sta. 93-50 to Sta. 188-20. Bids received from:

(1) J. F. Shea Co., Portland $1,025,208
(2) T. E. Connolly, San Francisco 1,001,460
(3) Fisher-Ross-McDonald & Kahn, San Francisco 1,025,238
(4) Utah Constr. Co., Ogden, Utah 1,017,023
(5) Morrison & Knudsen Co. 1,071,873
(6) Siems-Spokane Co., Spokane $1,266,275
(7) Rumsey & Jordan, Seattle 1,351,769
(8) A. Guthrie & Co., Portland 1,527,734
(9) W. S. Mead, Oakland 1,604,870

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
6,300 cu.yd. roadw. excav. Cl. 1	.50	.60	.40	.30	.60	.40	.40	.45	2.00
6,700 cu.yd. roadw. excav. Cl. 2	1.00	.80	.70	.50	.70	.60	.60	.75	2.00
15,000 cu.yd. roadw. excav. Cl. 3	2.00	1.40	1.25	1.00	1.50	1.20	1.30	1.10	2.00
23,000 sta.cu.yd. overhaul	.05	.03	.04	.02	.05	.05	.04	.05	.05
500 cu.yd. excav. open cut, Cl. 1	.50	.80	.50	.40	1.00	.60	1.00	.75	2.00
3,800 cu.yd. excav. open cut, Cl. 2	1.00	1.00	1.00	.60	1.00	.80	1.00	.75	2.00
200 cu.yd. excav. open cut, Cl. 3	2.00	1.50	2.50	1.20	1.00	3.00	3.00	1.25	2.00
106,900 cu.yd. excav. (tunnel)	6.35	6.02	7.00	5.80	7.25	8.65	9.00	9.50	11.24
600 ft. constr. 8-in. tun. drain	1.20	.25	.50	1.20	.50	2.50	1.00	1.50	1.00
4,000 ft. const. 10-in. tun. drain	1.40	.30	.60	1.40	.50	2.50	1.25	1.80	1.00
4,000 ft. const. 12-in. tun. drain	1.60	.35	.70	1.60	.50	2.50	1.50	2.00	1.00
744 ft. constr. 15-in. tun. drain	1.80	.40	1.00	1.80	.70	3.00	2.00	2.50	1.00
85 M ft. B. M. furn. erect tim. tun.	60.00	70.00	$110	70.00	70.00	80.00	80.00	$100	50.00
55,000 lb. fur. and er. st. liner pl.	.10	.07	.12	.10	.08	.08	.10	.12	.10
7,000 lb. fur. and er. I-beam wall pl.	.10	.07	.12	.10	.10	.08	.10	.20	.10
27,350 cu.yd. conc. in tun. lin.	10.00	11.23	8.00	12.60	12.50	10.00	12.00	16.25	11.50
200 ft. drilling grout holes	1.00	1.00	1.50	1.00	1.00	2.00	2.00	2.00	2.25
300 making grout connections	1.00	1.00	2.00	2.50	2.00	1.00	2.00	2.50	.75
400 cu.yd. crusher groutings	1.00	1.00	2.00	1.50	1.00	1.00	2.00	2.00	2.00

SCHEDULE No. 7—J. F. Shea Co., Henry Bdg., Portland, Ore., low at $606,970 (low for upper portion of Tunnel No. 5 (9 ft. 3 in. diameter) from Sta. 1-60 to 112-00. (See explanation under Schedule No. 6). Bids received from:

(1) J. F. Shea Co., Portland $606.970
(2) Fisher-Ross-McDonald & Kahn, San Francisco 548.925
(3) Utah Constr. Co., Ogden, Utah 605.800
(4) Morrison & Knudsen, Boise 610.532
(5) Siems-Spokane Co., Spokane 697.610
(6) Rumsey & Jordan, Seattle $645,005
(7) T. E. Connolly, San Francisco 715,716
(8) A. Guthrie & Co., Portland 803.925
(9) W. S. Mead, Oakland 919,005

(Continued Next Page)

NYSSA, ORE.—GOVT.—CONCRETE LINED TUNNELS—(Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2,000 cu.yd. excav. open cut	1.00	2.00	1.00	3.00	2.25	3.00	2.00	.95	2.00
40,000 cu.yd. excav. tunnel	10.55	10.30	10.25	10.25	12.15	12.00	12.95	14.25	18.80
3,500 ft. constr. 8-in. tun. drain	1.20	.50	1.20	.50	2.00	1.00	.25	1.50	1.00
3,500 ft. constr. 10-in. tun. drain	1.40	.60	1.40	1.00	2.50	1.25	.30	1.80	1.00
3,500 ft. constr. 12-in. tun. drain	1.60	.70	1.60	1.00	2.50	1.50	.35	2.00	1.00
450 ft. constr. 15-in. tun. drain	1.80	1.00	1.80	1.25	4.00	2.00	.40	2.50	1.00
46 M ft. B. M. fur. and er. tim. (tunnel)	60.00	112.50	70.00	70.00	85.00	80.00	65.00	$100	55.00
50,000 lb. fur. and er. st. liner pl.	.10	.12	.10	.08	.08	.10	.07	.12	.10
11,200 cu.yd. conc. in tun. lining	14.00	10.00	14.60	14.00	14.00	12.00	16.33	17.75	12.50
200 ft. drilling grout holes	1.00	1.50	1.00	1.00	2.00	2.00	1.00	2.00	2.50
300 making grout connections	1.00	2.00	2.50	2.00	1.00	2.00	1.00	2.50	.75
400 cu.yd. pressure grouting	1.00	2.00	1.50	1.00	1.00	2.00	1.00	2.00	2.00
1,000 M gal. pumping exc. water	2.00	.50	5.00	20.00	15.00	2.10	.10	1.00	3.00

SCHEDULE No. 8—S. F. Magoffin Co., Ltd., North Vancouver, B. C., $530,684 low for lower portion of Tunnel No. 5 (9 ft. 3 in. diam.). Bids from:

(1) S. S. Magoffin & Co., North Vancouver, B. C. $530,684
(2) Fisher-Ross-McDonald & Kahn 573,505
(3) Morrison & Knudsen Co., Boise 592,420
(4) Rumsey & Jordan, Seattle 624,390
(5) Utah Constr. Co., Ogden, Utah $624,766
(6) J. F. Shea Co., Portland 626,060
(7) T. E. Connolly, San Francisco 687,062
(8) A. Guthrie & Co., Portland 814,360
(9) W. S. Mead, Oakland 851,875

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
3,000 cu.yd. excav., open cut	2.00	2.00	3.00	1.00	.60	1.00	1.00	.95	2.00
40,600 cu.yd. tunnel excavation	9.50	10.30	9.75	11.00	10.25	10.55	11.75	13.50	16.75
50 cu.yd. exc. for outlet drain	3.00	2.50	2.00	1.00	1.00	1.00	1.00	4.00	2.00
200 ft. constr. 8-in. tun. drain	.75	.50	.50	1.00	1.20	1.20	.25	1.50	1.00
5,000 ft. constr. 10-in. tun. drain	1.00	.60	.75	1.25	1.40	1.40	.30	1.80	1.00
5,000 ft. constr. 12-in. tun. drain	1.50	.70	.75	1.50	1.60	1.60	.35	2.00	1.00
400 ft. constr. 15-in. tun. drain	2.00	1.00	1.00	2.00	1.80	1.80	.40	2.50	1.00
340 ft. constr. 18-in. tun. drain	3.00	1.00	1.50	2.50	2.00	2.00	.50	3.00	1.00
120 ft. lay 18-in. drain pipe	2.00	1.00	1.00	1.50	.80	1.00	.80	3.00	2.00
40 cu.yd. backfill (pipe)	1.00	1.00	1.00	4.00	.50	.50	1.00	2.00	.50
160 M ft. B. M. fur. and er. tim. tunnel	20.00	112.50	70.00	80.00	70.00	60.00	60.00	$100	55.00
50,000 lb. fur. and er. st. liner pl.	.06	.12	.08	.10	.10	.10	.07	.12	.10
11,600 cu.yd. conc. in tun. lin.	9.99	10.00	14.00	12.00	14.85	14.00	16.31	18.75	12.00
200 ft. drilling grout holes	2.00	1.50	1.00	2.00	1.00	1.00	1.00	2.00	2.50
300 making grout connections	2.00	2.00	2.00	2.00	2.50	1.00	1.00	2.50	.75
400 cu.yd. pressure grouting	2.50	2.00	1.00	2.00	1.50	1.00	1.00	2.00	2.00

BRIDGE AND CULVERTS

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

Rocca & Caletti, P. O. Box 243, San Rafael, who bid $16,170, submitted low bid to California Division of Highways, Sacramento, for construction of a timber, steel, and concrete overhead crossing over the tracks of the Northwestern Pacific Railroad at Forbes Station, MARIN COUNTY. Bids on:

(1) 3,500 ft. furn. redwood piles, including test piles
(2) 76 drive redwood piles, including test piles
(3) 53 M ft. B. M. redwood timber, dense select all heart structural grade
(4) 35 M ft. B. M. redwood timber, select all heart
(5) 38 cu.yd. A concrete (structures)
(6) 125 cu.yd. A concrete (pavement)
(7) 20,100 lb. reinforcing steel
(8) 41,500 lb. structural steel
(9) 1 lot miscellaneous items of work

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	TOTALS
Rocca & Caletti, San Rafael	.50	15.00	81.00	75.00	15.00	12.00	.045	.064	$732	$16,170
A. T. Howe, Santa Rosa	.60	18.00	85.00	80.00	20.00	13.00	.045	.06	500	17,052
W. L. Proctor, Santa Rosa	.65	25.00	90.00	86.00	18.00	14.00	.0525	.05	400	17,919
M. B. McGowan, San Francisco	.60	30.00	95.00	95.00	25.00	14.00	.05	.07	375	19,725
Fredrickson & Watson Const.	.72	23.00	100.00	92.00	20.00	13.80	.05	.075	550	19,963
Healy-Tibbitts Const. Co., S. F.	.60	45.00	100.00	100.00	20.00	15.00	.05	.07	500	21,365

SACRAMENTO, CALIF.—STATE—SAN JOAQUIN COUNTY—REINFORCED CONCRETE

Contract awarded to Jacobs & Pattiani, 337 17th St., Oakland, who bid $48,875 to California Division of Highways, Sacramento, for constructing four reinforced concrete bridges from Lodi to Stockton, SAN JOAQUIN COUNTY. Bids from:

(1) Jacobs & Pattiani, Oakland $48,875
(2) J. F. Knapp, Oakland 49,823
(3) Fredrickson & Watson Const. Co. and Fredrickson Bros. 50,056
(4) Geo. J. Ulrich Constr. Co. 51,803
(5) M. J. Bevanda, Stockton $56,722
(6) M. B. McGowan, San Francisco 56,726
(7) Bodenhamer Constr. Co., San Diego 60,797
(8) N. M. Ball, Porterville 64,914
(9) Average bid 55,000

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1,750 cu.yd. roadway excavation	.70	.60	.60	.40	.50	.50	.60	1.00	.61
2,515 cu.yd. structure excavation	1.15	1.50	1.10	1.40	1.50	2.60	2.50	1.50	1.66
Detour bridges complete	$5,565	$3,600	$3,700	$4,500	$6,000	$3,800	$4,500	$3,785	$4,430
Remove existing bridges	1,015	3,000	1,000	2,000	2,000	900	1,000	3,960	2,985
275 tons cr. gravel or stone (surf.)	2.65	3.00	2.90	2.66	4.00	3.00	3.00	2.80	3.00
1,468 cu.yd. A concrete	16.50	17.00	18.00	17.31	20.00	19.50	22.00	24.00	19.30
31 cu.yd. E concrete	43.00	50.00	60.00	70.00	60.00	60.00	65.00	75.50	60.50
240,000 lb. reinforcing steel	.0435	.04	.045	.045	.04	.05	.045	.05	.045
1,540 lb. phosphor bronze exp. plates	.60	.50	.55	.50	.75	.50	.50	.60	.56
1 lot miscel. items of work	$530	$700	$811	$1,200	$1,000	$531	$1,100	$380	$782

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.

LARGE WESTERN PROJECTS

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

WORK CONTEMPLATED

Viaduct at First and Glendale Blvd. for City of Los Angeles; $600,000.

Mains, wells, and pumps for City of Long Beach; $1,100,000.

Pipe lines, pumps, and reservoir for City of Anacortes, Wash.; $400,000.

Storm drain in District 29 near Sherman for County, Los Angeles, Calif.

Guilds Lake Storm Sewer for City of Portland, Ore.; $598,000.

Sewer and water improvements for City of Roswell, N. M.; $300,000.

Water, sewer, and street improvements for City of Albuquerque, N. M.; $768,000.

Bridge on Aurora Ave. over Lake Union for Washington State Highway Commission; $3,500,000.

Sugar plant for the Holly Sugar Co. at Stockton, Calif.; $1,600,000.

BIDS BEING RECEIVED

Viaduct over Los Angeles River at Fourth St. for City of Los Angeles; $600,000; bids to April 2.

BIDS RECEIVED

Clearing for Ariel Dam for Northwestern Electric Co., Portland, Ore.; Kelly & Sullivan, Portland, Ore., $1,000,000.

Tunnels on Owyhee Project for Bureau of Reclamation, Nyssa, Ore.: Schedule 5—E. E. Connolly, San Francisco, $982,566, low; Schedule 6 and 7—J. F. Shea Co., Portland, $1,569,010, low; and Schedule 8—Magoffin Co., North Vancouver, B. C., $530,684, low.

CONTRACTS AWARDED

Steam power plant for San Joaquin Light & Power Co., Fresno, Calif., to McClellan & Junkersfield, Inc., New York, $3,500,000.

Clearing for Lewis River Dam at Ariel, Wash., for Northwestern Electric Co., Portland, Ore., to Kelly & Sullivan, Portland, $1,000,000.

Auditorium for City of Long Beach, Calif., to R. E. Campbell, Long Beach, $742,000.

STREET and ROAD WORK

WORK CONTEMPLATED

BISBEE, ARIZ.—Bonds voted by City, $60,000, for improvement of streets fronting County Court House. R. L. Motz is City Engr. 3-11

HILLSBOROUGH, CALIF.—Plans by City Engineer, Geo. A. Kneese, for improving Ranelagh Road, etc., involving 3-in. asphalt base and 3-in. asphalt surface, concrete pipe, etc. Bids after April 1. 3-18

LOS ANGELES, CALIF.—Plans by County Surveyor, protests Mar. 31, for improving Carmenita Road from Section Line Road to Anaheim-Telegraph Road, involving 17,903 cu.yd. excavation, 304,788 sq.ft. 2-in. asph. conc. wearing surf., 281,672 sq.ft. 3-in. asph. conc. base, 318,578 sq.ft. 5-in. dis. rock subbase, 185,538 sq.ft. 4-in. dis. rock shoulder with rock and oil wearing surface, 130 ft. conc. curtain wall, rein. conc. culv., 58 ft. 18-in. and 48-ft. 24-in. corr. iron pipe. $84,940. 3-6

OXNARD, CALIF.—Plans by E. O. Imus, City Engr., for improving Oxnard Blvd., A St., etc., involving 264,053 sq.ft. 5-in., 57,500 sq.ft. 4-in., and 26,049 sq.ft. 6-in. concrete paving, 4755 ft. vitr. sewers, grading, lighting system, etc. $100,000. Bids after Mar. 25. 3-15

REDWOOD CITY, CALIF.—Plans by City Engineer for improving Oak, Sierra St., etc., involving 53,312 sq.ft. 4-in. asphalt paving, rock cushion, etc. Bids after April 7. 3-18

REDWOOD CITY, CALIF.—Plans by County Surveyor, Geo. A. Kneese, Court House, Redwood City, San Mateo County, protests to be heard March 24, with reference to the improvement of streets in Menalto Park; work consisting of paving with 4-in. waterbound macadam base and 3-in. asphalt surface, concrete curbs, gutters, and sidewalks; 1921 Act; $150,000. 3-18

SAN DIEGO, CALIF.—Plans by H. W. Jorgensen, City Engr., for improving Tennyson and Sterne Sts., involving 109,070 sq.ft. 6-in. concrete paving, 565 ft. 8-in. and 241 ft. 4-in. cast-iron pipe, etc. Bids after Mar. 25. 3-15

SAN FRANCISCO, CALIF.—Plans by City Engr. for improving Corbell Ave. from Clayton to 24th Sts., involving 17,600 cu.yd. excavation, vitr. sewers, 103 cu.yd. concrete in walls, 125,000 sq.ft. 6-in. concrete base with 2-in. asphalt surface, etc. Bids soon. 3-6

SAN RAFAEL, CALIF.—Plans by H. K. Brainerd, City Engr., for improving A, Second Sts., etc., involving 98,138 sq.ft. 5-in. asphalt paving with rock subbase, vitrified sewers, corr. pipe, etc. Bids after Mar. 20. 3-6

SUNNYVALE, CALIF.—Plans by Engineer, H. N. Bishop, Bank of Italy Bdg., San Jose, protests March 24 by the City of Sunnyvale, for improvement of portions of Washington Ave., Evelyn Ave., Pastoria Ave., Mathilda Ave., Taaffe St., Arques St., Sunnyvale Ave., and other streets by grading, paving with 3-in. asphalt base with 2-in. Warrenite Bitulithic wearing surface, corrugated culverts, 4-in. and 6-in. concrete sewers, and 8-in. to 21-in. concrete pipe storm sewer. 3-18

BIDS BEING RECEIVED

BURBANK, CALIF.—Bids to 7:30 p.m., Apr. 1, by City Clerk for improving Riverside Drive, involving 131,725 sq.ft. asphalt paving, water system, etc. 3-15

KING CITY, CALIF.—Bids to 8 p.m., Mar. 26, by City Clerk for improving streets, involving 495,902 sq.ft. grading and 5-in. concrete paving, corr. culverts. 3-10

LOS ANGELES, CALIF.—Bids to 10 a.m., April 2, by Board of Public Works, City Hall, Los Angeles, for the improvement of Laurel Canyon Road from Pacoima Ave. to Lookout Mountain Road; work involving grading (lump sum), 425,100 sq.ft. 8-in. concrete paving, storm drain system (complete), sanitary sewer system (complete), water system (complete). 3-19

LOS ANGELES, CALIF.—Bids to 2 p.m., April 2, by California Division of Highways, District Engineer, Associated Realty Bdg., Los Angeles, for the following work: LOS ANGELES and VENTURA COUNTIES—15 miles fuel oil to be applied to shoulders between Galivan and Irvine in Orange County, and between Leffingwell Ranch and north county line in Los Angeles County. SAN DIEGO COUNTY—18 miles fuel oiling of shoulders from Oceanside and north boundary. VENTURA COUNTY—24 miles fuel oiling of shoulders from Camarillo and Ventura, and from Ventura to 3 miles north of Seacliff. 3-19

MARTINEZ, CALIF.—Bids to 10 a.m., Mar. 29, by Alhambra Union High School District for grading for Martinez Jr. High School, involving 11,800 cu.yd. grading. 3-17

MENLO PARK, CALIF.—Bids to 8 p.m., April 2, by City Clerk for improving College Ave. and Cambridge Ave., work involving 13,600 cu.yd. grading, 295,000 sq.ft. 4-in. waterbound rock macadam base with 3-in. asphalt surface, 19,500 lin.ft. curb and gutter, 200 ft. 18-in. concrete sewer, 2000 ft. 24-in. concrete sewer, 9 brick catchbasins, 7000 ft. 4-in. vitrified sewer; 1911-15 Acts. Geo. A. Kneese is City Engineer 3-18

MONTEREY, CALIF.—Bids to 7 p.m., April 1, by City for paving the Camino Bienvenida, Mirado, and Copa del Ora in the Mesa tract, to be graded and surfaced with asphalt. 3-13

OAKLAND, CALIF.—Bids to 10:30 a.m., April 8, by County Clerk for: (1) Oil surfacing of 6500 lin.ft. of the Hopyard Road, involving 340,000 sq.ft. oil surface. (2) Oil surfacing of 11,500 lin.ft. of Vineyard Ave., involving 581,000 sq.ft. oil surfacing. 3-18

SACRAMENTO, CALIF.—Bids to 2 p.m., April 16, by California Division of Highways, Sacramento, for: (1) LOS ANGELES COUNTY—26.5 miles oiling from west boundary to Santa Monica, involving 5930 bbl. heavy fuel oil. (2) SAN DIEGO and IMPERIAL COUNTIES—A total of 35.4 miles of oiling as follows: 2.7 miles from La Mesa to El Cajon; 11.3 miles from Flynn Springs to Diejas Valley; 7.9 miles from Pine Valley Creek to Kitchen Creek; and 13.5 miles from Ja Cumba to Myers Creek. Work involves 3870 bbl. heavy fuel oil (location A), and 3350 bbl. heavy fuel oil (location B). (3) YUBA COUNTY—0.9 mile grading and concrete paving through Wheatland, involving 9300 cu.yd. roadway excavation, 2065 cu.yd. Class 'A' concrete paving, 54,000 lb. reinforcing steel, concrete structures, etc. 3-19

SALINAS, CALIF.—Bids to 10 a.m., Mar. 28, by County Clerk for: (1) Paving Salinas-Monterey Road from Salinas to Hilltown, involving 4820 cu.yd. 'A' concrete paving, 4190 cu.yd. base rock, 2630 tons 2-in. and 1360 tons ½-in. rock, 898 bbl. road oil, etc.; and (2) Improving San Miguel Canyon Road, involving 5150 cu.yd. excavation and 2000 cu.yd. local rock. 3-15

SAN DIEGO, CALIF.—Bids to Mar. 31 by City Clerk for improving Meade Ave., involving 81,677 sq.ft. 6-in. asphalt paving, 610 ft. 4-in. cast-iron pipe. 3-15

SAN GABRIEL, CALIF.—Bids to 7:30 p.m., Apr. 15, by City Clerk for improving Mission Drive, involving 147,346 sq.ft. 4-in. asphalt base, with 2-in. Warrenite Bit. surface, electroliers, etc. 3-8

SANTA ROSA, CALIF.—Bids to 12 m., Mar. 31, by County Clerk for oiling 65 miles in 4th, 2nd, 3rd, and 1st Districts, involving 4400 tons crushed rock, 5200 cu.yd. pea gravel, 5000 bbl. oil, etc. 3-13

VENTURA, CALIF.—Bids to 11 a.m., Apr. 1, by County Clerk for 4½ miles of Los Angeles Ave. from Simi to Moorpark, involving 40,800 cu.yd. excavation, 7910 cu.yd. 'A' concrete paving, corr. pipe, etc. 3-8

YREKA, CALIF.—Bids to 10 a.m., Apr. 8, by County Clerk for supplying 5000 cu.yd. gravel or stone for McCloud Road Dist. 3-15

DENVER, COLO.—Bids to 3 p.m., March 26, by Colorado State Highway Commission for: (1) 15 miles concrete paving north of Pueblo, State Highway No. 1, EL PASO and PUEBLO COUNTIES, involving in the main: 10,000 cu.yd. roadway excavation, 53,300 cu.yd. borrow, 163,880 sq.yd. concrete paving, etc., and (2) 10 miles grading and concrete paving south of Colorado Springs in EL PASO COUNTY, involving 36,600 cu.yd. borrow, 103,355 sq.yd. concrete paving, 240,000 lb. reinforcing steel, etc.

BOISE, IDA.—Bids to 2 p.m., Mar. 28, by State Comm. of Public Works for 4.7 miles from Shoshone to Dietrick, LINCOLN COUNTY, involving 26,500 cu.yd. excavation, 4300 cu.yd. gravel surfacing, etc.

PORTLAND, ORE.—Bids to 10 a.m., March 27, by Oregon State Highway Comm., for: CLACKAMAS COUNTY—Grading .93 mile of Multnomah County Line-Oswego Section of the Pacific Highway, involving 62,500 cu.yd. excavation; CLATSOP COUNTY—Furnishing broken stone for maintenance and betterment purposes for Cannon Beach Junction-Nehalem Summit Section, involving 12,000 cu.yd. broken stone; DOUGLAS COUNTY—Grading 5.17 miles of Tahkenitch-Gardiner Summit Section of Roosevelt Coast Highway, involving 310,000 cu.yd. excavation; DOUGLAS COUNTY—Grading 4.45 miles of Scottsburg-Burchard Creek Section of Umpqua Highway, involving 141,500 cu.yd. excavation; GRANT COUNTY—Surfacing 24.5 miles of Mountain Rest-Little Beech Creek Section of Pendleton-John Day Highway, Long Creek-Hamilton Section of Market Road No. 1, and Mt. Vernon-Biggs Ranch Section of Market Road No. 2 involving 40,000 cu.yd. broken stone, 8000 cu.yd. bank-run talus; LANE COUNTY—Resurfacing 21 miles of Nimrod-Belknap Springs Section of MacKenzie Highway, and furnishing materials for maintenance purposes, involving 40,000 cu.yd. broken and crushed gravel; MALHEUR COUNTY—Grading 13.31 miles of Tunnel-Harper Section of Central Oregon Highway, involving 235,000 cu.yd. excavation; SHERMAN, WASCO AND HOOD RIVER COUNTIES—16 miles of bituminous macadam wearing surface, 23.3 miles of oiled macadam, and application of non-skid treatment on 48.2 miles of pavement on The Dalles Oiling Project. 3-13

OLYMPIA, WASH.—Bids to 10 a.m., April 8, by State Highway Commission, Olympia, Wash., for the following: KLICKITAT COUNTY—Grading and draining about 5.3 miles of State Road No. 8, Unit 1 of Mary Hill west, Federal Aid Project No. 174-A, involving about 98,000 cu.yd. excavation, 116 cu.yd. concrete, 1800 lin.ft. pipe culverts, etc. KLICKITAT and YAKIMA COUNTIES—Clearing, grading, and draining about 5.3 miles of State Road No. 8, Unit 2 of Goldendale to Summit, Federal Aid Project No. 162-B, involving about 52 acres clearing, 250,250 cu.yd. excavation, 192 cu.yd. concrete, 2460 lin.ft. pipe culverts, etc. CLALLAN COUNTY—Clearing, grading, and surfacing with crushed stone, draining, and constructing bridge, Bear Creek bridge and approaches, on State Road No. 9, involving about five acres clearing, 5520 cu.yd. excavation, 1770 cu.yd. crushed stone surfacing, 72 lin.ft. pipe culverts, and reinforced concrete girder bridge, 440 ft. long, 12 spans with 20-ft. roadway, etc. GRAYS HARBOR and PACIFIC COUNTIES—10 miles State Road No. 13, Raymond to Salmon Creek, work involving 2450 cu.yd. excavation, and 32,300 cu.yd. crushed stone surfacing, etc. 3-18

OLYMPIA, WASH.—Bids to Apr. 1 by Washington State Highway Comm. for: KLICKITAT COUNTY—3 miles grading and draining of North Bank Highway, Unit 2 of Maryhill west, involving 186,470 cu.yd. excavation, 1450 lin.ft. pipe culverts, etc.; KLICKITAT COUNTY—4.9 miles clearing, grading, and draining of North Bank Highway, Unit No. 1, Goldendale to Summit, involving 39 acres clearing, 213,260 cu.yd. excavation, 670 cu.yd. concrete, 82,300 lb. reinforcing steel, 1850 ft. pipe culverts, etc.; DOUGLAS COUNTY—3.6 miles clearing, grading, and draining Chelan-Okanogan Highway, from Orondo north, involving 85,330 cu.yd. excavation, 108 ft. tunnel, 86 cu.yd. concrete, 550 lin.ft. pipe culverts, etc.; DOUGLAS COUNTY—40 miles bituminous treated road surface by penetration method, of Sunset Highway, from Waterville to Douglas-Grant County Line, involving 231,000 sq.yd. surfacing; GRANT COUNTY—35 miles bituminous treated road surface of Sunset Highway, by the road mix method, Douglas-Grant County Line to Wilbur, involving 369,450 sq.yd. surfacing; and GARFIELD AND ASOTIN COUNTIES—25 miles bituminous treated road surface of the Inland Empire Highway, by the road mix method, Pomeroy to Asotin, involving 261,620 sq.yd. surfacing. 3-8

BIDS RECEIVED

PHOENIX, ARIZ.—Skeels & Graham, P.O. Box 576, Roseville, $145,210 low bid to Arizona State Highway Comm. for 23 miles surfacing and oil processing Phoenix-Yuma Highway. (See Unit Bid Summary.) 3-17

OAKLAND, CALIF.—Western Roads Co., 1305 28th St., Oakland, $2636, low bid to Oakland Port Commission for asphalt paving apron wharf at Outer Harbor Terminal. 3-18

RIVERSIDE, CALIF.—Pearson & Dickerson, Riverside, who bid $74,000, only bid to County for 5.5 miles oil mix roadway from Winchester to Temecula on Hemet-San Diego Highway. Bid rejected, and work will be done by County by day labor under the supervision of R. L. McKenzie, County Road Superintendent. 3-19

SACRAMENTO, CALIF.—H. W. Rohl Co., Roosevelt Bdg., Los Angeles, who bid $100,372, submitted the low bid to the California Division of Highways, Sacramento, for 1.9 miles grading in SAN BERNARDINO COUNTY, between the Pass and two miles down Waterman Canyon. 3-19

SACRAMENTO, CALIF.—Chigris & Sutsos, 2211 18th St., San Francisco, $52,550, low bid to California Division of Highways for 1.4 miles grading and surfacing from south boundary to Richardson's Grove, HUMBOLDT COUNTY. (See Unit Bid Summary). 3-5

DENVER, COLO.—Wood, Morgan & Burnett, Durango, Colo., $43,432, low bid to State Highway Commission for 3 miles gravel surfacing and grading near Cortez, MONTESUMA COUNTY.

PORTLAND, ORE.—L. H. Hoffman, U. S. Bank Bdg., Portland, Ore., $128,830 low bid for Penn St. approach to Port of Portland Airport. 3-13

PROVO, UTAH—Christensen, Jacobs & Gardener, Vermont Bdg., Salt Lake City, Utah, who bid $90,552, submitted low bid to City for improvement of streets, involving 42,000 sq.yd. 6-in. concrete paving, grading, curbs, etc. 3-13

CONTRACTS AWARDED

PHOENIX, ARIZ.—To Phoenix-Tempe Stone Co., Phoenix, Ariz., $21,261 for improving 12th St. for City, paving with concrete base with Warrenite surf.

ALAMEDA, CALIF.—To Heafey-Moore Co., 344 High St., Oakland, $25,727 for asphalt paving, corrugated pipe on Park St., from San Antonio Estuary to San Jose Ave., for City. 3-19

BURBANK, CALIF.—Awards as follows by City. (1) To Gibbons & Reed Co., 221 E. San Fernando Blvd., Burbank, at $11,220 for improving Brighton St., between Olive and Verdugo Ave., by grading, asphalt concrete pavement, water system, etc.. and (2) To Southwest Paving Co., Washington Bdg., Los Angeles, who bid $47,932 for improving Glenoaks Blvd., between Eaton Drive and the city limits, by excavation, concrete pavement, asphalt concrete pavement, water system, etc. 3-7

HERMOSA BEACH, CALIF.—To Ed. Johnson & Sons, 4183 S. Normandie Ave., Los Angeles, who bid $56,589 to City for Camino Real and other streets on the Sepulveda Blvd. Route through Hermosa Beach, by grading, curbs, Permanite resurface, Permanite base, asphalt concrete pavement, cement sewer, vitrified house sewers, etc. 3-6

LOS ANGELES, CALIF.—To Geo. R. Curtis Paving Co., 2440 E. 26th St., L. A., $229,968 for improving Bellevue Ave. and Laveta Terrace Improvement Dist., grading, concrete and asphalt paving, water system, conc. walls, storm and sanitary sewers, etc., for City. 3-10

LOS ANGELES, CALIF.—Awards as follows by County: (1) To Martter & Bock, 1007 S. Harvard Blvd., L. A., who bid $19,415 for improvements in Alma St., from Hicks St. to Story St., by excavation, curb, concrete pavement, corr. iron pipe, etc.; and (2) To M. A. and P. R. Hughes, 1020 Loma Vista Drive, Long Beach, who bid $24,845 for improving Stockton Ave. and other streets, by excavation, construction of curb, gutter, concrete pavement, cast-iron water services, copper water services, etc. 3-12

LOS ANGELES, CALIF.—To Campbell-Reichert Co., Inc., 4000 Whiteside Ave., L. A., at $36,741 for improvement of streets in Marmion Way and Ave. 45 Imp. District, by grading, 8-in. conc. pave., storm drain, sanitary sewer, water system, etc., for City. 3-6

MONROVIA, CALIF.—To Griffith Co., L. A. Railway Bdg., L. A., $74,726 for improving Main St. (Duarte Road) by asphalt paving, etc., for City. 3-6

SACRAMENTO, CALIF.—To T. M. Morgan Paving Co., Edwards & Wildey Bdg., Los Angeles, who bid $251,562 to California Division of Highways, Sacramento, for 6.9 miles grading and concrete paving from Cherokee Station to Harney Lane, SAN JOAQUIN COUNTY. (See Unit Bid Summary.) 3-15

SAN DIEGO, CALIF.—To Griffith Co., 2104 Main St., San Diego, at $76,450 to City for improvement of Trumbull and other streets, by excavation, 6-in. asph. conc. pavement, curb, cast-iron water main, fire hydrants, conc. sewer main, rein. conc. culvert, corr. iron culvert, etc. 3-12

SAN JOSE, CALIF.—To Granite Construction Co., Watsonville, $15,700 for oil-macadam paving, Lawrence Station Road, for County.

SANTA ANA, CALIF.—To Bruce Bros., Route 1, Box 167, Huntington Beach, $39,725 for improving Westminster Ave. for County, involving grading, gravel shoulders and subbase and concrete paving. 3-6

SANTA CRUZ, CALIF.—To Thompson Bros., Santa Cruz, who bid $13,576 for the improvement of portions of Atlantic Ave., Fourth Ave., and East Cliff Drive. Work consists of paving with cement-concrete, constructing concrete curbs, cement-concrete driveway approaches, vitrified pipe sewer laterals, wrought-iron pipe water service connections, brass corporation cocks, concrete meter boxes, etc. 3-18

SANTA ROSA, CALIF.—To Smith & Silvia, Santa Rosa, who bid $29,439 for concrete paving 1.8 miles of Healdsburg-Forestville Road for County. 3-13

SONORA, CALIF.—To W. C. Colley, 35 N. Hampton Road, Berkeley, $7100 for improving Fuller-Longway Road, grading, corr. culverts, etc., for County. 3-7

TRACY, CALIF.—To J. E. Johnston, Weber Ave. and E St., Stockton, $104,369 for improving W. 10th St., E. 10th St., W. 9th St., etc., for City with asphalt. (See Unit Bid Summary.) 3-12

TRACY, CALIF.—To J. E. Johnston, Weber Ave. and E St., Stockton, $104,369 for improving W. Tenth, E. Tenth St., etc., with asphalt, for City. (See Unit Bid Summary.) 3-13

CARSON CITY, NEV.—To Dodge Bros., Fallon, Nev., $32,334 for 3.4 miles grading and surfacing in DOUGLAS COUNTY from Minden north for State. 3-6

PORTLAND, ORE.—To J. C. Compton, McMinnville, Oregon, who bid $130,142 to Oregon State Highway Commission for 43.6 miles bituminous macadam wearing surface in KLAMATH COUNTY, on The Dalles-California, Green Springs, and Klamath Falls-Lakeview Highways. (See Unit Bid Summary.) 3-7

PORTLAND, ORE.—To J. C. Compton, McMinnville, Oregon, at $166,093 for 11.4 miles of bituminous macadam wearing surface and application of 65.3 miles of bituminous surface treatment in MALHEUR AND HARNEY COUNTIES, for Oregon State Highway Commission. (See Unit Bid Summary.) 3-7

DAVENPORT, WASH.—To Colonial Building Co., Spokane, Wash., $32,331 for grading 6 miles of road for County.

KELSO, WASH.—To Hendricks & Co., Chehalis, Wash., $103,119 for grading and surfacing Lewis River Highway for County.

OLYMPIA, WASH.—Awards as follows by State: To Erickson Paving Co., 1550 N. 34th St., Seattle, at $159,235 for 6.7 miles paving with cement concrete Kent-Des Moines Road to Kits Corner, the Pacific Highway, in KING COUNTY. To Norris Bros., Burlington, who bid $258,781 for 8.1 miles paving with cement concrete the Inland Empire Highway, in SPOKANE COUNTY, from Freedom to North Pine. To Fred G. Redmon, Yakima, at $19,714 for 10.8 miles surfacing and resurfacing of North Bank Highway with crushed stone in YAKIMA COUNTY, from Toppenish to Toppenish Ridge. (See Unit Bid Summary.) 3-7

SEATTLE, WASH.—To J. Warter, Sr., Tacoma, Wash., $44,225 for concrete paving Highway No. 37 for County.

BRIDGES and CULVERTS

WORK CONTEMPLATED

LOS ANGELES, CALIF.—Plans by M. Butler, City Bridge Engr., for: (1) Washington St. Bridge over Los Angeles River, between Harriett St. and Soto St., $250,000; (2) Sixth St. Viaduct over Los Angeles River, between Boyle Ave. and Mateo St., first contract will be for concrete foundation, $200,000; and (3) First and Glendale Blvd. Viaduct over Los Angeles River, $600,000. 3-6

SAN CARLOS, CALIF.—Bond election Mar. 16 by City to vote $16,000 for 5 bridges over Pulgas Creek. Geo. A. Kneese is City Engr. 3-6

OLYMPIA, WASH.—Plans by State Highway Engineer, Samuel J. Humes, Olympia, Wash., and bids will be called for soon by the State Highway Commission on the following separate contracts for the construction of the Aurora Ave. Bridge over Lake Union in the City of Seattle: (1) Steel work consisting of the main span over the channel in Lake Union, which will be 800 ft. long; a 225-ft. span on the north end; a 200-ft. span on the south end; and three 75-ft. spans needed to carry the bridge approach to the highway ground on the east side of Queen Anne Hill. (2) For all concrete work. This will include a 600-ft. reinforced concrete approach at the north end of the bridge. Total cost of the bridge, $3,500,000. Contract for the construction of piers has been awarded. 3-18

BIDS BEING RECEIVED

LOS ANGELES, CALIF.—Bids to 10 a.m., Apr. 2, by Board of Public Works for the Fourth Street Viaduct over the Los Angeles River and the tracks of the Santa Fe Ry. and Union Pacific Ry. The bridge will be a reinforced concrete viaduct, consisting of a single arch 254 ft. long over the river and girder and arch approaches, 2400 lin.ft. total length, with a 600-ft. ramp to Mateo St. There will be two 5-ft. sidewalks, and a 58-ft. roadway. Work involves 48,000 cu.yd. Class 'F' concrete, 7,000,000 lb. reinforcing steel, ornamental balustrade and hand rail, special design concrete lighting posts, storm drain in approaches. 3-5

SACRAMENTO, CALIF.—Bids to 2 p.m., April 16, by California Division of Highways, Sacramento, for: CALAVERAS COUNTY—Reinforced concrete bridge over Calaveritas Creek, three miles south of San Andreas; work involving 560 cu.yd. 'A' concrete, 96,000 lb. reinforcing steel. PLUMAS COUNTY—Reinforced concrete bridge over north fork of the Feather River at Chester; work involving 610 lin.ft. reinforced concrete piling, 170 cu.yd. 'A' concrete, 38,000 lb. reinforcing steel. 3-19

SALINAS, CALIF.—Bids to 10 a.m., Mar. 28, by County Clerk for reinf. conc. bridges, one at Castroville and two on Salinas-Watsonville Road, involving 9680 ft. Douglas Fir piles, 545 cu.yd. concrete, 82,622 lb. reinf. steel. 3-17

BOISE, IDA.—Bids to 2 p.m., Mar. 28, by State Comm. of Public Works for bridge over Spokane Int. RR. near Athol, involving 530 cu.yd. concrete, 81,653 lb. reinf. steel, etc.

OLYMPIA, WASH.—Bids to 10 a.m., April 8, by State Highway Commission, Olympia, Wash., for construction of the following bridges: WHATCOM COUNTY—Construction of a reinforced concrete T-beam bridge, 344 ft. long, over Squallicum Creek in the City of Bellingham on the route of State Road No. 1, consisting of 10 spans, a 35-ft. roadway with 6-ft. sidewalk on both sides. KITTITAS COUNTY—Construction of Teanaway to Ellensburg City Well bridges, Federal Aid Project No. 165-D, on State Road No. 3, consisting of 104-ft. steel pony truss with 31 ft. 1½ in. reinforced concrete T-beam approaches at each end and 24-ft. roadway over Teanaway River; a reinforced concrete girder bridge, two 50-ft. spans, one 55-ft. span, with 27-ft. roadway over Swauk Creek, and frame bent timber trestle overcrossing, 7 spans 24-ft. roadway, over the Cascade logging railway. 3-18

BIDS RECEIVED

SACRAMENTO, CALIF.—Rocca & Caletti, PO Box 243, San Rafael, who bid $16,170, low bid to the California Division of Highways for timber, steel and concrete overhead crossing over the tracks of the Northwestern Pacific Co. RR. at Forbes Station, MARIN COUNTY. 3-19

CONTRACTS AWARDED

LONG BEACH, CALIF.—To John Simpson & Co., 701 Antonio Ave., Los Angeles, $25,458 for concrete retaining wall along ocean bluff at 36th Place. 3-6

SACRAMENTO, CALIF.—To Jacobs & Pattiani, 337 17th St., Oakland, who bid $48,875 to California Division of Highways, Sacramento, for construction of four reinforced concrete bridges from Lodi to Stockton, SAN JOAQUIN COUNTY. (See Unit Bid Summary.) 3-15

SEATTLE, WASH.—To D. Nygren, Lyon Bdg., Seattle, who bid $77,971 to Board of Public Works for construction of the east approach to the West Spokane Street Bridge No. 2. 3-18

SEWER CONSTRUCTION

WORK CONTEMPLATED

CAPISTRANO BEACH, CALIF.—Surveys by Burns-McDonnell-Smith Engineering Co., Western Pacific Bdg., Los Angeles, for complete sewer and ocean disposal for Capistrano Beach Sanitary District, Capistrano Beach. 3-6

CARPINTERIA, CALIF.—Plans by Engr., F. L. Johnston, Santa Barbara, and bids will be called at once by Carpinteria Sanitary District, Carpinteria, for outfall sewer into the ocean, treatment plant, several pumping plants, and one-half mile of collecting sewers. Bonds voted, $90,000. 3-10

GUSTINE, CALIF.—Plans by Engr., A. E. Cowell, 21 Maryland Ave., Berkeley, for 6100 ft. 24-in. outfall sewer for City. Bonds voted, $20,000, bids soon. 3-11

LOS ANGELES, CALIF.—Plans by C. E. Arnold, Chief County Storm Engr., Hall of Records, L. A., protests Apr. 7, for Drainage Dist. 29, near Sherman, involving: 9000 cu.yd. excavation, 2217 cu.yd. Class 'A' concrete, 40 cu.yd. Class 'B' concrete, 45 cu.yd. Class 'C' concrete, 257,745 lb. reinforcing steel; REINFORCED CENTRIFUGALLY SPUN CONCRETE PIPE, STANDARD WEIGHT—1190 lin.ft. 18-in. pipe, 2591 lin.ft. 21-in. pipe, 2529 lin.ft. 24-in. pipe, 1327 lin.ft. 27-in. pipe, 2451 lin.ft. 30-in. pipe, 1221 lin.ft. 33-in. pipe, 3101 lin.ft. 36-in. pipe, 1124 lin.ft. 39-in. pipe, 994 lin.ft. 42-in. pipe, 584 lin.ft. 45-in. pipe, 915 lin.ft. 48-in. pipe, 356 lin.ft. 51-in. pipe, 90 lin.ft. 54-in. pipe, 608 lin.ft. 57-in. pipe, 686 lin.ft. 66-in. pipe, 888 lin.ft. 72-in. pipe; SPECIAL REINFORCED CONCRETE CENTRIFUGALLY SPUN PIPE, 'A'—180 lin.ft. 27-in. pipe, 260 lin.ft. 30-in. pipe, 436 lin.ft. 36-in. pipe, 329 lin.ft. 48-in. pipe, 1086 lin.ft. 54-in. pipe, 476 lin.ft. 66-in. pipe, 528 lin.ft. 72-in. pipe; SPECIAL REINFORCED CONCRETE CENTRIFUGALLY SPUN PIPE, 'B'—30 lin.ft. 27-in. pipe, 68 lin.ft. 36-in. pipe, 271 lin.ft. 72-in. pipe; PLAIN CEMENT PIPE—91 lin.ft. 6-in. pipe, 1244 lin.ft. 12-in. pipe, 1593 lin.ft. 15-in. pipe, 1183 lin.ft. 18-in. pipe, 9 lin.ft. 21-in. pipe; VITRIFIED CLAY SEWER PIPE—1750 lin.ft. 10-in. pipe, 6 lin.ft. 8-in. pipe, 50 lin.ft. 6-in. pipe. 3-11

SAN FRANCISCO, CALIF.—Plans being prepared by City Engineer's Office, City Hall, San Francisco, for the construction of sewer improvements as follows: (1) Section B of the Fillmore St. sewer, from Harrison St. to Van Ness Ave. on Tenth St., and Fell St. Work involves 3084 lin.ft. 6 ft. 9-in. circular reinforced concrete sewer; 3000 lin.ft. vitrified pipe underdrain, 6-in. to 12-in. diam.; also manholes, etc; cost, $105,000. (2) Section C of the Fillmore St. sewer, from Fell street and Van Ness Ave. to Laguna and Grove Sts., involving 1408 lin.ft. 6 ft. 9-in. circular reinforced concrete sewer; 1116 lin.ft. 6 ft. 6-in. circular reinforced concrete sewer; also manholes, etc; cost, $80,000. (3) Geary St. and 23rd Ave. sewer system from 27th Ave. and Geary St. to 23rd Ave. and Lake St., involving 1673 lin.ft. 2 ft. by 3 ft. reinforced concrete sewer; 276 lin.ft. 2 ft. 6 in. by 3 ft. 9 in. reinforced concrete sewer; 706 lin.ft. 3 ft. 6 in. by 5 ft. 3 in. reinforced concrete sewer; 1391 lin.ft. 4 ft. by 6 ft. reinforced concrete sewer; cost, $70,000. Call for bids will be issued about April 15; bids to be opened at a later date. 3-19

YOSEMITE VALLEY, CALIF.—An appropriation of $140,000 has been approved for extensions and improvements to the sewerage system at Yosemite National Park, including 2½ miles of additional sewers and a new sewage treatment plant. Plans are being drawn in the office of H. B. Hommon, District Engineer, Call Bdg., San Francisco, U. S. Public Health Service, and bids will be advertised as soon as the appropriation is made available. Construction will be under the direct supervision of O. G. Taylor, Resident Engineer at Yosemite. 3-18

PORTLAND, ORE.—Plans by O. Laurgaard, City Engr., for Guilds Lake Trunk Sewer, involving 14,000 ft. 10-in. subdrain, 400 ft. 8-in. and 100 ft. 6-in. sewer pipe, 10 ⅛ bends, 24 manholes, 5 inlets, 105,000 cu.yd. excavation, 50 cu.yd. 'A' concrete, 350 M ft. b.m. lumber, 9600 cu.yd. crushed rock or gravel, 54 sq.yd. pavement taken up and relaid, 150,000 lin.ft. piles, 1000 lb. steel in place, 1 junction 78 by 96 by 104 in., 2022 lin.ft. 104 by 104-in., 1365 ft. 96 by 96-in., 2765 ft. 93 by 93-in., 2460 ft. 90 by 90-in., and 423 ft. 62 by 62-in. Mon. concrete sewer. Work will be done under the regular sewer improvement proceedings. Estimated cost of project is $598,126. 3-11

BIDS BEING RECEIVED

EL CERRITO, CALIF.—Bids to 8:30 p.m., Mar. 27, by Stege Sanitary Dist. for 311 ft. 6-in. and 52 ft. 4-in. vitr. sewer in Berkeley Park. 3-14

GALT, CALIF.—Bids to 10 a.m., March 29, by Albert Osler, Secretary, Galt Sanitary District, at Osler's Pharmacy, Galt, Sacramento County, for sewer improvements as follows: 13,550 lin.ft. 5-in., 11,150 lin.ft. 6-in., 4800 lin.ft. 8-in., and 1700 lin.ft. 10-in. vitrified pipe. PUMPING PLANT, involving 40 cu.yd. concrete, 3000 lb. reinforcing steel, 38 cu.yd. structure excavation, two 3-in. pumps and motors, etc., and 7200 ft. 8-in. or 10-in. vitrified pipe. IMHOFF TANK, involving 80 cu.yd. concrete, 7600 lb. reinforcing steel, 2500 cu.yd excavation (ditches). Cost, $45,000. Bonds voted. Contractor must take bonds of District. Plans from C. W. Deterding, Jr., Engineer, Court House, Sacramento. 3-17

SEBASTOPOL, CALIF.—Bids up to April 7 by City Clerk, Sebastopol, Sonoma County, for sewage treatment plant consisting of Dorr clarifier, sewage and sludge pumps, separate sludge digester with gas collection and sludge-heating system, sludge drying beds and effluent oxidation ponds. Work involves 2150 ft. 14-in. sewer with two manholes, 183 cu.yd. 'A' concrete, 18,930 lb. reinforcing steel, 79 cu.yd. structure excavation, 5300 cu.yd. excavation, one operating house, one 26-ft. Dorr tractor clarifier and skimmer, one 4-in. Dayton-Dowd sewage pump system, one 4-in. Barnes sludge pumping system, separate sludge digester with gas collection and sludge heating, one effluent distributor system of 12-in. pipes, two sludge drying beds, and clear grounds of existing rubbish dump; cost, $21,500. The site is at the northeasterly corner of Sebastopol and is on high ground not touched by flood waters. Ground is a sandy loam. C. E. Mueller and John A. Mitchell prepared above plans. 3-17

VENTURA, CALIF.—Bids to 11 a.m., April 1, by County for concrete sewer 2100 ft. long and 24-in. diam. at Piru. 3-8

BIDS RECEIVED

OCEANSIDE, CALIF.—J. C. Duncan, American Bank Bdg., Los Angeles, $12,898 as follow (low bid to City for sewer on the Strand):

534 ft.	6-in. cast-iron sewer pump main	$1.50
1,962 ft.	8-in. vitrified pipe sewer	2.25
663 ft.	6-in. vitrified pipe sewer	1.75
2	concrete flushtanks	75.00
7	concrete manholes	50.00
1	reinforced concrete pump station, 100 cu.yd. with two 4-in. sewer pumps, 10-hp. motors	$8550

3-14

CONTRACTS AWARDED

HEALDSBURG, CALIF.—To A. W. Garrett, Healdsburg, $6992 for vitrified sewer improvements for City. 3-18

HAWTHORNE, NEV.—To Thos. Haverty Co., 316 E. Eighth St., Los Angeles, who bid $286,885 to Bureau of Yards and Docks, Navy Department, Washington, D. C., for steam, oil, and electrical distributing systems, and sewage disposal plant, and concrete and bituminous macadam roads at the Naval Ammunition Depot, Hawthorne. 3-7

WATER SUPPLY SYSTEMS

WORK CONTEMPLATED

CLOVERDALE, CALIF.—City will hold election during April for permission to transfer $15,000, now in the City Treasury, and use same for the construction of necessary improvements to the Water System. A. C. Reger is City Water Supt. 3-11

LONG BEACH, CALIF.—Bond election, May 13, by City to vote $4,460,000 of which $1,100,000 is for transmission mains, wells, pumps, pump houses, collecting cisterns, etc. The balance of the bond issue will be used for the purchase of reservoir sites and water-bearing lands. 3-8

MONTECITO, CALIF.—Bond election Mar. 25 by Montecito County Water District to vote on issuing bonds in the amount of $200,000 for the construction of additional water system improvements. Carl Wyant, 29 San Ysidro Road, Santa Barbara, is the Chief Engineer. 3-11

SAN JUAN CAPISTRANO, CALIF.—Plans being made by W. K. Hillyard, Engineer, Drawer C, Santa Ana, Orange County, for water system improvements in Orange County Water District No. 4 at San Juan Capistrano, Orange County, involving one 250,000 gal. concrete reservoir, and installation of water mains and fire hydrants; $36,000. 3-19

LAS CRUCES, N. M.—Bond election April 1 by City of Las Cruces to vote on issuing bonds in the amount of $125,000 to finance water system improvements, including a water storage tank, and a $10,000 issue to finance the purchase of fire fighting equipment. 3-13

ABERDEEN, WASH.—Plans by S. C. Watkins, Superintendent, Water Department, Aberdeen, Washington, for replacing approximately five miles of 28-in. continuous wood-stave pipe. This pipe was of douglas fir staves, cut and milled locally. Constructed in 1916. Bids will be considered on untreated and treated wood-stave pipe, steel pipe, and concrete pipe. The line is a gravity flow line, total length 22 miles, maximum heads on replacement portion 150 ft., minimum 40 ft. Payment for work will be made from water funds; no bond issue necessary. 3-6

ANACORTES, WASH.—Bond election, April 22, by City to vote $400,000 for water system improvements as follows: 12 miles laying of a 20-in. main from Skagit River to an equalizing reservoir; 11,000 ft. laying of 16-in. industrial main from a filtration plant to the industrial district of the city; auxiliary pump station to be installed at Whistle Lake. W. C. Morse Co., L. C. Smith Bdg., Seattle, are the Engineers. 3-8

HOQUIAM, WASH.—Bonds, $100,000, were voted by the City for an industrial pipe-line about 9000 ft. long, estimate based on steel pipe with no restrictions on use of wood, subject to latest specifications, pipe about 32 in. E. J. Austin is City Engineer. 3-5

BIDS BEING RECEIVED

ANTIOCH, CALIF.—Bids to 8 p.m., Mar. 31, by City Clerk for raising earth dam, to cost $4500. 3-14

SAN DIEGO, CALIF.—Bids to 11 a.m., April 8, by A. V. Goeddel, Supt. Purchasing Department, for construction of Hodges Reservoir Spillway Enlargement, involving 9000 cu.yd. excavation, 175 cu.yd. concrete, furnish and place, 275 bbl. cement, furnish, 10,000 lb. reinf. steel, hauling and placing. 3-13

WOODSIDE, CALIF.—Bids to 11 a.m., March 27, by Comptroller, University of California, California Hall, Berkeley, for construction of a 1,000,000-gallon capacity reinforced concrete water reservoir for the Bear Gulch Water Company near Woodside, San Mateo County. 3-12

SALEM, ORE.—Bids to Mar. 28 by Public Works Engineering Corp., Hunter-Dulin Bdg., San Francisco, for furnishing pumping plant equipment for pumping station in Willamette River, consisting of two 1800-g.p.m. vertical centrifugal pumps and motors and one 2500-g.p.m. vertical centrifugal pump and motor. 3-15

BIDS RECEIVED

SAN DIEGO, CALIF.—Gist & Bell, 186 East El Dorado St., Arcadia, who bid $61,489, submitted low bid to the City of San Diego for Morena Dam spillway enlargement. 3-19

WATSONVILLE, CALIF.—Grant L. Miner, Bank of Palo Alto Bdg., Palo Alto, $116,924 low bid to City for constructing reinf. concrete filter plant and reservoir for City. H. B. Kitchen is City Engr. and Chas. Gilman Hyde, Berkeley, is Consulting Engineer. 3-12

NYSSA, ORE.—Low bids as follows by the U. S. Bureau of Reclamation, c/o Owyhee Irrigation District, Nyssa, Oregon, for the construction of concrete-lined tunnels for the distribution system of the Owyhee Project in Oregon and Idaho: SCHEDULE NO. 5—T. E. Connelly, Sheldon Bdg., San Francisco, $982,566 low bid for constructing 16-ft. 7-in. diam. tunnel from Sta. 0-50 to Sta. 93-50; SCHEDULES NO. 6 AND 7—J. F. Shea Co., Henry Bdg., Portland, Ore., who bid $1,569,010, low for 16-ft. 7-in. diameter tunnel from Sta. 93-50 to Sta. 188-20, and from Sta. 1-60 to Sta. 112-00; SCHEDULE NO. 8—Magoffin Co., North Vancouver, B. C., $530,684 low for lower portion of Tunnel 5 from Sta. 112 to Sta. 222-60; and SCHEDULE NO. 9—General Construction Co., Colman Bdg., Seattle, $7916 low for west side road to top of dam. (See Unit Bid Summary.) 3-11

CONTRACTS AWARDED

TEMPE, ARIZ.—To Arizona Concrete Co., Phoenix, Ariz., who bid $17,388 for water works extensions to water system for City of Tempe, Ariz., by fire hydrants, cast-iron pipe, new valves and boxes. 3-6

OAKLAND, CALIF.—Awards as follows by East Bay Municipal Utility District for pumping plant equipment: (1) To Byron-Jackson Pump Mfg. Co., Berkeley, $8136 for Claremont Pumping Plant, and $7558 for Pleasant Valley Pumping Plant; and (2) To United Iron Works, Oakland, $8755 for Pine St. Pumping Plant. 3-13

SAN DIEGO, CALIF.—To Butterfield Construction Co., Box 157, San Diego, who bid $12,800 for Hodges Reservoir-San Dieguito Conduit Betterment Work, for the Purchasing Department of the City. 3-5

ST. HELENA, CALIF.—To DeGolyer & Bruce, Federal Telegraph Bdg., Oakland, $3109 for pipe laying for City. 3-12

THE DALLES, ORE.—To Pacific States Cast Iron Pipe Co., who bid as follows for furnishing cast-iron pipe to the City: 2133 lin.ft. of 8-in. cast-iron pipe, $1.15 ft.; 2841 ft. 6-in. cast-iron pipe, 0.755 ft. 3-7

CAMAS, WASH.—To P. E. Maddocks, Camas, Wash., $8786 for cast-iron mains in Dist. 85. 3-14

TACOMA, WASH.—To American Concrete Pipe Co., Tacoma, $127,520 for furnishing and installing 16,045 lin.ft. 42-in. reinforced concrete pipe. Work for the City. 3-7

ARIEL, WASH.—To Kelly & Sullivan, Pittock Bdg., Portland, for clearing 10,000 acres of land, to cost over $1,000,000, for Lewis River Dam at Ariel, Washington, for Northwestern Electric Co., Public Service Bdg., Portland, Oregon. 3-14

IRRIGATION and RECLAMATION

BIDS BEING RECEIVED

TURLOCK, CALIF.—Bids to 2 p.m., Mar. 31, by Turlock Irrigation District for concrete lining. 3-6

DENVER, COLO.—Bids to 3 p.m., April 25, by Bureau of Reclamation, Denver, Colorado, for furnishing high-pressure gates with hydraulic hoists, conduit lining, conduit lining-transitions, circular conduit linings, elbows, and bolts, for the sluice, irrigation, and power outlets at Owyhee dam, Owyhee project, Oregon. All gates and conduits will be installed by the Government. 3-14

BIDS RECEIVED

ARIEL, WASH.—Kelly & Sullivan, Pittock Bdg., Portland, low bid, and will probably be awarded contract for clearing 3000 acres of land to cost over $1,000,000 for Lewis River Dam at Ariel, Washington, for Northwestern Electric Co., Public Service Bdg., Portland. 3-10

CONTRACTS AWARDED

TURLOCK, CALIF.—Awards as follows by Turlock Irrigation District: (1) To Alldrin & Anderson, Turlock, $12,283 for concrete lining and structures in Dist. 19; (2) To Ed. Erickson, Modesto, $3815 for concrete lining Dist. 28; and (3) To Alldrin & Anderson, Turlock, $10,781 for concrete lining and concrete pipe in Dist. 40. 3-13

TURLOCK, CALIF.—Awards as follows by Turlock Irrigation District: (1) Contract awarded to Alldrin & Anderson, Turlock, who bid as follows for work in Improvement District 23: 24,076 sq.ft. 2-in. concrete canal lining, Section 1, 10¢; 71,806 sq.ft. 2-in. concrete canal lining, Section 2, 11¢. (2) Contract awarded to United Concrete Pipe & Construction Co., Merced, who bid $5446 for concrete pipe in Improvement District No. 30. 3-19

POWER DEVELOPMENT

CONTRACTS AWARDED

FRESNO, CALIF.—By San Joaquin Light & Power Co., Fresno, for McClellan & Junkersfield, Inc., New York (a subsidiary of Stone & Webster, 315 S. Broadway, Los Angeles, and 58 Sutter St., San Francisco), for the construction of steam power plant, site not yet decided. Plant will probably use natural gas for fuel. Size and type similar to Hunter Point steam plant of the Great Western Power Co. at San Francisco. Plant will have capacity of 35,000 kw. and will cost about $3,500,000. 3-6

SAN FRANCISCO, CALIF.—To Western Pipe & Steel Co., 444 Market St., San Francisco, for the major portion of Tiger Creek penstock for Salt Springs hydro-electric development on Mokelumne River, for the Pacific Gas & Electric Co. Contract includes 3400 ft. riveted penstock tapering from 102-in. diameter (5/16-in. shell) to 84-in. diameter (1½-in. shell); also two short siphons, 93-in. diameter, and some distributing pipe at Tiger Creek powerhouse. Length of siphons, 1357 ft. The remaining section of the penstock will be awarded shortly, amounting to 1200 lin.ft. 3-10

SEATTLE, WASH.—Awards as follows by City of Seattle for power equipment for Diablo power plant: (1) To Westinghouse Electric & Manufacturing Co., Lloyd Bdg., Seattle, for furnishing two 66,700-kva. turbines and seven 22,250-kva. transformers; and (2) To Maloney Electric Co., Smith Tower, Seattle, for furnishing three 1000-kva. transformers. 3-7

SWIMMING POOLS

WORK CONTEMPLATED

HAYWARD, CALIF.—Plans by City Engr., J. B. Holly, for reinf. conc. swimming pool, filtration and purification equipment, etc. Bond election to vote $75,000 on Apr. 15. 3-11

SAN LEANDRO, CALIF.—Plans by City Engr., W. A. Richmond, for reinf. conc. swimming pool, including filtration equipment. $20,000. 3-11

LIGHTING SYSTEMS

WORK CONTEMPLATED

BAKERSFIELD, CALIF.—Plans by City Engineer, protests will be heard April 7 with reference to the installation of 72 electroliers, Union Metal Manufacturing Co. design 1891; also conduit system, etc. on 17th St. from K St. and Union Ave., and on portion of L St.; 1911-15 Acts. 3-19

TRACY, CALIF.—To Butte Electric & Mfg. Co., 956 Folsom St., San Francisco, who bid $11,684 for installing 63 King Post street lighting system on Eleventh St., from West Park Subdivision to East St. 3-15

MISCELLANEOUS

CONTRACTS AWARDED

SAN FRANCISCO, CALIF.—To Conrad Sovig, 248 Oak St., San Francisco, at $12,972, by Board of Public Works for painting, lighting, repairing, and waterproofing Stockton St. Tunnel. 3-7

MUNICIPAL DEVELOPMENTS

WORK CONTEMPLATED

ALBUQUERQUE, N. M.—Bond election April 1 by City to vote $768,000 for: $315,000 for sanitary sewer system, $185,000 for water works extensions, $55,000 for park improvements, $155,000 for extension of storm sewers, $39,000 for extension of fire protection equipment, $19,000 for streets and alleys. 3-15

ROSWELL, N. M.—Bond election April 1 by City of Roswell, to vote on issuing bonds in amount of $300,000, as follows: $165,000 for sewer extension and improvements, $50,000 for water extensions, $25,000 for roads and bridges, $20,000 for parks within the city, $40,000 for parks outside the city. 3-11

RIVER AND HARBOR WORK

WORK CONTEMPLATED

HUNTINGTON BEACH, CALIF.—Plans by City Engr., M. Rosson, call for bids will be issued about May 1, bids to be opened about May 20, for: (1) Gunite repairs for 1400 ft. present pier, to be 25 ft. wide, $60,000; and (2) 500-ft. extension to present concrete pier, to be 25 ft. wide, using centrifugally spun concrete piling, and concrete girders and beam for deck, replacing of ornamental lighting system on old pier, $62,000. Bonds were voted by the City. 3-11

LAKEPORT, CALIF.—City Council has requested the City Engineer, D. F. McIntire, to prepare estimates of cost with reference to replacing the present wharves with new wharves and boat landings. 3-11

BIDS BEING RECEIVED

STOCKTON, CALIF.—Bids to 11 a.m., Mar. 31, by County for ferry boat at Middle River, equipped to operate by means of a slack cable, power to be furnished by gasoline engine. $3500. 3-12

STOCKTON, CALIF.—Bids to 11 a.m., Mar. 31, by County for constructing ferry landings and approach trestle on Bacon Island and Lower Jones Tract at Middle River. Work involves 3654 lin.ft. piles, 64,400 ft. b.m. douglas fir, 2200 ft. b.m. redwood, 450 lin.ft. wire fabric. $6500. 3-12

BIDS RECEIVED

RICHMOND, CALIF.—Franks Contracting Co., 260 California St., San Francisco, who bid 0.0972 per yd., low bid to U. S. Engineer's Office, San Francisco, for dredging in Richmond Harbor. Other bids:

San Francisco Bridge Co.	0.1005 yd.
American Dredging Co.	0.102 yd.
Hydraulic Dredging Co.	0.1025 yd.
Engineer's estimate	0.1084 yd.

Work involves 193,000 cu.yd. of dredging. 3-5

SACRAMENTO, CALIF.—Longview Dredging & Construction Co., Rio Vista, who bid 0.089 per cu.yd., low bid to U. S. Engineer's Office, Sacramento, for dredging in New York Slough and Suisun Bay, first unit of Stockton Deep Water Channel. Other bids:

Hydraulic Dredging Co., Oakland	0.0898 yd.
American Dredging Co., San Francisco	0.092 yd.
F. C. Franks Contracting Co., San Francisco	0.0945 yd.
San Francisco Bridge Co., San Francisco	0.095 yd.

Work involves 1,772,000 cu.yd. dredging, etc. 3-5

SAN FRANCISCO, CALIF.—Bids as follows for dredging in Suisun Bay Channel, (1) Section A; (2) Section B; and (3) Sections A and B combined:

	(1)	(2)	(3)
Hydraulic Dredging Co., Central Bank Bdg., Oakland (low)	.1455	.126	.1357
Hydraulic Dredging Co. (alternative bid)	.0871	.0871	.0765
Longview Dredging Co.			.14
San Francisco Bridge Co., San Francisco	.15	.15	.15
Engineer's estimate	.1238	.0673	.0944

Work involves 683,200 cu.yd. dredging. 3-12

CONTRACTS AWARDED

SAN DIEGO, CALIF.—To Chas. & F. W. Steffgen, Spreckels Bdg., San Diego, who bid $83,475 for the construction of an extension to the Broadway Pier. Work for the City. 3-19

RAILROAD CONSTRUCTION

CONTRACTS AWARDED

COYOTE, CALIF.—To J. P. Holland, Inc., 1834 McKinnon Ave., San Francisco, for the construction of a fill near Coyote, Santa Clara County, for the Southern Pacific Co. Work involves 45,000 cu.yd. fill. 3-18

SACRAMENTO, CALIF.—To W. A. Bechtel Co., 206 Sansome St., San Francisco, for bank widening and re-ballasting from Sacramento to Chipps Island and from Burton to Bay Point, also replacement of 60-lb. rail with 85-lb. rail from Burton to Bay Point, work for the Sacramento Northern Railroad. 3-10

SURETY BOND AND CASUALTY INSURANCE DIRECTORY

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

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

MACHINERY and SUPPLIES

BIDS BEING RECEIVED

SACRAMENTO, CALIF.—Bids to 11 a.m., April 1, by U. S. Engineer Office, California Fruit Bdg., Sacramento, for furnishing one motor-generator electric arc welding set. 3-17

SAN FRANCISCO, CALIF.—Bids to 3 p.m., March 31, by Board of Supervisors of San Francisco, for furnishing 200 rolled steel car wheels, 34 in. diam., for Municipal Railway. Leonard S. Leavy, 270 City Hall, is the Purchaser of Supplies. 3-13

SANTA ANA, CALIF.—Bids to 7:30 p.m., March 31, by City Clerk for furnishing the following cast-iron pipe: 15,000 ft. 4-in., 11,000 ft. 6-in., 4500 ft. 8-in., 3000 ft. 10-in., and 6300 ft. 12-in. cast-iron pipe. 3-17

STOCKTON, CALIF.—Bids to 11 a.m., Mar. 31, by County for motor drive on drawbridge over Grant Line Canal. $1270. 3-12

TURLOCK, CALIF.—Bids to 7:30 p.m., April 1, by City Clerk, A. P. Ferguson, Turlock, for furnishing the following: 500 ft. 6-in. and 800 ft. 7-in. 'B' cast-iron pipe. Pipe to be bell and spigot. 3-13

UPLAND, CALIF.—Bids to 7:30 p.m., Apr. 3, by City for pipe and fittings. 3-7

PUGET SOUND, WASH.—Bids to 11 a.m., April 2, by Bureau of Yards and Docks, Navy Department, Washington, D. C., for surface condenser, air ejector, condensate pump, motor-driven exciter set, switchboard panels and instruments, at the Navy Yard, Puget Sound, Washington. 3-15

BIDS RECEIVED

LOS ANGELES, CALIF.—Bids received as follows by the Los Angeles County Board of Supervisors (Flood Control District) for furnishing f.o.b. nearest siding 102,000 bbl. of portland cement for the Hansen Dam:

		Total	
Riverside Cement Co.	$1.85 bbl.	$188,700	
Monolith Portland Cement Co.	1.86 bbl.	189,720	
California Portland Cement Co.	1.94 bbl.	197,880	
Southwestern Portland Cement Co.	1.94 bbl.	197,880	3-19

CONTRACTS AWARDED

LOS ANGELES, CALIF.—Awards as follows by Los Angeles City Water & Power Bureau for furnishing cast-iron pipe under Spec. 1303: (1) To U. S. Pipe & Foundry Co., Los Angeles, as follows: 35,000 ft. 6-in. cast-iron pipe, f.o.b. Vesper and Aetna Sts., Van Nuys, 0.685¢ ft.; 28,000 ft. 8-in. cast-iron pipe, f.o.b. Vesper and Aetna Sts., Van Nuys, 0.965¢ ft.; 5000 ft. 12-in. cast-iron pipe, f.o.b. Vesper and Aetna Sts., Van Nuys, $1.61 ft.. (2) To Pacific States Cast Iron Pipe Co., Los Angeles, who bid 0.6675¢ ft. for 12,000 ft. 12-in. cast-iron pipe, f.o.b. First and Meyler Sts., San Pedro. (3) To American Cast Iron Pipe Co., Los Angeles, who bid 95¢ ft. for 40,000 ft. 8-in. cast-iron pipe, f.o.b. Hewitt St. Yard, Los Angeles. (4) To National Cast Iron Pipe Co., Los Angeles, who bid as follows: 20,000 ft. 8-in. cast-iron pipe, f.o.b. Hewitt St. Yard, Los Angeles, 0.968¢ ft.; 20,000 ft. 8-in. cast-iron pipe, f.o.b. Slauson and Compton Aves., Los Angeles, 0.955¢ ft. 3-17

OAKLAND, CALIF.—Awards as follows by East Bay Municipal Utility District: (1) To Henry Cowell Lime & Cement Co., San Francisco, who bid $2.54 per bbl. for 1050 bbl. of portland cement. (2) To Baker-Hamilton-Pacific Co., San Francisco, who bid $1000 for 40,000 lb. ½-in. square deformed reinforcing steel bars, and $960 for 40,000 lb. ⅝-in. round reinforcing steel bars. (3) To Tilden Lumber Co., San Francisco, who bid $1345 for furnishing various quantities of rough redwood lumber and rough pine lumber. 3-6

ORANGE, CALIF.—To U. S. Pipe & Foundry Co., Los Angeles, 59½¢ ft. for 4000 ft. 'B' 6-in. cast-iron pipe for City. 3-6

YREKA, CALIF.—To Pacific States Cast Iron Pipe Co., Hunter-Dulin Bdg., San Francisco, who bid $2009 for furnishing pipe and fittings (precaulked) to City. 3-13

PORTLAND, ORE.—Awards as follows by City for 3675 tons of cast-iron pipe: (1) Contract awarded to U. S. Pipe & Foundry Co., Portland, who bid $143,192 for all pipe except 6-in. and 4-in.; and (2) Contract awarded to Pacific States Cast Iron Pipe Co., who bid $1432 for 6-in. and 4-in. pipe. 3-14

BUILDING CONSTRUCTION

WORK CONTEMPLATED

STOCKTON, CALIF.—Plans by Thomas Heath Construction Superintendent, c/o Franklin Sugar Co., Preston, Ida., for the construction of a group of brick and steel buildings, consisting of one main building and one pump drier building, for the Holly Sugar Co., c/o John P. French, W. Weber Point and Waterfront, Stockton, to be erected in the Bishop Tract, Stockton; $1,600,000. 3-18

BIDS BEING RECEIVED

CENTERVILLE, CALIF.—Bids to 2 p.m., April 5, by Washington Union High School District for reinforced concrete gymnasium building for the District; $60,000. 3-18

STOCKTON, CALIF.—Bids to 2 p.m., April 8, by Geo. B. McDougall, State Architect, Sacramento, for construction of Assistant Physician's Cottage No. 2, Stockton State Hospital Farm, near Stockton; $7000. 3-12

BIDS RECEIVED

BERKELEY, CALIF.—E. T. Lesure, 87 Ross Circle, Oakland, $53,285 low for Central Heating Plant building for University of California. 3-13

KELSEYVILLE, CALIF.—Petaluma Bdg. & Const. Co., Petaluma, $30,400 low bid to Kelseyville Union High School District for reinf. concrete High School. 3-17

OAKLAND, CALIF.—S. S. Herrick, 18th and Campbell Sts., Oakland, $19,772, low bid to Oakland Port Commission for steel frame for Ninth Ave. Pier. 3-18

SAN FRANCISCO, CALIF.—Monson Bros., 475 Sixth St., San Francisco, $26,480, low bid to Park Commission for repairs to Palace of Fine Arts, involving concrete foundations, new roof, etc. 3-19

CONTRACTS AWARDED

HAYWARD, CALIF.—To Fred J. Westlund, 354 Hobart St., Oakland, $65,840 to City for constructing concrete and steel frame City Hall. 3-14

LONG BEACH, CALIF.—Awards as follows by City for Municipal Auditorium: General Construction to R. E. Campbell, 130 Linden Ave., Long Beach, $742,000; Electric Wiring to Baty Electric Co., 128 W. Fourth St., Long Beach, $76,000; Plumbing to O. E. Ross, 521 E. First St., Long Beach, $74,789; Heating and Ventilating to Jones Heating Co., 28 E. Union St., Pasadena, $155,750. 3-10

ORLAND, CALIF.—To Azevedo & Sarmento, 920 O St., Sacramento, who bid $46,500 for constructing stucco, terra cotta, and reinforced concrete Veterans' Memorial Building for County at Orland. 3-12

SALINAS, CALIF.—To M. J. Murphy, Carmel, who bid $31,593 to County for reinforced concrete Detention Home. 3-14

SAN JOSE, CALIF.—Awards as follows by San Jose School District for Anne Darling Elementary School: GENERAL CONTRACT—To the Minton Co., Mountain View, $55,675; ELECTRICAL WORK—To Roy Butcher, 1020 Sherwood, San Jose, $3630; PLUMBING—To William F. Serpa, 497 N. 13th Street, San Jose, $4500; HEATING—To A. J. Peters, 455 E. Washington, San Jose, $5987. 3-13

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 80

Acetylene Generating Apparatus
- Oxweld Acetylene Co.

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

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

Asphalt, Emulsified
- American Bitumuls Co.

Asphalt Plants and Equipment
- Bacon Co., Edward R.
- Harron, Rickard & McCone Co.
- Jenison Machinery Co.
- Link-Belt Meese & Gottfried Co.
- Madsen Iron Works
- Peerless Mchy. & Mfg. Co.
- Spears-Wells Mchy. Co., Inc.
- Standard Boiler & Steel Works
- Union Tank & Pipe Co.

Back Fillers
- Bacon Co., Edward R.
- Bucyrus-Erie Co.
- Caterpillar Tractor Co.
- Cleveland Tractor Co., The
- Garfield & Co.
- Harnischfeger Sales Corp.
- Harron, Rickard & McCone Co.
- Industrial Brownhoist Corp.
- Jenison Machinery Co.
- Link-Belt Meese & Gottfried Co.
- Northwest Engineering Co.
- Orton Crane & Shovel Co.
- Spears-Wells Machy. Co., Inc.
- Speeder Machinery Corp.
- Thew Shovel Co., The
- United Tractor & Equipment Corp.
- Universal Crane Co., The
- West Coast Tractor Co.
- W-K-M Company, Inc.

Bars, Steel
- Pacific Coast Steel Co.

Beams, Channels, and Angles
- Pacific Coast Steel Co.

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

Blacksmithing—Drop Forgings
- Payne's Bolt Works

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

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

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

Bonds, Surety
- Associated Indemnity Corp.
- Commerce Casualty Co.
- Detroit Fidelity & Surety Co.
- Fidelity & Casualty Co. of N. Y., The
- Fidelity & Deposit Co. of Maryland
- Glens Falls Indemnity Co.
- Globe Indemnity Co.
- Great American Indemnity Co.
- Indemnity Insurance Co. of North America

Bonds, Surety (Continued)
- Maryland Casualty Co.
- New Amsterdam Casualty Co.
- Rolph, James Jr., Landis & Ellis

Brick, Common
- Kartschoke Clay Products Co.

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

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

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

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

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

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

Cars, Industrial
- Bacon Co., Edward R.
- Jenison Machinery Co.
- Lakewood Engr. Co.

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

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

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

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

Cement
- Portland Cement Association

Chemicals
- California Filter Co., Inc.
- Great Western Electro-Chemical Co.

Chlorinators
- California Filter Co., Inc.
- Wallace & Tiernan
- Water Works Supply Co.

Chlorine
- Great Western Electro-Chemical Co.

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

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

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

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

Concrete Curing
- Concrete Curing Co.
- McEverlast, Inc.

Concrete Forms
- Harron, Rickard & McCone Co.

Concrete Roads
- Portland Cement Association

Conveyors, Portable
- Diamond Iron Works, Inc.
- Harron, Rickard & McCone Co.
- Jenison Machinery Co.

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

Cranes (Electric, Gasoline Locomotive)
- American Hoist & Derrick Co.
- Bacon Co., Edward R.
- Bucyrus-Erie Co.
- Garfield & Co
- Hackley Equipment Co., P. B.
- Harnischfeger Sales Corp.
- Harron, Rickard & McCone Co.
- Industrial Brownhoist Corp.
- Jenison Machinery Co.
- Link-Belt Meese & Gottfried Co.
- Marion Steam Shovel Co.
- Northwest Engineering Co.
- Ohio Power Shovel Co., The
- Orton Crane & Shovel Co.
- Speeder Machinery Corp.
- Thew Shovel Co., The
- Universal Crane Co., The
- W-K-M Company, Inc.

Cranes, Tractor
- West Coast Tractor Co.

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

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

Culverts, Concrete
- Portland Cement Association

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

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

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

Curing—Concrete
- Concrete Curing Co.
- McEverlast, Inc.

Cutting Apparatus
- Oxweld Acetylene Co.

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

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

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

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

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

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

Drill Sharpening
- Compressor Service & Tool Co.

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

Dump Wagons
- Le Tourneau Mfg. Co.
- West Coast Tractor Co.

Engineers
- Ambursen Dam Co., Inc.
- Burns-McDonnell-Smith Engr. Co.
- Hunt Co., R. W.
- Porter, Geo. J.

Engineering Instruments
- American Paulin System, Inc., The

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

Excavating Machinery
- Bacon Co., Edward R.
- Bodinson Mfg. Co.
- Bucyrus-Erie Co.
- Caterpillar Tractor Co.
- Cleveland Tractor Co., The
- Garfield & Co.
- Excavating Equipment Dealers, Inc.
- General Excavator Co.
- Harnischfeger Sales Corp.
- Harron, Rickard & McCone Co.
- Industrial Brownhoist Corp.
- Jenison Machinery Co.
- Link-Belt Meese & Gottfried Co.
- Marion Steam Shovel Co.
- National Equipment Corp.
- Northwest Engineering Co.
- Ohio Power Shovel Co.
- Orton Crane & Shovel Co.
- Osgood Co., The
- Owen Bucket Co.
- Sauerman Bros., Inc.
- Speeder Machinery Corp., The

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OPPORTUNITY PAGE

CONTINUED

THE BUYERS' GUIDE—*Continued from Page 74*

Excavating Mchy.(Continued)
Thew Shovel Co., The
United Tractor & Equipment Corp.
Universal Crane Co., The

Expansion Joints
Industrial & Municipal Supply Co.
U. S. Cast Iron Pipe & Fdy. Co.
Water Works Supply Co.

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

Equipment—Rental
Atkinson Construction Co.
Contractors Mchy. Exchange
Hackley Equipment Co., P. B.
Tieslau Bros.

Filters—Water
California Filter Co., Inc.

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

Floating Roofs
Chicago Bridge & Iron Works

Flood Lights
Oxweld Acetylene Co.

Flooring, Industrial
Paraffine Companies, Inc., The

Floors, Mastic
Wailes Dove-Hermiston Corp.

Flumes, Concrete
Portland Cement Association

Flumes, Metal
California Corrugated Culvert Co.
Montague Pipe & Steel Co.

Fluxes
Oxweld Acetylene Co.
Victor Welding Equipment Co.

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

Freight, Water
American-Hawaiian Steamship Co.

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

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

Gates, Cast-Iron
California Corrugated Culvert Co.

Gates, Radial
California Corrugated Culvert Co.

Gates, Sheet Metal
California Corrugated Culvert Co.

Governors, Steam Engine
Gardner-Denver Co.
Young Machy. Co., A. L.

Governors, Turbine
Pelton Water Wheel Co., The

Gravel Plant Equipment
Bacon Co., Edward R.
Bodinson Mfg. Co.
Bucyrus-Erie Co.
Diamond Iron Works, Inc.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Link-Belt Meese & Gottfried Co.
Smith Engineering Works
Young Mach. Co., A. L.

Hammers, Steam Pile
Bacon Co., Edward R.
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.

Hoists, Hand and Power
Bacon Co., Edward R.
Gardner-Denver Co.
Garfield & Co.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.
Ingersoll-Rand Co.
Jaeger Machine Works, The
Jenison Machinery Co.

Hoists, Hand and Power (Continued)
Link-Belt Meese & Gottfried Co.
Novo Engine Co.
Sullivan Machinery Co.
West Coast Tractor Co.
Young Machy. Co., A. L.

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

Hose (Steam, Air and Water)
Gardner-Denver Co.
Ingersoll-Rand Co.
Leitch & Co.
Rix Company, Inc., The

Hydro-Tite
Industrial & Municipal Supply Co.

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

Iron—Plates and Sheets
American Rolling Mill Co., The

Jacks, Lifting
Jenison Machinery Co.

Kettles, Tar and Asphalt
Bacon Co., Edward R.
Harron, Rickard & McCone Co.
Montague Pipe & Steel Co.
Peerless Mchy. & Mfg. Co.
Spears-Wells Machy. Co.
Young Machy. Co., A. L.

Leadite
Water Works Supply Co.

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

Locomotives (Electric, Gas and Steam)
Bacon Co., Edward R.
Garfield & Co.
Hackley Equipment Co., P. B.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
United Commercial Co.

Lumber
McCormick Lumber Co.

Metal Lath
Truscon Steel Company

Meters, Venturi
Water Works Supply Co.

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

Mixers, Chemical
Dorr Co., The

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

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

Motors, Gasoline
Continental Motors Corp.

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

Oxy-Acetylene Apparatus
Oxweld Acetylene Co.

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

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

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

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

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

Paving Breakers
Gardner-Denver Co.
Harron, Rickard & McCone Co.
Ingersoll-Rand Co.
Leitch & Co.
Rix Company, Inc., The
Schramm, Inc.
Sullivan Machinery Co.

Paving Plants
Bacon Co., Edward R.
Jaeger Machine Works, The
Jenison Machinery Co.
Madsen Iron Works
Standard Boiler & Steel Works

Paving Tools
Bacon Co., Edward R.
Harron, Rickard & McCone Co.

Penstocks
Chicago Bridge & Iron Works
Lacy Manufacturing Co.
Pittsburgh-Des Moines Steel Co.
Water Works Supply Co.
Western Pipe & Steel Co.

Pile Drivers
Bacon Co., Edward R.
Bucyrus-Erie Co.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.
Ingersoll-Rand Co.
Jenison Machinery Co.
Northwest Engineering Co.
Orton Crane & Shovel Co.
Thew Shovel Co., The

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

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

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

Pipe—Centrifugal
National Cast Iron Pipe Co.

Pipe Clamps and Hangers
Kortick Mfg. Co.

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

Pipe, Concrete
Lock Joint Pipe Co.
Portland Cement Association

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

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

Pipe—Flanged
National Cast Iron Pipe Co.

Pipe Line Machinery
Bacon Co., Edward R.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
W-K-M Company, Inc.

Pipe, Lock-Bar
Western Pipe & Steel Co.

Pipe, Preservative
Columbia Wood & Metal Preservative Co.

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

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

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

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

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

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

Plows, Road
Bacon Co., Edward R.
Galion Iron Works & Mfg. Co.
Hackley Equipment Co., P. B.
Jenison Machinery Co.
Spears-Wells Machy. Co.

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

Portable Lights
Oxweld Acetylene Co.

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

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

Preservative—Wood, Metal, etc.
Columbia Wood & Metal Preservative Co.
Paraffine Companies, Inc., The

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

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

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OPPORTUNITY PAGE

CONTINUED

OFFICIAL BIDS

NOTICE TO CONTRACTORS

Bridges, Oiling, and Paving

Sealed proposals will be received at the office of the State Highway Engineer, Public Works Building, Sacramento, California, until 2 o'clock p.m. on April 16, 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:

Plumas County, a reinforced concrete girder bridge across the North Fork of Feather River at Chester (II-Plu-29-A), consisting of three 35-foot spans on concrete pile bents.

Yuba County, through Wheatland (III-Yub-3-A), about nine-tenths (0.9) mile in length, to be graded and paved with Portland cement concrete.

Los Angeles County, between the westerly boundary and Santa Monica (VII-L.A-60-A, B), about twenty-six and five-tenths (26.5) miles in length, heavy fuel oil to be furnished and applied to the shoulders.

San Diego and Imperial Counties, between La Mesa and El Cajon (S.D-12-B), about two and seven-tenths (2.7) miles in length; between Flinn Springs and Viejas Valley (S.D-12-C, D), about eleven and three-tenths (11.3) miles in length; between Pine Valley Creek and Kitchen Creek (S.D-12-D, E, F), about seven and nine-tenths (7.9) miles in length; between Jacumba and Myers Creek (S.D, Imp-12-G, H, A), about thirteen and five-tenths (13.5) miles in length; a total of about thirty-five and four-tenths (35.4) miles in length, heavy fuel oil to be furnished and applied to the shoulders.

Calaveras County, a reinforced concrete girder bridge across Calaveritas Creek 3 miles south of San Andreas (X-Cal-65-B), consisting of one 60-foot span on concrete piers and six 30-foot spans on concrete bents and abutments with rubble masonry wing walls.

Proposal forms will be issued to only those Contractors who have furnished verified statement of experience and financial condition in accordance with the provisions of Chapter 644, Statutes 1929, and whose statements so furnished are satisfactory to the Department of Public Works. Bids will not be accepted from a Contractor to whom a proposal form has not been issued by the Department of Public Works.

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

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

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

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

DEPARTMENT OF PUBLIC WORKS,
DIVISION OF HIGHWAYS.
C. H. PURCELL, State Highway Engineer.
Dated March 19, 1930.

OFFICIAL BIDS

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PUBLIC ROADS

Grading

Standard Government Form of Invitation for Bids

San Francisco, California, March 20, 1930.

Sealed bids, in single copy only subject to the conditions contained herein, will be received until 2:00 o'clock p.m. on the 10th day of April, 1930, and then publicly opened, for furnishing all labor and materials and performing all work for grading section "D" of route No. 26, Yuba Pass National Forest Highway, located in the Tahoe National Forest, Sierra County, California.

The length of the project to be graded is 3.10 miles. The principal items of work are approximately as follows:

Unclassified excavation, 80,645 cu.yd. C.M. pipe (in place), 1212 lin.ft.

Structural excavation, 340 cu.yd. hand laid rip rap, 500 cu.yd.

Overhaul, 28,000 sta.yd. hand laid rock embankment, 400 cu.yd.

Finishing earth graded road, 3.10 miles, hauling and piling logs, lump sum.

Class C concrete, 30 cu.yd., right of way monuments (in place), 114 each.

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

Where copies of plans and specifications are requested, a deposit of $10 will be required to insure their return. If these are not returned within 15 days after opening of bids the deposit will be forfeited to the Government. Checks must 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 sixty (160) calendar days from that date exclusive of any time which may intervene between the effective date of orders of the Government to suspend operations on account of weather conditions and the effective date of orders to resume work and subject to such extensions as may be provided for under the special provisions.

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

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

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

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

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

OFFICIAL BIDS

Envelopes containing bids must be sealed, marked, and addressed as follows:
Bid for ROAD CONSTRUCTION. To be opened 2:00 p.m., April 10, 1930.
Project 26-D1, LADIES CANYON-SHADY FLAT, YUBA PASS NATIONAL FOREST HIGHWAY, 807 Sheldon Bldg., 461 Market Street, San Francisco, California.
C. H. SWEETSER, District Engineer.

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Gates and Hoists, Etc.

Washington, D. C., March 3, 1930

Sealed bids (Specifications No. 510) will be received at the office of the Bureau of Reclamation, Denver, Colorado, until 3 o'clock p.m., April 25, 1930, and will at that hour be opened, for furnishing high-pressure gates with hydraulic hoists, conduit linings, conduit lining-transitions, circular conduit linings, elbows, and bolts, for the sluice, irrigation, and power outlets at Owyhee dam, Owyhee project, Oregon. All gates and conduits will be installed by the Government. For particulars, address the Bureau of Reclamation, Owyhee, Oregon; Denver, Colorado; or Washington, D. C.

M. A. SCHNURR, Acting Commissioner.

NOTICE TO CONTRACTORS

Valves

Sealed proposals will be received at the office of the East Bay Municipal Utility District, 512 Sixteenth Street, Oakland, California, until 8:00 p.m., March 26, 1930, and will at that hour be opened, for the purchase and delivery of 805 Valves, in sizes 4" to 16" inclusive, for the Distribution System.

Specifications may be obtained upon application at Room 33 of the office of the District.

JOHN H. KIMBALL, Secretary.
Oakland, California, March 13, 1930.

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Dikes

Washington, D. C., February 20, 1930

Sealed bids (Specifications No. 509) will be received at the office of the Bureau of Reclamation, Fairfield, Montana, until 2 o'clock p.m., April 16, 1930, and then publicly opened, for furnishing all labor and materials and performing all work for the construction of dikes Nos. 1 and 2 for the Pishkun Reservoir enlargement, Sun River project, Montana. The work is located about 15 miles north of Augusta, Montana, a station on the Sun River Branch of the Great Northern Railroad. The principal items and the estimated quantities involved are as follows: 22,000 cubic yards stipping foundations for dikes; plowing 12 acres of foundations for dikes; and placing 340,000 cubic yards of materials in dikes. For particulars, address the Bureau of Reclamation, at Fairfield, Montana; Denver, Colorado; or Washington, D. C.

ELWOOD MEAD, Commissioner.

HELP WANTED

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

STRUCTURAL DRAFTSMAN, young college man with 3 to 5 years' experience on general construction drawings to design steel frame and concrete structures. $150-200 mo. Location, San Francisco. R-3050-S.

THE BUYERS' GUIDE—*Continued from Page 76*

Pumps, Dredging and Sand
Jenison Machinery Co.

Pumps, Hydraulic
Jenison Machinery Co.

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

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

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

Pumps, Sewage Ejector
Industrial & Municipal Supply Co.

Pumps, Sludge
Dorr Co., The

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

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

Reinforcing Bars
Pacific Coast Steel Co.
Soulé Steel Co.

Reinforcing Wire Fabric
Soulé Steel Co.

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

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

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

Road Forms
Bacon Co., Edward R.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Lakewood Engr. Co.

Road Graders and Scrapers
Bacon Co., Edward R.
Caterpillar Tractor Co.
Galion Iron Works & Mfg. Co.
Jenison Machinery Co.
Spears-Wells Machinery Co.
West Coast Tractor Co.
Young Machinery Co.,A. L.

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

Road Oil, Emulsified
American Bitumuls Co.

Road Rollers
Bacon Co., Edward R.
Galion Iron Works & Mfg. C.
Hackley Equipment Co., P. B.
Huber Manufacturing Co.
Jenison Machinery Co.
Spears-Wells Machinery Co.

Roofing
Paraffine Companies, Inc., The

Rules, Steel, Wood and Aluminum
Lufkin Rule Co., The

Saws, Portable
Harron, Rickard & McCone Co.
Ingersoll-Rand Co.
Jenison Machinery Co.
Young Machinery Co., A. L.

Scarifiers
Bacon Co., Edward R.
Jenison Machinery Co.
Le Tourneau Mfg. Co.
Spears-Wells Machinery Co.
West Coast Tractor Co.

Scrapers (Dragline, Fresno, Wheeled)
Bacon Co., Edward R.
Galion Iron Works & Mfg. C.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Killefer Manufacturing Co.
Sauerman Bros., Inc.
West Coast Tractor Co.

Screens, Sand and Gravel
Bacon Co., Edward R.
Bodinson Manufacturing Co.
Diamond Iron Works, Inc.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Link-Belt Meese & Gottfried Co.
Smith Engineering Co.
Young Machinery Co., A. L.

Screens, Sewage
Dorr Co., The
Link-Belt Meese & Gottfried Co.

Screens, Vibrating
Harron, Rickard & McCone Co.
Link-Belt Meese & Gottfried Co.
Smith Engineering Co.

Second-Hand Equipment
Atkinson Equipment Agency
Contractors Mchy. Exchange
Excavating Equipment Dealers, Inc.
Hackley Equipment Co., P. B.
Harron, Rickard & McCone Co.
Tieslau Bros.

Sewage Disposal Apparatus
Dorr Co., The
Industrial & Municipal Supply Co
Link-Belt Meese & Gottfried Co.
Wallace & Tiernan
Water Works Supply Co.

Sharpeners, Rock Drill Steel
Gardner-Denver Co.
Ingersoll-Rand Co.

Shovels (Electric, Gasoline, Steam)
American Hoist & Derrick Co.
Bacon Co., Edward R.
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