# WESTERN CONSTRUCTION NEWS

CIVIL ENGINEERING AND CONSTRUCTION IN THE FAR WEST

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VOLUME IV NUMBER 19

SAN FRANCISCO, OCTOBER 10, 1929

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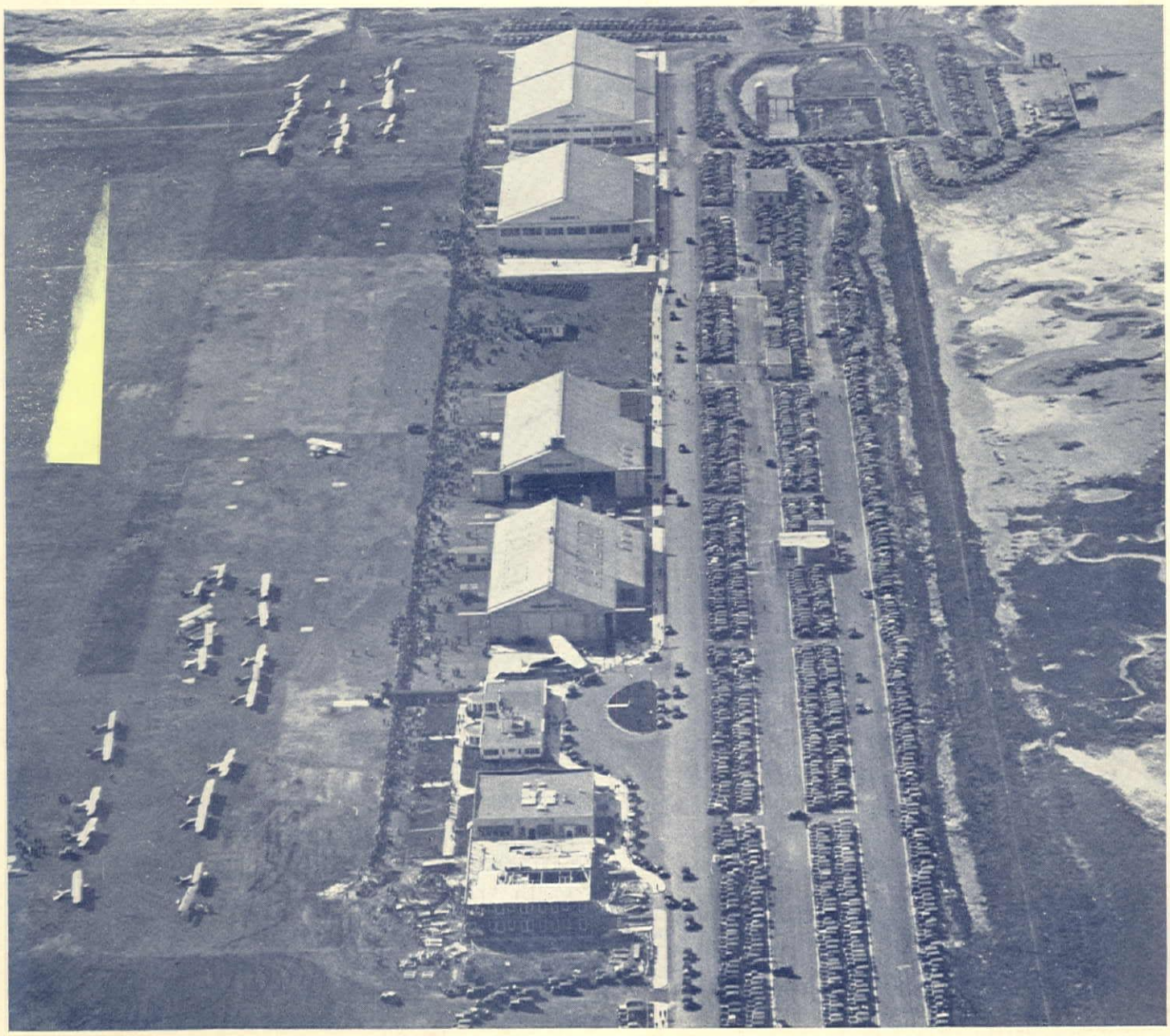
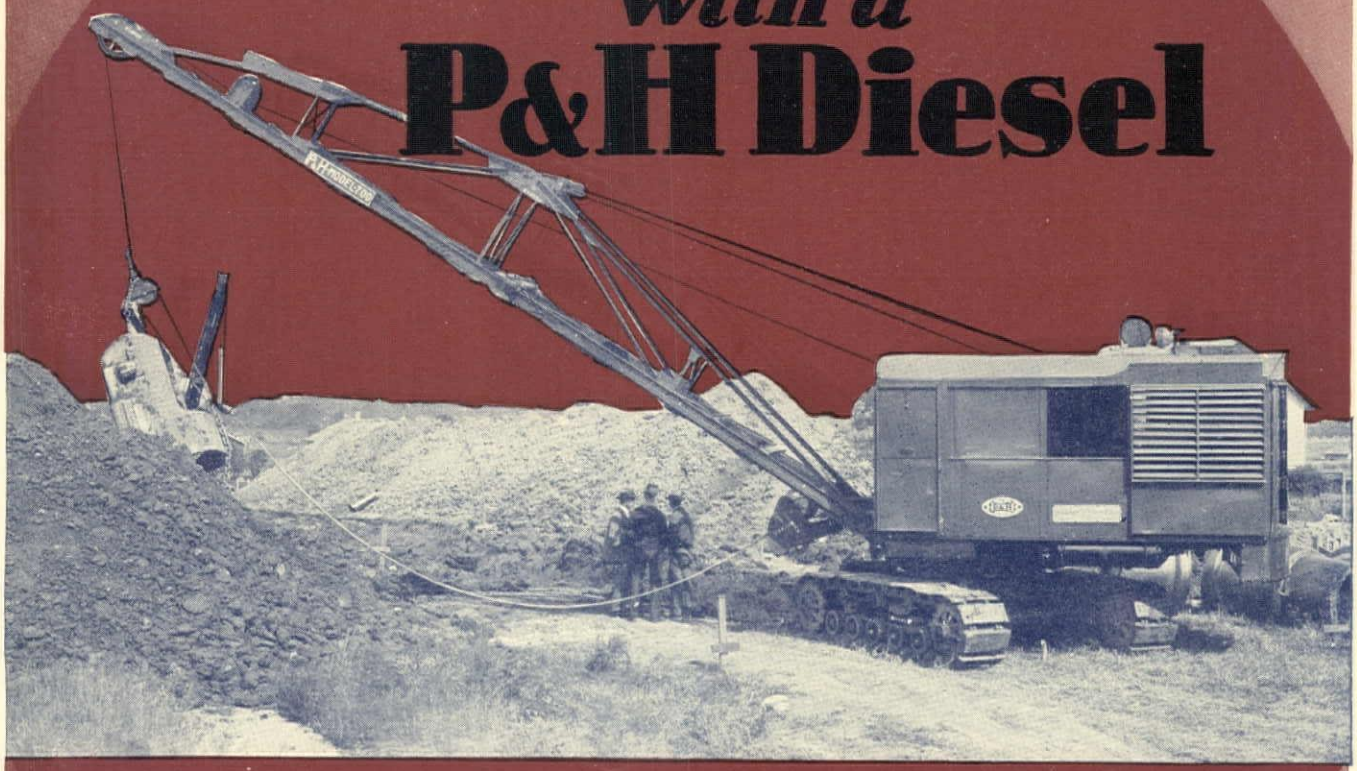


SUNDAY TRAFFIC AT THE OAKLAND AIRPORT. SEAPLANE LANDING IN RIGHT BACKGROUND. 'AIRPORT INN' IN FOREGROUND, ADMINISTRATION BUILDING AND HANGARS 1 TO 4 NEXT IN LINE
(VIEW COPYRIGHT BY ROYLE AERIAL SURVEY)

# Cheaper Dirt *with a* P&H Diesel



Output... fuel cost... maintenance expense... these are the factors that determine the cost per yard of dirt moved.

The harder the going the harder the P&H Diesel pulls, for the torque of a Diesel engine increases as the speed decreases. This means at least 15% greater yardage per shift.

A P&H Diesel uses fuel generally costing one-third as much as gasoline... and burns only one-half as many gallons. The average fuel saving is 85% but varies according to locality.

The P&H with its heavy unit cast steel frames and alloy steel shafts and gears has shown that it requires a minimum amount of upkeep, over a period of years.

*We have prepared an elaborate folder on Diesel Excavators, giving photographs, specifications, and cost of operation. Send for your copy. It will point the way to greater profits.*

P&H

## HARNISCHFEGER SALES CORPORATION

Established 1884

3890 National Ave., Milwaukee, Wis.

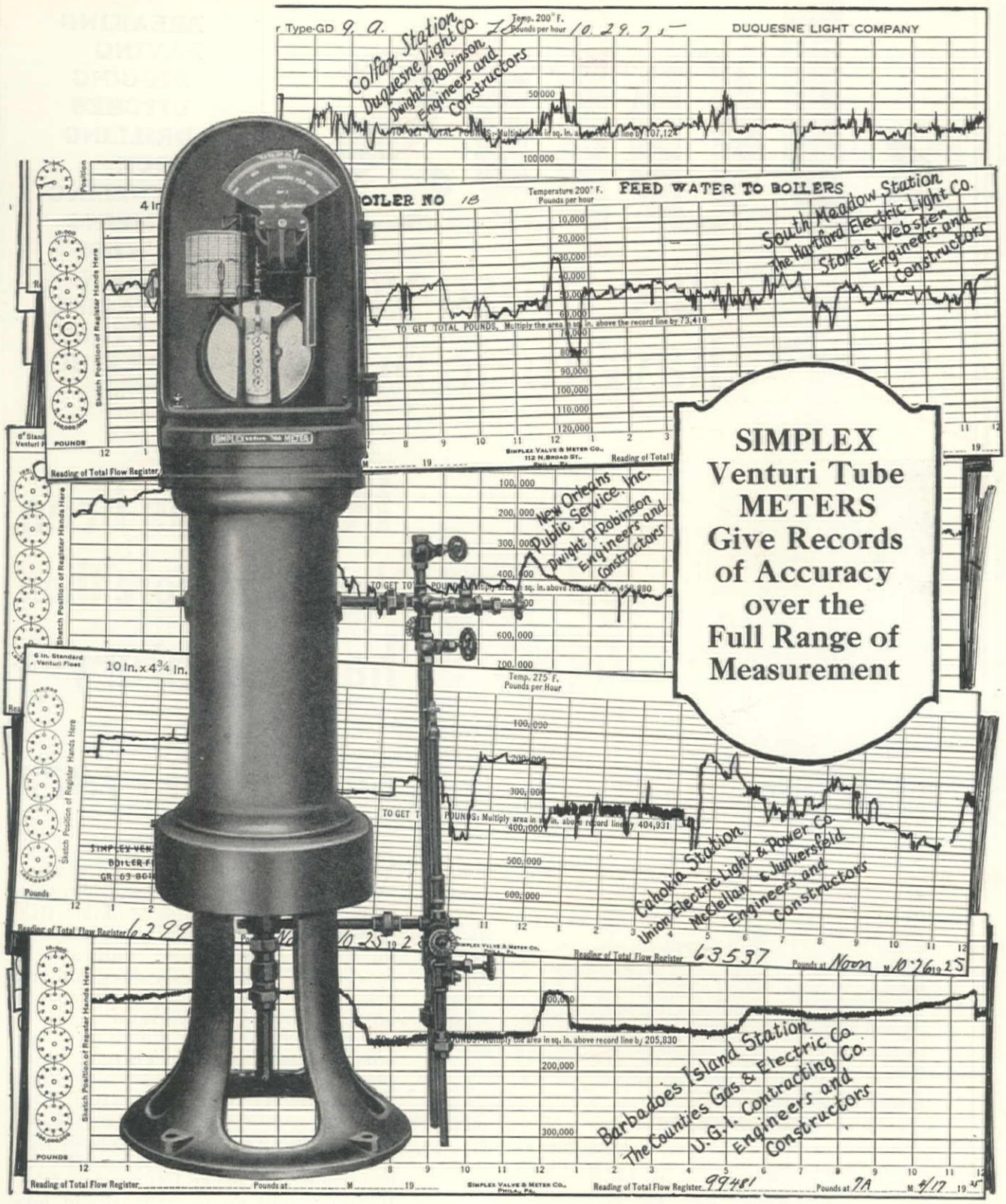
32 Beale St., San Francisco  2036 Santa Fe Ave., Los Angeles

ROBERT M. TAYLOR, *Pacific Coast Manager*

*Service Stations, Complete Repair Part Stocks and Excavators at San Francisco, Los Angeles and Seattle, Wash.*

# P&H DIESEL EXCAVATORS

9417




# Water Works Supply Co.

501 Howard Street
SAN FRANCISCO

Wright & Callender Building
LOS ANGELES

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

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DEVOTED TO CIVIL ENGINEERING AND CONSTRUCTION IN THE FAR WEST

Volume IV OCTOBER 10, 1929 Number 19

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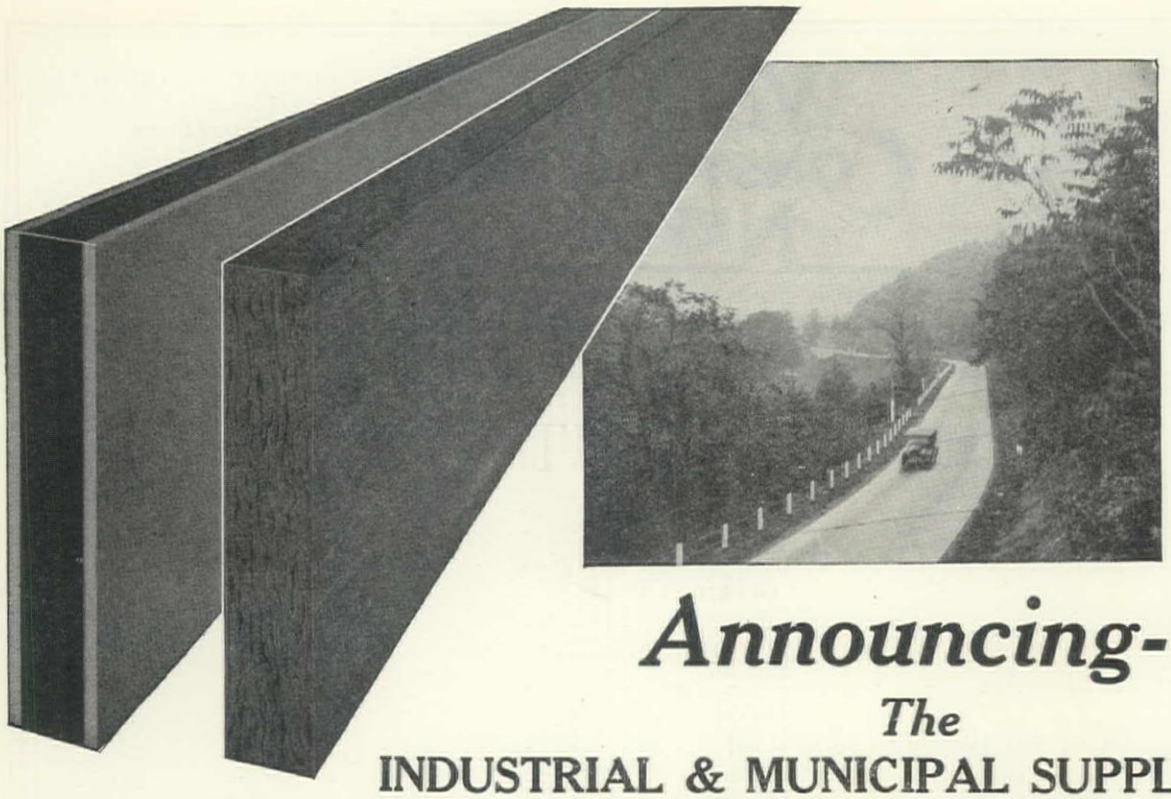

# *Announcing---*

## *The*

## INDUSTRIAL & MUNICIPAL SUPPLY CO., Inc.

### SAN FRANCISCO, CALIFORNIA

**As Distributors for Servicised Fibrated Bituminous Construction Materials**

SERVICISED LOOK FOR IT ON ALL PURCHASES © 1929

**SERVICISED APPROVED PRODUCTS**

Asphalts, Paving, Waterproofing
Asphalt Planking
Bridge Planking
Expansion Joint for Walls, Walks, Buildings, Pavement
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Roofs, Built-up, Bonded
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TO contractors, municipalities and engineers the Industrial & Municipal Supply Co., Inc., states:

That Servicised Products have been selected by them for distribution because Servicised factories are specialists in producing fibrated asphalt construction materials that have proven by universal acceptance to be the most reliable.

That they are ready to handle orders for Servicised Products on an immediate delivery basis as follows:

**Servicised Expansion Joint** for protection of pavements, sidewalks, curbs, reservoirs and all classes of concrete work.

**Servicised Sewer Pipe Belt** for extra tight, flexible, root-proof sewer joints.

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**Spaulding Building Material Depot**
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PORTLAND

SERVICISED REG. U. S. PAT. OFF © 1918

## PREMOULDED PRODUCTS, INC.

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GENERAL DISTRIBUTORS For Products Manufactured By

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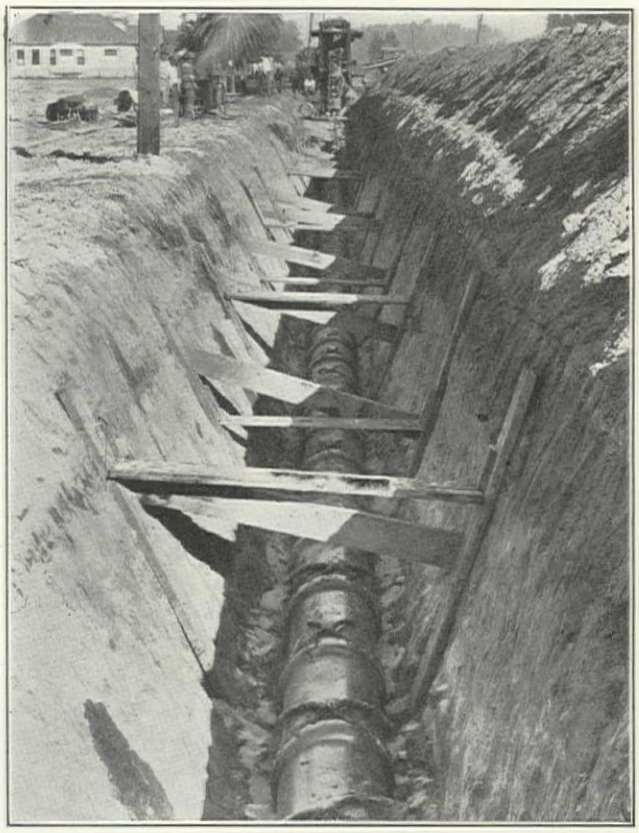
CHICAGO, ILLINOIS

**SERVICISED PRODUCTS CORPORATION**

DISTRIBUTORS AND DEALERS IN PRINCIPAL TRADING CENTERS

# VITRIFIED CLAY— the Only Everlasting Material for Sanitary Sewers



A 28-mile waste water sewer at Santa Fé Springs oil fields, California---all salt glazed, vitrified clay pipe, ranging from 12 to 24 inches in diameter, and jointed throughout with "Petrolastic" Asphalt cement.

Designed by engineering department of the Waste Water Disposal Company and laid by the Drainage Construction Company.

## Pacific Clay Products

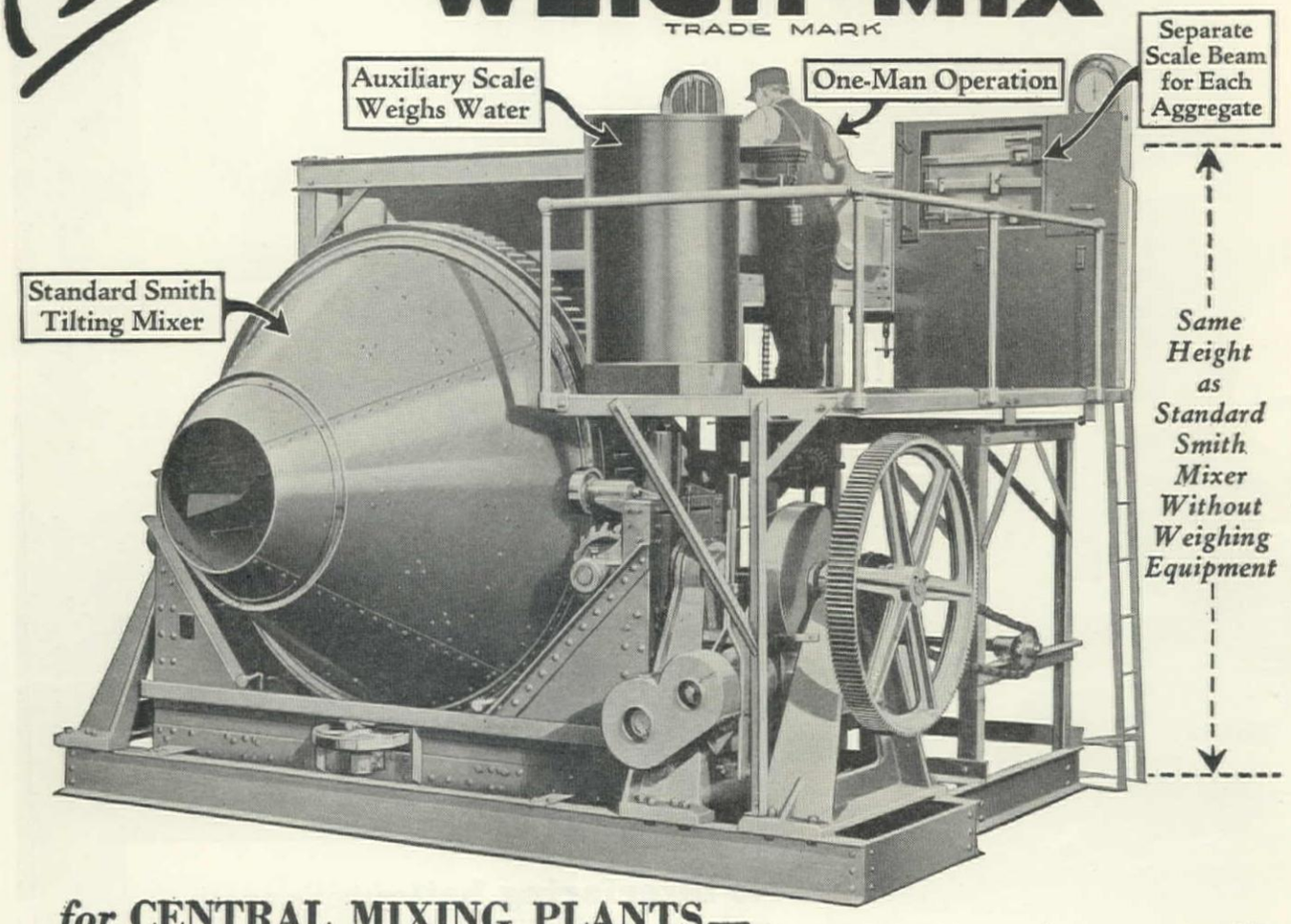
PACIFIC

Suite 650
Chamber of Commerce Bldg.

1151 South Broadway
Los Angeles

# Announcing the New Smith WEIGH-MIX

TRADE MARK




## *for* CENTRAL MIXING PLANTS—

a complete self-contained manufacturing unit that accurately proportions ALL materials by WEIGHT and then thoroughly mixes them—Standard Smith Mixer and hopper used—No need for additional weighing hoppers—Vibrating device cleans hopper and allows scale to return to balance—Centralized control with one-man operation—a compactly built unit with fast portability—Easily applied to any of the larger size Smith Mixers in the field—Requires less capital and effects tremendous savings in operating costs. Write for complete descriptive information.

## *Weighs All the Aggregates -then Mixes!*

## THE T. L. SMITH COMPANY

1111-32nd STREET, MILWAUKEE, WISCONSIN

*Division of National Equipment Corporation*

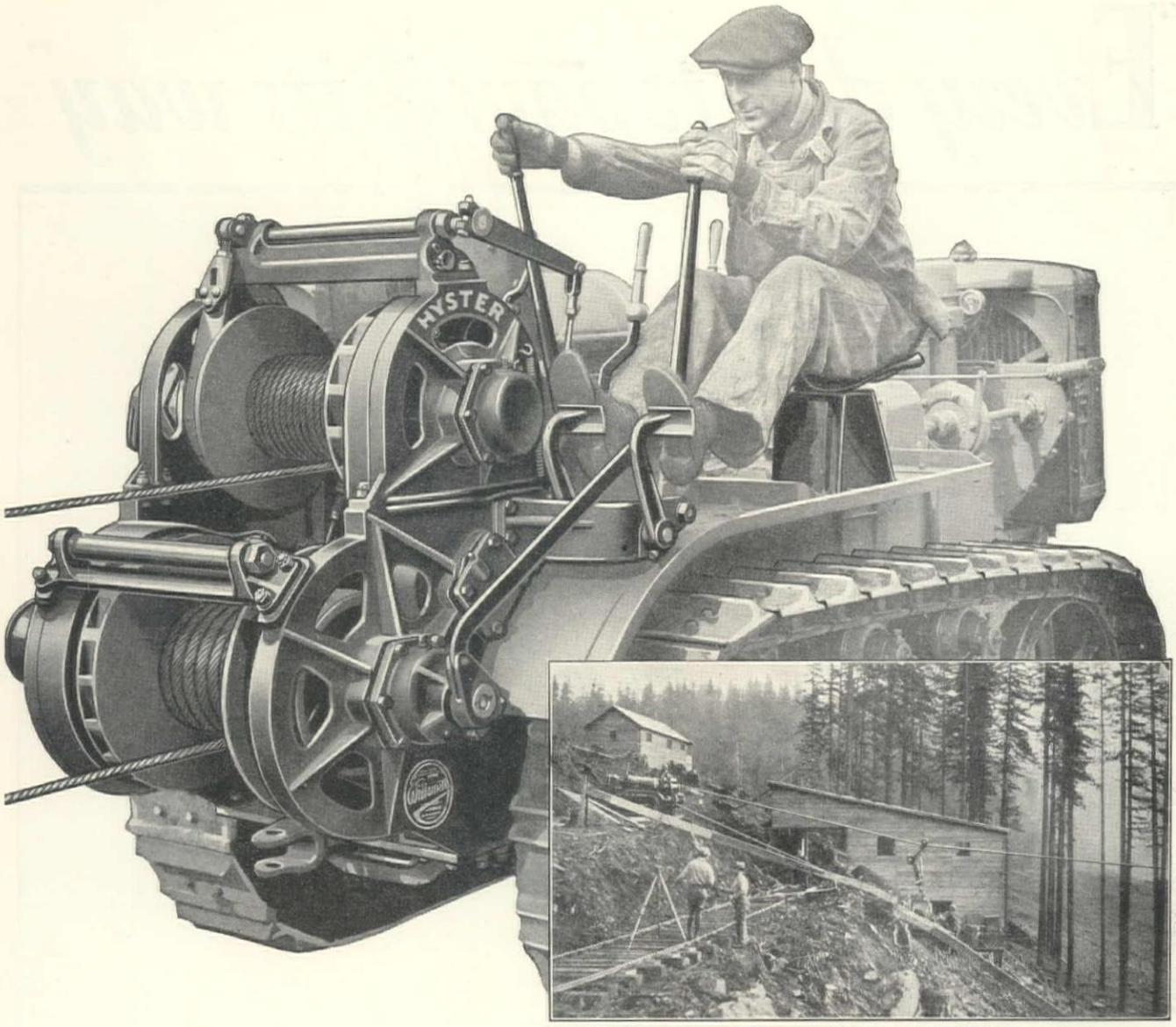
*Sales Offices and Service Warehouses in all principal cities.*

# SMITH MIXERS

A5270-I-WM

HARRON, RICKARD & McCONE COMPANY

1600 Bryant Street, at 15th, San Francisco SINCE 1875 2205 Santa Fe Avenue, Los Angeles




Hyster, mounted on a "Caterpillar" Thirty, swinging a nine-foot concrete bucket over a 1200-foot span.

# HYSTER does the job!

HYSTER
TRADE MARK REGISTERED
FOR ANY LIFT OR PULL

IF YOUR operations require any kind of lift or pull, HYSTER will do the job more efficiently . . . at less cost to you. Hoisting building materials, pulling heavy loads, cable stringing, sand and gravel pit work, digging or backfilling . . . these are but a few of the many operations for which the HYSTER is adapted.

Tell us what your job is, and we will explain fully how the HYSTER can help you.

**Selling Agents:** Authorized "Caterpillar" Dealers

2928

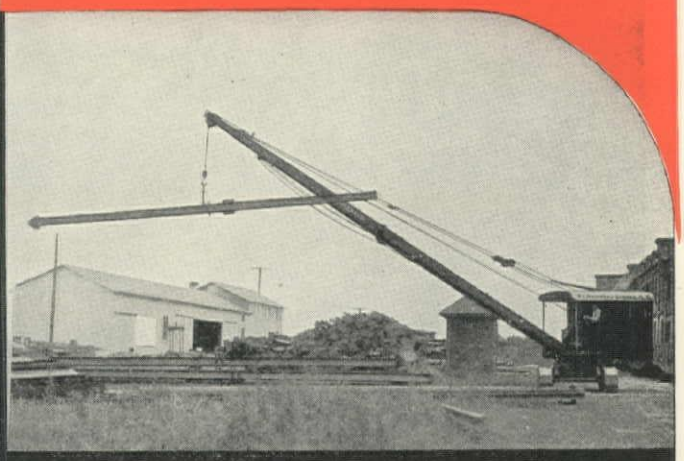
**WILLAMETTE-ERSTED COMPANY**

PORTLAND, OREGON . . . . PEORIA, ILLINOIS

MONONGALIA COUNTY (West Va.) uses this ½ yd. Universal 35 to remove road slides and slips. Notice how far reach of the shovel boom permits casting on the far side of the road.

UNIVERSAL 35 owned by William Muirhead, Durham, N. C., unloading 900 tons of steel forms, girder and beams in ten hours.

# When it comes to Close Figures— Count the UNIVERSAL-35 in on the job

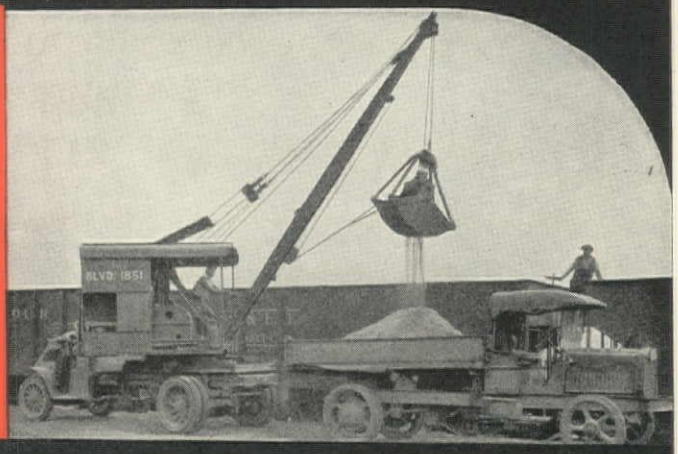


THIS fast stepping half yarder is big enough and powerful enough to handle a sizeable job alone. And it's small enough to be cheaply operated on clean up work around the big jobs. Use it with any type of boom equipment—shovel, crane, dragline, clamshell, skimmer scoop, backdigger. The correct boom equipment protects your profit margin on the closely figured jobs.

THE UNIVERSAL CRANE CO., *Lorain, O.*

UNIVERSAL 35 with backdigger boom, mounted on the famous 2 speed Center Drive Crawler. One of the two Universal machines owned by Coahoma County (Mississippi).

THE Universal 35 superstructure is readily transferable to motor truck mounting when quick mobility is required. Universal Truck Cranes are built in 5, 6, 7½ and 10 ton capacities.

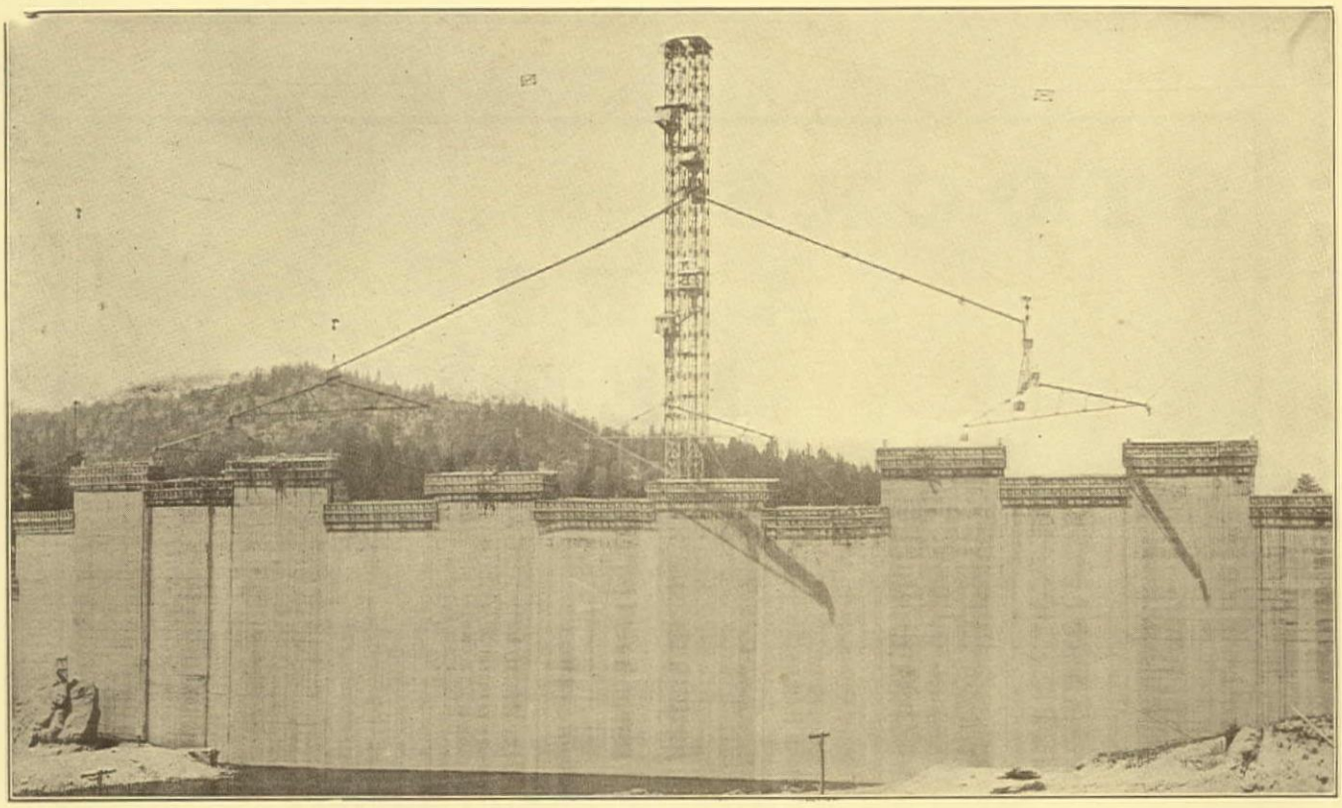


# UNIVERSAL-35

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

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

[SEE EIGHT JENISON MACHINERY COMPANY PAGES FOLLOWING]



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

# The Shaver Lake Dam

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

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

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

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

# LAKEWOOD

**The Lakewood Engineering Co., CLEVELAND · O.**

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

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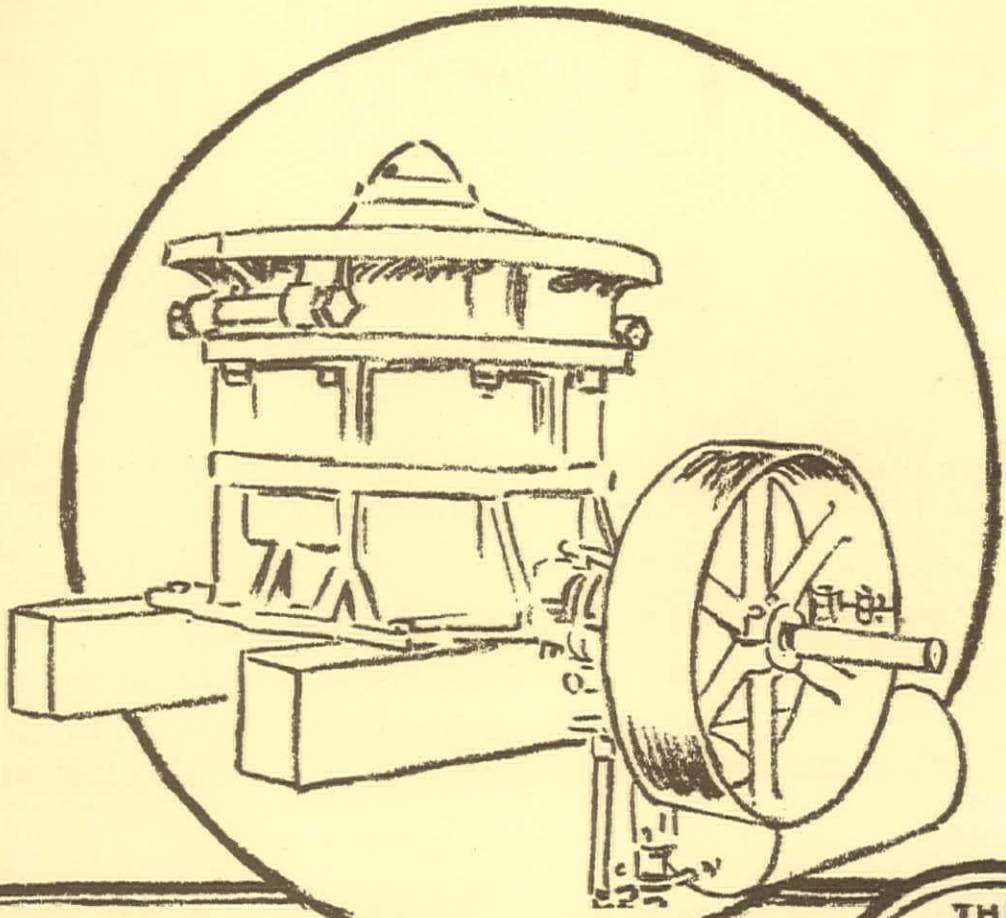

# Security—*even against* Tramp Iron

THE TELSMITH GUARANTEE

Frame, crown and main shaft of the Telsmith Crusher are guaranteed for two years, from shipment, against breakage by tramp iron. Damage done by dynamite is not covered.

WHEN the unexpected happens—and a sledge head, drill point, dipper tooth or any stray steel sneaks into your crusher—then what?

If it's an ordinary iron crusher with a lever shaft, there's a broken shaft, production stops—your payroll goes on, repair bills pile up. But, if it's a Telsmith—with *steel* frame, *steel* crown and a fixed *unbreakable* shaft—the crusher is undamaged—the intruding iron is easily extracted, production schedules are maintained. Not merely a claim but a FACT—backed up by Telsmith's positive guarantee. Why carry your own risk when Telsmith offers "*crusher insurance?*"

The story of security is told in detail in Catalog 176 (Telsmith Primary Breaker) and Bulletin 2F26 (Telsmith Reduction Crusher). Yours for the asking.

**SMITH ENGINEERING WORKS**

**1826 Holton Street :: :: Milwaukee, Wisconsin**

*Consult the nearest representative or write or wire TELSMITH direct*

**Jenison Machinery Co.**
58 Fremont Street
SAN FRANCISCO

**Garlinghouse Bros.**
2044 Santa Fe Avenue
LOS ANGELES

B-7

# TELSMITH

★ LOCAL STOCKS JENISON MACHINERY COMPANY AND SERVICE ★

# EASY OPERATION

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

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

*Write for special bulletins*

FOR SUCCESSFUL PERFORMANCE · A.G.C. OF A.

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SAN FRANCISCO

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LOS ANGELES

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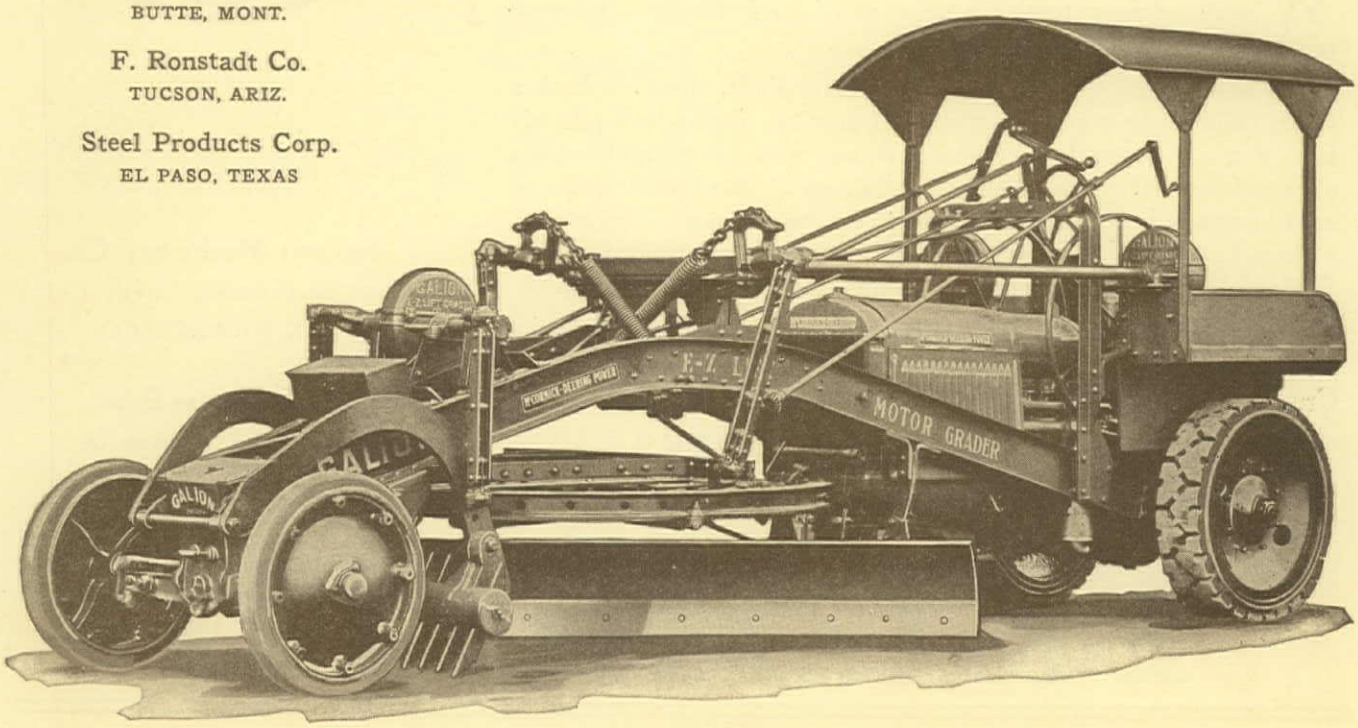
F. Ronstadt Co.
TUCSON, ARIZ.

Steel Products Corp.
EL PASO, TEXAS

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




★ LOCAL STOCKS JENISON MACHINERY COMPANY AND SERVICE ★

# Dependable Power for Every Purpose


"SPEED the job along" is the cry of the boss. Delays are too expensive to countenance in road building. ¶ Among the many road building jobs where Heavy Duty Continental Engines lead the way to profits a significant number is located in Southern California. The T. L. Smith Co. 10S Mixer shown above is powered with a Heavy Duty Continental Engine applied by Brown Bevis Co. as assurance of profitable power dependability under all conditions.

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Mendenhall Auto Parts Co.

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*Southern California and Arizona*
Brown-Bevis Company

*Northern California and Western Nevada*
Jenison Machinery Company

*Los Angeles*
Brown-Bevis Company
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*Seattle, Washington*
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Colyear Motor Sales
Jenison Machinery Company

*Portland, Oregon*
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Colyear Motor Sales

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

# Continental Engines

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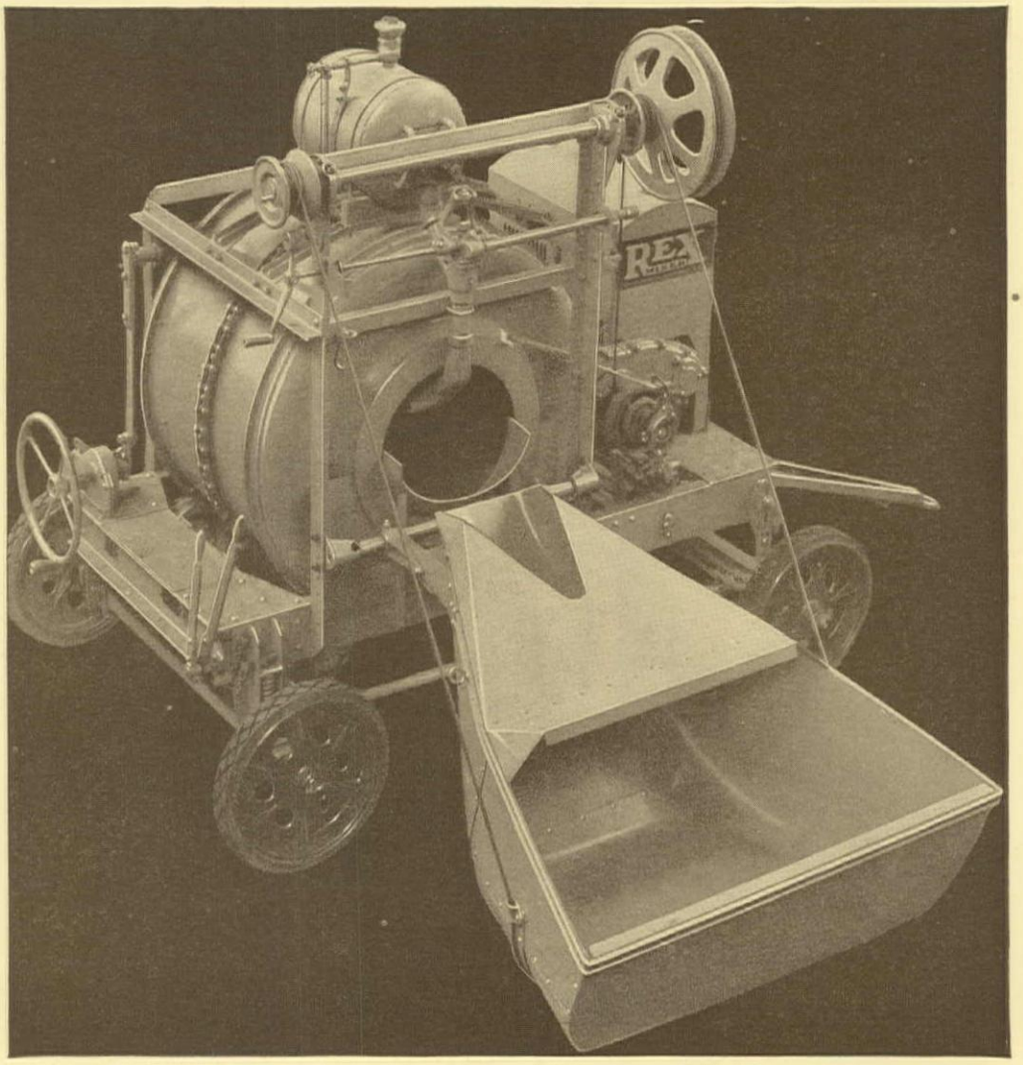
# Not On Design And Performance Alone




# But On Sheer Value This Rex 10-S Leads Its Class

Advanced engineering—new design—elimination of unscientific weight—closer control of water and mixing—unprecedented performance; all these mean little, unless they are within the reach of the ordinary job.

Fortunately, such engineering leadership usually coincides with leadership in production facilities.

As a result, even such a remarkably advanced mixer as the Improved Rex 10-S can be built at costs that more ordinary plants can only consider as hopelessly idealistic.

And on every suitable concrete job can be put a mixer far in advance of its times:

*in the way it is built*
*in the way it performs*

at a price that sets a standard of value in the industry.

Check this remarkable 10-S or any other Rex through the medium of this coupon.

CHAIN BELT COMPANY, 731 Park Street, Milwaukee, Wisconsin

*Improved Again for 1929*

After a year of exhaustive tests plus 18 months in the field, the time-proven Rex 10-S makes its 1929 bow with even more new features. Check them in the catalog for your evidence of what your dollar should buy in a modern 10-S mixer.

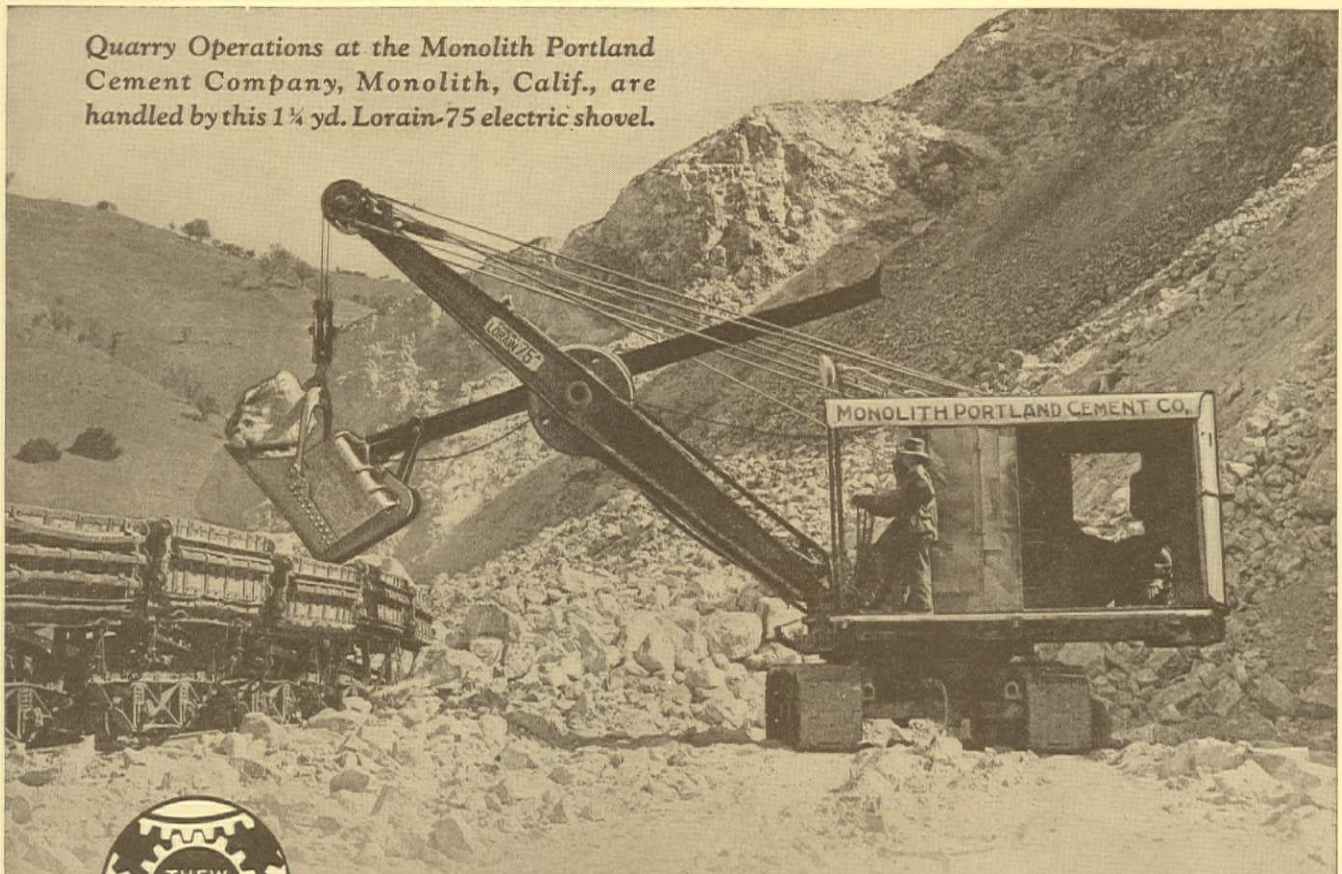
CHAIN BELT CO.,
731 Park Street, Milwaukee, Wisc.
Send me Catalogs on the mixers I've checked.

| | | | |
|---|---|---|---|
| ½-bag tilter | ☐ | 2- to 3-bag 14-S | ☐ |
| ½- to 1-bag 5-S | ☐ | 6-bag 28-S | ☐ |
| 1-bag 7-S | ☐ | 12-bag 56-S | ☐ |
| 1- to 2-bag 10-S | ☐ | 27-E Paver | ☐ |

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

REX MIXERS
(Reg. U. S. Pat. Off.)

★ LOCAL STOCKS JENISON MACHINERY COMPANY AND SERVICE ★




*Quarry Operations at the Monolith Portland Cement Company, Monolith, Calif., are handled by this 1¼ yd. Lorain-75 electric shovel.*

THEW CENTER DRIVE

HERE, rock is shot down from a 300 foot quarry face by tunnel blasts. Except in the case of occasional exceptionally heavy blocks, the rock is loaded without any secondary shooting whatever.

Large rock is picked up on top of the dipper, and eased into the cars, without a heavy drop, by a slight movement of the dipper stick.

Heavy loads, like this, are easily handled by the single motored Center Drive Lorain-75 shovel. This machine permits the operator to concentrate all the power of the electric motor on a single motion. At the same time it gives him accurate control of the dipper.

The performance of this 1¼ yd. Lorain-75 is typical of its service in quarries all over the country. Cutting the costs per ton of rock excavating, this machine has more than doubled its sales to quarries during the last year.

THE THEW SHOVEL COMPANY · *Lorain, Ohio*

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

**THEW LORAIN 55-60-75**

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

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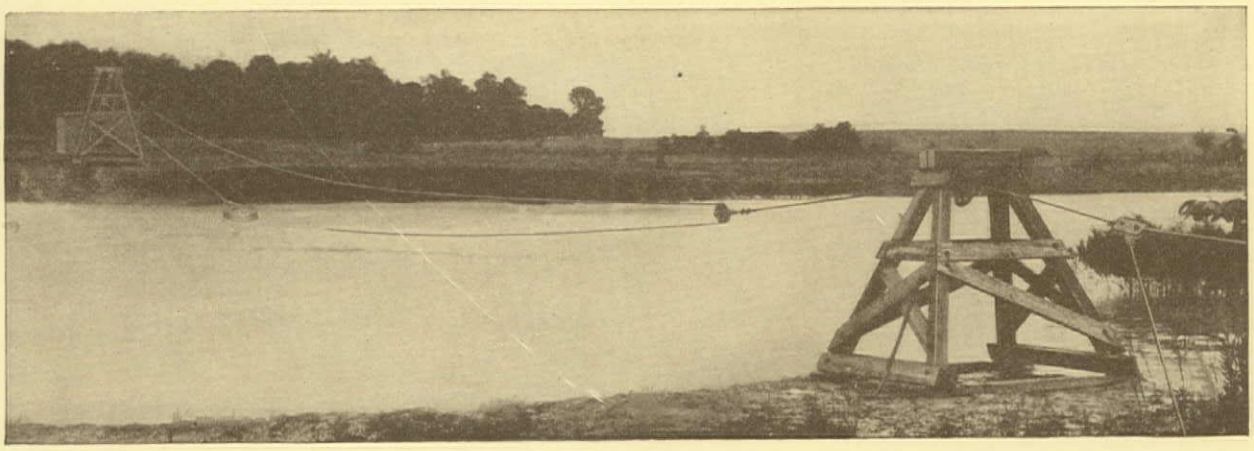
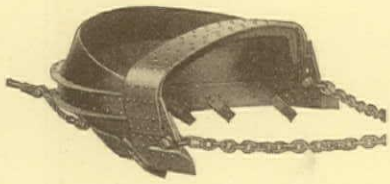


# No Water Lost---No Great Expense In Cleaning Out this Reservoir



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

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

WHEN the water storage reservoir of a Western industrial plant became clogged up with sediment, the engineers began looking around for some economical means of cleaning it out without sacrificing the water.

As a result of their study, they decided to use a simple Sauerman Drag Scraper installation with a head-tower mounted on trucks and an ordinary A-frame tail tower.

The Sauerman "Crescent" Scraper worked back and forth between the towers, digging and conveying the sediment from the bottom of the reservoir to a point on the bank without wasting the water or endangering the supply.

There was no great investment because the initial cost of the Sauerman Scraper was low. Operating costs were exceptionally small because the scraper requires one operator only and the wearing parts are few.

This same equipment can be used for many other jobs that come up in the general line of contracting work. There is a size of scraper to meet any capacity requirement up to 400 cu.yd. per hour.

Write for Drag Scraper Catalog No. 10. Ninety-six pages of useful information with illustrations of more than 100 excavating and material-handling jobs of different size and description handled by Sauerman Scrapers.

## SAUERMAN BROTHERS, Inc.

CHICAGO, ILLINOIS

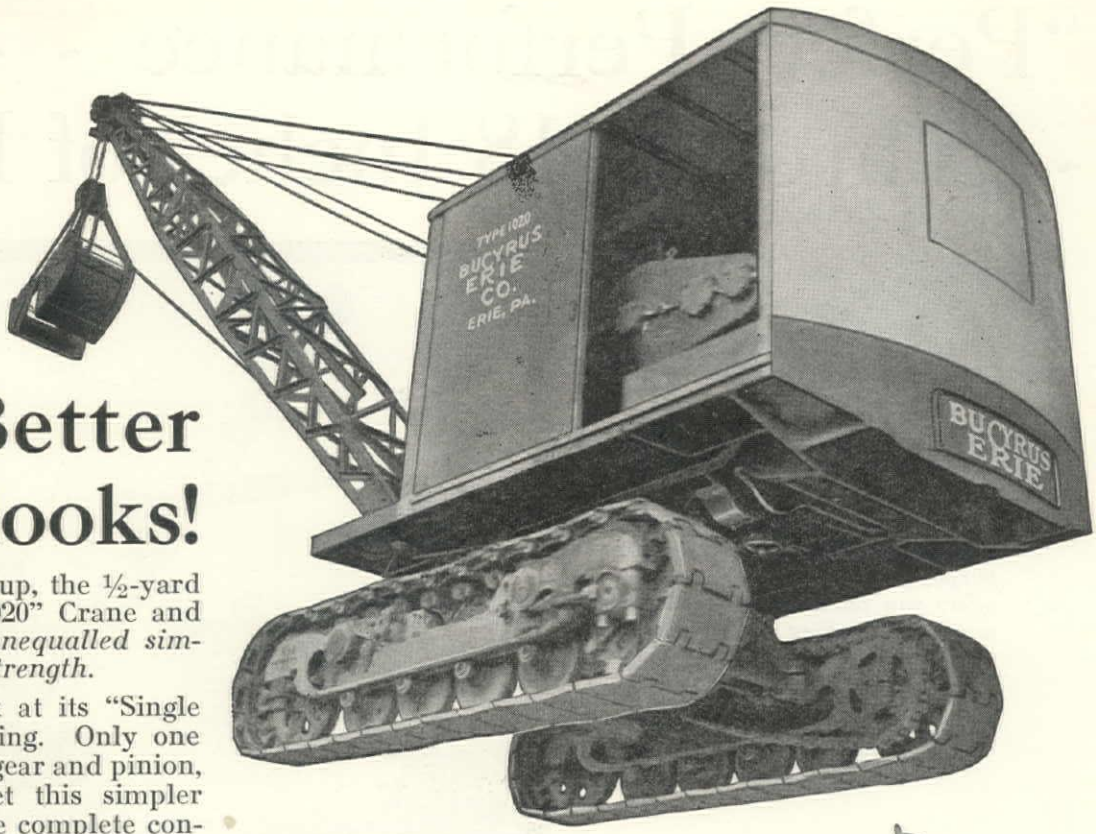
**Jenison Machinery Co.**
58 Fremont St., San Francisco

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

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

# SAUERMAN

★ LOCAL STOCKS JENISON MACHINERY COMPANY AND SERVICE ★



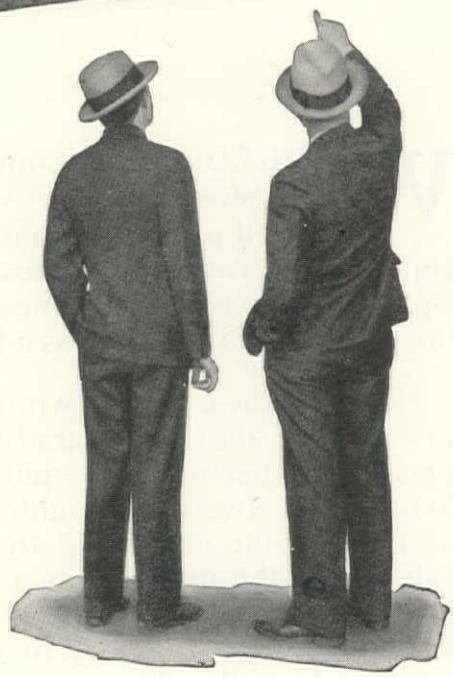

# Even Better than it looks!

FROM the ground up, the ½-yard BUCYRUS-ERIE "1020" Crane and Shovel shows you *unequalled simplicity* and *greater strength.*

For instance, look at its "Single Shaft Drive" mounting. Only one drive shaft, and one gear and pinion, below the deck—yet this simpler mounting gives more complete control than others! The operator can make sharp turns or gradual turns—can pivot right around in one spot if necessary—can set a brake to stop travel in either direction, while allowing free travel the other way.

This simpler and stronger construction is carried right through the machine—

It has a one-piece truck frame and turntable—it has larger and stronger shafts—anti-friction bearings on *all* high speed shafts—big oversize clutches, of the outside band type—gears, transmission, and boom hoist running in oil baths.



## A Standard of Reliability that you can't match in its size class—

In every detail, this ½-yard machine is built to the BUCYRUS-ERIE standard of Reliability—the "1020" has the same ruggedness, size for size, that you find in the 15-yd. BUCYRUS-ERIE shovel.

IT PAYS TO GET QUALITY when buying a small Crane or Shovel. Buy the machine that is *not built to sell at the lowest price, but to do the hardest work, and give the most continuous service.*

That's the BUCYRUS-ERIE "1020." Let us tell you more about this machine! Write us.

**BUCYRUS-ERIE COMPANY**

General Offices: South Milwaukee, Wis.

*Plants:* South Milwaukee, Wis.; Erie, Pa.; Evansville, Ind.
*Western Branch Office:* 989 Folsom Street, San Francisco, Calif.

Representatives:
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777 Merrill Ave., Los Angeles, Calif.
Clyde Equipment Co.
Portland, Ore.—Seattle, Wash.

BUCYRUS ERIE

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Adv. 764

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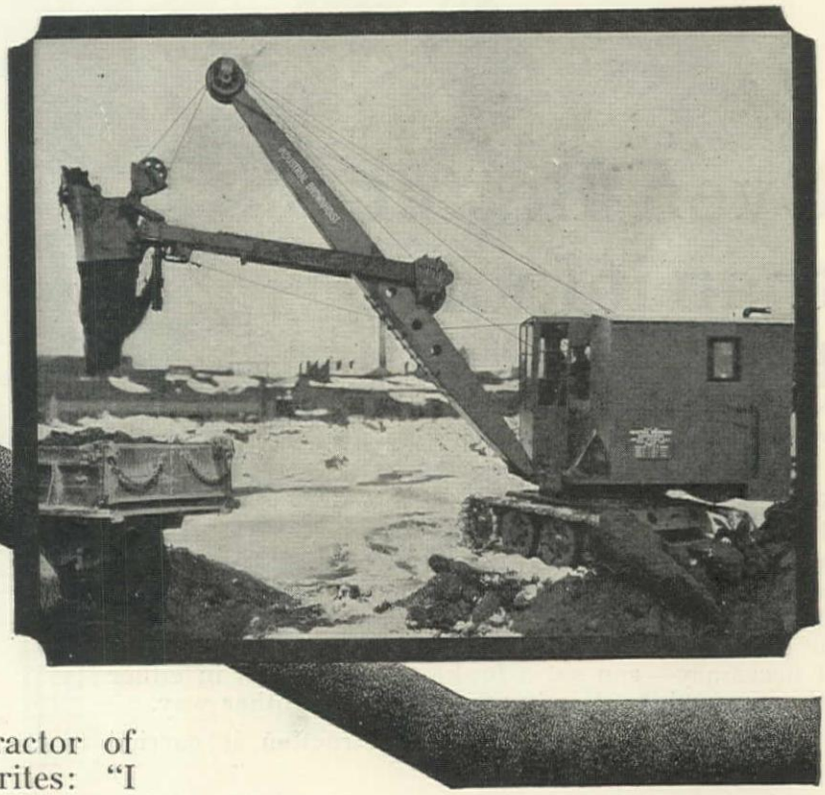

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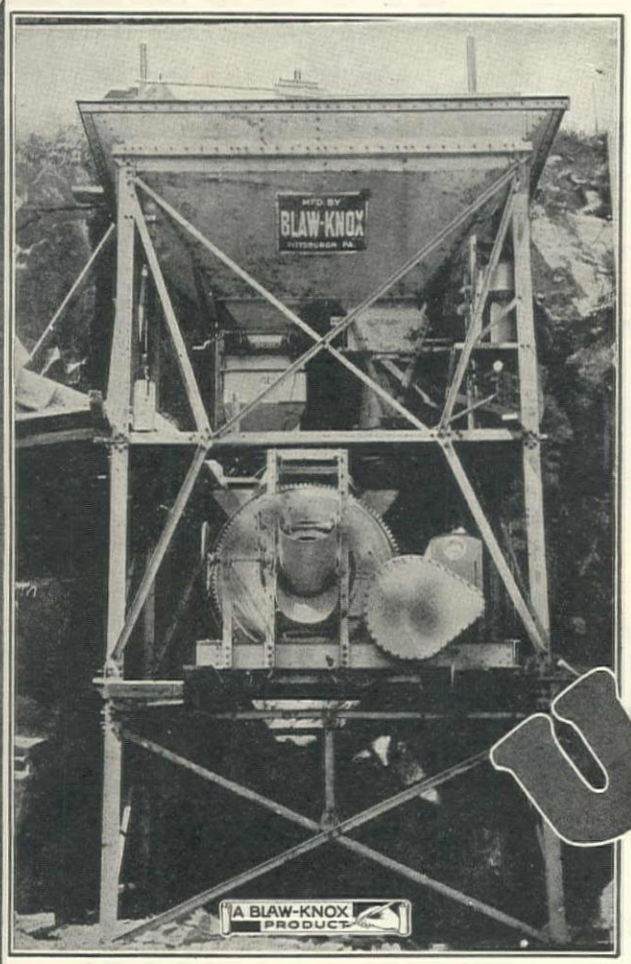


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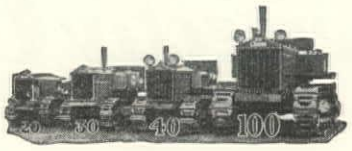

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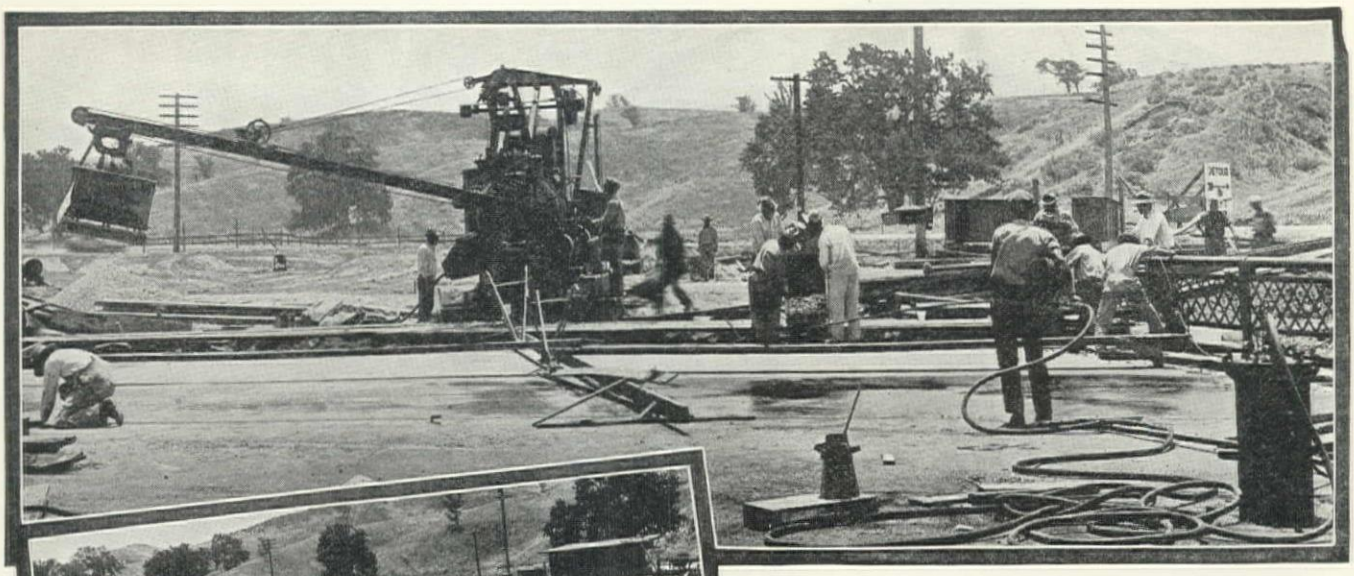

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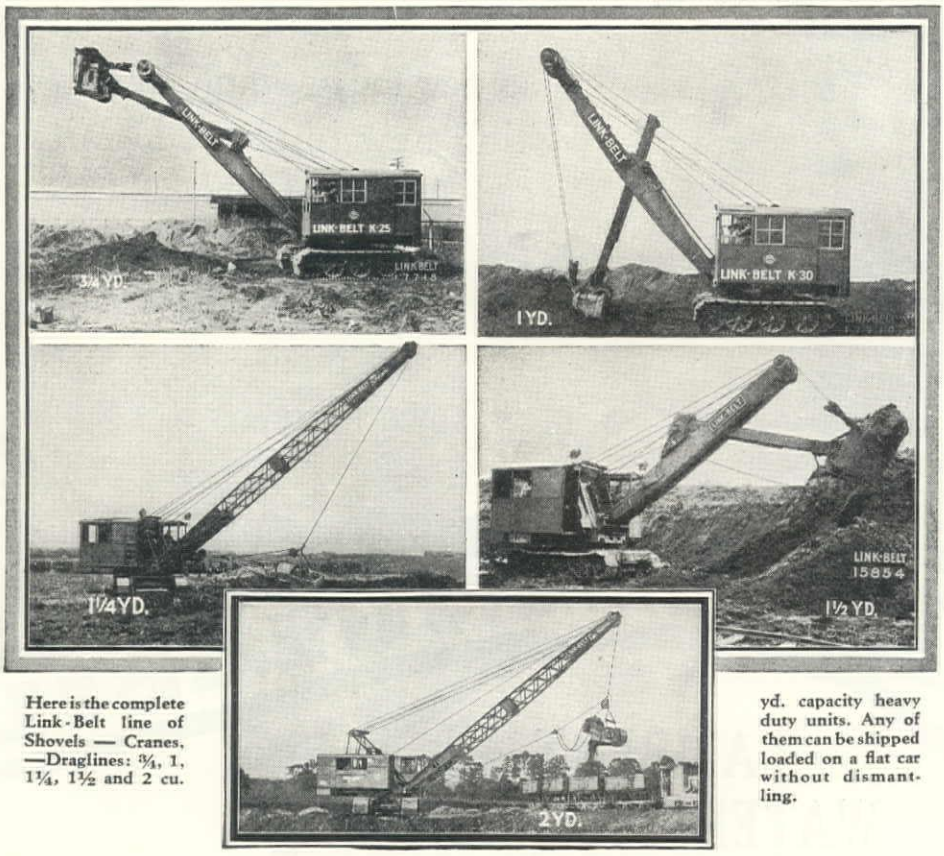


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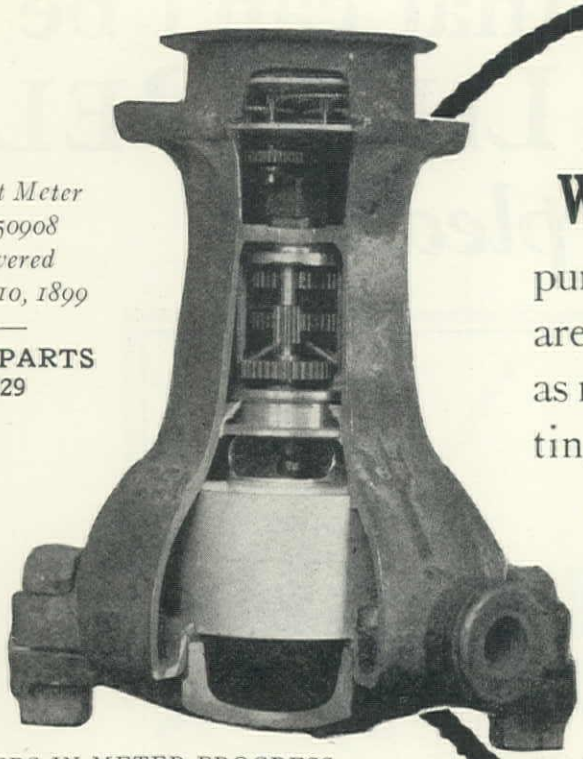

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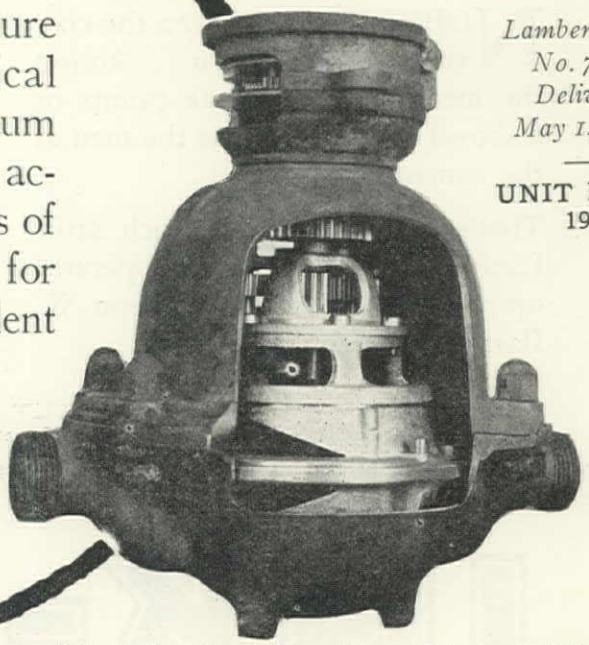

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VOLUME IV | OCTOBER 10, 1929 | NUMBER 19

The second annual meeting of the California Sewage Works Association, now in session (October 7 to 9) in Oakland, promises to surpass in attendance and in achievements the records set at the first annual meeting in San Bernardino in 1928 and the 1929 spring meeting in Fresno.

**Two Conventions**

The C. S. W. A. meeting is being held in conjunction with the thirty-first annual convention of the League of California Municipalities, which also should surpass all previous conventions. Much of the worth while municipal, county, and state legislation is formulated at these conventions.

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Donald M. Baker has outlined the new 'California Planning Act' in this issue. The act covers county, city and regional planning and makes it possible for municipal or county units, wherever the act does not conflict with existing freeholder charters, to establish commissions that will work for the orderly development of the area. These commissions are empowered to employ the necessary technical planning consultants and staff; they can do much to educate their people in the value and benefits of planning, the need of set-back building lines, and other progressive steps. With the new act they can do more than this, since means are provided whereby the improvements may be obtained. Other states in the Far West, it is hoped, will soon provide this type of legislation.

**A New Planning Era**

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It is anticipated that the new regulatory measures adopted by the last state legislature in California, will markedly reduce reckless driving and the rapidly increasing accidents on state highways and on the city streets. Every motorist holding a driver's license issued prior to August, 1927, has had to secure a new license by passing an examination which consisted of a questionnaire based on the 'rules of the road'; a check-up on his eyesight and other infirmities; and his previous 'record'. Although this questionnaire was not difficult to answer, it was couched in a manner to leave the 'rules of the road' firmly implanted in the memory of all motorists.

**Regulation of Automobile Drivers in California**

Hereafter any misdemeanor will be recorded on the driver's license of the offending motorist. Also, all highway traffic 'cops' will be under state control, and the highways properly policed to secure safe and sane driving and not merely to collect fines for county support, as frequently was the case in the past. The responsibility of the owner of a vehicle has been increased and there will be fewer minors permitted to drive.

Taken all in all, the new State regulations, together with improved highways and more safety signals, should do much toward a curtailment of the present trend toward reckless driving.

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The field of the city planner finds its ideal in a non-existent but projected industrial or residential community where all the important details of city layout, restrictions, and design may be arranged in advance. One of the first required improvements in an existing and unorderly city, the usual field for the planner, may be the relief of serious traffic-congestion centers, with the establishment of effective safety measures for pedestrians. Herein he specializes and becomes the city traffic engineer or the traffic consultant. We present in this issue the 'Traffic Control Plan for the Central Districts of San Francisco' by George D. Burr, city traffic engineer. This author analyzes the peculiar traffic situation of San Francisco, briefly describes the studies made to obtain working data for a new 'Market St. Plan', and explains the steps taken to improve conditions, both for vehicular and pedestrian rush-hour flow.

**City Traffic Regulation**

The San Francisco traffic problem was given to Dr. Miller McClintock, nationally-known traffic consultant, for solution. Beneficial results of the intensive study made by McClintock and by the city personnel delegated to work with him are now being felt. By progressive timing, an arrangement of vehicular control signals along a street so that their operation is not simultaneous on every intersection, it is theoretically possible for a through vehicle to maintain a low but continuous rate of speed. By vehicular traffic direction signs painted on the pavement at each intersection, both the driver and pedestrian are clearly shown the allowable turning movements at that point. The construction of safety islands at wide and irregular intersections decidedly improves the dual control, and increases the flow of vehicles and pedestrians. Separate signals for each type of traffic, vehicular and pedestrian, are found useful in the new San Francisco traffic system.

# Traffic Control Plan for the Central Districts of San Francisco

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

**Editor's Note**—George D. Burr was born in Minneapolis, Minnesota. He graduated from the University of Washington with the B.S. (CE) degree and subsequently received the professional degree of C.E. from the same university. He served in the World War from April 6, 1917, to December, 1918, in the successive grades of private, radio sergeant, and second lieutenant, and now holds a reserve commission as a captain of coast artillery. For 2 years Burr was employed by the city engineer of Seattle on street improvements. He was for 5 years in the King county engineer's office, Seattle, as assistant engineer on highways. For 3½ years he was employed under M. M. O'Shaughnessy, city engineer of San Francisco, as airport engineer in charge of location and development of the municipal airport. Since November, 1927, Burr has been the city traffic engineer of San Francisco.

Burr holds memberships in Sigma Xi and Tau Beta Pi, national honorary fraternities. He is the author of numerous articles in technical publications and of several bound bulletins on pavements, highway design and structures, and traffic control.

The traffic problem of today is not peculiarly a large city problem. Some of the smallest towns are suffering most acutely. Before the days of the Caesars, in fact from the time man first found means of transporting himself and his goods about on the backs of animals, this problem has existed in various degrees of intensity. What part is played in the problem by the mere presence of large masses of population in concentrated areas; development of great vertical height of buildings; concentration of business and industrial

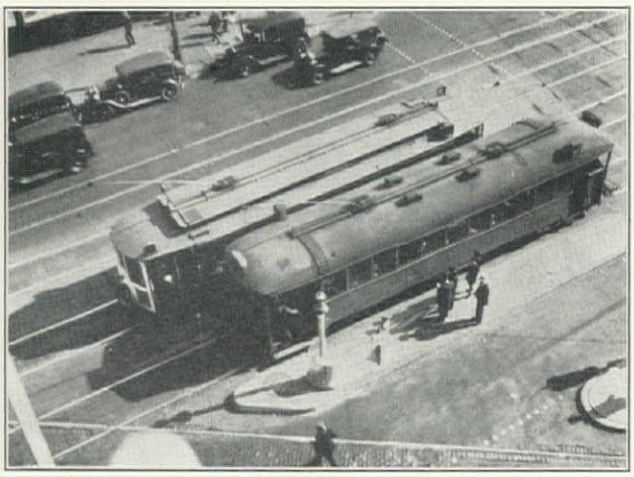

Fig. 1. Berthing of Two-Lane Street Cars at Safety Island With Inside Car 10 ft. to Rear. This Gives Safe Entry to Rear Platform of Inside Car

districts separated at material distances from residential districts; present practice of opening and closing practically all business at the same hours; existing economic structure that has created a large individual wealth and social custom which allows great individual freedom of movement; existing street and highway patterns which have more or less grown up without plan; and what part is played by the mere presence of a large number of motor vehicles, is difficult to state. A complete solution of the problem must have some bearing on each of these factors. Many of these factors are substantially beyond present reach and are hedged about with great difficulties.

The concrete problem now presented to traffic engineers is to ascertain the source, destination, and volume of traffic; to provide safe means of rapid circulation; and to furnish terminal storage and loading facilities. The most aggravating portions of the existing difficulties are: first, to adapt existing streets to types of vehicles and volumes of traffic for which they were not designed; second, to solve the terminal storage and loading enigma; and third, to cut down the heavy accident toll. All of these difficulties, as well as the many other underlying factors in the problem, are closely interrelated. The problem of movement in the central districts is also closely related to that in the outlying urban districts and, again in turn, is materially affected by rural traffic routes.

The entire subject is too broad to treat in its many ramifications in any short space. I will confine this discussion to the adaptation of existing streets in the central district of San Francisco to the demands of modern traffic. The solution of the difficulties encountered in this city may assist other communities in finding a relief from their own conditions.

**The Market Street Problem**—As defined by law, the 'Central Traffic District' in San Francisco is bounded by and includes Sixth st. from Mission to Market st., Taylor st. from Market to Sutter st., Sutter st. from Taylor to Grant ave., Grant ave. from Sutter to California st., California st. from Grant ave. to Market st., Market st. from California to First st., First st. from Market to Mission st., and Mission st. from First to Sixth st. However, in a broader sense, it includes the area bounded by Van Ness ave., Howard st., California st., and The Embarcadero.

San Francisco's peninsular location, and consequent few means of outside communication by land, has caused this central district to grow up on the extreme eastern edge of the city. The town map of 1847 was bounded by Montgomery st. (which was then the waterfront), Mason, Green, and Post st. The growth of the city has been westward to the ocean, and, in recent years, southerly down the peninsula. This peculiarity has caused the bulk of traffic entering and leaving the congested district to come from and go to the west. The average American city is built like a wagon wheel with the central district as the hub and the entering traffic arteries radiating in all directions. The fact that such a large volume of San Francisco traffic centers from one direction, places an unusually heavy demand on the east and west streets leading from the central district.

There is an additional topographic difficulty in the many hills in the city, three of which rise to a height of over 900 ft. These hills limit and define the traffic

*Associate Member, American Society of Civil Engineers.

arteries, particularly for street car transportation. The hill just northerly from the central district rises from an elevation of 92 ft. at Sutter and Powell st. to 275 ft. at California and Mason st., with street grades ranging from 17 to 24%. There are, therefore, but a limited number of streets which can carry heavy traffic.

Each business day sees in excess of 1,000,000 persons, and 250,000 vehicles of all types, enter or leave the central business district. Of this number of vehicles, 21,600 are street cars and 200,000 are automobiles and trucks. Freight is hauled almost exclusively by auto truck. However, as far as people are concerned, 25% arrive by automobiles, 30% walk, and 45% arrive or leave by street car. Of the total number of persons entering the district daily, 120,000 pass through the Ferry Building. Of the 21,600 street cars entering and leaving the district during the business day, 9000, or 42%, use Market st.

The block pattern of the central district and the many instances of inadequate street widths also have materially complicated the problem. The area north of Market st. is made up of approximately uniform blocks 412.5 ft. long and by streets 68.75 ft. wide in the east and west direction, and by blocks 275 ft. long in the north and south direction separated by streets 68.75 ft. wide. This makes blocks 481.25 by 343.75 ft. between street center lines.

The area south of Market st. is made up of approximately uniform blocks between First and Eighth st., 825 ft. long and separated by streets 82.5 ft. wide in the east and west direction, and 550 ft. long, separated by streets 85 ft. wide in the north and south direction; making blocks 907.5 by 632.5 ft. between street center lines. South of Market st. from The Embarcadero to First st., the blocks are 357.5 by 632.5 ft. between street center lines, and from Eighth st. to Van Ness ave. they are of varying length.

These two districts are separated by Market st. which is parallel to those east and west streets to the south but cuts diagonally through the block pattern to the north. The streets intersecting Market st. from the north and south bear no apparent relationship to one another. From The Embarcadero to Van Ness ave., a distance of nearly two miles, they form 25 independent intersections, through 13 of which a vehicle may cross Market st. Of these 13, only 5 lie within the central traffic district as defined by ordinance, making an average distance between cross streets of

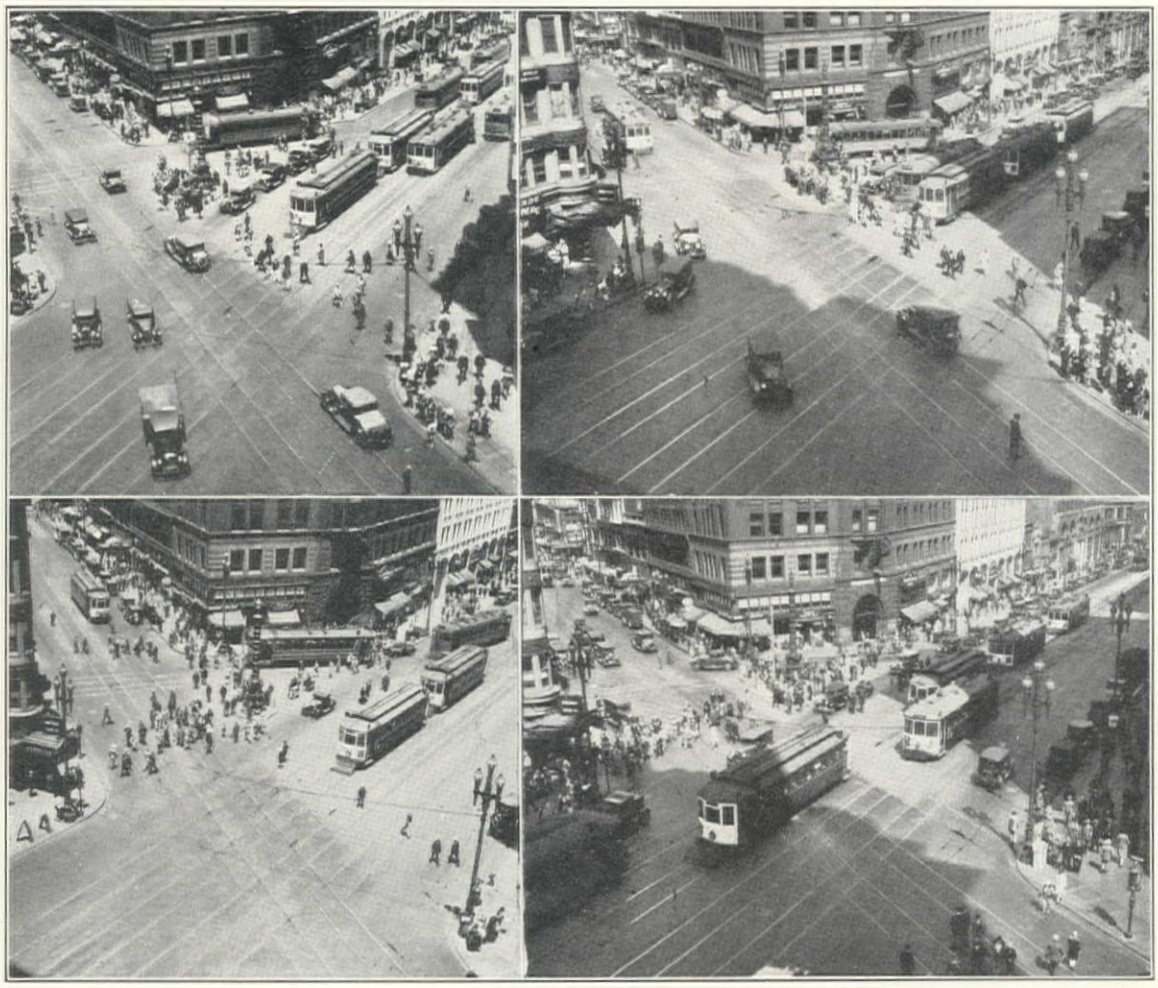

FIG. 2. (UPPER LEFT) CROSS TRAFFIC FLOWING AT INTERSECTION OF MARKET, THIRD, GEARY, AND KEARNY ST. BEFORE 'MARKET ST. PLAN' WENT INTO EFFECT. ONLY ONE TRAFFIC LANE PASSES LOTTA'S FOUNTAIN BECAUSE OF PEDESTRIANS STANDING IN ROADWAY. POOR PEDESTRIAN CONTROL ON ALL CROSS WALKS. (UPPER RIGHT) CROSS TRAFFIC FLOWING PAST SAME INTERSECTION AFTER 'MARKET ST. PLAN' WENT INTO EFFECT. LOTTA'S FOUNTAIN HAS BEEN MOVED BACK OUT OF PEDESTRIAN LANES AND A SAFETY ISLAND HAS BEEN CONSTRUCTED FOR PEDESTRIANS. TWO LANES OF NORTHBOUND TRAFFIC MAY NOW PASS. PEDESTRIAN CONTROL IS IMPROVED. LOWER LEFT) MARKET ST. TRAFFIC FLOWING PAST THE SAME INTERSECTION BEFORE 'MARKET ST. PLAN' WENT INTO EFFECT. FOUNTAIN IS DIRECTLY AT THE INTERSECTION OF TWO PEDESTRIAN LANES AND PEDESTRIAN CONTROL IS POOR. (LOWER RIGHT) MARKET ST. TRAFFIC FLOWING PAST SAME INTERSECTION AFTER 'MARKET ST. PLAN' WENT INTO EFFECT. FOUNTAIN HAS BEEN MOVED BACK TO LEAVE BOTH PEDESTRIAN LANES UNOBSTRUCTED AND PEDESTRIAN CONTROL HAS IMPROVED. PEDESTRIANS NOW STAY BACK OF CURB WHILE WAITING FOR 'GO' SIGNAL

1000 ft. This has led to congestion on the few cross streets available. Each of the 25 intersections differs from all the others in its irregularities.

The manner in which Market st. intercepts the available east and west traffic arteries; its low grade; its 120 ft. of width; and its termination at the Ferry building through which the commuters from the eastern side of San Francisco bay and those who arrive by train from the east and north all pass, make it the principal artery for street-car travel in the city. It also has the highest front-foot property values of any street in the city. This stresses its utility as a retail business street. During a 12-hr. traffic day, in excess of 6000 street cars traverse this street from Sutter st. to The Embarcadero. To care for the large rail movement four tracks are required.

**Organization to Solve the Problem**—The impetus to improve traffic conditions in the central district came from the appointment by the mayor of a citizens traffic survey committee who retained Miller McClintock to prepare a report on the street traffic control problem in San Francisco. The peculiar organization of the municipal government, and the many city departments and several private organizations involved in carrying out any proposed plan for relief, led to formation of the so-called 'Traffic Law Enforcement Board'. This board is composed of the chief of police, captain of traffic, chief of the department of electricity, district attorney, police judges, coroner, chairmen of the traffic and finance committees of the board of supervisors, editors of the four newspapers, representatives of the California State Automobile Association, representatives of the citizens traffic survey committee, and the city traffic engineer. Action of this board is based on recommendation of its subcommittees.

For the solution of the problem in the central traffic district, a subcommittee of five was appointed. This is composed of the city traffic engineer, captain of police traffic bureau, engineer of the California State Automobile Association, chief of the department of electricity, and engineer of the citizens traffic survey committee. This subcommittee, after six months' intensive study, published a report on the 'Market Street Control Plan'. After adoption by the traffic law enforcement board, the several city departments under whose jurisdiction the work fell, did the construction. This same subcommittee, after an additional six months of study, published a supplemental report on signal timing.

**The Market Street Plan**—Due to the regularity of the districts north and south of Market st., no special planning or reconstruction has there been necessary. Although each of these two districts is distinctly different, each is fairly regular in itself. Therefore, the bulk of the subcommittee report deals with the method of control for the key artery—Market st.

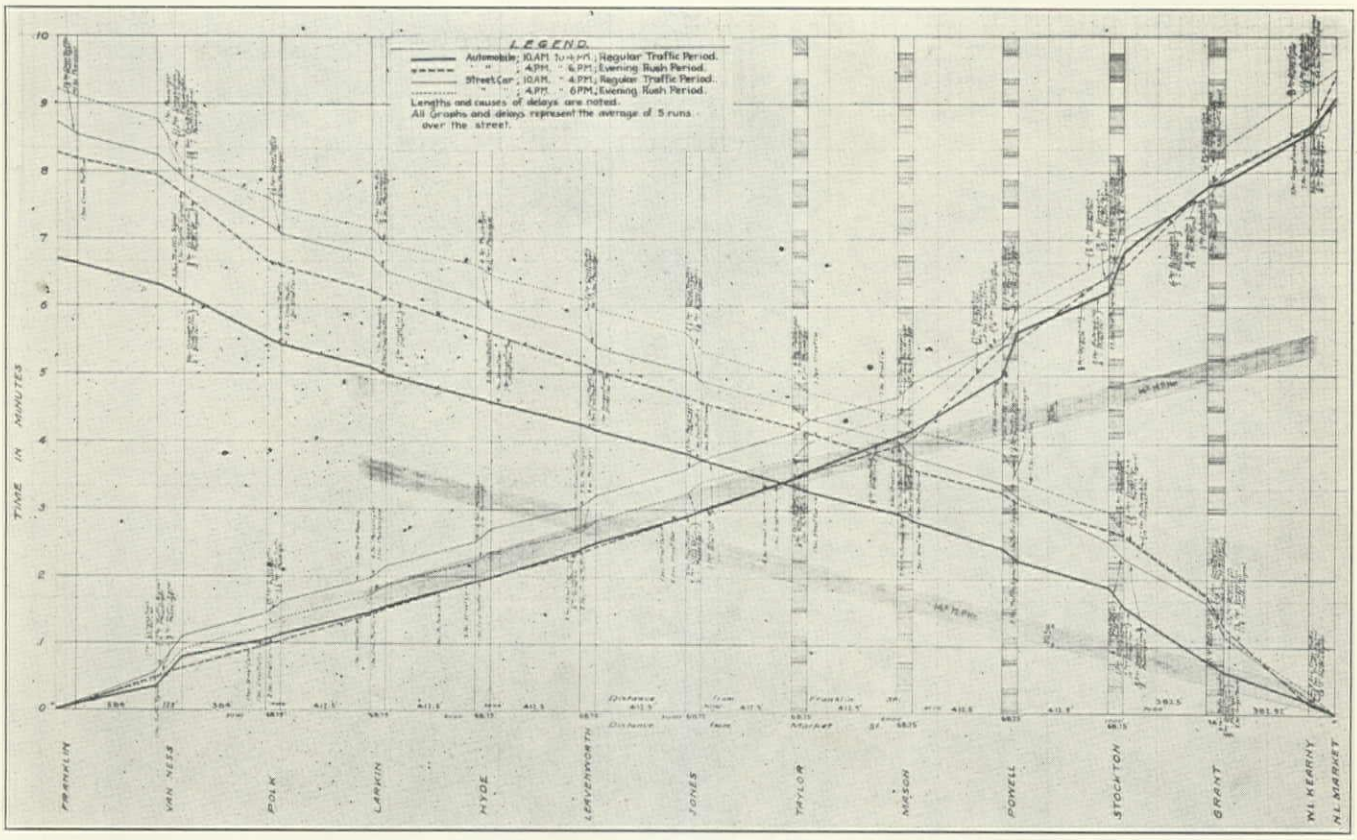


FIG. 3. SPEED STUDY ON GEARY ST. BROAD, STRAIGHT SHADED LINES REPRESENT IDEAL CONTINUOUS FLOW OF TRAFFIC AT SPEED OF 14½ M.P.H. WITH PROGRESSIVE TIMING OF NEW SIGNAL SYSTEM

The streets of the district north and south of Market st. are in some instances badly congested. This congestion is at present caused by two primary factors, the parked automobile and the poor routing of street car lines.

The traction problem of the city and county of San Francisco is complicated by the existence of two competing organizations. The Municipal Railway operates an efficient system, but is greatly handicapped in its routing by the existence of franchises given to the

Market Street Railway Co. over sections of streets that should be used for loops. The Market Street Railway and California Cable Railway still operate obsolete cable car lines on Jones st. and O'Farrell st.; these lines materially obstruct traffic. Until the various lines can be brought under unified control, satisfactory movement of traffic in the central district and on Market st. will not be completely attained.

Fig. 4. Pedestrian Signal on Left and Control Box for Intersection on Right

The problem of the parked automobile is most vexing. A system of painted loading zones and marked curbs adjacent to each corner has been installed to keep them clear. This system has reduced double parking to an absolute minimum. In the near future it is planned to eliminate all parking during the rush hours of morning and evening, so as to allow peak traffic to move more freely. However, both of these steps are but temporary expedients. Eventually automobile parking or even loading at the curb will have to be discontinued. Streets are primarily designed and set aside for moving traffic. Temporary storage and terminal loading facilities soon will have to be provided within the buildings served, if our present intensely concentrated business districts are to endure.

The 'Market Street Plan' considers the present fact that the Ferry Building is the principal attraction for the heavy street car load on the easterly end of that street. A new bridge, which will probably terminate several blocks to the south of Market st., connecting Oakland and San Francisco, soon will be built. Its construction will cause a material alteration in the street car traffic characteristics of Market st., and of the character of control required.

In approaching a solution to the problem on Market st. itself, the principal loads on the street are pedestrians and street cars. Automobile traffic along the street is not only much smaller in importance but also much less in amount. Therefore, first consideration was given to pedestrians and street car traffic.

**Speed Studies**—Speed studies were undertaken on Market st. and the principal tributary streets. Traffic studies were made on typical weekdays and were segregated as to time of day into morning rush traffic, regular morning traffic, regular afternoon traffic, evening rush, and theatre rush. Five counts were made over a given street in one direction during the same time of day, but on different days. The time was noted at each side of every intersection as was the cause and length of all delays. The time of the five counts and of the causes of delay at each point were averaged, and the average was plotted on the time-distance curves as shown for Geary st. on Fig. 3. On Market st., separate curves were plotted for the Market Street Railway, Municipal Railway, and automobile traffic lanes.

Eliminating those causes of delay which could be removed, gave the rate of speed that might be reasonably expected with proper control. Based on this information, a 45 to 55-sec. cycle was chosen for the district north of Market st. Similarly, a 60-sec. cycle was chosen for the south of Market st. district, and a 74 to 90-sec. cycle was selected for Market st. The range in cycle length is used to accommodate traffic to changing traffic volume and speed throughout the day.

A study of the Geary st. timing diagram shows the characteristic street-car time-distance curve, with rapid

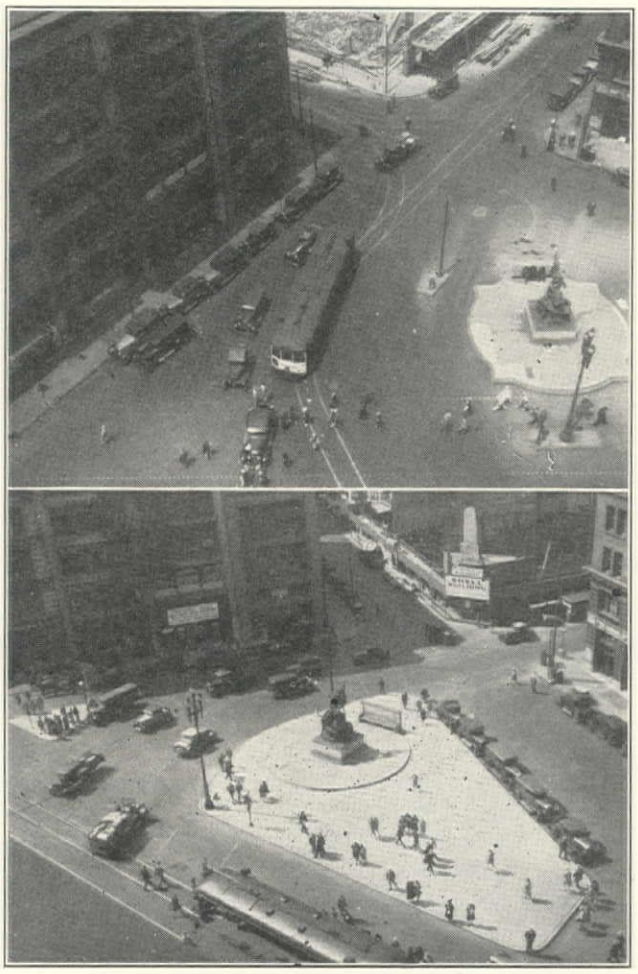

Fig. 5. (Upper) Cross Traffic Flowing at Intersection of Market, First, Bush, and Battery St. Before 'Market St. Plan' Was Put Into Effect. Although Intersection is Signalized, There is Little Control Over Pedestrians. Hazardous Islands Endanger Vehicles and Cause Them to Scatter Badly. Only One Lane of Traffic Gets Through in Each Direction. (Lower) Same Intersection After Plan Was Put Into Effect. Two Adequately Protected Safety Islands Allow Two Lanes of Traffic to Move Easily in Each Direction and Permit Good Control of Both Vehicles and Pedestrians, Reducing All Movements to the Simplicty of Those at a Right-Angled Intersection

mid-block movement, and with low speed at intersections due to passenger loading. By such speed studies, the correct average speed for which signals may be

set can readily be determined. The great slowing down of traffic between Powell and Market st. was chargeable primarily to the fixed 72-sec. cycle on which the street formerly operated. This resulted in the large signal delays noted on the chart.

**Detailed Plan**—The plan prepared for Market st. showed in detail the location, direction of indication, and angle of spread of beam for each traffic and pedestrian signal; the location of each pedestrian cross walk, safety zone, painted traffic lanes and direction arrows; the 'no left-hand turn' regulation; the position

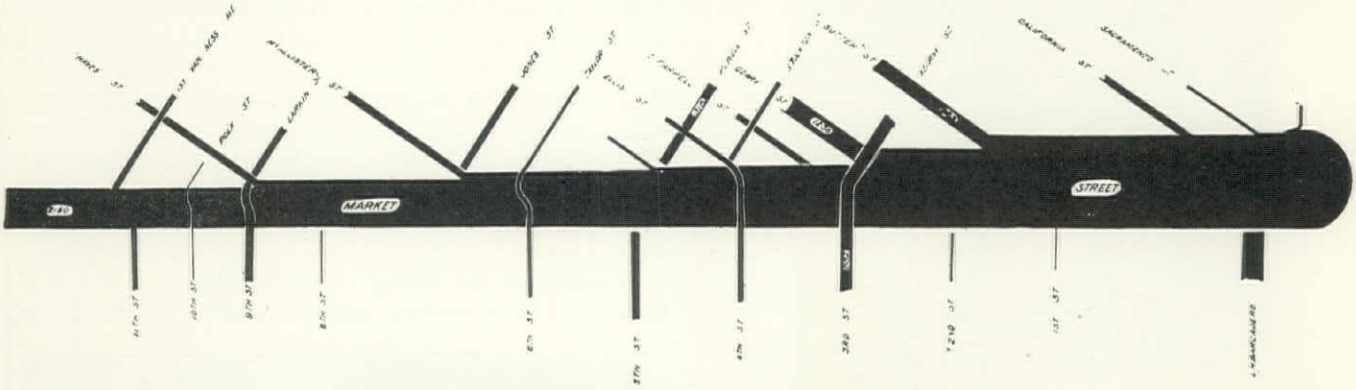


FIG. 6. STREET CAR FLOW DIAGRAM FOR MARKET ST.

of each street car stop; the location of each raised concrete pedestrian island and of each warning beacon.

**Signals**—As yet certain signals on Market st. are not timed as called for. This is due to incomplete work on timing devices and the defect will be remedied on completion of the necessary equipment.

The pedestrian signals are an innovation in traffic control. These signals mark the ends of each cross walk at every signalized Market st. intersection, thus giving a clear indication, entirely separate from the vehicular signals, of the time when a pedestrian may cross the roadway. These signals are justified for two reasons. First, the 120-ft. width of Market st., its four street-car tracks, and the great lengths of the cross-walks at the gore intersections on the northerly side of the street, make clearance intervals of about 15 sec. necessary to allow the last pedestrian leaving the curb an opportunity to reach the far side of the roadway. Such long clearance intervals would not leave enough 'go' period remaining out of the cycle to permit the existing volume of vehicular traffic to pass through the intersection. The necessary clearance period for pedestrians is obtained by stopping them with the pedestrian signal before vehicular traffic is stopped. Second, due to the irregular shapes of the intersections, pedestrians are unable in many instances to get proper indications from the vehicular signal as to when to go and when to wait.

**Pedestrian Safety Island**—The pedestrian signals have proved effective in securing control of, and thereby protecting, this most vulnerable element of traffic while it is in the roadway. When it is considered that 70% of all those killed in traffic accidents within this city are pedestrians, the importance of protecting them may be appreciated. In San Francisco, by stressing pedestrian protection, we have been able to reduce our traffic accident rate relative to population, to the lowest of any city in the United States, with one exception. Relative to automobile ownership, we have reduced this pedestrian accident rate to the very lowest of any city in the United States.

In some instances there were unprotected crosswalks as long as 300 ft. at gore corners. Such conditions not only exposed pedestrians to vehicular traffic hazards but made intersections of such length that too long vehicular clearance periods were required. These large irregular intersections were of such a nature that a motorist entering them had no clear idea what was expected. To overcome these difficulties, pedestrian islands were constructed in the longest gore corners. Such an intersection is shown in Fig. 5.

These islands have proved most effective and useful. However, after dark they would present a hazard to

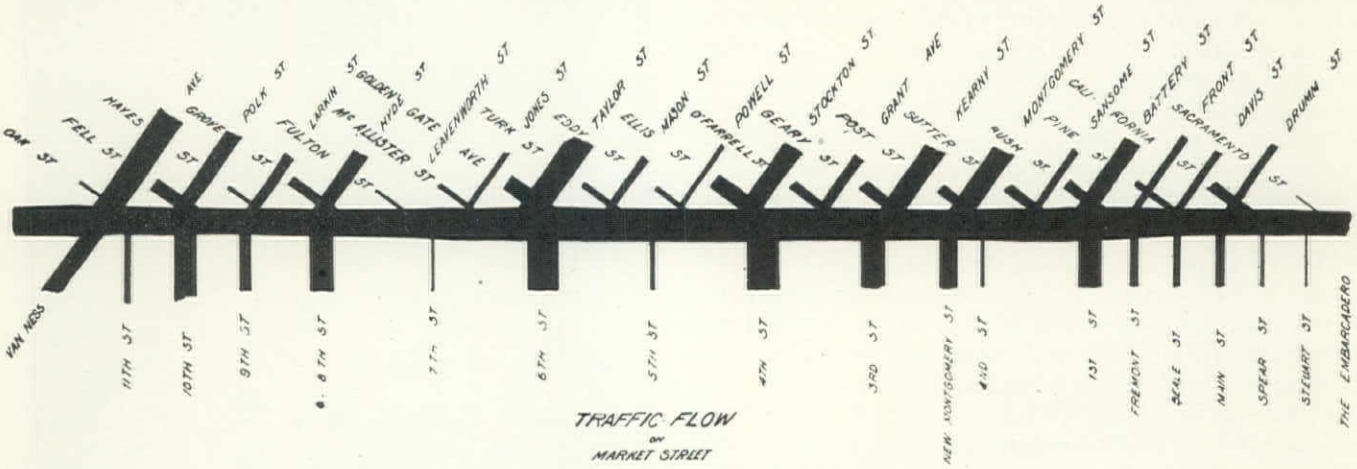


FIG. 7. TRAFFIC FLOW DIAGRAM FOR MARKET ST.

vehicular traffic if they were not adequately protected by lighting. Although Market st. is brilliantly illuminated by street lighting, store front illumination, and advertising signs up to 12 o'clock at night; and traffic signals curb excessive speeds up to such time, after that hour two-thirds of the street lights and substantially all store front illumination and advertising signs are turned off. Signals are also shut down at that hour. The street is then comparatively dark and is open for high-speed travel. Therefore, a flashing yellow beacon and steady floodlight mounted on a substantial concrete base was placed on each exposed

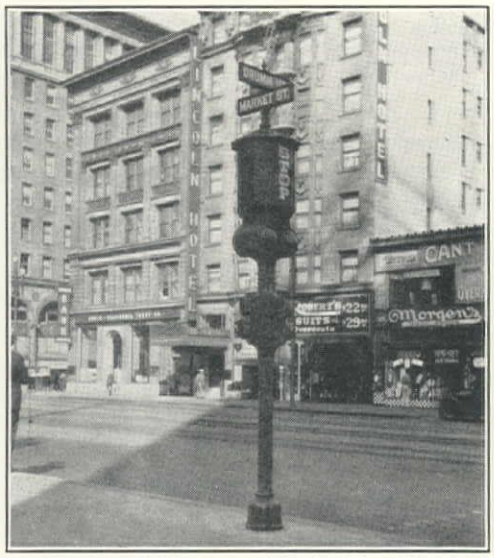


Fig. 8. Combination Vehicular and Pedestrian Signal. Vehicular Signal Given by Red and Green Lights and by Visible Word, Pedestrian Signal Given by Red and Green Lights

island and on the end of each raised concrete safety zone used for street-car loading. The beacon head is mounted at a sufficient elevation to be seen over the top of any vehicle immediately in front of another. The floodlight not only illuminates the beacon post but also brightly floodlights an area 60 ft. in diameter. The beacon head is also sufficiently visible in the day time to act as a warning to the auto behind, even if the auto in front suddenly swerves to one side.

These beacons employ the principle that should be used generally on traffic warnings and signs. There should be a flashing light to attract attention to the point of danger and a steady light to show the nature of that danger. A flashing light alone is not sufficient, as it is difficult to ascertain its distance away, or the nature of the danger, or the obstacle. The heavy construction of the beacon base provides material protection for pedestrians relying on the island for safety. These islands, beacons, and curb set-backs were constructed by myself under the direction of M. M. O'Shaughnessy, city engineer.

**Curb Set-Backs**—Traffic signals indicate when a vehicle may move, but do not indicate what may be done or where it may be done, and cannot provide space or avenues for moving traffic. They are, therefore, quite limited as tools to assist in solving the traffic problem. New physical construction or reconstruction is the most potent weapon available for relieving traffic congestion and eliminating traffic hazards.

At seven important Market st. intersections minor curb set-backs and reconstruction work was undertaken, with the result in each instance that a new traffic lane was added. In most cases this increases by 100% the capacity of the intersection to move traffic over these cross streets in the one direction affected.

At the following Market st. intersections curb moving projects over vault space are called for under the plan but have not yet been constructed: southeast corner of New Montgomery st.; southeast corner of Third st.; northeast corner of Stockton st.; northeast corner of Taylor st. Detailed plans are now being drawn in the city engineer's office for this work.

**Channels for Traffic**—One of the least expensive, and at the same time most effective means of increasing the capacity of an intersection or street, is by channelizing the traffic. Definite lanes for the movement of vehicles were painted on the pavement surface, and direction arrows and signs were painted to indicate the movements which might be made at important intersections. At the intersection of Drumm, California, Main, and Market st. the capacity of the intersection for cross traffic was increased 100% by this means alone.

In making channel plans, care must be exercised to allow ample width of traffic lanes, and for widening of curves of these lanes. Ten feet may be considered the width of the standard traffic lane and nine feet as the minimum width to be permitted. The marking of cross walks is also important from two points of view as it promotes safety by giving the pedestrian a cer-

Fig. 9. Detail of Vehicular Warning Beacon on Safety Island at Intersection of Market, Eigheh, Grove, and Hyde St. Control Boxes House Meter, Switch, Fuses, Flasher, and Relay to Street Lighting Circuit. Combination Traffic Eignal, Pedestrian Signal, and Street Name Sign in Background by Statue

tain place to cross the street and provides a definite point at which approaching vehicles shall be halted when the signal indicates 'stop'.

**Street-Car Stops**—There were many instances where far-side street-car stops on car lines crossing Market st. were causing congestion of traction traffic on Market st. itself by keeping automobiles from clearing the intersection until after the Market st. traffic was released. These objectionable street-car stops were removed and the transfer privilege was extended to one block away from Market st.

# SEDIMENTATION OF SEWAGE*

By A. M. KIVARI
*Pacific Coast Manager, The Dorr Co.*

Sedimentation is employed so extensively in sewage disposal plants that engineers and operators are more or less familiar with the results obtained. The purpose of this paper is to discuss some of the principles involved.

Sewage has been described by the American Public Health Association as 'wash water and water-carried animal, culinary, and, in some cases, industrial wastes'. If the sewage is allowed to remain in a state of quiescence for a limited time, gravity will be the controlling factor and the settleable solids will gradually drop, the heaviest particles first, the lighter particles more slowly. The degree of clarification will depend upon the settling characteristics of the individual particles, the character and strength of the sewage, temperature, and time. In practice, the sewage flow is usually continuous and the purpose of the sedimentation tank is to retard the flow sufficiently to permit settling and collection of the solid particles. The usual procedure is to give the flow a pre-determined detention period, depending upon the purification desired. However, operating data from numerous plants show that there is no fixed relationship between these two requisites, covering all conditions. The percentage of removal of solid matter with different sewages, with the same detention period, varies appreciably, depending upon the settling characteristics of the solids, current velocity, shape of the sedimentation tank, and the overflow rate.

Consider a condition where a sufficiently satisfactory effluent can be produced with a one-hour detention period. The overflow rate with this detention should be known. By 'overflow rate' is meant the depth to which the solids will settle in one hour, leaving above the desired quality of effluent. By designating the overflow rate as O, the volume of the tank necessary for sedimentation as V, and the area as A, there results the formula $V = OA$, the volume being equal to the overflow rate times the area.

To further illustrate the point, assume a flow of 46,500 gal. or 6200 cu.ft. in one hour, and that a sedimentation tank is desired for this flow, with a one-hour detention period, the overflow rate being 6 ft. Using the formula $V = OA$ or $A = \frac{V}{O}$, then $A = \frac{6200}{6}$ 1033 sq.ft. If a square tank is used, the requirements would be satisfactorily fulfilled with a 32-ft. square tank, and a water depth of 6 ft., provided that suitable removal of the deposited solids is available. It is obvious from the above that there would be no object in having the tank deeper than 6 ft., or equivalent to the overflow rate, for the detention period given.

To again illustrate how this works, assume that for the above flow of 6200 cu.ft. per hour, there is used a tank 25 ft. square, with a water depth of 10 ft. In each case, the volume of the tank is the same, 6200 cu.ft. Substituting in the formula, the volume for sedimentation is $V = OA$, or $6 \times 625 = 3750$ cu.ft., although the tank was designed for 6200 cu.ft. per hour. Four feet of the depth is serving no purpose for sedimentation, because the overflow rate has been exceeded by this amount. Instead of getting a one-hour detention, there is actually only 60%, or 36 minutes, for the given flow. Conversely, in order to get the same detention, and consequently the same clarification, this tank can handle only 60% of the given flow.

Calculating such a problem as this on paper is comparatively simple, but in actual practice, conditions are more complicated. It is not uncommon to see peak flows in activated sludge plants, when the settling characteristics were near zero, and the overflow rates should have been the same. The point is, that in order to get the maximum capacity out of a sedimentation tank, its depth should not exceed the overflow rate for the given detention period. Area is the controlling factor, and not detention. As shown above, the 32-ft. tank would give the same clarification in 36 minutes that the 25-ft. tank would give in 60 minutes. The most efficient sedimentation tanks are designed with low overflow rates, so that the quality of the effluent is not impaired by fluctuations in the settling characteristics of the solids.

The introduction of the feed to the sedimentation tank is of the utmost importance, and if improperly arranged, poor removals may result, even if the tank is otherwise well designed. In square tanks, the feed should be uniformly distributed at one side, and at a low velocity, so that no unusual disturbances are created.

It is generally conceded that the best results from sedimentation tanks are obtained by introducing the feed on one side of the tank with uniform distribution and letting it flow the longest distance at the lowest possible velocity across the tank, so that the finer particles may settle. In order to bring this about, and bearing in mind overflow rates, experience in sedimentation indicates that shallow tanks, substantially square, give the best results. The bottoms of these tanks have a slight slope toward the center, so as to form temporary storage for the settled solids. A mechanism known as a 'clarifier', is placed in the tank and so constructed that in rotating, sludge that will not flow to the central discharge point, deposits on the bottom. The action of the blades in passing through the sludge results in reducing its moisture content.

The relationship between settleable and suspended solids and biochemical oxygen demand is of interest. At five plants using Dorr clarifiers for sedimentation of raw sewage, analyses of 24-hour composite samples showed a uniformly high percentage of removal of settleable solids, ranging from 93.3 to 98.5. At the same time, the degree of removal of suspended solids varied from 43.6 to 76.1%, the differences being largely due to varying character of the sewage. Generally speaking, the stronger the sewage, the higher the percentage of removals. At all of the plants there was a reduction in the biochemical oxygen demand through the clarifier, the figures averaging from 13 to 35.7%, although at one of the plants the reduction was as much as 52.8% during one day. This reduction, however, does not always follow the reduction in suspended solids.

*Paper presented before the sanitary engineering section, School of Citizenship and Public Administration, short course, University of Southern California, Los Angeles, June 19, 1929.

# California Planning Act

## *A Review of Its Provisions and Possibilities*

By DONALD M. BAKER*

*Consulting Engineer, and President, Board of City Planning Commissioners, Los Angeles, California*

**Editor's Note**—Donald M. Baker was born in Poway, San Diego County, California. He graduated from the college of engineering of the University of California in 1913. From 1913 to 1916 he was assistant engineer with the United States Indian Irrigation Service, engaged on reports for water supply and irrigation projects, and was in charge of construction on various Indian reservations in New Mexico, northern Arizona, and southern Colorado. He was with the county surveyor of Orange county, California, from 1916 to 1917. Baker attended the engineer officers training school at Camp A. A. Humphreys, Virginia. From 1917 to 1924 he was hydraulic engineer for the State Water Commission of California (now known as the Division of Water Rights of the State Department of Public Works) and after 1920 was in charge of field work connected with applications and permits.

Since 1924 Baker has been in private practice at Los Angeles. He has been a member of the Los Angeles Board of City Planning Commissioners since 1927 and is now president of that body. He served as president of the California Engineers Registration Association which successfully fostered the Act (A.B.No.174) of the 1929 State Legislature providing for examination and registration of civil engineers. Baker is the first vice-president of the American Association of Engineers. He has written a number of articles on city planning for the technical press and is a collaborator with Harold Conkling on 'Water Supply and Utilization', a book now in the process of publication by John Wiley & Sons, Inc.

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The passage by the 1929 Legislature and the approval by Governor Young of S.B.No.615 marks a most important step in the orderly development of the state of California. Up to this time there was no statutory procedure which allowed the creation of bodies outside of incorporated cities for the purpose of supervising the methodical planning of unincorporated areas. At present, county planning commissions exist in the counties of Los Angeles and Santa Barbara, being created by ordinance of the county boards of supervisors. The legislative act, which became effective August 14, 1929, makes it mandatory on all counties within the state to establish planning commissions, and extends the provisions of the act to such cities as desire to take advantage of its provisions. The act is the outgrowth of the 'Master Plan' act passed by the 1927 Legislature, which, however, did not appear to meet with public support or approval. There are also a number of new features in the 1929 act which were not included in the previous planning act relating to cities.

**The act in substance** provides for the establishment of a planning commission and its personnel; allows any city or county to adopt an official master plan; provides that planning commissions may do educational work to promote public understanding and appreciation of the master plan, make studies and carry on investigations relative to future growth of the community, control subdivisions (details concerning subdivision control are included in S.B.No.614, which was likewise passed by the Legislature and approved by the governor), require adherence to the master plan, establish setback lines along major traffic streets or highways after the master plan has been adopted; and also provides for the creation of regional planning districts.

The commission established in the act consists of nine members, six appointed by the chief executive officer of the city, or the chairman of the board of supervisors, with the approval of the legislative body; and three to be ex-officio, one of whom is to be the city engineer or county surveyor, the other two to be selected by the legislative body. Terms of the members of the commission are fixed at four years. Where cities or counties have freeholder charters which conflict with the provisions of the act, the charter provisions relative to the planning commission prevail.

**Duties of Planning Commission**—The commission, in addition to its usual duties, may employ outside consultants to aid its members at their work, and may levy and collect an annual tax of 2 mills per dollar of assessed valuation to defray its expenses. It may adopt a major traffic street plan, which shows the location and width of thoroughfares, and shall publish such plan separate from other parts of the master plan. It may establish districting plans (zoning) showing the use, height, and bulk regulation of buildings, and the use of premises; a transportation plan showing the development of port, harbor, and aviation facilities, location of rights-of-way, terminals, viaducts, grade separations, and other facilities for railroads; a transit plan showing a proposed system of rapid transit lines, car and bus lines, etc.; a park and recreational plan; and a group building plan, which last may show the location, grouping, and architectural treatment of public and other buildings. The commission may also prepare detail maps and plans in this connection, which may be adopted as amendments to the master plan, and may make other plans, reports, and investigations to carry out the orderly development of certain areas.

**Procedure** to be followed before the adoption of the master plan, or amendments thereto, is provided. This procedure includes hearings to be held on the plans and the certification of the same to the legislative body, which in turn must hold public hearings prior to the adoption thereof. While the planning commissions, as created in the act, are primarily advisory bodies, all matters pertaining to planning activities must be referred to those commissions for report, and in most cases the report and recommendations of the planning commission may be overruled only by a majority vote of the entire legislative body. The provision which

*Member, American Society of Civil Engineers.

allows the commission to carry on educational work with respect to understanding and appreciation of the master plan is very important, as planning work is largely a matter of public education. This section emphasizes the need of such educational work on the part of the commissions. The act instructs the planning commission to cooperate and advise with public officials and agencies, public utility companies, etc., in connection with the carrying out of its various plans, and instructs all public agencies to furnish necessary information to the commission; it also allows the receipt of gifts by the commission.

Where differences exist between cities, or cities and counties, over plans considered by each in adjacent areas, it instructs the respective planning commissions to hold joint conferences between the conflicting interests and to invite members of the legislative bodies to attend these conferences. It allows the legislative bodies to refer any matters pertaining to the orderly growth of the community to the planning commission and authorizes the commission to make necessary investigations, maps, and reports relating to such subjects. It specifically places the subject of subdivision control under the jurisdiction of the planning commissions created by the act, the details of the procedure being specified in another act previously mentioned.

**Major Traffic Streets**—Its provisions with reference to the protection and development of the major traffic street plan are particularly important. No improvements may be made upon any streets in the area included within such plan, unless the street has been opened or has received a legal status prior to the adoption of the plan, or unless it corresponds with the master plan, or unless it has been accepted by a subdivision plat approved by the planning commission, or is shown upon a map heretofore approved by the commission, until the matter has been referred to the planning commission for a report. The commission is allowed 30 days in which to make this report. While this procedure does not prevent improvements which will conflict with the master plan, it at least affords a brake upon unorderly development and requires that a study and report be made thereon.

Much difficulty has been experienced in the past in connection with the opening and widening of major traffic streets on account of excessive damages allowed for buildings extending beyond the taking lines of the improvement. The procedure of establishing setback lines along these streets prior to condemnation, in order to prevent building encroachment, appears to be questionable from the legal standpoint as it raises the point of the taking of property without compensation. No other way has thus far been provided whereby a community may protect future streets on which they are not in a position to begin condemnation.

The procedure set forth in this act requires that if the major traffic street plan has been adopted, the planning commission shall prepare precised maps of the street location, hold hearings thereon, and upon the approval of the precised plans, shall report the same to the legislative body, which in turn may approve and file copies of the map with the county recorder and with the department which has jurisdiction over the issuance of building permits. Within three months after these maps are filed, any property owner may claim that the establishment of such lines constitutes the taking of his property, and the legislative body must then within three months after the claim has been filed either acquire a limited easement over the property, begin condemnation proceedings for the acquisition of the same, or else vacate the ordinance insofar as it applies to the claimant's property. If none of these things is done, the ordinance automatically becomes vacated insofar as the owner's property is considered. If the property owner does not file a claim within this period, he is declared to have waived all damages caused by the easement but not the title to the property so included.

No owner who has been compensated for his easement or has waived his claim for damage may erect a building within the taking lines so established within three months after he has filed with the clerk of the legislative body an affidavit setting forth that he proposes immediately to begin construction of a building, specifying the character and estimated cost of the structure and the price at which he will convey to the city an easement over his property in accordance with the precised street plan. The city is allowed three months after the filing of the claim to commence proceedings for the acquisition of the easement and, if it does not do so, the owner is released of any cloud against his title due to the proposed widening. No damage may be awarded him in eminent domain proceedings for any structure erected within the taking lines set, unless he has filed such affidavit within the prescribed time and the damage does not extend beyond that established in the affidavit. As a further protection, no building permit may be issued within the taking lines established until the owner has proved that his property has been released under this procedure.

**Revolving Fund**—A most important provision of the act is that which allows the creation of a revolving fund through a tax levy not in excess of 2 mills on the dollar of assessed valuation. This provision makes funds available whereby property and rights-of-way may be obtained without falling back upon the general fund. The act also provides that the revolving fund may be reimbursed from assessments levied in the creation of any assessment district for opening and widening proceedings. While this method appears to be somewhat complicated and great care will have to be taken in its exercise in order that the actions of the governing body are reasonable, it does give promise of considerable value.

**Regional Planning**—The act also allows the formation of regional planning districts and commissions which may include both incorporated and unincorporated territory and may include more than one county, but may not include all of one county only. This provision allows for the orderly development of any large area which can be considered a unit from the planning standpoint. The district is initiated through petition to the board of supervisors. The petition must include a request for the formation of such district and for the creation of a commission; the boundaries and name of the district and of the commission created; the maximum tax to be levied for carrying on the work of the

commission, which cannot exceed 2 mills per dollar of assessed valuation; and the form and wording of the question which is to be submitted to the electors. Hearings are held upon the petition and upon the election of commissioners. The regional planning commission consists of five members who must be residents of the district. The powers and duties of the commission are the same as those of the city and county planning commission, unless such powers have been restricted in the petition.

**Possibilities**—Taking the act as a whole, it includes many worthwhile features, and promises great opportunities if it is administered in an intelligent manner. Some difficulty will undoubtedly be encountered at the start, particularly with counties, through attempts at the creation of commissions and employment of a technical personnel who are more or less uninformed as to the general purpose of planning work. Too ambitious ideas may result in public antagonism and opposition. The most important work of the commissions to be created under this statute for the first year or so will be of an educational nature. The larger cities of the state have fairly well sold their residents on the value of planning, both in its economic and its social aspects, but the idea is new in the unincorporated territories. However, the success which has been attached to the work of the regional planning commission of the county of Los Angeles in its comprehensive planning of the entire county—in the educational work it has undertaken, in the assistance it has given to the planning commissions of the smaller cities, and in the results which have been achieved through the coordination of the work in the metropolitan area, including many incorporated communities as well as much unincorporated territory—has proved the value of such a body.

# Reconstruction on San Diego-El Centro Road

The Nevada Contracting Co., of Fallon, Nevada, is reconstructing 4½ miles of the San Diego-El Centro road between La Posta and Miller creek. This is a California state highway project, S.D.12-F, in San Diego county. A new right-of-way is being used; the roadbed is 38 ft. wide. On the east half of the work

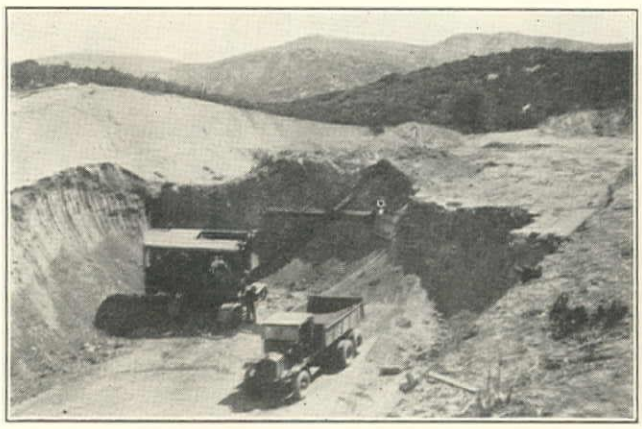
Thorough Cut on La Posta-Miller Creek Section of San Diego-El Centro Road, California

heavy rock is being encountered. About one-third of the excavation has been moved to date.

The contract price was $223,658. Estimated quantities and unit bids follow: clearing and grubbing—235 stations at $10.00; roadway excavation from sta. 225+25 to 394+50—205,000 cu.yd. at $0.42; roadway excavation from sta. 394+50 to 490—162,000 cu.yd. at $0.67; overhaul—3,000,000 sta.yd. at $0.0075; structure excavation—900 cu.yd. at $1.50; class A concrete in structures—180 cu.yd. at $30.00; reinforcing steel—12,000 lb. at $0.05; corrugated pipe—60 lin.ft. of 18-in. at $0.50, 1850 lin.ft. of 24-in. at $0.60, 200 lin.ft. of 30-in. at $1.00, 580 lin.ft. of 36-in. at $1.50, 230 lin.ft. of 42-in. at $2.50; new property fence—3 miles at $450; bank-protecting fence—500 lin.ft. at $2.50; finishing roadway—235 sta. at $5.00; monuments—86 at $3.00.

Equipment on the work includes one 1¼-yd. Northwest gas shovel, one 1¼-yd. Thew '75' gas shovel, one 1¼-yd. Bucyrus-Erie gas+air shovel, one Best '60' tractor and one 4-yd. McMillan scraper, two Gardner-Denver air-compressors, one Chicago Pneumatic air-compressor, one Ingersoll-Rand air-compressor, and one '14S' concrete mixer.

S. V. Cortelyou is district engineer of district VII,



Northwest 1¼-yd. Gas Shovel Loading Into Truck on Nevada Contracting Co. Job, S.D.-12-F, San Diego County

California Division of Highways, and C. P. Montgomery is the resident engineer. F. E. Gibbs is the superintendent for the Nevada Contracting Co.

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H. A. Van Norman, chief engineer of the Los Angeles bureau of water and power, is preparing plans for a 36,000-ac.ft. reservoir to be built in the Chatsworth district to replace the storage reservoir behind the former St. Francis dam. The estimated cost of the new reservoir is $4,500,000.

# Elements of Airport Requirements

By JOHN W. HOWARD*
*Assistant Professor of Civil Engineering,*
*University of Idaho, Moscow*

**Editor's Note**—John W. Howard was born in Florence, Colorado, in 1895. He received the B.S. (C.E.) degree from the University of Colorado in 1924 and in 1929 the M.S. (C.E.) degree from the University of Idaho.

From 1910 to 1914 he was chainman, rodman, and instrumentman on railroad and irrigation surveys in Colorado. From 1915 to 1916 he was an inspector on paving, sewer construction, and reinforced concrete building construction for the Denver Union Stock Yards Co. In 1916 he was levelman and instrumentman on precise surveys and triangulation for the Moffat tunnel. From January to June, 1917, he was assistant engineer in charge of location and construction of irrigation works for the Colmar Irrigation Co. Howard was a sergeant, 1st class, U.S. Corps of Engineers, from June, 1917, to August, 1919, with 22 months in the A.E.F. in charge of road construction and maintenance and four months of this time as a student at the Universite de Toulouse. For a portion of 1919 he was deputy state engineer of Colorado (acting as resident engineer) on construction of a circular-arch reinforced concrete water storage dam. From 1920 to 1921 and in 1924 he was with the valuation department of the D.& R.G.W. R.R. on preparation of unit cost data and of the protest to the tentative valuation offered the railroad by the Interstate Commerce Commission. In 1925 he was chief of the party for the Olinger Corp., Denver, on urban and suburban land development. From 1925 to 1926 he was a structural draftsman for the Colorado state highway department on the design of concrete and steel structures. Since 1927 he has been assistant professor of civil engineering at the University of Idaho, Moscow.

Howard is a member of Tau Beta Pi and Sigma Tau, national honorary engineering fraternities.

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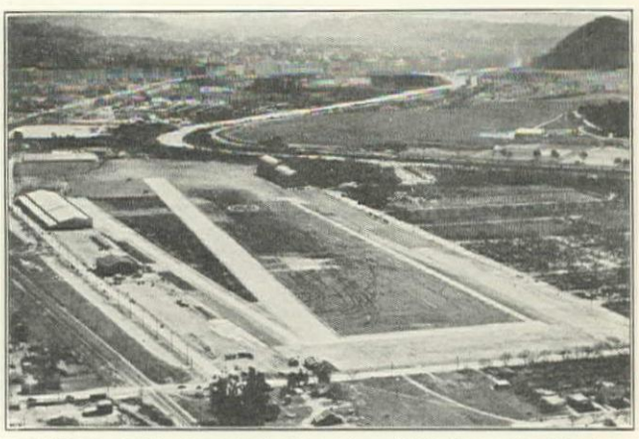
The future of aerial transport is dependent upon its terminal facilities. Any sort of aerial transportation is limited in its sphere of action by its ability to come to earth. Also, a vast majority of the activities of air transport is confined entirely to earth.

An analogy exists between a railroad passenger terminal and an airport. This comparison stands for nearly all the well-known components of the passenger depot: a building for housing passengers, ticket offices, plane dispatchers; and loading platforms for both passengers and air-moved merchandise, mail, etc. In addition, close by but frequently unnoticed, are the fueling, servicing, and storage departments where all equipment is cared for between trips or during stops. Then again, there is the yard corresponding to the landing field, with its runways and night lighting systems. Another comparison is location, and in both cases the desired result is exactly the same—namely, to have the passenger delivered as close to his destination as possible.

Since air traffic is dependent upon its landing facilities, it naturally follows rather than precedes any preparation for its reception. Small, high-powered equipment has the ability to alight upon and rise from almost any field, 40 acres or so in size, and fairly level. This ability is not inherent, however, in the type of transport plane which is fast proving itself to be an economic carrier of man and his equipment, and consequently does not enter into the discussion.

Every community worthy of the name is planning, or is building, a place for airplanes to alight. The National Chamber of Commerce is authority for the fact that, on January 1, 1929, there were 1324 airports and landing fields in the United States, and 894 more proposed for construction. These figures do not include the literally thousands of farm lots and open spaces being used for landing fields, which have none of the requirements of an airport except an open and level space.

**Ownership of Airports**—The question of having an airfield in a community naturally brings with it that of ownership. The idea frequently advanced that the airline should finance its own termini is a natural one to assume on first thought, but after reflection it becomes evident that the building and possibly the operation of an airport should be a strictly municipal function. A new port could hardly be expected to pay its own way for some time, and during the growth period, the municipality—out of public spiritedness, if nothing else—could afford to maintain it for the business it would generate. Then, too, the airport may be placed under the parks and playgrounds department and portions of it utilized as recreational areas until such time as it may be needed for the ultimate use. In this way, an airport could be acquired and operated from city funds already established, and for which there is a definite income or revenue. In support of the argument are three recent decisions from a like number of state supreme courts, those of New York, Missouri, and Oregon, upholding the idea that establishing and operating of airports is a legitimate municipal function. The New York case was Hesse vs. Rath, 164 N.E. 342, in which the validity of the 1928 law, allowing the use of city funds for airport purposes, was attacked. The court in rendering its decision used the following lan-



Grand Central Air Terminal, Glendale. Main Concrete Runway is 72 ft. Wide and 3000 ft. Long

*Associate member, American Society of Civil Engineers.

guage: "We think the purpose to be served is both public and municipal. A city acts for city purposes when it builds a dock or a bridge or a street or a subway" and, "Its purpose is not different when it builds an airport." Wichita vs. Clapp, 125 Kansas 100, 263 page 12: "Aviation is today an established mode of transportation. The future, even the near future, will make it more general. The city that is without the foresight to build the ports for the new traffic may soon be left behind in the race of competition. Chalcedon was called the city of the blind, because its founders neglected the nobler site of Byzantium lying at their feet. The need for vision of the future in the governance of cities has not been lessened with the years. The dweller within the city gates, even more than the stranger from afar, will pay the price of blindness."

**Location**—The location and size of airports requires a detailed and intimate study. The immediate needs rarely or never could dictate the size. It is the requirement 20 or 25 years hence that should actually control that item. The immediate requirement can be met usually by a field whose greatest diameter is in the neighborhood of 3000 ft., as that is probably the longest run a modern heavy machine, fully loaded, would be required to make. It is much better to have several times that area, rather than just the amount of land necessary, in order that enlargements, hangar space, aerodynamic laboratories, and factories may have room for growth, and to have that growth controlled by the port authorities. In case sufficient area cannot be had to actually control the type, size, and other features of buildings erected, a municipality can enforce proper construction by necessary zoning within any desired distance from the field.

An airport should be within a short distance of the center of population, as it is obviously waste to utilize the airplane for fast travel and then dissipate the time saved in getting from the port to the destination. It should also be so located as to have a minimum amount of flying over residential areas. In communities with water transportation at hand, the port should be at the water's edge, with the necessary docks and other equipment for handling flying boats. The problem of fog is one that should be studied until the movements and boundaries of the fog areas are fairly well defined, and the port then placed so as to be as free as possible from that particularly distressing hindrance. Wind and other meteorological conditions require study in order that wind eddies or rain belts will not be included in the port area. The topography of the surrounding terrain may be a key to the solution, as river valleys or junctions are frequently fog and wind foci. Rail transportation is a necessity for a modern airport, since large quantities of bulky material are used, and the railroad is the only means of handling them expeditiously. Other modes of transportation should also be close by. Electric interurbans or street cars, bus lines, and well-built highways should be contiguous; if necessary, trunk highways should be constructed to lessen time losses. In short, the location of the field is a problem requiring a large amount of time, study, and effort for solution. One particularly helpful kind of information is a series of air photos, taken both vertically and on the oblique, from all directions, and from considerable altitudes.

**General Plan or Layout**—The design of an airport is particularly the function of the engineer, as it is in effect the design of a small city. All the services of a city are demanded—heat, light, water supply, sewerage and sewage disposal, paving or treating the ground surface of the landing fields, runways, and taxi areas, building construction, drainage systems, and others.

The general plan is the first major problem. The passenger terminal or depot should be so located that the minimum amount of taxiing is necessary after landing or before taking off. This means that the loading platform should be as near the center of operation as is possible. Yet, care must be taken to prevent people from wandering onto the landing strips or coming in contact with planes warming up. A pilot has little control of the frontal speed of his machine, either just before the take-off or just after landing, hence anything in his way constitutes a real hazard both to the obstruction and to the plane. This is also a good reason for keeping grazing animals off the unused portions of the field, as emergency landings in the immediate area of the port are often necessary.

The drainage requirement is particularly severe. To prevent softening of the surface, water must be immediately conducted away from it. In many cases this implies a regular gridiron or herringbone system of tile drain either laid as open drains covered with cast-iron grates or blind drains with crushed rock or gravel covering. The crowning of runways follows that for highways quite closely, except possibly the crown is not as high in proportion to width as it is on a road or street. The main runway should be in the direction of the prevailing wind; for transport planes it should have a minimum length of 2500 ft. and a width of 75 to 300 ft. The minimum grade for drainage is fixed at 0.5%, and the maximum Department of Commerce allowance is 2%, both longitudinally and transversely, with the maximum fixed by the plane at 3½%. When

Administration Building and U.S. Weather Bureau Observation Station at Oakland Municipal Airport

large and comparatively flat areas are to be drained, the sizes of the conduits increase inversely as the square root of the slope. Hence, the item of drainage is liable to be one of the largest in point of money in the whole development.

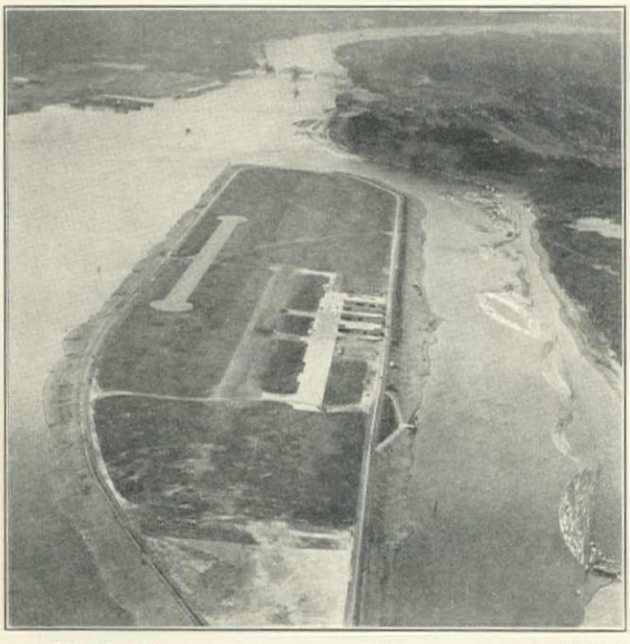
In a well-designed airport there should be enough runways so that a pilot can always take off into the wind. To place runways according to the U. S. Department of Commerce regulations, it is necessary to

have six of them. The requirements state that no takeoff should be necessary when the angle between runway and wind is greater than 30 degrees. The lay-out depends largely on the shape of the airport and the direction of the prevailing wind. At the intersection of the runways there should be provided the standard 100-ft. white circle which officially designates an airport.

**Surfacing**—The surfacing of an airport is considered one of the major items in its development—a condition brought about by a continually increasing demand upon the part of those engaged in aviation. One of these demands is safety, another is for personal comfort and cleanliness of airport patrons, a third is reduction in maintenance costs. The surfacing may be divided into two parts—landing surfaces and runway surfaces.

A type of surface is needed over which the planes can be accelerated until the desired flying speed is reached. It must be durable, free from dust, even and true to grade; it must be such that planes can land comfortably and quietly. On a well-surfaced airport, therefore, the dust nuisance is eliminated, maintenance costs are lowered, and the reliability factor of planes and motors is greatly increased.

Selection of the type of surfacing for landing areas and runways is yet a moot question. Natural or artificial sod has a good many adherents. Although it is one of the cheapest and perhaps easiest types to build, it is not easy to maintain—especially under semi-arid



Swan Island Airport of the Port of Portland Showing Asphaltic Concrete Takeoff Runway, Cinder Runways, North and South Landing Runway, and Hangars. Sea-Plane Landing at Edge of Old Channel in Middle Foreground (View by Brubaker Aerial Surveys, Portland)

western conditions. In humid climates this type of runway, unless well drained, is liable to become too soft for use. Untreated sand and cinders have been used to a considerable extent, but these materials pick up in the propeller blast and by their abrasive action damage both propeller and plane. This trouble may be controlled to a large extent by treatment with the proper grade of asphaltic oil. Untreated gravel and crushed rock are subject to exactly the same ills as are sand and cinders, except that the larger particles do more damage to the plane. The advantages of hard-surfaced runways and landing strips, of cement-concrete or asphaltic concrete, make this type almost a necessity. With such a surface the dust nuisance from idling and departing machines is entirely dispensed with; the drainage problem is greatly simplified; and, in climates where snow falls, the snow removal problem is most easily solved. This type of surface is rapidly gaining favor on Pacific coast fields.

Until recently, planes in the act of landing have been entirely dependent upon the action of the tail skid for braking and for a stabilizing effect after the plane was on the ground. This tail-skid, which is a more or less

Depot, Main Hangars, and Cement-Concrete Taxi Runway at Alameda Airport

rigid arm supporting the control surfaces at the rear end of the fuselage, is arranged so that manipulation of the control surfaces exerts a downward pressure on the tail-skid and causes it to dig deeply into the surface of any unpaved field. A stick or drag-type tail-skid which is biting into the ground assists in braking the plane and prevents a side wind from throwing it into a 'ground loop' with a possible nose-over. Thus, for this type of skid a soft landing surface is desirable from the standpoint of safety. The application of brakes to airplane wheels and the adoption of a caster wheel to replace the tail-skid on the large and most modern types of planes, have made possible easy handling, efficient braking, and greatly improved lateral control of the plane while on the ground. For this condition, hard-surfaced runways reach their best use. The action of the tail-skid or caster wheel need not be considered in the take-off, as the tail of the plane is in this case lifted from the ground as soon as possible.

**The appurtenances,** if they may be so called, to the flying field are what make the difference between a mere landing field and an airport. A true airport should have a large and comfortable waiting room for passengers, comfort stations, restaurants, a hotel or other sleeping quarters, and possibly tea-rooms where lookers-on could pleasantly spend an afternoon. The same building, or others close by, should have facilities for pilots, and also a first-aid room with an ambulance available. There should be an observation tower in the administration building or section. The airline between Miami, Florida, and Havana, Cuba, uses covered ways from the depot to the plane, thereby keeping the passengers under cover from the time they leave the hotel until they get into a cab at their destination. That particular company also uses a sort of 'gasoline

mule' which picks up the tail of a machine and tows it from the depot out onto the runways where the motors are started and from which the take-off is made. Covered ways are also used at the Oakland and Glendale, California, airports.

Hangars, machine shops, and a garage are absolute essentials. These are placed in as close proximity to the central control depot as is practicable. Houses for field attendants and mechanics usually must be supplied, as well as buildings for fuel and other material storage facilities. The location of these is of much importance and becomes a special problem for each port. Indeed the entire layout of every airport is just as individual and as specialized as is that of each hydroelectric development. A well-equipped port should have a meteorological laboratory, and a truck carrying fire-fighting and first-aid equipment; as crashes, when they do occur, are usually at the beginning or at the end of a flight.

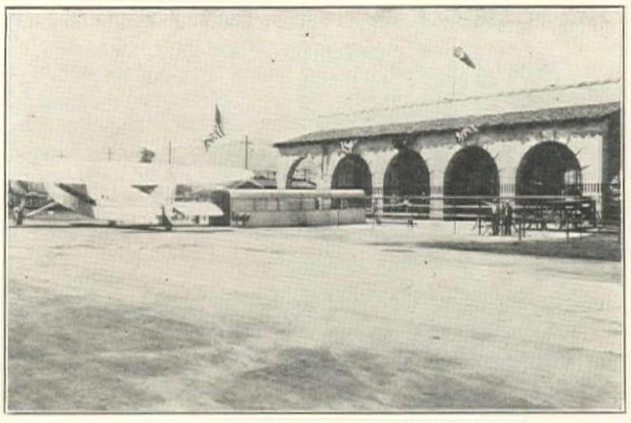
**Illuminating Requirements**—The lighting equipment of a landing field demands special study. In general, there are three types of lighting used at each landing field. One is a beacon or lighthouse which throws a revolving beam upward, and serves the double purpose of pointing out the field from afar, and of showing what the ceiling height at the time happens to be. The second type is exterior lighting of buildings in order that pilots may be able accurately to judge their distance above the ground before they finally land. The last type is flood-lighting of the entire field, and this type of lighting is further subdivided into two general types—centralized control and distributed control. In either case the final objective is the same and is to furnish good, clear ground illumination without getting the beam of light high enough to shine into the pilot's eyes. There have been developed several types of lamps which will do this. They consist essentially of a battery of lamps, mounted in a case behind a set of lenses, which throw a horizontal fan-shaped beam


Steel Frame and Corrugated Iron Hangar Construction at the Oakland Municipal Airport

through an angle of about 160 degrees and to an elevation no higher than the source, or 3 to 5 ft. above the ground.

In addition to the previous equipment are the signal and boundary lights. Any obstruction adjacent to, or dangerous areas within the field or within a considerable distance of its edges must be lighted with red lamps; flashing lights being preferable. The approaches are outlined with green lamps, and the actual landing strips or areas with white lamps. White paint on a black surface is likewise helpful in illuminating the runways. There is also a wind cone which must at all times be clearly visible and well illuminated. A useful, but not always necessary, adjunct in the vicinity of the port is a series of signs within the boundaries of the airway, illuminated at night, painted on building tops or laid out on the ground, and giving directions and distances to the port.

The airplane has taken its place in our transportation system and, consequently, it must function 365 days a year and 24 hours a day. The accessories to



Tri-Motored Ford Transport Plane at Loading Depot, Grand Central Air Terminal, Glendale, Showing Covered Way Between Plane and Terminal Building

flight should all be designed and constructed in such a manner that failure of operation will be as rare as it is humanly possible to make it. This because the safety of human life is more at stake in air transportation than in any other kind of transport.

## Railroad Fight in Eastern Montana

The Interstate Railroad Commission must soon determine whether one or two railroads shall develop an area 150 miles square, and now without rail service, in eastern Montana. This area is blocked out on the north and west by the Great Northern, on the south and southwest by the Milwaukee, and on the east by the Great Northern branch to Richey and the Northern Pacific branch to Circle and Brockway. The Great Northern has filed an application to extend its Richey branch for 105 miles to Jordan, the center of the contested territory.

## Arizona Highway System

Although the youngest state in the union, Arizona has advanced farther than most of the states in completing the 7% national road system. Of the 2206 miles in the state system, 1410 is 7% roads. Only 336 miles of the total system is unimproved to the standard required by the Bureau of Public Roads. In the fiscal year ending June 30, 1929, nearly $8,000,000 was expended in road improvement, betterment, and maintenance. A like expenditure is anticipated for the current year. To complete the program in progress will cost between $2,500,000 and $3,000,000. Maintenance of roads costs $1,000,000 annually. Because of the large area of the state in national reservations, 72% of the cost of Arizona Federal Aid highways is paid by the United States. W. W. Lane is the state highway engineer.

# Street Improvement Assessments

By HARRY GOODRIDGE
*City Engineer, Berkeley, California*

**Editor's Note**—Harry Goodridge was born in Edmonton, Alberta. He graduated from the University of Toronto, Canada, in 1912, with the B.A.Sc. degree. From 1913 to 1916 he was an assistant in the city engineer's office at Edmonton. In 1920 he moved to California and was employed by the Foundation Co. at Richmond on construction of the Standard Oil Co. refinery. He left this company to work on sewer location in San Anselmo for C. C. Kennedy, consulting engineer of San Francisco. From 1921 to May, 1925, he was employed by George A. Posey, county surveyor of Alameda county. Goodridge was assistant city engineer of Berkeley, under the late A. J. Eddy, from May, 1925, until July 18, 1929, on which date he was appointed city engineer.

No assessment for street improvement has ever been made, the method of which could not be subject to argument and possible change. Corner lots, lots of irregular shape or excessive depth, or lots with poor conditions upon which to build are some of the main points of difference in fixing the right amount to be assessed. It is for this reason that an effort is made to establish some rule for making proper assessments.

Under the California Legislative Improvement Act of 1911 provision is made for assessment by frontage plan and also by the district plan.

**Frontage Plan—Rules**—(1) The expense of the improvement shall be assessed (except as hereafter provided) on each lot or portion of a lot being separately assessed, in proportion to the frontage, at a rate per front foot sufficient to cover the total expense of the work. (2) The expense of the work done on a main street crossing shall be assessed at a uniform rate per front foot on the quarter block and irregular blocks adjoining and cornering upon the crossings, and separately upon the whole of each lot or portion of a lot having any frontage in the said blocks fronting on said main streets, half way to the next main street crossing, or to the end of such street if it does not meet another, and all the way on said blocks to a boundary line of the city where no such crossing intervenes, but only according to its frontage in said quarter blocks and irregular blocks.

When work is done on one side of the center line of a street, only that side can be assessed. Technically, this does not permit the construction of a main sewer in any place except the center line of the street. On this point the following decisions have been given in the courts: (1) The basis of frontage assessment is the frontage of the lot upon work, irrespective of shape, size, or depth of the lot (Diggins v. Hartshorne, 108 Cal. 154); (2) Property at the end of a street and at right angles to the street line does not front on such street (Duncan v. Ramish, 142 Cal. 686); (3) Corner lots are considered as having double frontage (Ross v. Barber Asphalt Paving Co., 158 Cal. 37).

The assessment is required to be made per front foot, regardless of the benefit. On this basis, lots which have a small frontage and increase in width at the back and have considerable usable area will have a small assessment. Also, lots having a large frontage and a triangular shape are unduly assessed.

The assessing of lots in the quarter blocks for work in intersections accomplishes some of the good points in the district assessment. It is obvious that a person residing a few hundred feet away from a paved street receives some benefit. Corner lots are assessed as double frontage and it is doubtful if this is equitable. The land is to be used for some purpose, either as a dwelling or a commercial enterprise. It is safe to say that two houses cannot occupy the space of one, hence double frontage is not correct. If the area of a corner lot is considered in units, judgment must be used in determining at what depth to consider an area as having double frontage. Certainly the infinitesimal part of the corner where the property lines meet cannot be so considered. Experience has established a depth of 100 ft. as the point where land can be considered as having double frontage.

The Improvement Act of 1911 does not permit a lien to be made against public school property by assessing it for benefits. The governing body controlling such property may agree to pay, but cannot be forced to pay. If this property is not excluded from the assessment by a statement in the resolution of intention, then the city is held liable unless the assessment is paid otherwise.

**District Assessment**—The frontage assessment has been only briefly outlined as it is my intent to go more fully into assessment by the district method. In the 1911 Improvement Act the following statement is made:

"Whenever the resolution of intention declares that the cost and expenses of the work and improvement are to be assessed upon a district, the city engineer shall make a diagram of the property affected or benefited by the proposed work or improvement, as described in the resolution of intention, and to be assessed to pay the expenses thereof. Such diagram shall show each separate lot, piece or parcel of land, the area in square feet of each of such lots, pieces or parcels of land, and the relative location of the same to the work proposed to be done, all within the limits of the assessment district * * *."

Here the area of the lot becomes a factor as well as the frontage, and each separate lot or parcel must be shown separately. The Act also states that "the superintendent of streets shall proceed to estimate the benefits." This does not give any fixed rule and might be dangerous but for the right of property owners to appeal to the council and have the assessment changed. (Railroad property can be assessed the same as any other private property.)

It is not necessary that the superintendent of streets

shall disclose his method of assessment (See 113 Cal. 314), but it is well that he have some mathematical basis in order to prove to the complainant that he has been impartially treated.

**District Boundary**—Considerable study should be given the boundary of the district. In a report given by the 'Committee of Sixteen', appointed by the mayor of Berkeley in 1925, an arterial highway system was approved and certain of these highways have since been improved. Berkeley is a city in which most of the traffic runs parallel to the coast line. In the study of an assessment district for the improvement of one of these highways on the hillside, the area approximately one-half block below the improvement and to within one-half block below the arterial highway next above the one to be improved, was included in the district. The northern and upper end of the district in this particular case was much wider than the southern end. The streets which would naturally flow into this artery had much to do in determining the size of the district. Attention was given to lots which had been assessed on a frontage plan for other street work, in an attempt to exclude them from the new district.

A district may include only the lots fronting on the improvement; this boundary fixing is often done on streets which are not arterial highways in order that the flexibility of a district assessment may be utilized. A sewer system could be assessed on an entire city but this would not be practical as the preparation of the assessment diagram would be an arduous and expensive task.

**Apportioning Benefits**—When the improvement is complete and the diagram is prepared, the assessment can then be made after considering the following factors which enter into the apportioning of benefits received: (1) Area, shape and depth of lot; (2) usable area; (3) corner lot; (4) distance from the improvement; (5) number of houses possible on any one lot; (6) frontage on the improvement or on any street in district; (7) double frontage on two parallel streets; (8) special benefits; (9) previous assessments; (10) possibility of damage by improvement; (11) value of property; (12) public property.

**(1) Area, Shape, and Depth of Lot**—The area and depth of a lot are closely related but, when the depth exceeds 100 ft., the additional area should not be assessed at a rate even approximating that of the first 100 ft. Table I is presented to assist in arriving at equitable units for a reasonable assessment on lots having depths other than 100 ft. Here the additional area due to the greater depth does not increase the unit of frontage at an unfair rate. The shape of the lot requires a rule for adjustment. It is assumed that a lot 50 ft. wide by 100 ft. deep will be assessed 100%, or 50 units. If this same lot is cut into two triangles by joining the two corners, one triangle has 50-ft. frontage and the other has no frontage. It is estimated that the lot with the 50-ft. frontage should receive two-thirds of the units, or 33.33 units, and that the remaining 16.67 units should be put on the lot with no frontage. Lots, the sides of which are not parallel, may then be resolved into rectangles and triangles in order to arrive at the proper number of units with which to make the right assessment.

**(2) Usable Area of the Lot**—It is fair in every computation to take account of the usable area of the lot; this is a matter for personal judgment. A creek, a cliff, or some other condition is reason for adjustment. The assessed value of the land is a good rule to follow. Thus, reduce the frontage in the same ratio that the value of the land has been reduced by reason of its character.

**(3) Corner Lot Benefit**—Corner lots have double frontage on an improvement when both streets are improved at the same time. If these are not so improved the frontage on the improvement is computed the same as for any other lot. Assume a corner lot 50 ft. wide and 100 ft. deep. From Table I the frontage unit becomes 50 ft. on one street and 72.5 ft. on the other street, making a total of 122.5 units to be assessed.

**(4) Distance from the Improvement**—Lots in the district are assessed on the basis of their distance from the improvement. The units of frontage are arrived at in the same manner as for the frontage outlined above. The distance factor table (Table II) is then used to compute the relative values according to the distance from the improvement. A new table should be prepared for each district, the first 50 ft. in distance being taken as 99% in value. The greatest distance of any lot from the improvement should then be made to represent the proper percentage to give that lot a reasonable assessment. Assume that a lot adjacent to the improvement should be assessed $50. The outlying lots in the district should not be assessed ridiculously low; they might better be left out entirely. A rate of $5 has been used successfully for a 50-ft. outlying lot. This means that the lot the greatest distance from the improvement should be assessed at 10%. It is also good practice to make a reasonably sharp drop at a point 250 ft. or one-half block distant from the improvement. With these three points a fair curve may be platted to give a gradual decrease in assessment the farther the lot is from the improvement.

**(5)—Number of Houses Possible on Any One Lot**—The depth of a lot often permits the construction of additional houses. This is one of the arguments for increasing the frontage units because of increased depth.

**(6) Frontage on the Improvement or on Any Street in the District**—Unless a lot has frontage on a street it is not well to assess it more than a nominal figure, but the area must be assessed or else the assessment is void.

**(7)—Double Frontage on Two Parallel Streets**—In this case the lots should be cut in two and a part made to front on each street. The depth factor then enters into the computation of the frontage units.

**(8) Special Benefits**—In the improvement of a street some lots may receive more benefit than others. Vacant lots often have lateral sewers put in at the time of paving to prevent the cutting of the paving at a later date. Also, private driveways may be constructed to existing houses. These must become a separate charge to the lot benefited.

(9)—**Previous Assessments**—It is always well to exclude from an assessment, property which previously paid for its paving on the frontage basis.

### TABLE I

**Depth Table for Determining the Equitable Frontage**

(Percentage of value for lots from 1 to 700 ft. deep)

| Ft. | % | Ft. | % | Ft. | % |
|---|---|---|---|---|---|
| 1 | 3.10 | 50 | 72.50 | 99 | 99.58 |
| 2 | 6.10 | 51 | 73.25 | 100 | 100.00 |
| 3 | 9.00 | 52 | 74.00 | 101 | 100.41 |
| 4 | 11.75 | 53 | 74.75 | 102 | 100.85 |
| 5 | 14.35 | 54 | 75.50 | 103 | 101.27 |
| 6 | 16.75 | 55 | 76.20 | 104 | 101.70 |
| 7 | 19.05 | 56 | 76.90 | 105 | 102.08 |
| 8 | 21.50 | 57 | 77.55 | 106 | 102.48 |
| 9 | 23.20 | 58 | 78.20 | 107 | 102.88 |
| 10 | 25.00 | 59 | 78.85 | 108 | 103.25 |
| 11 | 26.70 | 60 | 79.50 | 109 | 103.62 |
| 12 | 28.36 | 61 | 80.11 | 110 | 104.00 |
| 13 | 29.99 | 62 | 80.77 | 111 | 104.86 |
| 14 | 31.61 | 63 | 81.38 | 115 | 105.78 |
| 15 | 33.22 | 64 | 82.00 | 120 | 107.50 |
| 16 | 34.92 | 65 | 82.61 | 125 | 109.00 |
| 17 | 36.41 | 66 | 83.21 | 130 | 110.50 |
| 18 | 37.97 | 67 | 83.82 | 135 | 112.00 |
| 19 | 39.50 | 68 | 84.42 | 140 | 113.00 |
| 20 | 41.00 | 69 | 85.01 | 145 | 114.00 |
| 21 | 42.50 | 70 | 85.60 | 150 | 115.00 |
| 22 | 43.96 | 71 | 86.15 | 155 | 116.00 |
| 23 | 45.30 | 72 | 86.70 | 160 | 117.00 |
| 24 | 46.61 | 73 | 87.24 | 165 | 118.00 |
| 25 | 47.90 | 74 | 87.82 | 170 | 118.50 |
| 26 | 49.17 | 75 | 88.30 | 175 | 119.00 |
| 27 | 50.40 | 76 | 88.82 | 180 | 120.00 |
| 28 | 51.61 | 77 | 89.35 | 185 | 120.00 |
| 29 | 52.81 | 78 | 89.87 | 190 | 121.00 |
| 30 | 54.00 | 79 | 90.37 | 195 | 121.00 |
| 31 | 55.05 | 80 | 90.90 | 200 | 122.00 |
| 32 | 56.10 | 81 | 91.39 | 210 | 122.00 |
| 33 | 57.15 | 82 | 91.89 | 220 | 123.00 |
| 34 | 58.20 | 83 | 92.38 | 230 | 124.50 |
| 35 | 59.20 | 84 | 92.86 | 240 | 125.00 |
| 36 | 60.30 | 85 | 93.33 | 250 | 126.00 |
| 37 | 61.25 | 86 | 93.80 | 260 | 127.00 |
| 38 | 62.20 | 87 | 94.27 | 270 | 127.00 |
| 39 | 63.10 | 88 | 94.73 | 280 | 128.00 |
| 40 | 64.00 | 89 | 95.17 | 290 | 128.00 |
| 41 | 64.95 | 90 | 95.60 | 300 | 129.00 |
| 42 | 65.90 | 91 | 96.04 | 320 | 130.00 |
| 43 | 66.75 | 92 | 96.50 | 350 | 131.00 |
| 44 | 67.60 | 93 | 96.95 | 400 | 134.00 |
| 45 | 68.45 | 94 | 97.40 | 450 | 138.00 |
| 46 | 69.30 | 95 | 97.85 | 500 | 140.00 |
| 47 | 70.10 | 96 | 98.30 | 600 | 142.00 |
| 48 | 70.90 | 97 | 98.74 | 700 | 143.00 |
| 49 | 71.50 | 98 | 99.17 | | |

(10)—**Possible Damage from the Improvement**—This problem is not an easy one as the personal element enters into it more than others. Some people even prefer not to have the street improved, hoping to preserve some of its so-called natural beauty. Widening of a street does often cause some damage to private property. The 1911 Improvement Act provides the method of reimbursement in a definite manner.

(11) **Value of Property**—The value of business property often goes far beyond that of residential property. This naturally has a bearing on the question of whether the cost should be assessed on a district. Usually good business property can well afford to pay for improvements on the frontage plan.

(12) **Public Property**—If the frontage of public property is any great percentage of the total frontage and if this frontage is excluded from the assessment, then the improvement becomes an unfair burden on the balance of the total frontage. To avoid this, cities often pay for the frontage excluded. When main arteries are improved it is well for the cities to make a donation from the general fund to assist in reducing the cost to the frontage.

Each of the above factors must be given an open-minded consideration if a satisfactory assessment is to be made.

### TABLE II

**DISTANCE FACTOR TABLE**

**Per Cent Correction for Distance from Improvement**

(To be applied to the equitable frontage)

| Distance | % | Diff. | Distance | % | Diff. |
|---|---|---|---|---|---|
| 50 | 99.0 | ..... | 2050 | 22.2 | 0.3 |
| 100 | 97.8 | 1.2 | 2100 | 21.9 | 0.3 |
| 150 | 96.5 | 1.3 | 2150 | 21.6 | 0.3 |
| 200 | 95.0 | 1.5 | 2200 | 21.3 | 0.3 |
| 250 | 92.7 | 2.3 | 2250 | 21.0 | 0.3 |
| 300 | 90.3 | 2.4 | 2300 | 20.8 | 0.2 |
| 350 | 86.6 | 3.7 | 2350 | 20.6 | 0.2 |
| 400 | 80.9 | 5.7 | 2400 | 20.4 | 0.2 |
| 450 | 70.0 | 10.9 | 2450 | 20.2 | 0.2 |
| 500 | 58.5 | 11.5 | 2500 | 20.0 | 0.2 |
| 550 | 52.0 | 6.5 | 2550 | 19.8 | 0.2 |
| 600 | 47.2 | 4.8 | 2600 | 19.7 | 0.1 |
| 650 | 43.3 | 3.9 | 2650 | 19.5 | 0.2 |
| 700 | 40.6 | 2.7 | 2700 | 19.3 | 0.2 |
| 750 | 38.4 | 2.2 | 2750 | 19.1 | 0.2 |
| 800 | 36.5 | 1.9 | 2800 | 19.0 | 0.1 |
| 850 | 35.0 | 1.5 | 2850 | 18.8 | 0.2 |
| 900 | 33.7 | 1.3 | 2900 | 18.6 | 0.2 |
| 950 | 32.5 | 1.2 | 2950 | 18.5 | 0.1 |
| 1000 | 31.6 | 0.9 | 3000 | 18.3 | 0.2 |
| 1050 | 30.8 | 0.8 | 3050 | 18.2 | 0.1 |
| 1100 | 30.0 | 0.8 | 3100 | 18.0 | 0.2 |
| 1150 | 29.3 | 0.7 | 3150 | 17.9 | 0.1 |
| 1200 | 28.7 | 0.6 | 3200 | 17.8 | 0.1 |
| 1250 | 28.1 | 0.6 | 3250 | 17.6 | 0.2 |
| 1300 | 27.6 | 0.5 | 3300 | 17.5 | 0.1 |
| 1350 | 27.1 | 0.5 | 3350 | 17.4 | 0.1 |
| 1400 | 26.6 | 0.5 | 3400 | 17.4 | 0.0 |
| 1450 | 26.1 | 0.5 | 3450 | 17.3 | 0.1 |
| 1500 | 25.7 | 0.4 | 3500 | 17.3 | 0.0 |
| 1550 | 25.3 | 0.4 | 3550 | 17.2 | 0.1 |
| 1600 | 24.9 | 0.4 | 3600 | 17.1 | 0.1 |
| 1650 | 24.6 | 0.3 | 3650 | 17.0 | 0.1 |
| 1700 | 24.3 | 0.3 | 3700 | 17.0 | 0.0 |
| 1750 | 24.0 | 0.3 | 3750 | 17.0 | 0.0 |
| 1800 | 23.7 | 0.3 | 3800 | 17.0 | 0.0 |
| 1850 | 23.4 | 0.3 | 3850 | 16.9 | 0.1 |
| 1900 | 23.1 | 0.3 | 3900 | 16.9 | 0.0 |
| 1950 | 22.8 | 0.3 | 3950 | 16.9 | 0.0 |
| 2000 | 22.5 | 0.3 | 4000 | 16.8 | 0.1 |

## CHARTING SACRAMENTO AND SAN JOAQUIN RIVERS

Beginning in November, the U. S. Coast and Geodetic Survey will chart the Sacramento river from Pittsburg to Sacramento, and the San Joaquin river from Pittsburg to Stockton, California. Authorization was received from Washington early in September after efforts extending over a period of 20 years. These maps, which will be useful in plans for harbor improvement, will be more valuable than the existing War Department channel charts showing only the harbor lines and bridges.

# Aerating Sewage

## *Activated Sludge Process—New Mechanical Aerator—Method of Determining Air Requirements*

By JOHN L. MASON

*Sanitary Engineer, Water Works Supply Co., San Francisco*

**Editor's Note**—John L. Mason was born at Mt. Morris, Illinois, in 1897. From 1918 to 1920 he was 2nd lieutenant and instructor in airplane motors in the United States Army air service. He was a journeyman machinist for the Moore Shipbuilding & Dry Dock Co., Oakland, California, from 1920 to 1921. Mason graduated from the University of California in sanitary engineering in May of 1925. Since graduation he has been continuously employed as a sanitary engineer and salesman of sewage treatment plant equipment with the Water Works Supply Co., of San Francisco. He is now retained by the Hardinge Co., of York, Pennsylvania, as a sewage research consultant and on October 15 he will leave for the east to join that organization for full-time work.

Mason is a member of Chi Epsilon civil engineering honor society and of the California Sewage Works Association.

**Activated sludge** is produced by aerating sewage until the particles of organic matter become impregnated and coated with growths of micro-organisms. These organisms are primarily oxidizing bacteria capable of utilizing atmospheric oxygen with the food matter present. The activated sludge becomes flocculent with gelatinous surfaces and has oxidizing properties. When such sludge is mixed with sewage in the presence of an adequate supply of air, the bacteria and their enzymes oxidize the organic matter, dissolved and suspended, and the suspended particles attach themselves to the activated sludge floc. The resulting sludge separates from the liquor so as to leave a well purified and clear effluent. Varying proportions of the sludge are returned to the influent entering the aeration chambers for seeding, and the excess is cared for by digestion, burying, drying for use as a fertilizer, or otherwise.

The activated sludge process of sewage treatment can produce a purification of sewage equivalent to the best possible results obtainable by other methods, and it has the further advantage that a complete freedom from odors and flies may be had with a plant which is functioning properly; a minimum of plant area is required; and the lowest investment cost for high quality end results for large projects is obtained. The process also permits the utilization of the sludge as fertilizer. The sludge produced is an excellent plant food, the nitrogen compounds being in a form which plants can immediately use.

The process can reduce the biochemical oxygen demand of the sewage by 90% and can accomplish the removal of approximately 98% of the pathogenic bacteria and over 90% of the total organic matter.

The process has been rated as having a relatively high operating cost, requiring carefully trained supervision. Much work is being done to minimize these disadvantageous factors. Moreover, current experiences and new tank and appliance developments indicate a decided lessening in the cost and care of operation and supervision.

**Historical Development**—The purification of sewage by direct aeration was attempted previous to the present century. Working plants, however, date back only to 1916, when the plant at Worcester, England, was put into service, and 1917 in the United States, with the San Marcos and Houston, Texas, plants.

The experiments of Clark and Gage at the Lawrence Experiment Station, and of Ardern and Lockett at Manchester, England, and others in the United States during 1912 and 1913, showed that the growth of living organisms of a great many species was essential to the production of activated sludge.

Barton and Mohlman at the University of Illinois, 1914-1915, and other investigators, showed that rapid nitrification could be obtained and the process of treatment speeded up by mixing activated sludge (seeded material) with sewage. Hatton, at Milwaukee, and

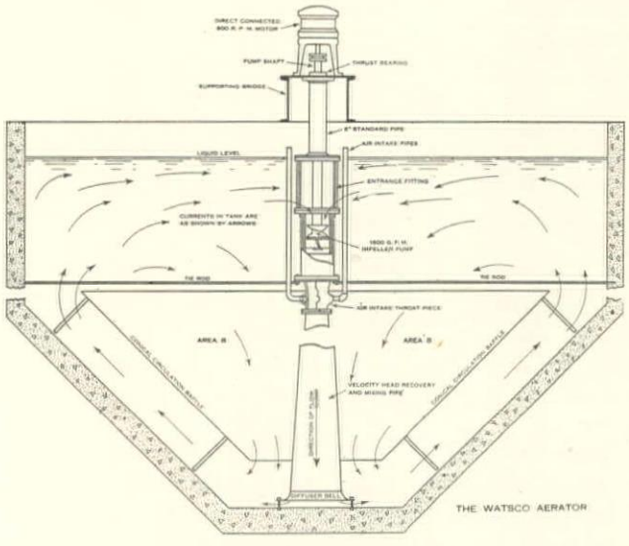



Fig. 1. The 'Watsco' Aerator

others, showed that, after establishing an activated sludge by aerating the sewage for a sufficient length of time to produce an accumulation, a continuous flow of sewage through aeration tanks, followed by separation tanks, could be used. The activated sludge which settled in the separation tanks could be returned to the incoming sewage in any desired proportion, to seed the raw material and accelerate the process. The present day types of continuous-flow activated sludge plants are universally designed on this principle.

The high degree of purification of sewage obtainable

by this process can be accounted for by the biochemical and physical action of the sludge floc. Where this floc can be brought into intimate contact with the raw sewage, the sticky gelatinous sludge particles pick up the suspended matter and the living organisms and their enzymes decompose and oxidize the organic compounds, producing additional sludge, the whole of which will settle readily in a properly functioning plant.

It has been shown at plants in use that sufficient oxygen to supply the needs of the bacteria is all that is necessary to produce a good floc, when proper mixing is had, and that an excess of oxygen over this requirement does not improve results. It is then apparent that the problem of aeration largely becomes one of adequate mixing of the raw sewage with the seeded sludge, after sufficient oxygen has been provided.

Fuller and McClintock state that:

In the aerating tank three conditions should be provided, namely:

(a) Some oxygen in all places at all times to promote the growth of oxidizing bacteria.

(b) Mechanical mixing of activated sludge with the sewage to be treated so that the colloidal and suspended matters will be collected on the gelatinous surfaces and biochemical changes may proceed.

(c) Avoidance of accumulations, especially on the floor of the tank, of suspended solids which facilitate the development of anaerobic or septic conditions antagonistic to the desired oxidizing bacteria, and capable of de-activating much or all of the sludge.

The major American plants have been laid out to use the air diffusion method of aeration, where air is introduced into the flowing-through sewage by the use of a porous medium at the bottom of the tank. Different bottom shapes and arrangements of placing the air vents are in use; the ridge and furrow bottom and the placing of the air vents nearer one side of the tank to produce a spiral circulation being the most common. Several mechanical means of producing agitation and introducing air are in use, notably the Simplex system and the paddle process at Sheffield, England. There are also plants in use in which air is introduced through porous media at the bottom of the tanks and agitation is assisted by paddles.

The main desire of investigators seems to be to cut down operating and investment costs and to maintain good results. Experience has shown that comparable end results may be produced by several of the various methods of aeration in common use.

**The 'Watsco' Aerator**—I collaborated with F. V. Hammerly of the Water Works Supply Co., of San Francisco, designer of the 'Watsco' aerator, in the development of this apparatus which applies established mechanical principles and design to the problem of aerating and mixing sewage in the activated sludge process.

The aerator unit (see Fig. 1) consists of a direct-connected, semi-displacement, screw-type pump, discharging downward through a restricted section or venturi throat. Air is drawn into the sewage stream at the throat by the suction which the flow through the restricted section produces.

The unit has been carefully laid out for accessibility and all working parts may be removed or replaced from the supporting bridge without de-watering the aeration tank.

The aerator in operation produces the greatest turbulence at the extremes of the tank. An excess of air is apparent from the fact that the bubbles break over the whole surface of the tank when the aerator is operating and for several minutes after it has stopped.

A complete emulsion of the air in the sewage is accomplished. The air is introduced into the sewage with a jetting velocity through ⅛-in. holes at the throat piezometer ring. The mixture of sewage and air discharges from the bottom of the unit at the tank floor with a velocity of 3 ft. per sec., and spreads immediately to the extremes of the tank.

The introduction of the conical baffle near the bottom assists in the mixing by producing an effect similar to the spiral flow air diffusion method. The air and sewage mixture leaving the bottom of the unit has a lower specific gravity than that above the deflector (some of the air having escaped from the mixture in Area 'B', Fig. 1) and this liquor is entrained in the flow from the bottom of the unit. There is a complete turbulence of all parts of the tank and an excess of air is apparent at all times when the unit is running.

The percentage of air which can be introduced can be varied, that is, by changing the ratio of the area of the restricted section to the area at the straight section, the proportion of air to liquor circulated may be either increased or decreased.

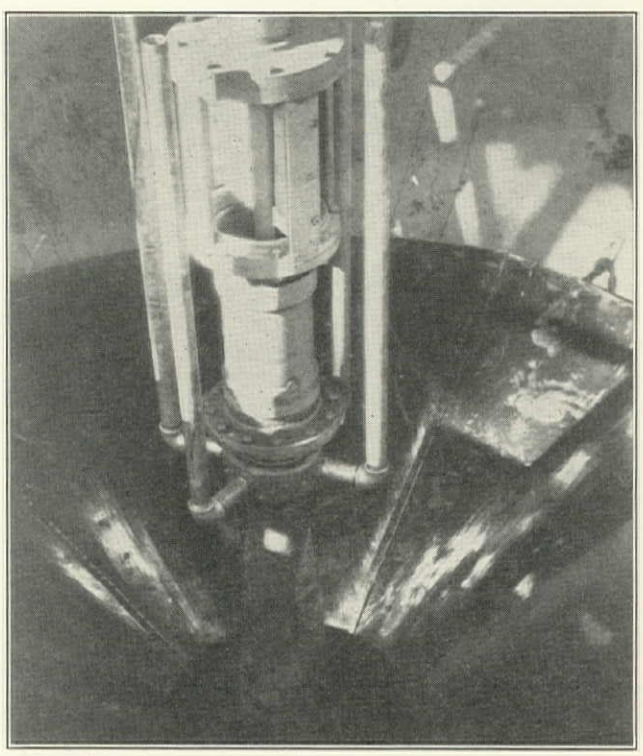


Fig. 2. The 'Watsco' Aerator at Montezuma School, California

The horsepower demand of a given unit is constant and is unaffected by a variation in sewage flow through the tank, because the pumping head is merely the frictional head used to draw in air at the throat ring, plus hydraulic friction in the down-draft tube.

Results secured at the Montezuma school plant ('Watsco' aerator installed March 17, 1929) from tests run April 4, 1929, were as follows:

| | |
|---|---|
| Biochemical oxygen demand of preliminary settling tank influent | 440 p.p.m. |
| B.O.D. of aerator tank influence | 220 p.p.m. |
| B.O.D. of aerator tank effluent after 30 min. setting | 21 p.p.m. |
| Percentage reduction in aerator | 90.5 |
| Appearance of effluent | Clear |
| Appearance of sludge | Light brown |

The designers of the Watsco aerator lay out the unit to furnish the amount of air required for treating any given sewage.

Given a sewage of pre-determined strength, the air requirements may be arrived at as follows:

| | |
|---|---|
| Pounds per cu.ft. $O_2$ in air at 760 min. pressure and 80° F. | 0.0167 |
| Weight of sewage approximately lb. per gal. | 8.3 |

1000 gal. of sewage of 100 p.p.m. B.O.D. requires 0.83 lb. of oxygen for complete oxidation to stability.

50 cu.ft. of free air at 80° F. and 760 min. pressure is required to furnish 0.83 lb. of $O_2$.

Therefore, 50 cu.ft. of free air would be required to provide oxygen for activating 1000 gal. of sewage of 100 p.p.m. B.O.D. if the mixing of sewage and air were 100% efficient.

Observation of the experimental units of the Watsco aerator tested in 1928, and the unit in use at the Montezuma school, in my opinion, justifies the assumption that at least 20% of the oxygen furnished will be available.

Applied to a standard 'Watsco' unit, which is capable of emulsifying 1600 gal. of sewage and 320 gal. of free air per minute, the capacity of an aerator is calculated as follows:

| | |
|---|---|
| Rate of circulating sewage liquor | 1,600 g.p.m. |
| Quantity of air entrained in liquor, 320 g.p.m. or | 42 cu.ft. per min. |
| Pounds of oxygen furnished at 80° F. 760 min. pressure | 0.7 per min. |
| Pounds of oxygen in 6 hours | 250 |
| Quantity of 100 p.p.m. B.O.D. sewage which aerator will treat in 6 hours | 60,000 gal. |
| Daily capacity of standard aerator unit, 100 p.p.m. B.O.D. sewage, 6 hours retention | 240,000 gal. |
| Horsepower requirement | 2.68 hp. per unit |

To determine the capacity of the unit for any given sewage, multiply 240,000 gal. by $\frac{100}{\text{B.O.D. in p.p.m. of sewage under consideration}}$

The apparent limitation to readily attaining the maximum efficiency of a unit is one of design of the aerator tank rather than the unit itself. Where plant site topography and quantity and character of sewage will permit, it is undoubtedly feasible to exceed the unit capacity shown, as an excess of air can readily be maintained in the sewage passing through the aerator.

It is apparent that many factors affect the efficiency of aeration; the design of aerator tank to avoid short circuiting, provision for continuous mixing of air, incoming sewage and activated floc, and the production of vertical circulation in the aeration tank to prevent bulking of the sludge being major points.

These features are matters of equipment and plant design on which much study has been given by all investigators in activated sludge problems, as is witnessed by the variety of methods of introducing oxygen into the sewage which are now in use.

I feel that the aerator described herein represents a major advance, in that a true emulsion of air and sewage may be maintained. Vertical circulation is obtained and flexibility of use is possible through varying the proportion of air to sewage.

# PERSONAL MENTION

**Robt. A. Conyes Co.** has moved its trucking business and warehouse to 5619 San Pablo ave., Oakland, California.

**Lytle Brown,** Brig.Gen., U.S. Army, has been named chief of army engineers, succeeding Maj.Gen. Edgar Jadwin.

**J. W. Carey,** of Portland, **H. F. Gray,** of Berkeley, and **G. M. Upington,** of Klamath Falls, were recently granted certificates to practice civil engineering in the state of Oregon.

**J. Owens,** in charge of a $15,000,000 highway program in London, England, called on M. M. O'Shaughnessy, city engineer of San Francisco, early in September to inspect local boulevard construction.

**W. C. Mendenhall,** chief geologist of the U. S. Geological Survey, is now in Nevada checking survey work in the Tonopah, Goldfield, and Mina districts and in the northern areas of the Lovelock section.

**J. R. D. Mattheson,** Major, U. S. Corps of Engineers, has succeeded Col. **T. H. Emerson** as the engineer in charge of the work of the California Debris Commission at San Francisco. Col. Emerson has been transferred to Washington.

**Donald R. Warren,** designing engineer on the Hetch Hetchy water supply project for the city of San Francisco, has been appointed associate hydraulic engineer in the division of water resources of the state of California, with headquarters at Sacramento.

**H. C. Neuffer,** formerly designing engineer for the United States Indian Field Service on the Coolidge dam, San Carlos, Arizona, has been transferred to Albuquerque, New Mexico, where he is the engineer representing the United States on the Middle Rio Grande Conservancy District.

**J. J. Mieldazis,** of the Rockefeller Foundation, International Health Division, was recently in California obtaining information on water supply and sewage disposal. He had previously come from the Philippine Islands and is now on his way to India to take a sanitary engineering post with the Foundation.

**Newton D. Cook,** manager of the San Francisco office, Engineering Societies Employment Service, reports that employment conditions are improving, especially for this season of the year. Several surveys are in progress or are just starting in northern California; activity on natural gas pipe-lines is responsible for much of this work.

**F. A. Savage,** Captain, U.S.A. (retired) has been granted a leave of absence by the Raymond Concrete Pile Co. for a sufficient time to serve as chief of the party on preliminary surveys for the proposed Golden Gate bridge over San Francisco bay. Savage was first assistant to A. W. Deuell on construction of the San Francisco bay toll bridge.

**A. P. Davis,** former chief engineer of the East Bay Municipal Utility District, has been appointed by the Russian government to supervise a large irrigation project in Turkestan. Water will be obtained from the 1500-mile Amudoria river to irrigate that portion of Turkestan between the Afganistan boundary and the 42nd parallel. The project will require five years to build and will cost $250,000,000.

**W. F. Webb,** concrete superintendent on lining of the Hetch Hetchy tunnels on part of the Moccasin and all of the Foothill division of the San Francisco municipal water supply project under M. M. O'Shaughnessy and N. A. Eckart, has been loaned to Boston for construction of that city's new aqueduct. Webb had previously been loaned to the Australian government. He is the inventor of the Webb concrete gun.

**L. J. van Dunné,** chief engineer of Public Works, and his assistant, **J. P. van Bruggen,** of Rotterdam, Holland, have been in California inspecting the George A. Posey subaqueous tube under the Alameda estuary. They had previously inspected the Holland tunnel, New York, and engineering works at Detroit. From the San Francisco bay region van Dunné and van Bruggen went to Los Angeles, en route to Holland. They are gathering information on design and construction of subaqueous tubes.

# ASSOCIATIONS

## AMERICAN WATER WORKS ASSOCIATION

### Tenth Annual Convention, California Section, Hotel Del Monte, Monterey, October 23 to 26

**Wednesday, October 23**

All-day golf tournament on Del Monte course. Registration and review of exhibits at convention headquarters.

**Thursday, October 24**

10 a.m.—General get-together with registration and review of exhibits.

2 p.m.—Address of welcome by S. F. D. Morse, president of the Del Monte Properties Co. and the Monterey County Water Works. 2:15 p.m.—'Monterey County Water Works' by C. S. Olmstead, superintendent. 3 p.m.—'East Bay Municipal Utility District' by Frank W. Hanna, chief engineer and general manager. 3:45 p.m.—Symposium session on the following practical water works topics: (1) 'Testing Water Meters and Accompanying Adjustments' by V. E. Perry, manager of sales department, Spring Valley Water Co. (followed by discussion); 'Contamination of Water Systems by Consumers Water Uses' by S. B. Morris, chief engineer Pasadena Water Department (followed by discussion); (3) 'What Is Adequate Pressure?' by R. L. Tait, superintendent, Santa Cruz Water Department (followed by discussion); (4) 'What Are Proper Sizes for Services?' by Geo. W. Pracy, superintendent of city distribution, Spring Valley Water Co. (followed by discussion).

6:30 p.m.—Informal dinner at Hotel Del Monte. (1) Business meeting with (a) reports of officers; (b) reports of committees; (c) election of officers; (d) selection of place of next meeting; (e) election of national director. (2) 'Some Problems of Hetch-Hetchy and Other Water Supplies' by M. M. O'Shaughnessy, city engineer, San Francisco.

Special entertainment for the ladies. Afternoon—Auto trip about 'Carmel-by-the-Sea'. Autos leave Hotel Del Monte at 1:30 p.m. Evening—Bridge and other card games, with light refreshments, at Hotel Del Monte.

**Friday, October 25**

10 a.m.—Symposium session with (1) 'Meter Testing and Registration' by Geo. Read, superintendent, meter and service division, Los Angeles Department of Water & Power (followed by discussion); (2) 'Service Installations' by (a) J. I. Prugh, superintendent, Sacramento Water Department, and (b) Orla Casad, superintendent, Merced Water Works (followed by discussion); (3) papers on 'Corrosion of Water Pipe' by (a) Logan, of the U. S. Bureau of Standards, (b) F. M. Faude, of the Loveland Engineers, Inc., (c) R. C. Wueste, San Diego Water Department, (d) I. F. Van Giesen, electrolysis engineer of the Los Angeles Department of Water & Power (followed by discussion).

2 p.m.—Symposium session with (1) 'California Water Service Corporation' by C. B. Jackson; (2) papers on 'Sanitation' by (a) L. B. Reynolds, of Stanford University, (b) Carl Wilson, biologist of the Los Angeles Department of Water & Power, (c) W. F. Langelier, of the University of California; (3) papers on 'Commercial Problems' by (a) Carl Chapin, commercial director, Los Angeles Department of Water & Power, and (b) L. M. Anderson, comptroller, Los Angeles Department of Water & Power.

7 p.m.—Informal dinner dance and special entertainment at Hotel Del Monte as guests of exhibitors.

Special entertainment for the ladies. 2 p.m.—Auto trip about Monterey or the Highlands, or to the movies. 6:30 p.m.—Participate with delegates, exhibitors' dinner dance at Hotel Del Monte.

**Saturday, October 26**

10 a.m.—Auto trip and lunch, Monterey peninsula. Leave Hotel Del Monte at this hour; ladies will join in the trip.

The present officers of the Section are: president—John Burt, of San Rafael; vice-president—C. S. Olmstead, of Monterey; executive committee—L. L. Farrell, of Oakland, and W. F. Goble, of Alhambra; secretary-treasurer—Wm. W. Hurlbut, of Los Angeles. Committee chairmen for the meeting are: reception—Geo. W. Pracy, Spring Valley Water Co., San Francisco; ladies' entertainment—Mrs. C. S. Olmstead, Pacific Grove; exhibits—James R. Barker, Neptune Meter Co., San Francisco; golf—H. S. Kittredge, president, San Jose Water Works; local arrangements—C. S. Olmstead, superintendent, Monterey County Water Works; membership—R. W. Martindale, United States Cast Iron Pipe & Foundry Co., San Francisco; nominating—P. Diederich, superintendent, Water Department, Glendale; entertainment—Alexander Bell, Wallace & Tiernan Co., Inc., San Francisco.

A list of exhibitors of the California Section, American Water Works Association, and the Water Works Manufacturers Association, Inc., follows:

American Brass Co.
American Cast Iron Pipe Co.
American Concrete Pipe Co.
Art Concrete Works
Badger Meter Mfg. Co.
Bethlehem Steel Corp.
California Corrugated Culvert Co.
California Filter Co.
Central Foundry Co.
Chase Brass & Copper Co.
Chicago Bridge & Iron Works
Claussen & Co., Inc., C. G.
DeLaval Steam Turbine Co.
Forni Manufacturing Co.
Gerlack Packing
Gillette Publishing Co.
Greenberg's Sons, M.
Great Western Electro-Chemical Co.
Hercules Foundry, Inc.
Hersey Manufacturing Co.
Hydraulic Development Co.
Hydraulic Engineering
James Jones Co.
Kennedy Valve Co.
Leadite Co.
McEverlast, Inc.
McWane Cast Iron Pipe Co.
Michigan Valve & Foundry Co.
Mueller Manufacturing Co.
National Cast Iron Pipe & Foundry Co.
National Meter Co.
National Tube Co.
Neptune Meter Co.
Pacific States Cast Iron Pipe Co.
Paradon Manufacturing Co.
Pittsburgh-Des Moines Steel Co.
Pittsburgh Equitable Meter Co.
Rensselaer Valve Co.
Rich Manufacturing Co.
Ross Valve Manufacturing Co.
San Jose Foundry
Simplex Valve & Meter Co.
Sparling, R. W.
Thompson Corp.
Thompson Meter Co.
United Casting Co.
United Concrete Pipe Co.
U. S. Cast Iron Pipe & Foundry Co.
Wallace & Tiernan
Water Works Supply Co.
Western Construction News
Western Pipe & Steel Co.
Wolworth Co.
Worthington Pump Co.

## LEAGUE OF CALIFORNIA MUNICIPALITIES

### Thirty-First Annual Convention at Hotel Oakland, Oakland, October 7 to 11

As the program for this convention was not available for publication in time for the September 25th issue, and as space is lacking in this issue, we will publish a review of the Convention in the October 25th issue. City planning and municipal airports are the principal engineering topics for discussion. Inspection of the Port of Oakland, George A. Posey tube, and Oakland and Alameda airports are scheduled, as is a trip by the city engineers to the Pardee dam on Friday, October 11.

## PARDEE DAM CELEBRATION

On Saturday, October 19, the Pardee dam banquet and dedication will be held, a special celebration being planned by the contractor for this event. The banquet (invitation only) follows the policy of the Atkinson Construction Co. in celebrating the completion of important projects.

On the same day the Calaveras Cement Co. has invited its friends to visit and inspect the new cement plant 10 miles east of Valley Springs and near San Andreas, California. This plant, of the wet process type, has a capacity of 3000 bbl. per day; it furnished over 3,000,000 sacks of cement for the Pardee dam.

# Construction Review

## SEWER CONSTRUCTION

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

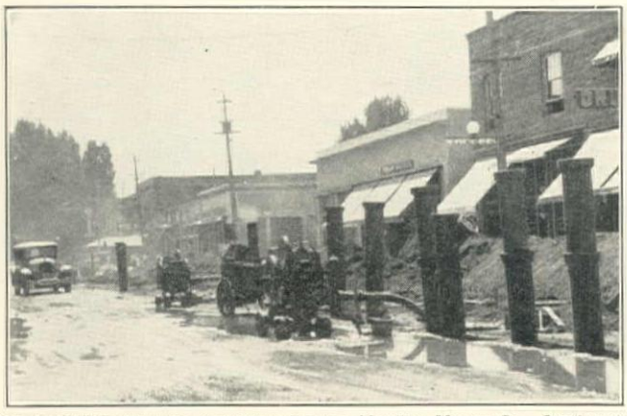
### ALTURAS SANITARY SEWER

Heafey-Moore Co., of Oakland, has completed and had the work accepted on a vitrified pipe sewer system in district 2, Alturas, California. The contract price was $83,828. The work was done under subcontract by Robert McNair, of Oakland. Principal equipment included one Austin model 105 trencher, one P&H model 151 trencher; one Best '30' bulldozer; and four Barnes diaphragm pumps.

S. A. Musken is the city engineer.

### RELIEF AND INTERCEPTING SEWER, LOS ANGELES

Harmon Co., of Alhambra, had completed 60% of the sewer work on September 13 on a large project in



Constructing Alturas Sanitary Sewer, Heafey-Moore Co., Contractor. Barnes Diaphragm Pump in Center Background

Ave. 57 and Carlotta blvd., Los Angeles. The contractor was then laying 18-in. main-line pipe in Carlotta blvd. and in the right-of-way east of Pasadena ave. and 15-in. pipe in Ave. 63 between Bertha st. and Arroya glen. The project was designed primarily as a relief and intercepting sewer for overflow conditions in Pasadena ave. and contiguous territory and to provide sewerage for low-lying tracts in Arroyo Seco. There is 96,268 ft. of 6 to 24-in. pipe in the project; the total cost will be $270,429. The assessment district includes 12,000 separate pieces of property.

Construction of this sewer has been difficult. In many places excavation has been carried to 30 ft. in sandy soil. The work is being rushed, as five separate paving projects must be delayed until the sewer is completed.

John C. Shaw is the city engineer.

### OUTFALL SEWER AND ACTIVATED SLUDGE PLANT, ESCONDIDO

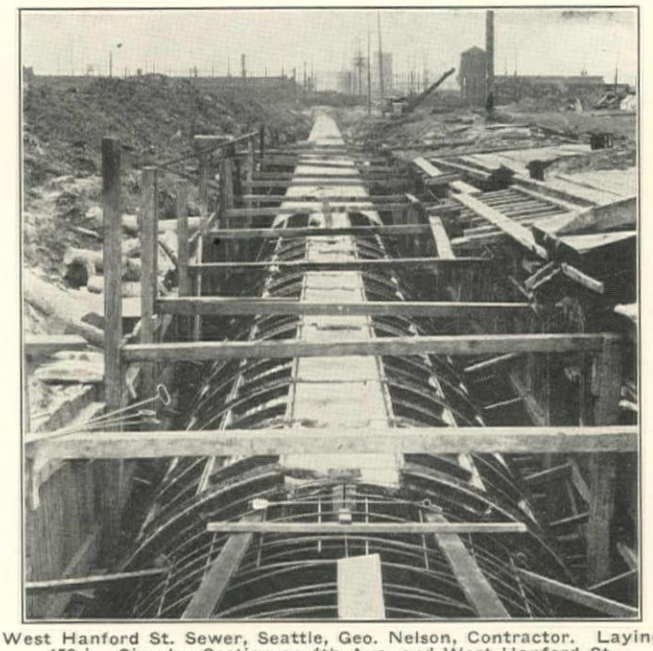
R. E. Burgund, of Beverly Hills is constructing an activated sludge type disposal works and a vitrified clay outfall sewer for the city of Escondido. The treatment plant was designed for a population of 4500. It has a preliminary settling tank and separate sludge digestion both for raw sewage and for activated sludge. The effluent will be chlorinated before discharging into a creek.

On September 7 the contractor had completed 2000 cu.yd. of plant excavation, had placed one-half of the concrete, and had laid 2024 lin.ft. of 15-in. vitrified pipe. Reinforcing steel, valves, fittings, and machinery for the plant are on the ground. The contract price for the disposal plant was $41,490; for the sewage pumping station $8836; and for the vitrified pipe outfall sewer $4774. Work started July 15.

Black & Veatch, of Los Angeles, are the engineers, with Alva J. Smith as resident engineer.

### SEWER SYSTEM AND DISPOSAL PLANT FOR SALINAS

E. M. Funk, of Arcadia, started work August 1 on a separate sludge digestion plant, activated sludge type, to treat domestic sewage; a treatment plant for cannery waste; and two district pumping stations for Salinas, California. The work will be completed December 1. The contract price was $102,900. Excava-



West Hanford St. Sewer, Seattle, Geo. Nelson, Contractor. Laying 150-in. Circular Section on 4th Ave. and West Hanford St.

tion at the main treatment plant has been completed; on September 5 the contractor had placed 20% of the concrete in this plant. Work had not been commenced on the pumping stations or cannery waste plant. The Dorr Co. is furnishing the clarifier; Fairbanks-Morse pumps and Connersville blowers will be used.

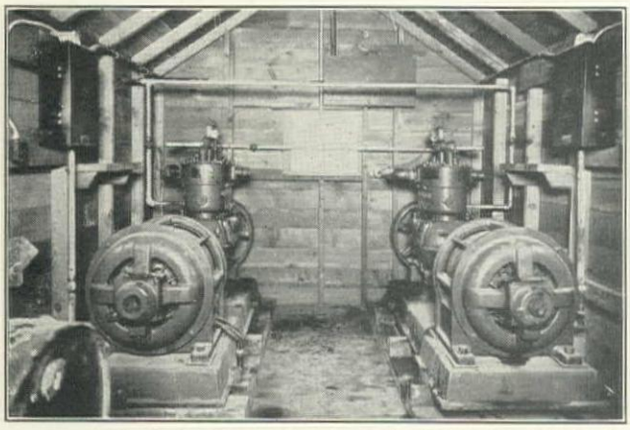
Gogo & Rados, of Los Angeles, began construction of a concrete pipe storm sewer and sanitary pressure sewer and vitrified clay pipe collecting sewers for the city of Salinas on August 1. The contract price was

$185,336. By September 4 this contractor had laid 5500 lin.ft. of 18-in. vitrified pipe sanitary sewer. There are 33,000 lin.ft. of 12 to 36-in. Hume centrifugal concrete pipe (furnished by the American Concrete Pipe Co.). Gladding, McBean & Co. is furnishing 17,239 lin.ft. of 8 to 18-in. vitrified sanitary sewer pipe.

Burns-McDonnell-Smith Engineering Co., of Los Angeles, are engineers for the city on both projects. The unit bid summary was published in the July 10th, 1929, issue.

## OUTFALL SEWER FOR WOODLAND, CALIFORNIA

C. E. Prentiss, of San Jose, started work August 19



Compressor Plant for Concreting Arch in 108-in. Tunnel Section, West Hanford St. Sewer, Seattle, Geo. Nelson, Contractor. Gardner-Denver Compressors and General Electric Motor Equipment

on the outfall sewer in Acquisition and Improvement District No. 3 for the city of Woodland. Items in the contract are: 13,286 lin.ft. of 24-in. centrifugal concrete pipe at $3.13; 13,171 lin.ft. of 24-in. vitrified pipe at $2.78; 5391 lin.ft. of 18-in. vitrified pipe at $1.37; 5875 lin.ft. of 15-in. vitrified pipe at $1.10; 9312 lin.ft. of 12-in. vitrified pipe at $0.77; 70 concrete manholes at $64; 16 Y branches, 18 by 4-in., at $2.00; 97 Y

Overflow Chamber for West Hanford St. Sewer, Seattle, Geo. Nelson, Contractor

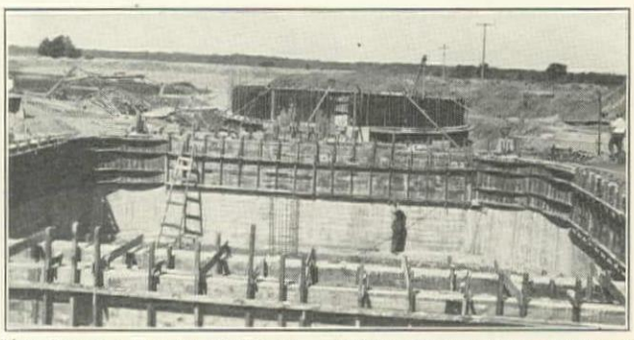
branches, 15 by 4-in., at $1.50; 124 Y branches, 12 by 4-in., at $1.00; backfilling, lump sum, $1725; outfall structure, lump sum, $1050; connection to sewer, $6.00.

On September 7 the contractor had finished placing 5500 lin.ft. of 24-in. vitrified pipe (furnished by Gladding, McBean & Co.) and the American Concrete Pipe Co. had started delivery on 24-in. Hume centrifugal concrete pipe. The smaller sizes of vitrified pipe will be furnished from the Sacramento yard of the Muddox Co. Asphaltic compound joints are being used on all vitrified pipe. The contractor plans to lay 1000 ft. of 24-in. Hume pipe per day. The project will be completed December 1; the contract price was $106,840.

Asa G. Proctor is the city engineer.

## WEST HANFORD AND WEST BARTON ST. SEWERS, SEATTLE

Geo. Nelson, contractor, of Seattle, is making good progress on Local Improvement District 4751, the West Hanford St. sewers, et al., for the city of Seattle. A detailed article on this project was published in the July 25th, 1929, issue. On September 9 excavation and invert lining of the 108-in. tunnel section had been completed; lining of the tunnel arch is now in progress. On that date 90% of the 102-in. circular, 55% of the 66-in. circular, 88% of the 60-in. circular, and 60% of the lateral sewers were completed. The outfall section has been finished and the entire project will be completed about February 1, 1930, the contractor being ahead of schedule. Equipment acquired since that listed in the detailed article includes one Whitcomb class CH9 gasoline locomotive (2½ tons);



Chico Sewage Treatment Plant. Clarifier Tank and Dorr Digester in Background. W. J. Tobin, Contractor

one 4-in. closed top, 750 g.p.m. gasoline driven duplex diaphragm pump; and one Leadville model 5 portable hoist.

Thos. Scalzo, of Seattle, had practically completed Local Improvement District 4933, the West Barton st. sewers, et al., by September 9. The job was finished in September whereas the contract required completion in December. This project, which includes an 8 to 36-in. vitrified pipe sanitary sewer, was contracted for $131,694. The unit bid summary was published in the April 10th, 1929, issue.

W. D. Barkhuff is the city engineer of Seattle. H. D. Silliman is the sewerage engineer and I. W. Embury is the district (construction) engineer.

## SAN JOSE OUTFALL SEWER

W. J. Tobin, of Oakland, is constructing the final unit of an outfall sewer for the city of San Jose. This unit extends from Artesian slough to the junction of Gray Goose and Coyote sloughs. Principal quantities in the work are: 13,845 lin.ft. of detail A 45-in. centrifugal concrete pipe sewer at $9.30 and 784 lin.ft. of assorted (details B to D) 45-in. centrifugal concrete

pipe sewer at $10.30 to $14.00; nine manholes at $100; a terminal structure complete at $9160; the Mallard slough crossing, complete, at $5414; 250 cu.yd. of broken stone at $5.00. Bids were received on March 25 and the contract was awarded for $154,822.

The American Concrete Pipe Co., San Francisco, is furnishing the pipe. By September 10 Rhodes-Jamieson barges had delivered 6300 lin.ft. of pipe, each barge load being composed of 100 pieces of pipe in sections 8 ft. long. On September 12 the contractor had completed laying 5000 lin.ft. of sewer. Pipe laying began July 18; the project will be completed November 1. A Dutton Dredging Co. dredge is being used to excavate the canal and trench and to lay pipe.

W. L. Popp is the city engineer of San Jose.

## SANITARY SEWERS AND DISPOSAL PLANT, CHICO

W. J. Tobin, of Oakland, is completing a sanitary sewer system and treatment plant for the city of Chico, California. The work includes a separate sludge digestion tank 40 ft. diam.; a clarifier tank 50 ft. square, with skimmer and automatic screen; installation of Dorr digestor machinery and tractor; 6 miles of 18-21-24-in. concrete pipe outfall sewer; 29 miles of vitrified

Laying Concrete Pipe on San Jose, California, Outfall Sewer, W. J. Tobin, Contractor

collecting mains and laterals, with black joints; 200 precast concrete, 100 brick, and 6 special manholes; and one double siphon on the outfall. (For the unit bid summary see May 10th, 1929, issue.) Pipe laying began May 26 and was completed September 13. The disposal plant will be finished October 15 and the entire work will be completed by November 1.

All piping and valves in the disposal plant were furnished by the Water Works Supply Co., San Francisco. Concrete pipe was obtained from the Chico yard of the Valley Concrete Co. Gladding, McBean & Co. and N. Clark & Sons furnished the vitrified pipe. Equipment on the work includes one Austin No. O trencher and two Barber-Greene trenchers; one Austin backfiller; one Caterpillar '30' tractor with Killifer equipment; one Fageol 4-yd. dump truck and one Graham truck; and one P&H dragline.

The general contract, originally awarded to Gogo & Rados, of Los Angeles, for $262,656, was subcontracted by W. J. Tobin. The disposal works was later subcontracted by C. Dudley Devilbiss.

M. C. Polk is the engineer of works for the city of Chico.

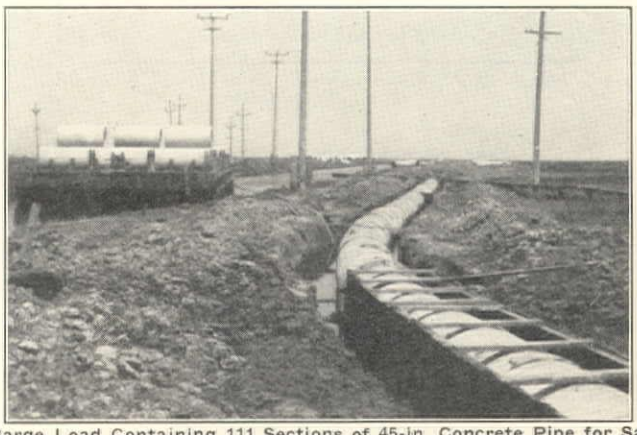
## BERKELEY STORM DRAINS

The city of Berkeley is constructing a 6-unit storm sewer project and will make some improvement in

Northwest Pull Shovel Placing 54-in. Concrete Pipe on Unit No. 2 of Berkeley Storm Drain System, Fredrickson & Watson Construction Co., Contractor

natural drainage channels. The status of the six units follows:

**Unit No. 1**—On October 15 Rocca & Caletti, of San Rafael, will complete Unit No. 1, which is an extension of the Ashby ave. system. The contract was let for $140,552, and included furnishing and laying pipe, inlets, structures, and appurtenances. The contract items were: 29,850 cu.yd. of excavation at $1.64; 120 ft. of 54-in. heavy centrifugal concrete pipe at $12.80; 890 lin.ft. of 54-in. light centrifugal concrete pipe at $8.50; 1320 lin.ft. of 48-in. centrifugal concrete pipe at $7.40; 2490 lin.ft. of 42-in. centrifugal concrete pipe at $6.25; 1025 lin.ft. of 36-in. centrifugal concrete pipe at $5.30; 710 lin.ft. of 30-in. centrifugal concrete pipe at $4.30; 750 lin.ft. of 27-in. heavy centrifugal concrete pipe at $3.70; 2010 lin.ft. of 27-in. light centrifugal con-



Barge Load Containing 111 Sections of 45-in. Concrete Pipe for San Jose Outfall Sewer. Pipe Barged from American Concrete Pipe Co. Plant Direct to Canal Where It Is Laid by Dredge

crete pipe at $3.26; 1005 lin.ft. of 24-in. heavy machine-made concrete pipe at $3.12; 960 lin.ft. of 24-in. light machine-made concrete pipe at $2.47; 760 lin.ft. of 21-in. heavy machine-made concrete pipe at $2.50; 500 lin.ft. of 21-in. light machine-made concrete pipe at $2.03; 2220 lin.ft. of 18-in. unreinforced concrete pipe at $1.25; 710 lin.ft. of 12-in. vitrified pipe at $1.80; 1050 lin.ft. of 10-in. vitrified pipe at $1.45; 170 lin.ft. of 8-in.

vitrified pipe at $1.25; 20 lin.ft. of 6-in. and 340 lin.ft. of 4-in. vitrified pipe at $1.00; 46 manholes at $113.50; 46 catchbasins, type 1, at $94.30; 17 catchbasins, type 2, at $147; 3 catchbasins, type 3, at $50; 15 curb inlets, type 1, at $25; 6 curb inlets, type 2, at $60; 9 curb inlets, type 3, at $25; 13 sanitary intercepts at $15; 50 cu.yd. of class A concrete at $20 and 50 cu.yd. of class B concrete at $18; 40 cwt. of reinforcing steel at $5.00; 200 cu.yd. of foundation rock at $0.50; 1200 sq.ft. of asphaltic concrete paving at $0.50; and 3000 sq.ft. of oil macadam paving at $0.20.

The 54 to 27-in. centrifugal concrete pipe is Hume process, manufactured by the Bent Concrete Pipe Co.; the 24 to 15-in. machine-made concrete pipe was manufactured with a Turk McKenzie machine by the California Concrete Products Co.; the 4 to 12-in. vitrified pipe was furnished by N. Clark & Sons. Major equipment includes one Northwest pull shovel, one bull-


A 'Rare Bird'. (Courtesy of 'The Highway Magazine', Middletown, Ohio)

dozer, one Austin ditcher, one gantry crane, and two Ingersoll-Rand compressors.

**Unit No. 2**—Fredrickson & Watson Construction Co., of Oakland, completed Unit No. 2, which is an extension of the Virginia and University outfall systems, on October 1. The contract was awarded in May for $74,014, and work commenced on June 15. This consisted of furnishing and laying 54 to 27-in. centrifugal concrete pipe; 24 to 15-in. machine-made concrete pipe; 12 to 4-in. vitrified pipe; inlets; structures; and appurtenances. The major equipment included one Northwest pull shovel; one Austin and one Barber-Greene ditcher; and one Austin backfiller.

**Unit No. 3**—This is an outfall line for the north Berkeley district, from San Pablo to the bay. It is a 75 to 84-in. precast reinforced concrete pipe with the outfall end on piling. Bids were received September 3. Rocca & Caletti were low with a bid of $83,500.

**Unit No. 4**—This unit, included in the north Berkeley system, connects to Unit No. 3. The assessment plan is based on the 1911 Boundary Act. Proceedings were started August 27 and bids were to be received about November 1, plans and specifications being completed during September.

**Unit No. 5**—This unit, the Gilman system, includes a 60-in. outfall sewer in the bay. Bids were received

Rocca & Caletti Laying 54-in. Hume Pipe on Sacramento St., Berkeley Storm Drain System, Unit No. 1. Gantry Crane and Northwest Shovel in Background

September 10 and Fredrickson & Watson were awarded the contract at $67,021.

**Unit No. 6,** which comprises 2000 ft. of sanitary outfall sewer, has not yet been completely designed.

Harry Goodridge is the city engineer of Berkeley and Sam Hart is the sanitary engineer.

# ITEMS OF INTEREST

### Grading Awarded on Colorado Highway Project

W. A. Colt & Sons, Las Animas, Colorado, was awarded the contract on a bid of $393,674, for grading 17.2 miles of the Fall river project, Section B, Rocky Mountain National Park, in Larimer county, Colorado, for the U. S. Bureau of Public Roads.

### Call for Bids on Hansen Dam

Bids will be received up to 2 p.m. October 14 by the board of supervisors of the Los Angeles County Flood Control District for constructing Hansen dam and other structures at a site one mile above Hansen's lodge and 12 miles northeast of Sunland. The dam will be a concrete arch type with an earth-fill wing on the north end; it will be about 204 ft. high above streambed and 300 ft. long between abutments. The quantities include: 90,000 cu.yd. of class A (rock) and 18,000 cu.yd. of class B (river wash) excavation; 10,000 cu.yd. of earth fill; 90,000 cu.yd. of plain and 2500 cu.yd. of reinforced concrete; 5500 sq.ft. of reinforced concrete face slab; drilling 4000 ft. of grout holes to 30 ft. depth or less; placing pipe in 250 grout holes; 250 cu.yd. of pressure grouting; placing 10,000 lb. of reinforcing steel in plain concrete, 50,000 lb. of trash racks and metal, 100,000 lb. of steel outlet pipes, 150,000 lb. of valves and gates, 8000 lb. of iron pipe railing, 4000 ft. of water and grout stops, and 800 ft. of tile drain.

# New Equipment and Trade Notes

## GENERAL EXCAVATORS NOW EQUIPPED WITH SIX-CYLINDER ENGINES

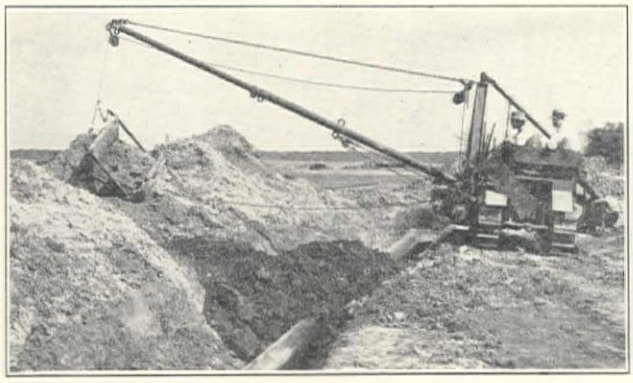
The General Excavator Company, Marion, O., manufacturers of convertible half-yard shovels, is now powering all machines with a standard make six-cylinder engine.

Built just like a big machine, only not so large, the General is capable of doing the same type of work as any of the larger capacity excavating machines. It can be quickly and easily changed in the field from one type of boom assembly to another without making any changes in the operating machinery. It is convertible to shovel, dragline, clamshell, crane, back-hoe, and back-filler service by simply changing the boom equipment.

Great strength and rigidity is obtained by the use of steel castings throughout. The machinery is simple in design and easy to operate. The powerful six-cylinder engine assures plenty of reserve power and smooth, rapid operation.

## W-K-M BOOM FOR CATERPILLARS

Where loads are to be carried by a portable tractor unit, the W-K-M swinging boom equipment has many uses. Also, for backfilling, the boom equipment can be rigged so that the cable on the slow-speed winch will be used as a drag-in line



W-K-M Swinging Boom Equipment Used with Caterpillar Tractor for Backfilling Trench

attached to the drag-in chain on the bucket and the high-speed winch can be used to spool the cable for the throw-out line attached to the throw-out chain. The boom is attached to the upright by a chain; for backfilling work it can be extended to a maximum of 20 ft.

With a 1-yd. maximum size of bucket, 10 throws per minute can be made without undue strain on the equipment. When the tractor is stationary, the boom can be swung so that the bucket will clean up a spoil bank to a distance of 10 ft. beyond the length of the tractor. Both the high- and low-speed winches are mounted on the left hand side of the tractor and are driven off the main shaft through a chain drive to the power takeoff. The boom is swung by two auxiliary winches on the left side.

## PACIFIC STATES CAST IRON PIPE CO.

The Pacific States Cast Iron Pipe Co. has opened a sales office at 326 First National Bank Bdg., Denver, in charge of Dana E. Kepner. This office, which will serve Colorado and adjacent territory, will relieve the Provo and Salt Lake City offices.

## DALLAS GETS WESTINGHOUSE EQUIPMENT

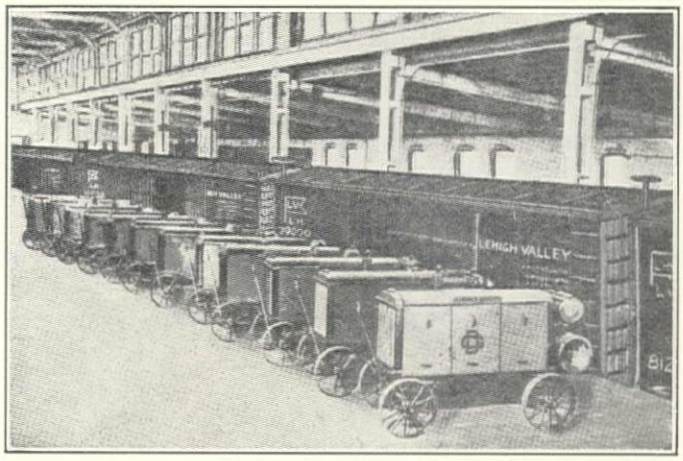
The Bachman pumping station, Dallas, Texas, will contain the following Westinghouse electrical equipment: three 800-hp., 900-r.p.m.; one 400-hp., 1200-r.p.m.; three 350-hp., 900-r.p.m.; and one 125-hp., 1200-r.p.m. synchronous motors with exciting and magnetic control equipment. The motors are 90% leading p.f. and operate from a 2200-volt, 3-phase, 60-cycle line; they have ample torques to start the pumps under load; all except the 125-hp. unit will have pedestal type bearings. Variable speed, from 5% below to 5% above normal, will be obtained for the pumps by varying the frequency of the line from 54 to 63 cycles.

## SOVIET TRUCKS WITH HERCULES ENGINES

A new type YA-5, Soviet-made, 3½-ton truck, powered by a Hercules motor, recently made a test run of 550 km. at an average speed of 50 and a maximum speed of 80 km. per hour. For a 100-km. stretch the loaded truck used 37 kg. of gasoline and ⅓ kg. of oil. A previous model, the YA-4, powered by a German motor, developed an average speed of 40 km. per hour. The Hercules engine will be copied and manufactured in Russia, with the Hercules Motors Corp. giving technical assistance. Regular monthly shipments continue on the 1700-motor order recently placed with the factory at Canton, Ohio.

## PORTABLE GARDNER-DENVER COMPRESSORS

The Gardner-Denver Co., of Denver, is supplying a $50,000 order for portable air compressors to be used by Smith Bros., Inc., of Dallas, in pipe-line construction from West Texas to Port Arthur. The compressors will be used in excavating a




Initial Order of 12 Gardner-Denver Portable Compressors Ready for Shipment to Texas

trench, 24 in. wide, 30 in. deep, and 630 miles long. The pipeline traverses an arid and sparsely populated country; it is often 100 miles from the base of supply; the contract time was but 150 days.

## CHAIN BELT CO. CHANGES HOUSTON OFFICE

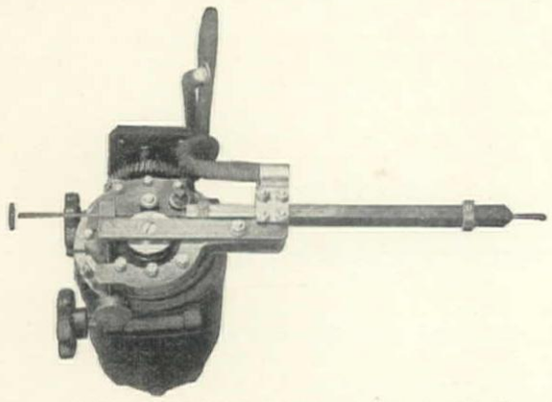
The Houston office of the Chain Belt Co., Milwaukee, manufacturers of 'Rex' deep well oil chains, conveyors, and concrete mixers, has been moved to 1310 Second National Bank Bdg.

## WESTINGHOUSE 'WELDOMATIC'

The Westinghouse Electric & Manufacturing Co. has developed the 'Weldomatic', a new and improved portable automatic welding outfit for use in the metal working industries. The equipment is complete with a compact electrode feeding device, control cabinet, and operator's panel; it is designed to operate

from Westinghouse variable-voltage or constant-voltage welding motor generator sets.

The 'Weldomatic' automatically strikes and holds an arc between an electrode and the work to be welded; no aid being required of the operator, other than to press the starting button. The drive motor is mounted in a cylindrical frame which supports the nozzle assembly. The latter can be reversed so



**Simplified 'Weldomatic' Head Showing Electrode Feeding Device and Cylindrical Frame Enclosing Drive Motor**

as to be a right-hand or left-hand assembly, and the nozzle can be adjusted to movement in two planes.

Positive feed without slippage, extreme sensitivity insuring instantaneous response to arc-voltage conditions, wide range of speeds, compact mounting dimensions and light weight, simplicity of design, ease of adjustment, and smoothness of operation are said to be outstanding features of the 'Weldomatic'.

## SULLIVAN MACHINERY CO.

Perry W. Olliver has been appointed manager of the San Francisco office of the Sullivan Machinery Co., succeeding the late Ray P. McGrath. Olliver has been a member of the Sullivan organization since 1914, and for the past eight years has been associated with the El Paso office.

## IMPROVED SULLIVAN PAVEMENT TESTER

With the rapid increase in the mileage of concrete highways and streets throughout the country and the high speed of constructing these highways, it has become a necessity for municipal, county and state officials to have some convenient means of taking full-depth samples of pavement at proper intervals along the road or street. The core test affords this means.

The improved Sullivan pavement tester, type 2, provides a core which gives an exact sample of the pavement at the point removed, thus showing a complete cross section of each layer of the foundation, coarse and fine concrete surfacing, each in its respective position and thickness. Bulletin 85-C describes this pavement drill.

Extensive use of the machine indicates its satisfactory adaptation to any class of concrete pavement coring, whether the pavement is new or old, and whether plain or with reinforcing steel. Any type of surfacing material, including asphalt, may be handled successfully with this machine, which is operated by a gasoline engine, and weighs complete slightly less than 900 lb. It is arranged for mounting on the rear end of a light motor truck.

The standard bit removes a 5¾-in. diam. core and cuts a hole about 7 in. across. A pavement 7 in. thick has been penetrated in 7 minutes, and a core can be removed ordinarily at the rate of 1 ft. in 15 or 20 minutes. With core barrels of ordinary length, this machine will drill to a depth of 24 in.

A steel core barrel, slotted at the bottom, and chilled steel shot are the means employed for taking the core. The core barrel is fed downward by a rotating drive rod, giving a speed varying from 40 to 50 r.p.m. for starting and up to 100 to 150 r.p.m. while regularly drilling. The drive rod is supported by ball bearings carried in a yoke, and is driven by the engine through beveled steel gearing. A 10 hp., twin cylinder, water-cooled, gasoline engine furnishes power.

## VAN DORN ELECTRIC TOOL DEMONSTRATION CAR

The Van Dorn Electric Tool Co. of Cleveland, Ohio, is now using a new electric tool demonstration car to assist the jobbers' salesmen in demonstrating various Van Dorn tools in operation.

This car consists of an especially designed closed body mounted on a chassis of one of the well-known car manufacturers. The large rear door, when opened, shows the various electric tools in neatly arranged sections, making them accessible for immediate use. This enables the salesmen to bring the tools to users so that they can prove for themselves the merits of the product.

At the present time, this car is being received enthusiastically by the trade in Maryland and Virginia and arrangements have been made to send it or similar cars to all parts of the United States.

## TELSMITH PLANT FOR MONTANA POWER CO.

The Morony dam of the Montana Power Co. is being constructed at a point on the Missouri river 25 miles northeast of Great Falls. The dam will be 850 ft. long and 92 ft. high and will contain 75,000 cu.yd. of concrete. It will be equipped with two 35,000 hp. turbines. The project is being built by the Phoenix Utility Co., of New York, with C. H. Tornquist as general superintendent; R. A. Moncreiff is the resident engineer.

A complete Telsmith gravel washing plant, capacity 150 cu.yd. per hour, is being used to wash and grade sand and gravel. Bank-run gravel, with everything over 6 in. scalped out, is brought from the Tintinger pit, Cascade, in railroad cars and is dumped into a track hopper equipped with a 30-in. by 5½-ft. plate feeder. A 24-in. by 86½-ft. belt conveyor takes the material from the feeder and discharges it into a washing box. Here enough water is introduced to flume the sand and gravel into a 60-in. by 20-ft. Ajax washer. The sand and dirty water is taken out of the first section of this washer and is flumed to a No. 8 sand settling tank which discharges the sand into a twin-screw rewasher. From here the sand is dumped to a ground storage pile; the gravel being carried on through the washer, graded to proper size, and then chuted to ground storage piles. Additional equipment reclaims the material from storage.

## NEW CATALOGS

**Concrete Curing**—Concrete Curing, Inc., of San Francisco, has issued a catalog setting forth its 'PaveCure' method of curing concrete. This method embodies the best features of the common water-cure, with additional features, and eliminates the use of mud and water at certain stages.

**Explosives**—The Hercules Powder Co., Wilmington, Delaware, has released 'Commercial Explosives: Their Safe and Proper Use', a booklet intended to aid users of explosives in improving blasting practices and avoiding accidents. The booklet defines explosives; lists the various types and their characteristics; offers directions for loading, priming, and firing; covers the handling and storage of explosives; gives general safety rules; offers information on detonators, blasting machines, and other blasting accessories.

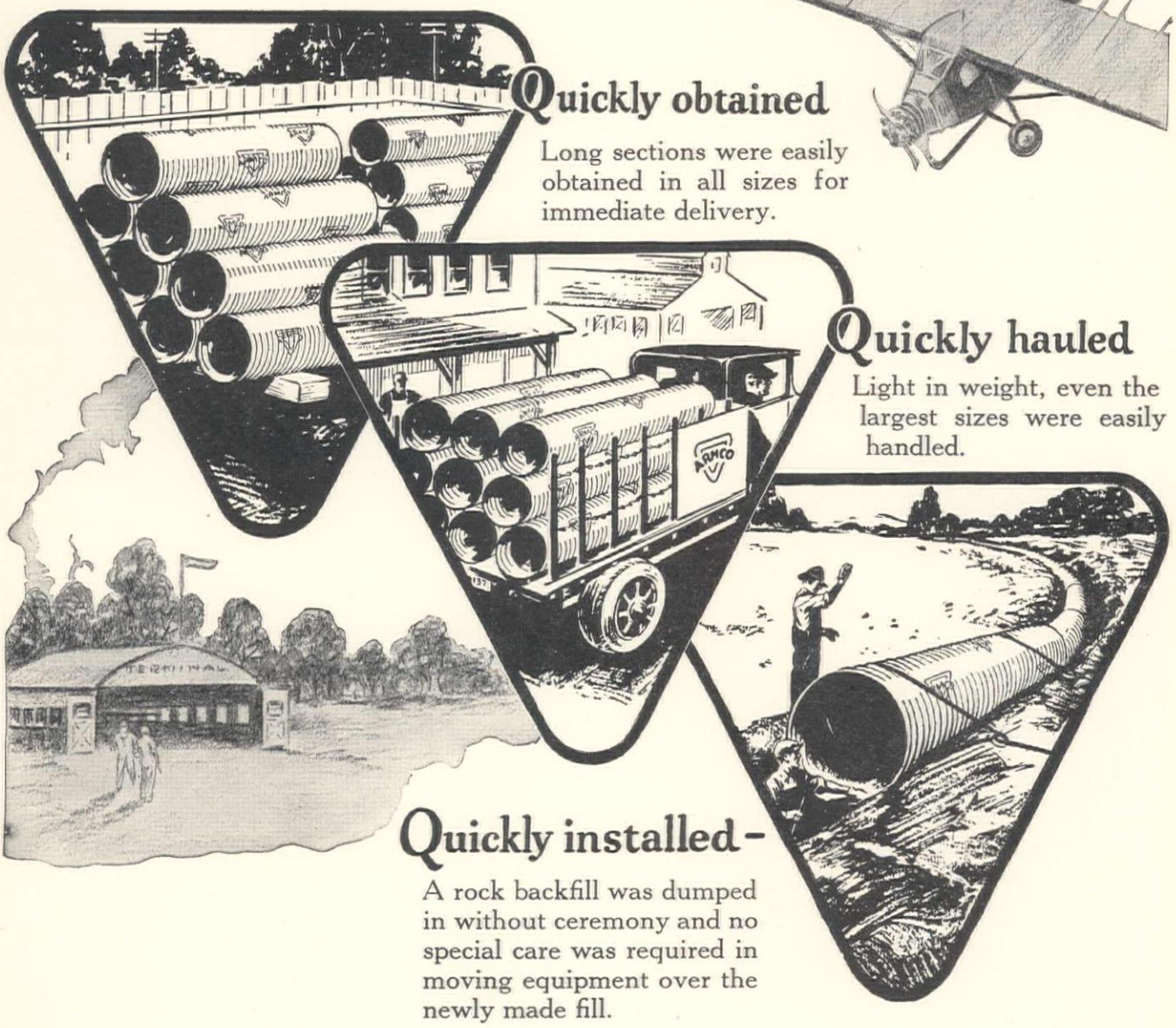
**Locomotive Cranes**—The Thew Shovel Co., Lorain, Ohio, has issued a bulletin covering the 15 and 20-ton Lorain locomotive cranes, powered by gasoline, electric, or diesel motors.

**Squirrel-Cage Motors**—The Wagner Electric Corp., of St. Louis, has issued Bulletin 165 which discusses and compares the seven types of squirrel-cage motors under the headings of general purpose, normal-torque-across-the-line, low-torque-across-the-line, high-torque, double squirrel-cage, punch press, and elevator type.

**Tractors**—The Caterpillar Tractor Co., San Leandro, Calif., has released three new pamphlets, forms S.L. 1526 to 1528 inclusive, which describe Caterpillar performance on varied work.

**Truck-Mounted Cranes**—The Universal Crane Co., Lorain, Ohio, has issued Bulletin 47 which deals with the use of Universal motor truck mounted cranes for steel erection, stone setting, and rigging service.

# With Magic Speed — our soggy field became a well drained - safe - Airport




## Quickly obtained

Long sections were easily obtained in all sizes for immediate delivery.

## Quickly hauled

Light in weight, even the largest sizes were easily handled.

## Quickly installed -

A rock backfill was dumped in without ceremony and no special care was required in moving equipment over the newly made fill.

ANY airport can enjoy the dependability of Armco drainage. Simplicity means quick installation. Flexibility means that Armco Perforated Pipe will withstand every shock. **It will not break!** Let us give you full information.

**CALIFORNIA CORRUGATED CULVERT COMPANY**

**Los Angeles: 424 Leroy Street** **Berkeley: 417 Parker Street**

6829

# UNIT BID SUMMARY

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

## STREET AND ROAD WORK

### PHOENIX, ARIZ.—STATE—OILING—WINSLOW-FLAGSTAFF AND WINSLOW-COCONINO COUNTY LINE HIGHWAYS

Contract awarded to New Mexico Const. Co., Box 592, Albuquerque, New Mexico, $192,299 for 35 miles oil processing Winslow-Flagstaff Highway, FAP No. 74; Winslow-Flagstaff Highway FAP No. 81; and Winslow-Coconino County Line Highway, FAP 22. Bids from:

(1) New Mexico Const. Co., Box 592, Albuquerque....$192,299
(2) T. J. Tobin Const. Co., Albuquerque.... 197,177
(3) Southwest Paving Co., L. A.... 205,666
(4) Hemstreet & Bell, Marysville....$198,830
(5) Schmidt & Hitchcock, Phoenix.... 203,700

WINSLOW-FLAGSTAFF HIGHWAY, FAP NO. 74

| | | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|---|
| 34,872 | sq.yd. prepare subgrade | .01 | .01 | .02 | .01 | .01 |
| 17,436 | gallons oil for subgrade | .07 | .08 | .08 | .075 | .08 |
| 3,357 | tons plant mix oil treated surface | 2.28 | 2.30 | 2.35 | 2.50 | 2.50 |
| 43,758 | ton mi. haul surface, plant mix | .12 | .14 | .12 | .10 | .11 |
| 3.302 | mi. spread, finish plant mix | $100 | $50 | $200 | $150 | $100 |
| 179,604 | sq.yd. prepare subgrade | .01 | .01 | .02 | .01 | .01 |
| 89,802 | gallons oil for subgrade | .07 | .08 | .08 | .075 | .08 |
| 27,480 | tons plant mix oil treat. surf. | 2.28 | 2.30 | 2.35 | 2.50 | 2.50 |
| 124,521 | tons mi. haul surface, plant mix | .12 | .14 | .12 | .10 | .11 |
| 17.008 | mi. spread, finish plant mix | $100 | $50 | $300 | $150 | $100 |
| | NON FEDERAL AID WORK | | | | | |
| 800 | cu.yd. borrow | .40 | .30 | .50 | .40 | .50 |
| 2,000 | cu.yd. additional material | 1.70 | 1.40 | 1.00 | 1.00 | 1.90 |
| 6,000 | cu.yd. mi. haul addt. material | .20 | .14 | .20 | .20 | .13 |
| 1,016 | tons stockpile plant mix, surf. | 2.28 | 2.30 | 2.35 | 2.50 | 2.50 |
| 5,506 | ton mi. haul stock. plant mix | .12 | .14 | .12 | .10 | .11 |

WINSLOW-FLAGSTAFF HIGHWAY, FAP NO. 81

| | 3-IN. PLANT MIX | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|---|
| 122,125 | sq.ft. prepare subgrade | .01 | .01 | .02 | .01 | .01 |
| 61,063 | gallons oil for subgrade | .07 | .08 | .08 | .075 | .08 |
| 19,664 | tons plant mix oil treat. surf. | 2.28 | 2.30 | 2.35 | 2.50 | 2.50 |
| 61,231 | ton mi. haul plant mix surf. | .12 | .14 | .12 | .10 | .11 |
| 12,171 | mi. spread and finish plant mix | $100 | $50 | $300 | $150 | $100 |
| | 3-IN. ROAD MIX | | | | | |
| 6,400 | sq.yd. prepare subgrade | .01 | .01 | .02 | .01 | .01 |
| 6,400 | gallons oil for roadway | .07 | .08 | .08 | .075 | .08 |
| 0.606 | mi. mix, lay down, and finish | $400 | $500 | $400 | $500 | $250 |
| | NON FEDERAL AID WORK | | | | | |
| 1,200 | cu.yd. borrow | .40 | .30 | .50 | .40 | .50 |
| 2,000 | cu.yd. additional material | 1.70 | 1.40 | 1.00 | 1.00 | 1.90 |
| 6,000 | cu.yd. mi. haul addt. material | .20 | .14 | .20 | .20 | .13 |
| 1,246 | tons stockpile plant mix | 2.28 | 2.30 | 2.35 | 2.50 | 2.50 |
| 3,793 | ton mi. haul stockpile plant mix | .12 | .14 | .12 | .10 | .11 |

WINSLOW-COCONINO COUNTY LINE PROJECT, FAP 22

| | | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|---|
| 28,506 | sq.yd. prepare subgrade | .01 | .01 | .02 | .01 | .01 |
| 14,253 | gallons oil for subgrade | .07 | .08 | .08 | .075 | .08 |
| 2,913 | tons plant mix oil treat. surf. | 2.28 | 2.30 | 2.35 | 2.50 | 2.50 |
| 44,686 | ton mi. haul plant mix surf. | .12 | .14 | .12 | .10 | .11 |
| 2.7 | mi. spread, finish plant mix | $100 | $50 | $200 | $150 | $100 |
| | NON FEDERAL AID WORK | | | | | |
| 200 | cu.yd. borrow | .40 | .30 | .50 | .40 | .50 |
| 135 | tons stockpile plant mix | 2.28 | 2.30 | 2.35 | 2.50 | 2.50 |
| 2,071 | ton mi. stockpile plant mix haul | .12 | .14 | .12 | .10 | .11 |

### CRESCENT CITY, CALIF.—CITY—MACADAM—DISTRICT TWO

Contract to Pacific States Const. Co., Call Bldg., S. F., $154,940 for improving streets in District 2 for city of Crescent City, Del Norte County. Bids from:

(1) Pacific States Const. Co., S. F....$154,940
(2) Webber Const. Co., Crescent City.... 159,670
(3) Mercer-Fraser Co., Eureka....$162,478
(4) California Const. Co., S. F.... 164,900

| | | (1) | (2) | (3) | (4) |
|---|---|---|---|---|---|
| 11,106 | cu.yd. grading | 1.29 | 1.20 | 1.25 | 1.30 |
| 47,808 | sq.yd. surface grading | .09 | .105 | .11 | .12 |
| 46 | cu.yd. reinf. concrete | 32.00 | 33.00 | 35.00 | 36.00 |
| 12,384 | lin.ft. 9-in. curb & gutter | 1.25 | 1.25 | 1.25 | 1.30 |
| 12,104 | lin.ft. 6-in. curb & gutter | 1.10 | 1.10 | 1.20 | 1.20 |
| 1,350 | lin.ft. concrete valley | 1.00 | 1.20 | 1.20 | 1.25 |
| 2.720 | lin.ft. 4-in. sewer | .75 | .95 | 1.00 | 1.00 |
| 3,421 | lin.ft. 6-in. sewer | 1.10 | 1.15 | 1.10 | 1.20 |
| 970 | ft. 10-in. sewer & found. | 4.50 | 5.00 | 4.50 | 5.00 |
| 73 | 6x4-in. Y branches | 1.75 | 2.00 | 2.25 | 2.00 |
| 40 | 10x4-in. Y branches | 3.50 | 5.00 | 4.50 | 5.00 |
| 934 | cu.yd. trench excav. | 4.50 | 5.00 | 5.50 | 6.00 |
| 110 | ft. 8-in. corr. culv. | 2.50 | 2.00 | 2.25 | 2.50 |
| 164 | ft. 12-in. corr. culv. | 3.00 | 3.00 | 3.25 | 3.50 |
| 202 | ft. 18-in. corr. culv. | 3.75 | 4.00 | 4.25 | 4.50 |
| 60 | ft. 24-in. corr. culv. | 4.50 | 5.00 | 5.25 | 5.50 |
| 86 | ft. 30-in. corr. culv. | 7.50 | 7.00 | 8.00 | 8.50 |
| 80 | ft. corr. iron & conc. culv. | 6.50 | 7.00 | 7.50 | 7.50 |
| 8 | catchbasins | 60.00 | 72.00 | 74.00 | 75.00 |
| 6 | manholes | $100 | $102 | $105 | $110 |
| 8 | lampholes | 25.00 | 27.00 | 28.00 | 30.00 |
| | Lighting system | $7,000 | $7,600 | $8,000 | $8,500 |
| 430,302 | sq.ft. asph. macadam pave. | .155 | .16 | .16 | .155 |
| 7,003 | sq.yd. macadam subbase | .72 | .75 | .75 | .80 |
| 170 | bbl. light oil | 6.50 | 6.75 | 6.50 | 7.00 |
| 83 | tons E grade asphalt | 37.00 | 37.50 | 35.00 | 40.00 |
| 200 | cu.yd. broken stone | 4.00 | 3.75 | 4.00 | 4.00 |
| 420 | cu.yd. screenings | 4.50 | 4.00 | 4.50 | 4.50 |

J. B. Piatt, Santa Rosa, is Engineer. Work is to be done under 1925 Act.

## SACRAMENTO, CALIF.—STATE—SAN BERNARDINO COUNTY—GRADING AND SURFACING

New Mexico Construction Co., 4015 Galapago street, Denver, Colorado, who bid $368,022, low bid to the California Division of Highways for 19.5 miles grading and surfacing with oil treated crushed gravel or stone from 2 miles west of Argus to 1½ miles west of Siberia, SAN BERNARDINO COUNTY. Bids received from:

(1) New Mexico Const. Co., Denver ..... $368,022
(2) Geo. Herz Co., San Bernardino ..... 380,396
(3) V. R. Dennis Const. Co., San Diego ..... 408,629
(4) Allied Contractors, Inc., Omaha ..... 408,799
(5) Macco Const. Co., Clearwater ..... $411,433
(6) Hodgman & MacVicar, Pasadena ..... 436,426
(7) Average bid ..... 402,000

| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|---|
| 6 | mi. grader ditch | 125.00 | 100.00 | 200.00 | 175.00 | 325.00 | 300.00 | 204.00 |
| 185,000 | cu.yd. road exc. | .49 | .46 | .55 | .67 | .57 | .85 | .60 |
| 353,000 | sta.yd. overh. | .01 | .02 | .015 | .015 | .01 | .01 | .013 |
| 25,000 | cu.yd. imp. borrow | .60 | .63 | 1.00 | .75 | .75 | .75 | .75 |
| 3,200 | cu.yd. str. excav. | 1.00 | 1.20 | 1.50 | 1.25 | 1.25 | .75 | 1.16 |
| 15,200 | yd. pit run gravel | .60 | 1.07 | 1.35 | 1.07 | .80 | 1.00 | .98 |
| 51,600 | tons oil treated gravel or stone surf. | 2.30 | 2.05 | 2.50 | 1.90 | 2.40 | 2.10 | 2.21 |
| 4,000 | M gals water | 4.00 | 5.25 | 4.25 | 4.00 | 4.00 | 4.50 | 4.33 |
| 1,100 | yd. gr. or stone scr. | 1.90 | 2.65 | 3.00 | 3.00 | 5.00 | 2.00 | 2.93 |
| 910 | bbl. fuel oil | 2.50 | 2.40 | 2.50 | 2.50 | 3.00 | 2.00 | 2.49 |
| 60 | ft. 12-in. corr. pipe | .50 | .50 | .50 | .75 | .40 | .50 | .53 |
| 1,108 | ft. 18-in. corr. pipe | .50 | .60 | .60 | .75 | .70 | .50 | .61 |
| 54 | ft. 24-in. corr. pipe | .70 | .75 | 1.00 | .75 | .90 | .60 | .78 |
| 704 | ft. 36-in. corr. pipe | .80 | .90 | 1.00 | 1.00 | 1.25 | .75 | .95 |
| 320 | ft. 48-in. corr. pipe | 1.00 | 1.10 | 1.50 | 2.00 | 2.00 | 1.00 | 1.43 |
| 411 | M ft. redwood (dense sel. all heart structural) | 105.00 | 110.00 | 95.00 | 110.00 | 102.00 | 100.00 | 104.00 |
| 264 | M ft. redwood (sel. all heart structural) | 100.00 | 100.00 | 81.00 | 110.00 | 95.00 | 100.00 | 98.00 |
| 23,890 | ft. Cr. douglas fir piles | .90 | .93 | .94 | 1.00 | .90 | .90 | .93 |
| 976 | drive piles | 10.00 | 20.00 | 8.00 | 15.00 | 20.00 | 10.00 | 13.85 |
| 1,028 | sta. fin. roadway | 3.70 | 4.00 | 5.00 | 4.00 | 6.00 | 6.00 | 4.78 |
| 241 | monuments | 2.50 | 3.00 | 3.00 | 3.00 | 4.00 | 3.00 | 3.08 |

## PORTLAND, ORE.—STATE—GRADING AND SURFACING—LINCOLN & TILLAMOOK COUNTIES

Contract awarded to Milne & Dussault, 1853 E. Broadway, Portland, Ore., $128,792, for 10.9 miles grading and resurfacing Neskowin-Otis Section of Roosevelt Coast Highway for State. Bids on main items as follows:

(1) Clearing and grubbing, lump sum.
(2) 60,000 cu.yd. "A" excavation.
(3) 10,000 cu.yd. "B" excavation.
(4) 17,500 cu.yd. subbase course surf.
(5) 8,200 cu.yd. base course surface.
(6) 5,000 cu.yd. top course surface.
(7) 5,000 cu.yd. "A" materials (stockpiles).
(8) 4,000 cu.yd. "B" materials (stockpiles).
(9) 4,300 cu.yd. "C" materials (stockpiles).
(10) 4,500 cu.yd. earth filler.
(11) 116,000 yd.mi. haul truck measure.
(12) 40,000 yd.mi. haul stockpile measure.
(13) 6,500 yd.mi. filler haul.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | TOTALS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Milne & Dussault | $7,000 | .50 | .55 | 1.05 | 1.05 | 1.05 | 1.00 | 1.00 | 1.00 | .30 | .16 | .18 | .17 | $128,792 |
| Wren & Greenough | 17,000 | .45 | .50 | 1.25 | 1.25 | 1.25 | 1.15 | 1.15 | 1.15 | .25 | .16 | .16 | .16 | 140,792 |
| Joslin & McAllister | 14,000 | .70 | .70 | 1.24 | 1.24 | 1.24 | 1.24 | 1.24 | 1.24 | .30 | .16 | .16 | .16 | 158,162 |
| Kern & Kibbe | 12,600 | .47 | .70 | 1.55 | 1.65 | 1.65 | 1.58 | 1.58 | 1.58 | .30 | .15 | .19 | .16 | 159,701 |
| Meyers & Co. | 15,200 | .48 | .85 | 1.55 | 1.60 | 1.65 | 1.55 | 1.60 | 1.70 | .40 | .16 | .18 | .20 | 164.461 |
| March Const. Co. | 7,000 | .40 | .90 | 1.85 | 1.95 | 2.05 | 1.95 | 1.95 | 1.95 | .35 | .15 | .17 | .20 | 166,562 |
| Joplin & Eldon | 12,800 | .68 | 1.00 | 1.54 | 1.54 | 1.64 | 1.50 | 1.50 | 1.50 | .50 | .16 | .18 | .16 | 172,958 |

## MONTEREY, CALIF.—COUNTY—GRADING AND SURFACING KING CITY-JOLON ROAD

Contract awarded to J. L. Conner, Box 542, Monterey, who bid $72,133 for 17 miles grading and surfacing King City-Jolon Road from King City Bridge to Jolon, work for Monterey County. Bids received from:

(1) J. L. Conner, Monterey ..... $72,133
(2) Granite Const. Co., Watsonville ..... 74,937
(3) Peninsula Paving Co., S. F. ..... 82,101
(4) Robt. Heaney, Hayward ..... 88,763
(5) Fredrickson & Watson, Oakland, and Fredrickson Bros., Stockton ..... 97,675
(6) McCray Co., Los Angeles ..... $ 98,161
(7) W. A. Dontanville, Salinas ..... 103,694
(8) Isbell Const. Co., Fresno ..... 108,232
(9) C. T. Malcolm, Walnut Creek ..... 108,844
(10) C. R. Johnson ..... 133,268

| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 158,000 | yd. road. excavat. | .25 | .28 | .278 | .28 | .35 | .35 | .34 | .35 | .37 | .45 |
| 520 | sta.yd. overhaul | .01 | .01 | .02 | .01 | .01 | .01 | .01 | .02 | .02 | .02 |
| 468 | cu.yd. struct. exc. | 1.00 | 1.00 | 1.00 | .80 | 1.25 | 1.00 | 1.00 | 1.00 | 1.50 | 1.50 |
| 7.28 | mi. grade and shape | $500 | $200 | $575 | $500 | $375 | $500 | $650 | $588 | $700 | $750 |
| 18,300 | cu.yd. truck measure from Pit A | .40 | .50 | .55 | .80 | .80 | .65 | .90 | .90 | .85 | 1.35 |
| 15,600 | cu.yd. truck measure from Pit B | 1.00 | .95 | 1.12 | 1.30 | 1.15 | 1.40 | 1.50 | 1.60 | 1.50 | 1.55 |
| 1,204 | ft. 12-in. corr. pipe | .50 | .30 | .65 | .50 | .75 | .35 | .30 | .50 | .50 | .50 |
| 640 | ft. 18-in. corr. pipe | .50 | .50 | .80 | .60 | 1.00 | .50 | .50 | .50 | .50 | .50 |
| 410 | ft. 15-in. corr. pipe | .50 | .40 | .65 | .50 | .75 | .45 | .40 | .50 | .50 | .50 |
| 16 | ft. 24-in. corr. pipe | .50 | .50 | .80 | 1.00 | 1.25 | .60 | .75 | 1.00 | .75 | 1.00 |
| 20 | ft. 36-in. corr. pipe | .50 | .50 | 1.00 | 2.00 | 1.25 | .80 | 2.00 | 1.00 | 1.00 | 1.00 |
| 125 | cu.yd. 'A' concrete (bridge) | 25.00 | 21.00 | 22.00 | 25.00 | 25.00 | 22.00 | 22.00 | 30.00 | 22.00 | 32.00 |
| 11,840 | lb. reinf. steel | .06 | .06 | .055 | .05 | .06 | .05 | .05 | .06 | .05 | .07 |
| 4 | cu.yd. 'E' concrete | 50.00 | 45.00 | 35.00 | 50.00 | 75.00 | 75.00 | 60.00 | 70.00 | 70.00 | 70.00 |

## PORTLAND, ORE.—STATE—PAVING—JACKSON COUNTY

L. O. Herrold, Salem, Ore., $119,455 low bid to Oregon State Highway Commission for paving with bituminous center and concrete shoulders 5.87 miles Medford-Phoenix Section of the Pacific Highway, JACKSON COUNTY. Bids on main items as follows:

(1) 24,000 cu.yd. excavation
(2) 200 ft. 12-in. concrete pipe
(3) 40 ft. 24-in. concrete pipe
(4) 50 ft. 36-in. corr. pipe
(5) 80 ft. 60-in. corr. pipe
(6) 15 ft. 72-in. corr. pipe
(7) 14,000 lin.ft. concrete shoulders
(8) 85,000 lb. reinf. steel (shoulders)
(9) 1,900 tons coarse Bit. binder
(10) 1,200 tons fine Bit. binder
(11) 6,200 tons Bit. conc. surface
(12) 55,000 sq.yd. seal coat

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | TOTALS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L. O. Herrold, Salem, Ore. | .31 | .70 | 2.00 | 4.50 | 10.00 | 15.00 | 2.35 | .0575 | 5.75 | 5.75 | 5.75 | .12 | $119,455 |
| I. C. Compton, McMinnville | .40 | 1.50 | 3.40 | 6.00 | 12.00 | 16.00 | 2.40 | .06 | 5.90 | 5.90 | 7.00 | .06 | 135,656 |
| United Contr. Co. | .45 | 1.25 | 2.90 | 6.30 | 13.50 | 18.25 | 2.71 | .065 | 7.60 | 7.60 | 7.50 | .07 | 153,658 |
| Northwest Roads Co. | .45 | 1.30 | 3.00 | 6.50 | 13.00 | 18.00 | 2.45 | .06 | 8.31 | 8.76 | 8.18 | .10 | 159,015 |
| I. L. Young | .50 | 1.50 | 4.00 | 6.00 | 12.00 | 20.00 | 2.75 | .055 | 9.40 | 9.50 | 9.00 | .15 | 171,700 |

## SAN DIEGO, CALIF.—COUNTY—GRADING AND CONCRETE PAVING

Contract awarded to Watson & Sutton, Box 396, San Diego, $148,447 for cement pavement, 5 in. thick with 8-in. edges and 18 ft. wide with 5-ft. earth shoulders, on County Route 15, Division 1, from Fourth Ave. and Ash St. in the city of Escondido, easterly to Eng. Sta. 153-78; and to grade that portion of Route 15, Division 1 and Division 2, and its relocation from Eng. Sta. 153-78 to Sta. 546-00, 20 ft. in width for a distance of 7.4 miles, work for San Diego County. Bids from:

(1) Watson & Sutton, San Diego ..... $148,447
(2) Ben Pearce, San Diego ..... 159,624
(3) Isbell Const. Co., Fresno ..... 163,999
(4) Chas. G. Willis & Son, Los Angeles ..... 170,965
(5) Hazard Constr. Co., San Diego ..... $186,950
(6) E. S. Carroll, San Diego ..... 170,689
(7) J. S. Yglesias, San Diego ..... 180,000

| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|---|
| 144,715 | cu.yd. excavation | .445 | .45 | .40 | .49 | .95 | .57 | .50 |
| 13,864 | lin.ft. subgrade | .25 | .45 | .25 | .21 | .25 | .10 | .25 |
| 251,492 | sq.ft. cement concrete pavement | .149 | .169 | .18 | .175 | .18 | .168 | .20 |
| 167,790 | sta.yd. overhaul | .0075 | .02 | .02 | .01 | .01 | .01 | .01 |
| 147 | cu.yd. plain concrete headwalls | 20.00 | 24.20 | 25.50 | 26.00 | 20.00 | 24.50 | 22.00 |
| 500 | ft. rock mat bank protection | 3.75 | 5.00 | 5.50 | 3.00 | 3.60 | 2.40 | 8.50 |
| 165 | cu.yd. superstructure, one 60-ft. reinf. conc. bridge | 32.00 | 23.50 | 32.50 | 33.24 | 31.00 | 29.00 | 34.00 |
| 167 | cu.yd. conc. abut. and wingwalls | 22.00 | 22.00 | 39.00 | 30.50 | 28.00 | 29.00 | 26.00 |
| 176 | cu.yd. conc. 40-ft. bridge | 24.00 | 22.10 | 33.00 | 28.90 | 30.00 | 26.00 | 27.00 |
| 1 | pile bridge, 58x20 ft. | $3500 | $3000 | $4650 | $4000 | $3700 | $2780 | $3500 |
| 74 | cu.yd. 8x12-ft. r.c. cattleway | 23.00 | 20.60 | 25.50 | 26.00 | 25.00 | 24.00 | 25.00 |
| 28 | cu.yd. 6x6-ft. r.c. culvert | 22.50 | 21.00 | 26.75 | 26.00 | 26.00 | 27.00 | 27.00 |
| 93 | cu.yd. 3 5x8-ft. r.c. culverts | 22.50 | 22.00 | 23.75 | 26.00 | 25.00 | 25.00 | 27.00 |
| 103 | cu.yd. 4 5x5-ft. r.c. culverts | 22.50 | 22.00 | 27.00 | 26.00 | 25.00 | 24.00 | 27.00 |
| 23 | cu.yd. 1 5x6-ft. r.c. culvert | 22.50 | 22.00 | 30.00 | 26.00 | 25.00 | 24.00 | 27.00 |
| 16 | cu.yd. 1 3x6-ft. r.c. culvert | 22.50 | 23.00 | 28.00 | 26.00 | 25.00 | 25.00 | 27.00 |
| 18 | cu.yd. 1 2x6-ft. r.c. culvert | 22.50 | 22.00 | 27.50 | 26.00 | 25.00 | 25.00 | 27.00 |
| 12 | cu.yd. 1 2x4-ft. r.c. culvert | 22.50 | 25.00 | 32.75 | 26.00 | 25.00 | 24.00 | 27.00 |
| 30 | ft. 36-in. corr. iron pipe culvert | 4.50 | 4.85 | 6.00 | 5.75 | 4.30 | 4.80 | 5.00 |
| 34 | ft. 30-in. corr. iron pipe culvert | 4.00 | 4.00 | 5.00 | 5.00 | 3.70 | 4.15 | 4.50 |
| 198 | ft. 24-in. corr. iron pipe culvert | 3.00 | 3.00 | 4.00 | 3.60 | 3.08 | 3.25 | 3.50 |
| 1,162 | ft. 18-in. corr. iron pipe culvert | 2.20 | 2.00 | 2.25 | 2.30 | 2.23 | 2.30 | 2.50 |
| 1,986 | ft. 15-in. corr. iron pipe culvert | 1.90 | 1.80 | 1.90 | 2.00 | 1.70 | 1.90 | 2.25 |
| 352 | ft. 12-in. corr. iron pipe culvert | 1.70 | 1.60 | 1.60 | 1.60 | 1.55 | 1.61 | 2.00 |
| 54,000 | ft. barbed wire fencing | .055 | .07 | .09 | .12 | .07 | .05 | .09 |
| 300 | ft. wire mesh fencing | .40 | .165 | .75 | .40 | .50 | .35 | 1.12 |
| 48 | ft. 8-in. d.s. conc. pipe | .50 | .45 | 1.00 | .50 | .80 | 1.00 | 2.00 |
| 116 | ft. 14-in. d.s. conc. pipe | 1.00 | 1.20 | 1.90 | .75 | 1.15 | 1.60 | 3.00 |
| 68 | ft. 16-in. d.s. conc. pipe | 1.00 | 1.50 | 2.20 | 1.00 | 1.65 | 1.70 | 3.00 |
| 7 | cattle guards (each) | $135 | $200 | $170 | $150 | $125 | $100 | $200 |
| 90 | cu.yd. masonry wall | 2.00 | 11.00 | 7.00 | 8.00 | 7.50 | 2.00 | 8.00 |

## SACRAMENTO, CALIF.—STATE—MARIN COUNTY—GRADING AND PAVING

Granfield, Farrar & Carlin, 65 Hoff Ave., San Francisco, $133,231 low bid to California Division of Highways for 1.8 miles grading and paving with concrete and bituminized macadam from Bolinas Creek to San Rafael, MARIN COUNTY. Bids from:

(1) Granfield, Farrar & Carlin, S. F. ..... $133,231
(2) J. P. Holland, Inc., San Francisco ..... 156,243
(3) W. H. Hauser, Oakland ..... 162,744
(4) Fredrickson & Watson Const. Co., Oakland, and Fredrickson Bros., Stockton ..... 173,875
(5) Hanrahan Co., San Francisco ..... 175,558
(6) C. T. Malcom, Walnut Creek ..... $174,359
(7) E. C. Coats, Sacramento ..... 176,575
(8) D. McDonald, Sacramento ..... 178,538
(9) Isbell Const. Co., Fresno ..... 198,593
(10) M. J. Bevanda, Stockton ..... 227,185
(11) Average bid ..... 175,690

| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 181,000 | yd. road. excav. | .32 | .42 | .43 | .48 | .50 | .42 | .55 | .48 | .61 | .62 | .48 |
| 2,421,000 | sta.yd. overhaul | .005 | .005 | .01 | .007 | .005 | .01 | .005 | .01 | .005 | .015 | .008 |
| 800 | cu.yd. struct. excav. | 1.00 | 1.00 | 1.00 | 1.00 | 1.50 | 1.50 | 1.00 | 1.00 | 1.50 | 1.50 | 1.20 |
| 8,120 | tons crush. run base | 1.90 | 2.00 | 1.75 | 2.20 | 2.50 | 2.30 | 1.70 | 2.10 | 2.50 | 2.25 | 2.12 |
| 9,910 | sq.yd. subgrade | .08 | .09 | .10 | .10 | .10 | .10 | .10 | .09 | .10 | .12 | .10 |
| 2,350 | cu.yd. 'A' conc. (pave.) | 9.50 | 10.00 | 9.50 | 10.80 | 10.50 | 11.00 | 10.00 | 9.28 | 11.00 | 11.60 | 10.32 |
| 150 | cu.yd. 'A' conc. (struc.) | 20.00 | 22.00 | 18.00 | 20.00 | 22.00 | 23.00 | 22.00 | 20.00 | 30.00 | 25.00 | 22.20 |
| 66,500 | lb. reinf. steel | .0475 | .05 | .045 | .05 | .05 | .05 | .045 | .05 | .04 | .05 | .048 |
| 560 | sq.yd. reinf. steel | .25 | .25 | .30 | .32 | .30 | .30 | .40 | .30 | .30 | .35 | .31 |
| 1,880 | tons broken stone | 2.00 | 2.50 | 2.25 | 3.00 | 2.50 | 2.50 | 2.50 | 2.50 | 3.00 | 3.00 | 2.58 |
| 102 | tons asph. oil | 21.00 | 23.00 | 20.00 | 24.00 | 20.00 | 25.00 | 25.00 | 20.00 | 25.00 | 24.00 | 22.70 |
| 684 | ft. 18-in. corr. pipe | .50 | .60 | .50 | .50 | .50 | .75 | .50 | .50 | .50 | 1.00 | .59 |
| 44 | ft. 30-in. corr. pipe | .75 | 1.00 | 1.00 | .50 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | .93 |
| 1,550 | ft. 8-in. per. met. und. | 1.50 | 1.50 | 1.30 | 1.25 | 1.30 | 1.30 | 1.50 | 1.35 | 1.20 | 1.50 | 1.37 |
| 270 | ft. 8-in. vitr. pipe | .80 | .75 | 1.50 | .50 | .75 | 1.00 | .75 | .70 | 1.20 | 1.00 | .90 |
| 500 | ft. asph. cobble gut. | 1.00 | 1.25 | 1.00 | 2.00 | 1.50 | 2.50 | 1.00 | 1.50 | 1.50 | 2.00 | 1.43 |
| 180 | yd. remove concrete | 1.00 | 1.00 | 1.50 | 1.50 | 3.00 | 2.00 | 2.00 | 5.00 | 2.00 | 3.00 | 2.20 |
| 4 | mi. move and reset fence | $450 | $350 | $150 | $180 | $250 | $300 | $200 | $180 | $200 | $300 | $256 |
| 6,559 | ft. timb. guard rail | .80 | 1.00 | .80 | .80 | .95 | 1.00 | .90 | 1.10 | 1.00 | 1.00 | .94 |
| 110 | each remove trees | 5.00 | 5.00 | 2.50 | 3.00 | 5.00 | 3.00 | 10.00 | 8.00 | 1.00 | 15.00 | 5.75 |
| 98 | sta. finish roadway | 4.00 | 5.00 | 5.00 | 3.50 | 5.00 | 6.00 | 4.00 | 4.50 | 10.00 | 10.00 | 5.70 |
| 30 | monuments | 2.50 | 3.00 | 3.00 | 2.50 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 4.00 | 3.00 |

## SACRAMENTO, CALIF.—STATE—TEHAMA COUNTY—SURFACING

A. F. Giddings, P. O. Box 1020, Sacramento, who bid $95,757, low bid to California Division of Highways for 28.7 miles surfacing from Paynes Creek to Morgan Springs, TEHAMA COUNTY. Bids received on:

SECTION B

(1) 11,230 cu.yd. untr. gravel or stone surface.
(2) 6,880 cu.yd. screenings in stockpile.
(3) 270 M gal. water applied to surface.

SECTION C

(4) 9,800 cu.yd. untr. gravel or stone surface.
(5) 3,950 cu.yd. screenings in stockpile.
(6) 350 M gal. water applied to surface.

| | (1) | (2) | (3) | (4) | (5) | (6) | TOTALS |
|---|---|---|---|---|---|---|---|
| A. F. Giddings, Sacramento | 2.60 | 3.65 | 2.50 | 2.60 | 3.65 | 2.50 | $95,757 |
| Milne & Dussault (bid irr.) | 2.95 | 3.10 | 3.00 | 2.95 | 3.10 | 3.00 | 97,471 |
| Hemstreet & Bell, Marysville | 3.10 | 3.45 | 3.50 | 2.80 | 3.15 | 2.50 | 100,251 |
| Average bid | 2.89 | 3.40 | 3.00 | 2.79 | 3.30 | 2.67 | 97,800 |

# BRIDGES AND CULVERTS

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

DeWaard & Sons, 207 Granger Bdg., San Diego, who bid $94,840 (as stated in our issue of September 25), submitted low bid to California Division of Highways, Sacramento, for bridge widening over San Gabriel River on Foothill Blvd., near Azusa, LOS ANGELES COUNTY. Bids submitted on the following items:

(A) 4,800 cu.yd. structure excavation
(B) 1,400 cu.yd. roadway embankment
(C) 1,910 cu.yd. C cement concrete
(D) 1,490 cu.yd. A cement concrete
(E) 46 cu.yd. E cement concrete
(F) 293,000 lb. reinforcing steel
(G) 67 M b.m. redwood timber sel. all-ht.
(H) 124 M b.m. redwood timber, dense sel. all-ht.
(I) 205 cu.yd. removing concrete
(J) 990 sq.yd. subgrade for pavement
(K) 1,080 tons asph. conc. A surface
(L) 16,000 lb. cast steel rockers and plates

| | (A) | (B) | (C) | (D) | (E) | (F) | (G) | (H) | (I) | (J) | (K) | (L) | TOTALS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| deWaard & Sons, San Diego | .90 | .95 | 14.00 | 15.80 | 40.00 | .04 | 85.20 | 85.20 | 5.00 | .20 | 4.90 | .16 | $94,840 |
| Johnson Const. Co. (bid irreg.) | 1.16 | .625 | 8.23 | 14.05 | 35.90 | .039 | 92.70 | 88.90 | 16.33 | .90 | 5.75 | .142 | 86,130 |
| Sharp & Fellows Contr. Co., Los Angeles | 1.50 | .75 | 13.00 | 16.75 | 55.00 | .035 | 85.00 | 80.00 | 5.00 | .10 | 5.50 | .12 | 95,421 |
| E. S. Johnson, Pasadena | 1.50 | .75 | 11.00 | 17.00 | 50.00 | .038 | 90.00 | 90.00 | 5.00 | .15 | 7.00 | .12 | 95,867 |
| Whipple Eng. Co., Monrovia | 2.25 | .35 | 12.90 | 16.50 | 40.00 | .038 | 79.00 | 78.00 | 12.50 | .13 | 5.50 | .13 | 99,164 |
| R. R. Bishop, Long Beach | 1.75 | 1.00 | 14.00 | 17.00 | 50.00 | .035 | 82.00 | 85.00 | 8.00 | .10 | 6.00 | .12 | 100,598 |
| Oberg Bros., Los Angeles | 2.00 | .50 | 15.00 | 15.00 | 50.00 | .042 | 80.00 | 80.00 | 5.00 | .20 | 7.00 | .12 | 101,889 |
| Byerts & Dunn, Los Angeles | 2.50 | .60 | 12.00 | 17.00 | 55.00 | .04 | 83.00 | 88.00 | 12.50 | .10 | 6.50 | .13 | 103,574 |
| Edwards, Wildey & Dixon Co., L. A. | 1.65 | .50 | 12.50 | 16.00 | 75.00 | .0425 | 103.25 | 109.25 | 10.00 | .15 | 6.25 | .15 | 104,050 |
| Gist & Bell, Arcadia | 2.50 | .50 | 14.00 | 17.00 | 50.00 | .05 | 100.00 | 100.00 | 10.00 | .20 | 5.00 | .08 | 109,748 |
| S. M. Kerns, Long Beach | 3.00 | 1.50 | 15.00 | 15.00 | 80.00 | .0475 | 72.00 | 80.00 | 6.00 | .27 | 12.00 | .10 | 115,438 |
| Pozzo Constr. Co., Los Angeles | 2.54 | .76 | 11.00 | 23.60 | 72.00 | .045 | 107.00 | 107.00 | 15.00 | 1.25 | 6.40 | .15 | 119,988 |
| Average Bid | 1.93 | .73 | 11.54 | 16.70 | 54.30 | .041 | 88.30 | 89.30 | 9.20 | .31 | 6.48 | .13 | 104,200 |

## SACRAMENTO, CALIF.—STATE—HUMBOLDT COUNTY—STEEL

Mercer-Fraser Co., 109 G St., Eureka, who bid $97,650, low bid to California Division of Highways for steel bridge over south fork of Trinity River, 2 miles west of Saylor, HUMBOLDT COUNTY. Bids on:

(1) 2,700 cu.yd. bank excavation.
(2) 600 cu.yd. structure excavation.
(3) 358 cu.yd. A cement concrete.
(4) 520 cu.yd. B cement concrete
(5) 82,500 lb. reinforcing steel.
(6) 810,000 lb. structural steel.
(7) 18,500 lb. cast steel (rockers and bearings).
(8) 1,000 lin.ft. timber rail.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | TOTALS |
|---|---|---|---|---|---|---|---|---|---|
| Mercer-Fraser Co. | 1.75 | 3.10 | 27.50 | 19.25 | .05 | .078 | .13 | 1.50 | $97,650 |
| Smith Bros. Co. | 1.50 | 4.00 | 27.00 | 22.00 | .65 | .084 | .15 | 1.25 | 104,983 |
| Bayly Hipkins | 2.00 | 2.50 | 27.00 | 24.00 | .065 | .0857 | .16 | 1.70 | 108,485 |
| Northwestern Contr. Co. | 4.00 | 4.00 | 30.00 | 30.00 | .054 | .075 | .13 | 1.80 | 108,950 |
| Gutleben Bros. | 1.20 | 4.00 | 31.00 | 28.00 | .065 | .086 | .13 | 1.50 | 110,225 |
| Butte Constr. Co. | 2.25 | 3.25 | 28.00 | 27.00 | .097 | .083 | .176 | 2.75 | 113,327 |
| Average bid | 2.12 | 3.47 | 29.15 | 25.00 | .066 | .082 | .147 | 1.75 | 107,300 |

# IRRIGATION AND RECLAMATION

## FAIRFIELD, MONT.—CANAL EXCAVATION AND STRUCTURES—GOVT.

J. A. Terteling & Sons, Moscow, Ida., $142,540 low bid to Bureau of Reclamation (on Schedules 1 and 2 combined) for earthwork and structures on Spring Valley Canal, Sun River Project, Fairfield, Montana. Bids as follows:

SCHEDULE 1—S. H. Newell & Co., 1254 Reed College Place, Portland, $67,495 low. Bids on:

(1) 615,000 cu.yd. canal excavation, Class 1
(2) 1,000 cu.yd. canal excavation, Class 2
(3) 500 cu.yd. canal excavation, Class 3
(4) 20,000 sta.yd. overhaul
(5) 4,450 cu.yd. structure excav., Class 1
(6) 50 cu.yd. structure excav., Class 2
(7) 10 cu.yd. structure excav., Class 3
(8) 2,100 cu.yd. excav. drainage channel
(9) 1,500 cu.yd. backfill about structures
(10) 600 cu.yd. puddling or tamping backf.
(11) 100 sq.yd. dry rock paving
(12) 100 sq.yd. grouted paving
(13) 300 cu.yd. concrete
(14) 27,000 lb. reinf. steel, place
(15) 11 M b.m. timber in bridge
(16) 9,000 lb. radial gate, install and paint

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | TOTALS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S. H. Newell & Co., Portland | .09 | .60 | 1.50 | .06 | .09 | 1.50 | 1.50 | .20 | .20 | .50 | 2.00 | 3.50 | 20.00 | .03 | 25.00 | .05 | $ 67,495 |
| General Const. Co., Seattle | .09 | .40 | .80 | .05 | .50 | 1.50 | 3.00 | .20 | .30 | .50 | 2.00 | 2.50 | 18.00 | .03 | 25.00 | .05 | 68,035 |
| J. A. Terteling & Sons | .096 | .60 | 1.00 | .02 | .17 | 1.00 | 2.00 | .15 | .25 | .40 | 1.50 | 2.50 | 20.00 | .03 | 20.00 | .05 | 70,176 |
| Barnard-Curtiss Co. | .10 | .45 | 1.50 | .05 | .50 | 2.00 | 3.00 | .30 | .30 | .60 | 3.00 | 4.00 | 20.00 | .03 | 25.00 | .05 | 75,730 |
| Winston Bros. Co. | .10 | .30 | 1.00 | .05 | .50 | 2.50 | 4.00 | .30 | .50 | 1.25 | 2.00 | 3.00 | 21.50 | .02 | 20.00 | .06 | 76,070 |
| Kremer & Hog | .0975 | .0975 | .0975 | .02 | 1.00 | 2.00 | 4.00 | .15 | .40 | .50 | 1.75 | 2.00 | 29.60 | .015 | 25.00 | .03 | 76,518 |
| McWilliams Dredging Co., Chicago | .10 | .35 | 1.50 | .05 | 1.00 | 2.00 | 3.00 | .15 | .35 | .30 | 1.50 | 3.00 | 25.00 | .02 | 35.00 | .05 | 78,525 |
| John Phillips Co., S. F. | .105 | .35 | 1.50 | .04 | .50 | 1.50 | 3.00 | .25 | .35 | .50 | 2.50 | 4.50 | 20.00 | .03 | 25.00 | .10 | 78,840 |
| W. H. Puckett, Boise, Ida. | .12 | .35 | 1.25 | .04 | .50 | 1.00 | 3.00 | .20 | .25 | .60 | 2.50 | 3.50 | 25.00 | .04 | 25.00 | .10 | 89,390 |
| Callahan-Walker Const. Co. | .14 | .75 | 1.35 | .03 | .40 | .80 | 1.50 | .40 | .35 | .45 | 2.50 | 2.50 | 20.00 | .02 | 20.00 | .10 | 99,755 |
| S. Birch & Sons, Great Falls, Mont. | .20 | .60 | 1.50 | .04 | 1.50 | 3.00 | 5.00 | .50 | .35 | 1.50 | 2.00 | 3.00 | 24.00 | .03 | 35.00 | .045 | 144,550 |

SCHEDULE 2—J. A. Terteling & Sons, Moscow, Idaho, $72,364 low. Bids received on:

(1) 307,000 cu.yd. canal excavation, Class 1
(2) 11,000 cu.yd. canal excavation, Class 2
(3) 4,000 cu.yd. canal excavation, Class 3
(4) 800 cu.yd. compacting embankments
(5) 1,600 cu.yd. struc. excav., Class 1
(6) 4,500 cu.yd. backfill about structures
(7) 80 cu.yd. gravel backfill
(8) 3,100 ft. 6-in. drain pipe, lay
(9) 2,100 cu.yd. concrete
(10) 117,000 lb. reinf. steel, place

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | TOTALS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| J. A. Terteling & Sons | .09 | .60 | 1.00 | .50 | .17 | .25 | 4.00 | .10 | 12.35 | .03 | $ 72,364 |
| S. H. Newell & Co. | .09 | .50 | .70 | .50 | .09 | .20 | 2.50 | .30 | 16.50 | .03 | 77.764 |
| General Constr. Co. | .09 | .45 | .85 | .60 | .50 | .30 | 4.00 | .15 | 17.50 | .02 | 79,390 |
| Kremer & Hog | .0975 | .0975 | .0975 | .50 | 1.00 | .40 | 3.50 | .20 | 20.50 | .015 | 81,550 |
| Winston Bros. Co. | .10 | .30 | 1.00 | 1.00 | 1.50 | .50 | 4.00 | .10 | 19.25 | .02 | 88,045 |
| John Phillips Co. | .105 | .35 | 1.40 | .25 | .50 | .35 | 3.00 | .20 | 20.00 | .02 | 90.235 |
| Barnard Curtiss Co. | .10 | .40 | 1.00 | .60 | 1.00 | .25 | 4.00 | .15 | 21.50 | .02 | 91,510 |
| McWilliams Dredging Co. | .125 | .35 | 1.50 | .30 | 1.00 | .35 | .50 | .10 | 25.00 | .02 | 107,670 |
| Callahan-Walker Constr. Co. | .15 | .75 | 1.35 | .40 | .40 | .30 | .40 | .20 | 20.00 | .02 | 107,752 |
| W. H. Puckett | .15 | .35 | 1.00 | .60 | .50 | .25 | 2.50 | .20 | 25.00 | .04 | 115,085 |
| S. Birch & Sons | .20 | .60 | 1.50 | 1.50 | 1.50 | .85 | 3.00 | .10 | 24.00 | .025 | 136,550 |

## BURLEY, IDAHO—GOVT.—CANAL EXCAVATION AND STRUCTURES

Mittry Bros. Const. Co., Detwiler Bdg., Los Angeles, $905,887 (bid stipulating all or no schedules), low bid on Schedules 1 to 6, inclusive, for earthwork and structures on main canal gravity extension unit of Minidoka Project, for Bureau of Reclamation, Burley, IDAHO. Bids received as follows:

SCHEDULE 1—Callahan Walker Const. Co., Omaha, Nebr., $147,278 low. Bids received on:

(1) 240,000 cu.yd. canal excav., Class 1
(2) 2,000 cu.yd. canal excav., Class 2
(3) 82,000 cu.yd. canal excav., Class 3
(4) 20,000 sta.yd. overhaul
(5) 210 sq.yd. dry rock paving
(6) 300 cu.yd. concrete
(7) 17,000 lb. placing reinf. steel
(8) 30 ft. lay 24-in. conc. pipe
(9) 170 ft. lay 36-in. conc. pipe
(10) 2,200 lb. install and paint structural steel

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | TOTALS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Callahan-Walker Const. Co. | .14 | .45 | 1.25 | .10 | 2.50 | 21.00 | .02 | 1.00 | 1.00 | .10 | $147,278 |
| J. A. Terteling & Sons | .1275 | .40 | 1.30 | .05 | 1.50 | 25.00 | .05 | 2.00 | 3.00 | .06 | 149,059 |
| Mittry Bros. Const. Co. | .15 | .30 | 1.25 | .05 | 2.00 | 30.00 | .02 | 1.25 | 2.00 | .02 | 151,414 |
| Utah Const. Co., Ogden, Utah | .15 | .35 | 1.35 | .04 | 2.00 | 25.00 | .03 | 1.75 | 2.25 | .06 | 157,470 |
| S. J. Groves & Sons | .13 | .65 | 1.40 | .05 | 2.00 | 25.00 | .03 | 2.50 | 3.00 | .05 | 158,632 |
| John Phillips Co., S. F. | .12 | .40 | 1.50 | .05 | 2.50 | 26.00 | .03 | 1.50 | 2.00 | .05 | 163,895 |
| S. H. Newell & Co. | .17 | .40 | 1.40 | .02 | 1.50 | 18.00 | .03 | 1.20 | 2.00 | .03 | 164,305 |
| Morrison-Knudsen Co. | .12 | .30 | 1.60 | .03 | 2.00 | 22.50 | .035 | 1.50 | 2.00 | .10 | 170,790 |
| General Const. Co. | .15 | .60 | 1.75 | .20 | 2.50 | 30.00 | .03 | 1.50 | 2.50 | .05 | 196,537 |

SCHEDULE 2—Mittry Bros. Const. Co., Los Angeles, who bid $131,576 low. Bids on:

(1) 194,000 cu.yd. canal excav., Class 1
(2) 2,000 cu.yd. canal excav., Class 2
(3) 79,000 cu.yd. canal excav., Class 3
(4) 25,000 sta.yd. overhaul
(5) 60 cu.yd. exc. embankment tr. Class 3
(6) 600 cu.yd. backfill about structures
(7) 110 cu.yd. puddle or tamp backfill
(8) 70 sq.yd. dry rock paving
(9) 190 cu.yd. concrete
(10) 12 M ft. BM erect timber (bridge)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | TOTALS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mittry Bros. Const. Co. | .12 | .30 | 1.25 | .05 | 2.50 | .75 | 1.25 | 2.00 | 30.00 | 45.00 | $131,576 |
| Callahan-Walker Const. Co. | .14 | .45 | 1.25 | .10 | 1.50 | .30 | .50 | 2.50 | 21.00 | 20.00 | 134,507 |
| J. A. Terteling & Sons | .13 | .40 | 1.32 | .05 | 3.00 | .25 | .50 | 1.50 | 25.00 | 28.00 | 137,834 |
| Utah Const. Co., Ogden, Utah | .15 | .35 | 1.34 | .04 | 3.00 | .50 | .75 | 2.00 | 25.00 | 30.00 | 143,111 |
| S. J. Groves & Sons | .13 | .65 | 1.40 | .10 | 4.00 | .50 | .50 | 2.00 | 25.00 | 40.00 | 146,404 |
| Morrison-Knudsen Co. | .12 | .30 | 1.50 | .03 | 3.50 | .50 | 1.00 | 2.00 | 22.50 | 30.00 | 149,325 |
| S. H. Newell & Co. | .17 | .40 | 1.40 | .02 | 2.25 | .30 | 1.00 | 1.50 | 18.00 | 25.00 | 149,662 |
| John Phillips Co. | .12 | .40 | 1.50 | .05 | 3.00 | .50 | 1.00 | 2.50 | 26.00 | 25.00 | 150,395 |
| General Const. Co. | .15 | .60 | 1.75 | .20 | 5.00 | .50 | .50 | 2.50 | 30.00 | 30.00 | 181,035 |

SCHEDULE 3—Callahan-Walker Const. Co., Omaha, Nebraska, $200,918 low. Bids on:

(1) 95,000 cu.yd. canal excav., Class 1
(2) 5,000 cu.yd. canal excav., Class 2
(3) 140,000 cu.yd. canal excav., Class 3
(4) 20,000 sta. yd. overhaul
(5) 460 cu.yd. exc. struct., Class 3
(6) 470 cu.yd. backfill about structures
(7) 270 cu.yd. concrete
(8) 18,500 lb. place reinf. steel
(9) 10,000 lb. install and paint gates, gate lifts, etc.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | TOTALS |
|---|---|---|---|---|---|---|---|---|---|---|
| Callahan-Walker Const. Co. | .14 | .45 | 1.25 | .10 | 1.50 | .30 | 21.00 | .02 | .10 | $200,918 |
| Mittry Bros. Const. Co., L. A. | .16 | .35 | 1.25 | .05 | 3.00 | 1.00 | 30.00 | .02 | .03 | 204,181 |
| Utah Const. Co., Ogden, Utah | .15 | .35 | 1.34 | .04 | 4.00 | .50 | 25.00 | .03 | .08 | 215,105 |
| S. H. Newell & Co. | .30 | .30 | 1.27 | .05 | 2.00 | .30 | 18.00 | .03 | .03 | 216,056 |
| J. A. Terteling & Sons, Moscow, Ida. | .20 | .40 | 1.40 | .06 | 2.00 | .25 | 28.00 | .06 | .07 | 229,043 |
| Morrison-Knudsen Co. | .13 | .30 | 1.50 | .03 | 3.50 | .50 | 22.50 | .035 | .09 | 234,604 |
| S. J. Groves & Sons | .15 | .65 | 1.50 | .10 | 3.00 | .50 | 25.00 | .03 | .08 | 239,815 |
| General Const. Co. | .40 | .60 | 1.50 | .20 | 5.00 | .50 | 30.00 | .03 | .05 | 267,255 |
| A. Guthrie & Co., Portland | .24 | .60 | 1.85 | .07 | 4.00 | 1.00 | 30.00 | .04 | .10 | 299,265 |

SCHEDULE 4—Mittry Bros. Const. Co., Detwiler Bdg., Los Angeles, $137,437 low. Bids on:

(1) 363,000 cu.yd. canal excav., Class 1
(2) 5,000 cu.yd. canal excav., Class 2
(3) 57,000 cu.yd. canal excav., Class 3
(4) 286,000 sta.yd. overhaul
(5) 100 cu.yd. struct. excavat., Class 1
(6) 50 cu.yd. exc. cutoff trench, Class 3
(7) 260 cu.yd. backfill about structures
(8) 175 cu.yd. concrete
(9) 6,700 lb. place reinf. steel
(10) 12 M ft. BM erect timber (bridge)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | TOTALS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mittry Bros. Const. Co. | .12 | .35 | 1.25 | .05 | .75 | 3.00 | .50 | 30.00 | .02 | 45.00 | $137,437 |
| S. J. Groves & Sons | .13 | .65 | 1.40 | .03 | 1.00 | 4.00 | .50 | 25.00 | .03 | 40.00 | 144,652 |
| Morrison-Knudsen Co. | .13 | .30 | 1.50 | .03 | .75 | 1.50 | .50 | 22.50 | .04 | 30.00 | 148,123 |
| Utah Const. Co., Ogden, Utah | .15 | .35 | 1.34 | .04 | .50 | 3.00 | .50 | 25.00 | .03 | 30.00 | 149,637 |
| Callahan-Walker Const. Co. | .14 | .45 | 1.25 | .10 | .40 | 1.50 | .30 | 21.00 | .02 | 20.00 | 157,524 |
| J. A. Terteling & Sons | .18 | .40 | 1.40 | .04 | .25 | 3.00 | .25 | 28.00 | .06 | 30.00 | 164,743 |
| S. H. Newell & Co. | .24 | .24 | 1.25 | .03 | .60 | 2.50 | .30 | 18.00 | .03 | 25.00 | 172,306 |
| Wheeler & England, Moreland, Ida. | .23 | .35 | 1.35 | .03 | 1.00 | 3.00 | .50 | 27.00 | .04 | 30.00 | 182,513 |
| General Const. Co. | .18 | .60 | 1.75 | .05 | .50 | 5.00 | .50 | 30.00 | .03 | 30.00 | 188,946 |

SCHEDULE 5—Mittry Bros. Const. Co., Detwiler Bdg., Los Angeles, $131,998 low. Bids on:

(1) 223,000 cu.yd. canal excav., Class 1
(2) 5,000 cu.yd. canal excav., Class 2
(3) 79,000 cu.yd. canal excav., Class 3
(4) 25,000 sta.yd. overhaul
(5) 50 cu.yd. exc. cut-off trench, Class 3
(6) 120 cu.yd. concrete

| | (1) | (2) | (3) | (4) | (5) | (6) | TOTALS |
|---|---|---|---|---|---|---|---|
| Mittry Bros. Const. Co. | .14 | .30 | 1.20 | .05 | 3.00 | 25.00 | $131,998 |
| Callahan-Walker Const. Co. | .14 | .45 | 1.25 | .10 | 1.50 | 21.00 | 137,367 |
| Morrison-Knudsen Co. | .11 | .30 | 1.40 | .03 | 3.50 | 25.00 | 140,659 |
| J. A. Terteling & Sons | .14 | .40 | 1.32 | .05 | 3.00 | 25.00 | 142,030 |
| Utah Const. Co., Ogden, Utah | .15 | .35 | 1.34 | .04 | 3.00 | 25.00 | 145,288 |
| S. J. Groves & Sons | .13 | .65 | 1.40 | .10 | 4.00 | 25.00 | 148 618 |
| S. H. Newell & Co. | .27 | .27 | 1.40 | .05 | 2.50 | 18.00 | 175,773 |
| General Const. Co. | .20 | .60 | 1.75 | .20 | 5.00 | 30.00 | 194,778 |

SCHEDULE 6—Mittry Bros. Const. Co., Detwiler Bdg., Los Angeles, $149,280 low. Bids on:

(1) 307,000 cu.yd. canal excav., Class 1
(2) 5,000 cu.yd. canal excav., Class 2
(3) 80,000 cu.yd. canal excav., Class 3
(4) 117,000 sta.yd. overhaul
(5) 50 cu.yd. exc. cut-off trench, Class 3
(6) 110 cu.yd. concrete

| | (1) | (2) | (3) | (4) | (5) | (6) | TOTALS |
|---|---|---|---|---|---|---|---|
| Mittry Bros. Const. Co. | .14 | .30 | 1.20 | .05 | 3.00 | 25.00 | $149,280 |
| Morrison-Knudsen Co. | .11 | .30 | 1.40 | .03 | 3.50 | 25.00 | 153,805 |
| J. A. Terteling & Sons | .1375 | .40 | 1.30 | .05 | 3.00 | 25.00 | 157,087 |
| Callahan-Walker Const. Co. | .14 | .45 | 1.25 | .10 | 1.50 | 21.00 | 159,365 |
| S. J. Groves & Sons | .13 | .65 | 1.40 | .03 | 4.00 | 25.00 | 161,695 |
| Utah Const. Co., Ogden, Utah | .15 | .35 | 1.34 | .04 | 3.00 | 25.00 | 162,655 |
| S. H. Newell & Co. | .23 | .23 | 1.40 | .05 | 2.50 | 18.00 | 191,790 |
| General Const. Co. | .20 | .60 | 1.75 | .10 | 5.00 | 30.00 | 219,725 |

# 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

Auditorium for City of Long Beach, Calif.; $1,400,000.

Office building on Sixth St. for H. G. Ferguson Corp., Los Angeles; $1,500,000.

Pipe-lines, meters, wells, pumps, and reservoirs for City of Phoenix, Ariz.; $2,930,000.

Diesel engine plant for Imperial Irrigation District, El Centro, Calif.; $2,100,000.

Power project on Skykomish River near Everett, Wash., for Puget Sound Power & Light Co., Seattle, Wash.; $2,000,000.

### BIDS BEING RECEIVED

Hansen dam in Big Tujunga Canyon, concrete arch type, for Los Angeles County Flood Control District, Los Angeles; bids to Oct. 14; to cost $1,250,000.

Steel and concrete bridge on 14th Ave. South over Duwamish waterway for County at Seattle, Wash.; bids to Oct. 21; $725,000.

Steel and concrete viaduct on E. 11th St. for City of Tacoma, Wash.; $350,000; bids to Oct. 21.

### BIDS RECEIVED

Vitrified southside sanitary sewer for City of Missoula, Mont., Morrison-Knudsen Co., Boise, Ida., $464,420, low.

### CONTRACTS AWARDED

Stock Exchange Bdg. for Los Angeles Stock Exchange at Los Angeles, to P. J. Walker Construction Co., Los Angeles, $1,000,000.

Grading Rocky Mountain National Park, Colorado, for Bureau of Public Roads, to W. A. Colt & Sons, Las Animas, Colo., $393,674.

## STREET and ROAD WORK

### WORK CONTEMPLATED

**HAYWARD, CALIF.**—Plans by J. B. Holly, City Engr., for: (1) Improving Jackson St. from Castro St. to Meek Ave., involving 30,172 sq.ft. 3½-in. asphalt base with 1½-in. Warrenite Bit. surface, etc.; and (2) Jackson St. from Meek St. to south city limits, involving 12,365 sq.ft. 3½-in. asphalt base with 1½-in. Warrenite Bit. surface. Bids after Oct. 2. 9-20

**LOS ANGELES, CALIF.**—Plans by County Surveyor, protests Oct. 21, for improving Firestone Blvd., 4.04 miles, involving 83,792 cu.yd. excavation, 1,291,192 sq.ft. 8-in. concrete paving, curbs, gutters, cement sewers, lighting system; $632,102. 9-28

**OAKDALE, CALIF.**—City is considering paving 15 blocks of City streets. Geo. Macomber is City Engineer. 9-27

**SAN DIEGO, CALIF.**—Plans by City Engineer for Santa Cruz Ave., involving 75,649 sq.ft. 5-in. concrete paving, 80 ft. 10-in. cast-iron pipe. Bids after Oct. 21. 9-28

**SAN DIEGO, CALIF.**—Plans by H. W. Jorgensen, City Engr., for: (1) Improving 40th St., involving 287,293 sq.ft. 6-in. concrete paving, 7707 ft. 6-in. 'C' cast-iron pipe, 9 hydrants; and (2) Tennyson St., involving 56,386 sq.ft. 6-in. asphalt paving, 710 ft. 6-in. 'C' cast-iron pipe, 1 hydrant. Bids after Oct. 14. 9-21

**TRACY, CALIF.**—Plans by E. T. A. Bartlett, City Engineer, for improving Highland Ave., 12th St., Bessie Ave., etc., grading, pavng with 2½-in. gravel foundation, 5-in. concrete paving, vitrified sewers, etc. Bids after Oct. 15. 9-27

### BIDS BEING RECEIVED

**PHOENIX, ARIZ.**—Bids to 2 p.m., Oct. 28, by Arizona Highway Commission for 12,300 cu.yd. surfacing on Globe-Safford Highway. 9-30

**ALHAMBRA, CALIF.**—Bids to 9 a.m., Oct. 15, by City for improving Marion Ave. and other streets, macadam paving, asphalt paving, sewers, etc.

**LONG BEACH, CALIF.**—Bids to 2 p.m., Oct. 11, by City Clerk for: Stanley Ave. and Gaviota Ave., between 11th and Anaheim Sts., involving concrete curbs and walks. Pleasant St., between Long Beach Blvd. and Virginia Ave., involving cement concrete curbs and walks, cast-iron pipe water mains and fire hydrants. Pleasant St., between Long Beach Blvd. and Elm St., involving cement concrete curbs and walks, cast-iron pipe water mains and fire hydrants.

**SACRAMENTO, CALIF.**—Bids to 2 p.m., Oct. 23, by California Division of Highways for 26 miles surfacing in SHASTA COUNTY from Bayha to La Moine, involving 7150 cu.yd. gravel or stone surfacing, 12,415 cu.yd. screenings (stockpiles). 9-26

**SALINAS, CALIF.**—Bids to 10 a.m., Oct. 14, by County Clerk for: (1) Paving Salinas-Monterey Road from Hilltown Bridge to Spreckels Road, involving 1750 cu.yd. 'A' concrete, etc.; and (2) Surfacing roads adjacent to Lighthouse Reservation, involving 1631 tons rock and 288 bbl. fuel oil. 9-27

**SAN FRANCISCO, CALIF.**—Bids will be opened during February, March or April, 1930, by Bureau of Public Roads, Sheldon Bdg., San Francisco, for: (1) 9.8 miles grading North Park entrance to Fuller Canyon, Grand Canyon National Park, Arizona, involving 85,000 cu.yd. excavation, etc.; and (2) 26 miles surfacing North Rim of Grand Canyon Park, Arizona, involving 42,000 cu.yd. rock surfacing and 330,000 gal. asphaltic oil; (3) Surfacing 7.9 miles Loop Route, Lassen Volcanic National Park, California, involving 15,000 cu.yd. crushed rock surfacing; and (4) Grading 8 miles northwest portion of Loop Route, Lassen National Park, California, involving 110,000 cu.yd. excavation. As country adjacent to construction will be covered with snow soon, contractors interested should go over work at once. (For additional data see "Official Bids" this issue.) 9-30

**SANTA ROSA, CALIF.**—Bids to 12 m., Oct. 15, by County Clerk for: (1) Grading 2½ miles of Mark West Springs Road, involving 20,000 cu.yd. roadway excavation; and (2) Grading Sonoma Ave. at Penngrove, involving 2200 cu.yd. roadway excavation and 540 cu.yd. rock surfacing. 9-30

**PORTLAND, ORE.**—Bids to Oct. 11 by Bureau of Public Roads for 3.7 miles Babb-Many Glacier Highway, Glacier National Park, GLACIER COUNTY, Montana, involving 45,400 cu.yd. excavation, 11,000 cu.yd. crushed rock surfacing, concrete structures, etc.

**OLYMPIA, WASH.**—Bids to Oct. 22, by State Highway Commssion for: North Bank Highway No. 8—Clearing, grading and draining about 19 miles, Summit Creek vicinity, KLICKITAT COUNTY. Sunset Highway No. 2—Clearing, grading and draining about 2.3 miles from Renton west, in KING COUNTY. Pacific Highway No. 1—Paving with cement a portion of the Snohomish River Bridge approach, in SNOHOMISH COUNTY.

### BIDS RECEIVED

**BURBANK, CALIF.**—Gibbons & Reed Co., 221 E. San Fernando Blvd., Burbank, $46,927, low bid to City for improving Lime St., etc., grading, asphalt base with Warrenite-bitulithic surface and water mains to cost $7995. 9-27

**LOS ANGELES, CALIF.**—Gibbons & Reed Co., 221 E. San Fernando Road, Burbank, who bid $13,352, as follows, only bid to Division of Highways, District Engineer, 1111 Associated Realty Bdg., Los Angeles, for 0.8 mile north of Sandberg's to 2.5 miles north of Sandberg's, surfacing with bituminous macadam, LOS ANGELES COUNTY. 9-21

**LOS ANGELES, CALIF.**—Matich Bros., Elsinore, $8872, low bid to California Division of Highways, District Engineer, Los Angeles, for 0.2 mile grading and concrete paving in ORANGE COUNTY west of San Clemente. 9-27

**OAKLAND, CALIF.**—Low bids as follows by City: (1) Central Construction Co., Oakland Bank Bdg., Oakland, $27,875, low for improving Liggett Drive from Hampton Road to Estates Drive, grading, paving with 5-in. concrete base with 1½-in. Warrenite-bitulithic surface, corrugated iron and concrete culverts, vitrified pipe conduits, etc. (2) Western Roads Co., 1305 28th St., Oakland, $18,598, low for improving 101st, 102nd, and 103rd Aves., grading, paving with 3-in. macadam foundation, 3½-in. asphalt base, and 1½-National surface. (3) California Construction Co., Standard Oil Bdg., San Francisco, $46,111, low for improving Foothill Blvd., from 90th Ave. to Jones, grading, 6-in. concrete base with 2-in. Warrenite-bitulithic surface, vitrified conduits. (4) Heafey-Moore Co., 344 High St., Oakland, $15,287, low for improving Johnston Drive, from Estates Drive southeast. 9-23

**SACRAMENTO, CALIF.**—A. F. Giddings, PO Box 1020, Sacramento, $95,757, low bid to California Division of Highways for 28.7 miles surfacing from Paynes Creek to Morgan Hills, TEHAMA COUNTY. (See Unit Bid Summary.) 9-26

**SAN DIEGO, CALIF.**—R. E. Hazard Contracting Co., 2548 Kettner Blvd., San Diego, $68,683, low bid to County for improving DeWitt Ave., Victor St., etc., grading, paving with Nationalite, corrugated culverts, cast-iron mains. 9-25

**SAN FRANCISCO, CALIF.**—F. C. Amoroso & Sons, Wallace and Keith Sts., San Francisco, $15,897, low bid to State Architect's Office for sidewalk and retaining wall at State Teachers College. 9-25

**SAN MATEO, CALIF.**—Low bids as follows by San Mateo Union High School District: (1) H. Rosenberg, 420 Fifth St., San Francisco, $18,500, low for grading football field; and (2) J. S. Baker, 1421 O'Farrell St., San Francisco, $2500, low for grading girls' athletic field. 9-24

**WHITTIER, CALIF.**—To Griffith Co., L. A. Railway Bdg., Los Angeles, $37,292 for concrete paving streets in Citrus Grove Heights, also vitrified sewers and cast-iron mains for City.

**DENVER, COLO.**—Taggart Construction Co., Cody, Wyo., $59,168, low bid to Bureau of Public Roads for grading and surfacing 4.77 miles Cody-Yellowstone Project, Shoshone County, Wyoming.

**PORTLAND, ORE.**—Wm. Endicott, Madras, Ore., $46,972 low for 7.7 miles grading Fremont Highway, Deschutes National Forest, LAKE COUNTY, Ore., for Bureau of Public Roads. 9-21

**PORTLAND, ORE.**—Low bids as follows by State Highway Commission: DOUGLAS COUNTY—Liesch & Tofte, Marshfield, Ore., $8323, low bid for 0.57 mile grading and surfacing of 'L' St. (Reedsport) Section of Umpqua Highway. F. J. Kernan, Reedsport, $8720, next low. JACKSON COUNTY—L. O. Herrold, Salem, Ore., $119,455, low for 5.87 miles paving Medford-Phoenix Section of Pacific Highway. J. C. Compton, McMinnville, $135,656, next low. (See Unit Bid Summary.) 9-30

## CONTRACTS AWARDED

**CRESCENT CITY, CALIF.**—To Pacific States Construction Co., Call Bdg., San Francisco, who bid $154,940 for improvement of streets in District 2 for City of Crescent City, Del Norte County. Webber Construction Co., $159,670, next low. Work consists of grading, reinforced concrete work, sewers, corrugated culverts, ornamental lighting system, asphalt macadam paving, etc. (See Unit Bid Summary.) 9-26

**PHOENIX, ARIZ.**—To Rawls & Wright, 1031 River St., El Paso, Texas, who bid $95,619 to Arizona State Highway Commission for grading 9 miles of Douglas-Rodeo Highway, project beginning at Sta. 676-71, about 12.5 miles northeast of Douglas, extending northeasterly about 9 miles toward Rodeo. (See Unit Bid Summary, Sept. 25th issue.) 9-20

**PHOENIX, ARIZ.**—To New Mexico Const. Co., Box 592, Albuquerque, New Mexico, who bid $192,299 to Arizona State Highway Commission for 35 miles oil processing of Winslow-Flagstaff Highway FAP No. 74; Winslow-Flagstaff Highway FAP No. 81; and Winslow-Coconino County Line Highway FAP 22. (See Unit Bid Summary.) 9-20

**LONG BEACH, CALIF.**—Awards as follows by City: (1) To Sully-Miller Contracting Co., 1500 W. Seventh St., Long Beach, $50,860 for improving Canal Ave., asphalt paving, water mains to cost $15,550, and gas mains to cost $6800; and (2) To Griffith Co., L. A. Railway Bdg., Los Angeles, $14,110 for improving Ocean Ave., curbs, sidewalks and water mains to cost $7662. 9-20

**LOS ANGELES, CALIF.**—To Geo. R. Curtis Paving Co., 2440 E. 26th St., Los Angeles, who bid $173,461 for improving Canyon Drive for City of Los Angeles, work consisting in the main of grading, concrete paving, construction of storm drain, sanitary sewer, water system, concrete retaining wall, ornamental lighting system. 9-27

**LOS ANGELES, CALIF.**—To J. L. McClain, 3452 W. Slauson Ave., Los Angeles, $24,314 for improving Denker Ave., grading, concrete paving, water system, etc., for City.

**MONTEREY, CALIF.**—To J. L. Conner, Box 542, Monterey, $72,133 for 17 miles grading and surfacing King City-Jolon Road for County. (See Unit Bid Summary.) 9-26

**OAKLAND, CALIF.**—To Hutchinson Co., 1450 Harrison St., Oakland, who bid $73,888 for improvement of 14th Ave. from E. 12th St. to E. 22nd St., work for the City, consisting of grading, paving with 6-in. concrete base with 2-in. National surface, vitrified pipe conduits, etc. 9-20

**SACRAMENTO, CALIF.**—To Nate Lovelace, 3433 N St., Sacramento, who bid $179,936 for 1.8 miles grading from Bayview Rest to 1 mile from Eagle Falls, EL DORADO COUNTY, work for the California Division of Highways. (See Unit Bid Summary, Sept. 25th issue.) 9-24

**SAN DIEGO, CALIF.**—To Watson & Sutton, Box 396, San Diego, $148,447 for concrete paving and grading County Highway, Route 15, near Escondido, for County. (See Unit Bid Summary.) 9-24

**SAN DIEGO, CALIF.**—To Daley Corp., 4430 Boundary St., San Diego, who bid $47,505 to City of San Diego for improvement of 31st St. and Greeley Ave., by excavation, 6-in. asphalt-concrete pavement, cast-iron water main, fire hydrant, 6-in. concrete sewer main, reinforced concrete culvert, etc. 9-25

**SAN FRANCISCO, CALIF.**—To J. Welsh, Ray Bdg., Oakland, who bid $189,882 to Bureau of Public Roads, Sheldon Bdg., San Francisco, for 6.59 miles grading Eleven Mile-Grouse Creek Section, Wawona Road 2A3, Yosemite Natonal Park, Yosemite Valley. (See Unit Bid Summary, Sept. 25th issue.) 9-25

**SAN FRANCISCO, CALIF.**—To California Const. Co., Standard Oil Bdg., San Francisco, who bid $24,330 for paving with 10-in. waterbound macadam surface with asphalt or emulsified surface Mills Field Airport for the City. 9-21

**SAN JOSE, CALIF.**—To U. B. Lee, 888 Rodney Drive, San Leandro, $18,803 for macadam paving Main St., District 1, for County. 9-24

**SAN JOSE, CALIF.**—To San Jose Paving Co., San Carlos and Dupont Sts., San Jose, who bid $25,600 for improvement of Home St., from Harrison St. to Prevost St., work consisting of grading, paving with 2½-in. asphalt concrete base with 1½-in. asphalt-concrete surface, 4-in. vitrified sewer latteral, storm drains, etc., for City. 9-25

**SANTA BARBARA, CALIF.**—To Hunter & Richardson, Santa Barbara, $59,844 for grading 5.4 miles of Julian Road for County. 9-25

**SANTA CRUZ, CALIF.**—Awards as follows by County: (1) To Granite Construction Co., Watsonville, $2986 for quarry waste surfacing Soquel-San Jose Road; and (2) To Granite Construction Co., Watsonville, $7760 for macadam paving Branciforte Drive and Chanticleer Ave. 9-24

**SOUTHGATE, CALIF.**—To Geo. H. Oswald, 366 E. 58th St., Los Angeles, who bid $216,028 for improving Tweedy Blvd., between Alameda St. and Atlantic Ave., for City by grading, concrete paving. 9-21

**YUBA CITY, CALIF.**—To Hemstreet & Bell, Marysville, who bid $5040 for grading 2.3 miles of highway, the Woodland-Yuba City cutoff, from town of Robbins, Sutter County, southerly, for Joint Highway District No. 12. 9-26

**DENVER, COLO.**—To W. A. Colt & Sons, Las Animas, Colo., who bid $393,674 to Bureau of Public Roads, Denver, for 17.2 miles grading Fall River Project, Section B, Rocky Mountain National Park, LARIMER COUNTY, Colorado. (See Unit Bid Summary, Sept. 25th issue.) 9-25

**BOISE, IDA.**—Awards as follows by State: (1) To C. A. Robinson, Montpelier, Ida., $67,318 for 10 miles grading and surfacing Payette Highway from Star to Freezeout Hill, ADA and GEM COUNTIES; and (2) To C. A. Robinson, Montpelier, Ida., $14,719 for 6 miles grading Grays Lake Highway from Blackfoot River to Henry, CARIBOU COUNTY.

**PORTLAND, ORE.**—Awards as follows by State Highway Commission: (1) To Milne & Dussault, 1853 E. Broadway, Portland, $128,792 for 10.3 miles grading and surfacing Neskowin-Otis Section of Roosevelt Coast Highway, LINCOLN and TILLAMOOK COUNTIES. (2) To Yunker-Wiecks Co., Toledo, Ore., $25,689 for 1.2 miles grading Glenada Section of Roosevelt Coast Highway, LANE COUNTY. 9-30

**OLYMPIA, WASH.**—Awards as follows by State Highway Commission: Lake Samish Road—Clearing, grading, draining and surfacing 1.1 miles, Belfast to State Fish Hatchery in SKAGIT COUNTY, to Alex Beseloff Co., Seattle, for $21,020.36. Inland Empire Highway—Construction of bridges between Prosser and Sunnyside in BENTON and YAKIMA COUNTIES, to G. M. Barber, of Prosser, Wash., for $28,328.75. Inland Empire Highway—Surfacing with crushed stone 12 miles, end of pavement to Kiano, in BENTON COUNTY, to Lyon & Price, of Spokane, for $73,789. Inland Empire Highway—Regrading and draining between College Place and Oregon State Line, in WALLA WALLA COUNTY, to James Tobin & Son, Clarkston, Wash., for $9033.

**SEATTLE, WASH.**—Awards as follows by City: (1) To S. A. Moceri, Inc., Seattle, $87,654 for paving 44th Ave. SW, etc.; and (2) To Conguista & Greco, Seattle, Wn., $11,795 for walks and watermains on Gilman Ave.

# BRIDGES and CULVERTS

## WORK CONTEMPLATED

**LONG BEACH, CALIF.**—Plans by City Engineer, A. P. Adams, bids to be called for soon for the following work: (1) Construction of Orange Ave.-Hill St. viaduct to cost $140,000. (2) Construction of Pacific Ave. underpass to cost $140,000. 9-27

## BIDS BEING RECEIVED

**SAN RAFAEL, CALIF.**—Bids to 11 a.m., Oct. 15, by County Clerk for reinforced concrete bridge on upper Novato-Black Point Road, involving 46 cu.yd. 'A' concrete. 9-30

**SANTA CRUZ, CALIF.**—Bids to 3 p.m., Oct. 14, by City for reinforced concrete bridge over San Lorenzo River at Riverside Ave.; $50,000. 9-26

**OLYYMPIA, WASH.**—Bids to Oct. 22, by State Highway Commission for: Inland Empire Highway No. 3—Constructing three reinforced concrete-slab bridges, with concrete-pile foundation (one of six 18-ft. spans, one of four 20-ft. spans, and four of 18-ft. 10-in. spans); also three pile trestles (one 64 ft., one 79½ ft., and one 33 ft. long), and seven reinforced box culverts. Sunset Highway No. 2—Constructing approximately 370 lin.ft. of timber sidewalk, supported by steel brackets, on Fall City arch bridge, in KING COUNTY. Sunset Highway—Constructing a 13-ft. span reinforced concrete-slab bridge over Cotton-

**SEATTLE, WASH.**—Bids to 10 a.m., Oct. 21, by County for 14th Ave. South bridge over Duwamish waterway, involving 10,000 cu.yd. concrete, 235 tons reinforcing steel, 1000 tons structural steel, 1000 piles; $725,000. 9-30

**TACOMA, WASH.**—Bids to 2 p.m., Oct. 21, by Board of Contracts and Awards, City Hall, for reinforced concrete and steel viaduct on E. 11th St., to cost $350,000. 9-26

## BIDS RECEIVED

**FRESNO, CALIF.**—L. J. Immel, 1031 Evelyn Ave., Berkeley, $9748, low for widening reinforced concrete structures in MERCED COUNTY for California Division of Highways. 9-28

**SACRAMENTO, CALIF.**—C. H. Gildersleeve, Napa, $8738 for reinforced concrete bridge over Coon Creek overflow near Ewing, PLACER COUNTY, for District 3, California Division of Highways. 9-27

**SACRAMENTO, CALIF.**—Low bids as follows by California Division of Highways: (1) LOS ANGELES COUNTY—DeWaard & Sons, Granger Bdg., San Diego, $94,840, low for widening reinforced concrete bridge over San Gabriel River on Foothill Blvd., near Azusa; and (2) HUMBOLDT COUNTY—Mercer-Fraser Co., Eureka, $97,650, low for steel bridge over south fork of Trinity River near Sayler. (See Unit Bid Summary.) 9-26

## CONTRACTS AWARDED

**SAN RAFAEL, CALIF.**—To L. Lambretti, Mill Valley, $2784 for reinforced concrete bridge at Station 34-25 on Point Reyes-White House Pool Road, for County. 9-23

**STOCKTON, CALIF.**—To J. E. Fitzsimmons, Rt. 1, Box 80, Lodi, $34,558 for reconstructing timber bridge over Mokelumne River on Bruella Road for County. 9-24

**OLYMPIA, WASH.**—To J. F. Ward, Inc., Seattle, $56,441 for steel bridge over North River, GRAYS HARBOR COUNTY for State.

# SEWER CONSTRUCTION

## WORK CONTEMPLATED

**CARPINTERIA, CALIF.**—Plans by Engineer, F. J. Johnston, Santa

Barbara, bids soon by Carpinteria Sanitary District for outfall sewer into the ocean, treatment plant, several pumping plants and ½ mile of collecting sewer. Bonds voted, $90,000. 9-20

### BIDS BEING RECEIVED

**OAKLAND, CALIF.**—Bids to 12 m., Oct. 17, by City Clerk for reinforced concrete double box culvert sewer on 50th Ave. from Clement to E. Eighth St.; $50,000. 9-27

**SANTA BARBARA, CALIF.**—Bids to 10 a.m., Oct. 14, by County Clerk, for activated sludge type sewage treatment plant to serve County Hospital to cost $7000: Jules W. Markel & Son, Santa Ana, $10,900; R. E. Burgund, Beverly Hills, $12,900. These bids received Sept. 23, but were rejected. Plans from Burns-McDonnell-Smith Co., Western Pacific Bdg., Los Angeles. 9-25

### BIDS RECEIVED

**LOS ANGELES, CALIF.**—Byron-Jackson Pump Manufacturing Co., 2150 E. Slauson Ave., Los Angeles, who bid $7815, submitted only bid to Board of Public Works for furnishing and installing sewage pumping equipment for the Manchester Ave. pumping plant, including two pumps and motors. 9-27

**MISSOULA, MONT.**—Bids as follows by City for south side vitrified sanitary system: Morrison-Knudsen Co., Boise, Ida., $464,420; J. F. Shea, San Francisco, and Clifton, Applegate & Toole, Spokane, Wash., $469,419; J. C. Maguire, Butte, Mont., $481,505. Engineer's estimate, $470,260. 9-28

### CONTRACTS AWARDED

**ALTURAS, CALIF.**—To Heafey-Moore Co., 344 High St., Oakland, $79,696 for vitrified sewers and sewage treatment plant in Dist. 1 for City. 1925 Act. 9-19

**BERKELEY, CALIF.**—To Fredrickson & Watson Construction Co., 354 Hobart St., Berkeley, who bid $67,021, based on centrifugal cast concrete pipe for constructing Unit No. 5 of storm sewer system for City. 9-24

**CARLSBAD, CALIF.**—To Harmon Co., 1501 Mission Road, Alhambra, $43,182 to Carlsbad Sanitary District for sludge digestion disposal plant, using Dorr Co. mechanism; ocean outfall, consisting of 1000 lin.ft. 6-in. wrought-iron pipe; and trunk sewer, consisting of 9000 lin.ft. 8-in. to 15-in. pipe. 9-21

**LOS ANGELES, CALIF.**—To Bebek & Brkich, 5011 E. Slauson Ave., Maywood, who bid $116,080 for constructing cement sewers in Anaheim-Telegraph Road, between Brannick St. and Downey Road, and portions of Wilkins Ave., Marianna Ave., Augusta St., and other streets, about 12.22 miles of sewer, for County. 9-27

**SAN FRANCISCO, CALIF.**—To J. A. Doyle, bidding for G. M. Gest, 503 Market St., San Francisco, at $20,994 for tile drainage system at Mills Field Airport for City. 9-21

**SANTA MONICA, CALIF.**—To M. Simunovich, 3305 W. 66th St., Los Angeles, $91,140 to City of Santa Monica for concrete storm drain system in Pier Ave., 27th St., etc. 9-28

## WATER SUPPLY SYSTEMS

### WORK CONTEMPLATED

**PHOENIX, ARIZ.**—City is considering holding $2,930,000 bond election for: 42-in. flow line from Verde River intake structures to the City, about 28 miles, cost $1,054,000; 36-in. flow line replacement, 8 miles of steel or concrete pipe, cost $300,000; water meters, cost $150,000; five wells, $25,000; sump and pumping stations, $24,000; projection work on Verde River, $110,000; 10,000,000-gal. storage reservoir, $92,000; 24,500,000 ft. 48-in. main from reservoir to Thomas Road, $225,000; 7800 ft. 42-in. main from 16th to 12th Sts., $74,000; 15,840 ft. 24-in. main from 16th St. and Thomas Road west to Seventh Ave., $65,000; distribution lines, 6, 8, and 12-in. cast-iron pipe, $138,000. 9-24

**RENO, NEV.**—Sierra Pacific Power Co., Reno Nev., will install the following water system improvements at Reno, Nev.: Water mains to cost $200,000; wells to cost $60,000. 9-27

### BIDS BEING RECEIVED

**OAKLAND, CALIF.**—Bids to 8 p.m., Oct. 9, by East Bay Municipal Utility District for pumping plant equipment for Lafayette pumping plant. 9-28

**OAKLAND, CALIF.**—Bids to 5:30 p.m., Oct. 18, by East Bay Municipal Utility District for furnishing 32 gate valves and sluice gates, 6 to 30-in., inclusive; 35 tons of standard cast-iron fittings, 7670 ft. of 2½-in. wrought-iron piping, structural steel, operating tables, and other items for enlargement of the San Pablo filter plant. 9-28

### BIDS RECEIVED

**SAN DIEGO, CALIF.**—Butterfield Construction Co., Box 157, San Diego, $81,313, low for concrete sewer and cast-iron mains in Chesterton District for City. 9-25

### CONTRACTS AWARDED

**PUENTE, CALIF.**—To E. H. Walters, Covina, $8065 for 650,000-gal. reinf. concrete reservoir for La Puente Valley Co. Water Dist. 9-21

**SANTA BARBARA, CALIF.**—To Western Pipe & Steel Co., 5717 Santa Fe Ave., Los Angeles, who bid $2.24 per lin.ft. for furnishing and delivering 12,000 lin.ft. of 18-in. welded steel pipe to the Montecito County Water District. 9-20

**WHITTIER, CALIF.**—To American Cast Iron Pipe Co., 412 W. Sixth St., Los Angeles, who bid 38¢ per foot for furnishing 10,000 ft. 4-in. Class B or Class 150 cast-iron pipe for City of Whittier. 9-26

**HOOD RIVER, ORE.**—To D. P. Slater, The Dalles, Ore., $5530 for 3½-in. distributing system for City.

**CAMAS, WASH.**—To California Filter Co., San Francisco and Seattle, for the design and construction of a water filtration plant of 15,000,000 gal. per day capacity (sedimentation basins followed by filtration) for the Crown-Willamette Paper Co.'s plant at Camas, Wash. 9-26

## IRRIGATION and RECLAMATION

### WORK CONTEMPLATED

**MANTECA, CALIF.**—Bond election Oct. 11 by South San Joaquin Irrigation Dist. to vote $204,000 for concrete lining of canals. 9-20

### BIDS BEING RECEIVED

**MERCED, CALIF.**—Bids to 10 a.m., Oct. 22, by Merced Irrigation District for: (1) 6½ miles concrete lining; (2) Furnishing 8 drainage pumps and motors; and (3) Drilling and casing 8 wells. 9-30

### BIDS RECEIVED

**FAIRFIELD, MONT.**—J. A. Terteling & Sons, Moscow, Ida., $142,540 (Schedules 1 and 2 combined), low bid to Bureau of Reclamation for canals and structures on Spring Valley Canal, Sun River Project, Montana. (See Unit Bid Summary.) 9-25

## RIVER AND HARBOR WORK

### WORK CONTEMPLATED

**NEWPORT BEACH, CALIF.**—Bond election Oct. 22 by City to vote $200,000 for harbor improvements, including $150,000 for dredging harbor entrance and $50,000 for 2 rock groins. 9-20

### BIDS BEING RECEIVED

**SAN FRANCISCO, CALIF.**—Bids to 2 p.m., Oct. 9, by State Harbor Comm., Ferry Bdg., S. F., for reinf. conc. Pier No. 1. $275,000. 9-20

### BIDS RECEIVED

**RICHMOND, CALIF.**—Kern & Kibbe, Portland, as follows low bid to U. S. Engineer's Office for extension to training wall in Richmond Harbor:

120,000 tons of core rock..... 68¢ ton
24,000 tons of face rock.....$1.80 ton

**SAN FRANCISCO, CALIF.**—G. C. Rubke, Marysville, who bid as follows, low bid to U. S. Engineer's Office: (1) $2205 for 6 retards on Yuba River at Moran Place; and (2) $11,200 for 6 retards on Yuba River at Rubke Bend. 9-23

## LIGHTING SYSTEMS

### WORK CONTEMPLATED

**BERKELEY, CALIF.**—Plans by H. Goodridge, City Engineer, for 166 heavy duty fluted steel poles, conduit system, etc., on San Pablo Ave. from Virginia St. to south city limits. Bids after Oct. 8. 9-24

**SEATTLE, WASH.**—Plans by W. D. Barkhuff, City Engineer for lighting system, involving 735 posts on Fourth Ave. North and other streets; $217,000; bids after Oct. 17.

### CONTRACTS AWARDED

**MONTEREY, CALIF.**—To E. E. Burgess, 430 Natoma St., S. F., $2700 for 9 single-light electroliers on Main St., etc., for City. 9-19

**SACRAMENTO, CALIF.**—To Latourrette-Fical Co., 907 Front St., Sacramento, who bid $2920 for installation of 12 single-lamp electroliers on 39th St., between Folsom Blvd. and R St., for City. 9-21

**SAN FRANCISCO, CALIF.**—To R. Flatland, 1899 Mission St., S. F., $7592 for landing lights at S. F. Airport at Mills Field. 9-21

## POWER DEVELOPMENT

### WORK CONTEMPLATED

**EL CENTRO, CALIF.**—Plans being considered by Imperial Irrigation District, El Centro, for a 6000-kw. diesel engine plant to substitute for the five hydroelectric plants proposed under the District's $2,100,000 power project. Estimate of cost of diesel plant:

| | |
|---|---|
| Distribution system | $457,470 |
| Transmission lines | 208,000 |
| Andrade connection | 121,700 |
| Diesel plant | 720,000 |
| Electrical warehouse | 25,000 |
| 11-kv. distribution | 40,000 |

9-24

**HAWTHORNE, NEV.**—Bureau of Yards & Docks, Washington, D. C., has advised that drawings and specifications for the extension of the

transmission line at the Naval Ammunition Depot, Hawthorne, Nev., are nearing completion. The work consists of electric and telephone transmission lines, including poles, messenger cables, conductor cables, and accessory pole-line material, all completed and ready for operation. Work under Spec. 6016. 9-25

**SEATTLE, WASH.**—Plans by Engineering Department, Puget Sound Power & Light Co., Stuart Bdg., Seattle, Wash., for construction of a hydroelectric power project at Sunset Falls on south fork of Skykomish River near Everett, Wash., to develop 20,500 hp., and to cost about $2,000,000. 9-24

# RAILROAD CONSTRUCTION

## BIDS RECEIVED

**LONG BEACH, CALIF.**—Weller & Bond, Inc., 2303 Newton St., Los Angeles, who bid $22,893, submitted low bid to City of Long Beach for the construction of tracks and pavement on Water St. and Riverside Drive, near Pier No. 1, Long Beach Harbor. 9-19

## CONTRACTS AWARDED

**SAN FRANCISCO, CALIF.**—To W. A. Bechtel Co., 206 Sansome St., San Francisco, for cleaning out tunnel and removing slides from the Niles Tunnel for the Western Pacific Railroad Co. 9-30

**SONORA, CALIF.**—To Bechtel & Palmer, 206 Sansome St., San Francisco, for reconstruction, at a higher elevation, of 1½ miles of the Pickering Lumber Co. railroad sidings, etc., which lies within the reservoir to be formed by the Lyons dam now under construction by the Pacific Gas & Electric Co., on the south fork of Stanislaus River, Tuolumne County. 9-25

# FLOOD CONTROL WORK

## BIDS BEING RECEIVED

**LOS ANGELES, CALIF.**—Bids to 2 p.m., Oct. 14, by Board of Supervisors of the Los Angeles County Flood Control District, for construction of Hansen Dam and other structures in the Big Tujunga Canyon, about 1 mile above Hansen's Lodge and 12 miles northeast of Sunland. The dam will be a concrete arch structure with earthfill wing, and will be about 204 ft. high above streambed and 300 ft. between abutments, earthfill wing on the north end, valve outlets, and a spillway. Work involves: 90,000 cu.yd. 'A' excavation (rock), 18,000 cu.yd. 'B' excavation (river wash), 10,000 cu.yd. earthfill, 90,000 cu.yd. plain concrete, 2500 cu.yd. reinforced concrete, 5500 sq.ft. concrete reinforced face slab, 4000 ft. drill grout holes (30 ft. or less), 250 holes (place pipes in grout holes), 250 cu.yd. pressure grouting, 10,000 lb. place reinforced steel in plain concrete, 50,000 lb. place trash racks and metal, 100,000 lb. place steel outlet pipes, 150,000 lb. place valves and gates, 8000 lb. place iron pipe railing, 4000 ft. place water and grout stops, 800 ft. place tile drain. E. Court Eaton is Chief Engineer. 9-27

# MACHINERY and SUPPLIES

## BIDS BEING RECEIVED

**PHOENIX, ARIZ.**—Bids to 2 p.m., Oct. 18, by Arizona Highway Commission, for 6 motorized road graders, 4 motorized dual-drive graders, 7 'crawler' type tractor, and two 4-wheel type drive tractors. 9-30

**LONG BEACH, CALIF.**—U. S. Cast Iron Pipe & Foundry Co., Los Angeles, $183,592, low bid to City for furnishing cast-iron pipe.

**EL CENTRO, CALIF.**—Bids to 10 a.m., Oct. 11, by J. G. Scott, Purchasing Agent, City of El Centro, for one 60-hp. caterpillar tractor and 2½-ton truck. 9-25

## BIDS RECEIVED

**LONG BEACH, CALIF.**—Standard Pipe & Supply Co., Los Angeles, $21,979, low bid to City for furnishing wrought-steel pipe. 9-25

## CONTRACTS AWARDED

**OAKLAND, CALIF.**—To W. S. Dickey Manufacturing Co., 604 Mission St., San Francisco, who bid $2000 to Oakland Port Commission, 424 Oakland Bank Bdg., Oakland, for furnishing and delivering 4-in. clay drain tile for draining airport field at Oakland Municipal Airport. 9-24

# SWIMMING POOLS

## BIDS BEING RECEIVED

**SAN MATEO, CALIF.**—Bids to 7:30 p.m., Oct. 10, by San Mateo Union High School for constructing two swimming pools at San Mateo High School and Burlingame High School, including filters, pumps, piping, etc. 9-27

## CONTRACTS AWARDED

**LOS ANGELES, CALIF.**—To A. D. Paschall, 1661 Forest Ave., Pasadena, who bid $63,269 to Board of County Supervisors, Los Angeles, for construction of a stone-tile and brick bathouse with tile roof, a concrete swimming pool fully equipped with ladders, fencing, springboard, etc., filtration plant, water dispersion system, water heater and laundry equipment, irrigation system, street improvement, tennis courts, ornamental lighting system, etc., in Baldwin and Morgan Parks, Los Angeles County. 9-27

# BUILDING CONSTRUCTION

## WORK CONTEMPLATED

**BERKELEY, CALIF.**—Plans by Julia Morgan, Architect, Merchants Exchange Bdg., San Francisco, for steel and concrete club building on Durant St. and Dana for Berkeley Women's Club; $300,000. 9-25

**LONG BEACH, CALIF.**—Plans by J. H. MacDowell, Architect, New York, for Municipal Auditorium at Long Beach, to be of steel frame, concrete, and brick construction. $1,400,000. 9-20

**LOS ANGELES, CALIF.**—Plans by Walker & Eisen, Architects, Western Pacific Bdg., Los Angeles, for 13-story and basement, steel frame office building at 731 W. 6th St., Los Angeles, for Harold G. Ferguson Corp. $1,500,000. 9-20

**PACIFIC GROVE, CALIF.**—Plans by Swartz & Ryland, Architects, Brix Bdg., Fresno, for a 2-story bank and office building at Pacific Grove, Monterey County, for the First National Bank of Salinas; $75,000. 9-25

**SAN JOSE, CALIF.**—Plans by Wm. H. Weeks, Architect, Hunter-Dulin Bdg., San Francisco, for 'A' hotel on Santa Clara and Notre Dame for San Jose Hotel Co.; $500,000. 9-25

## BIDS BEING RECEIVED

**ALAMEDA, CALIF.**—Bids to 8 p.m., Oct. 15, by City Clerk for public bathhouse at foot of Washington Park. C. Werner, S. F., is Architect. $20,000. 9-20

**MODESTO, CALIF.**—Bids to 10:30 a.m., Oct. 15, by County for ward building and power house at County Hospital. R. G. deLappe, 1710 Franklin St., Oakland, is Architect. 9-26

**SAN FRANCISCO, CALIF.**—Bids to 2:30 p.m., Oct. 16, by Board of Public Works, City Hall, San Francisco, for addition to San Francisco Junior High School on Francisco and Stockton, steel and reinforced concrete; $145,000. 9-25

**TALMAGE, CALIF.**—Bids to 2 p.m., Oct. 15, by State Architect, Sacramento, for brick and concrete main building and four dormitory buildings at Mendocino State Hospital covering area of 25,000 sq.ft. 9-20

**YOUNTVILLE, CALIF.**—Bids to 2 p.m. Oct. 22, by Geo. B. McDougall, State Architect, Public Works Bdg., Sacramento, for construction of completion at Veterans' Home employees cottages, at Yountville, Napa County. The two buildings are to be 1-story frame structures with stucco exterior and tile roofs. 9-25

## BIDS RECEIVED

**PESCADERO, CALIF.**—P. K. Jones, 527 Fourth Ave., San Francisco, $14,852, low for frame and stucco school for Pescadero School District. 9-27

**TALMAGE, CALIF.**—Thollander Construction Co., 154 Leavenworth St., San Francisco, $8882, low for frame residence at Mendocino State Hospital. 9-25

**VACAVILLE, CALIF.**—Azevedo & Sacmento, 920 O St., Sacramento, $38,635, low for general construction of high school building. 9-27

## CONTRACTS AWARDED

**BENICIA, CALIF.**—To Standard Construction Co., 185 Stevenson St., San Francisco, for construction of a group of frame section buildings at Benicia for the Southern Pacific Co., 65 Market St., San Francisco. 9-24

**LOS ANGELES, CALIF.**—To P. J. Walker Const. Co., Garland Bdg., Los Angeles, at $1,000,000 for 13-story Class 'A' Stock Exchange building on South Spring St. for the Los Angeles Stock Exchange. S. E. Lunden, Rowan Bdg., Los Angeles, and J. & D. B. Parkinson, Title Insurance Bdg., Los Angeles, are the Architects. 9-23

**OAKLAND, CALIF.**—To Larsen & Larsen, Russ Bdg., S. F., at $35,000 for steel, brick, and corrugated iron warehouse and office building to be located on Third and Clay Sts., for the E. M. Jorgensen Co. 9-23

**SACRAMENTO, CALIF.**—To M. R. Petersen, 4530 Parker Ave., Sacramento, $7140 for Airport Hangar for City. 9-28

**SALINAS, CALIF.**—To Carl N. Swensen, 640 Stockton Ave., San Jose, who bid $45,640 for construction of a 3-story frame and stucco apartment building at Salinas for Frederick Hart. 9-24

**SAN FRANCISCO, CALIF.**—Awards as follows by City for construction of viewing stand at Balboa South Side High School: General construction awarded to MacDonald & Kahn, Financial Center Bdg., San Francisco, who bid $44,982; Plumbing awarded to A. Lettich, 365 Fell St., San Francisco, who bid $4337. 9-21

**SAN RAFAEL, CALIF.**—To Graubert Bros., 4735 Brookdale, Oakland, $14,360 for general construction of school at San Rafael for San Rafael School District. 9-30

**TAFT, CALIF.**—To G. A. Graham & Son, Dinuba, $26,952 for concrete manual training school building for Taft School District. 9-26

**TALMAGE, CALIF.**—Awards as follows for reinforced concrete and brick veneer cottages at State Hospital, Talmage, Mendocino County, for State of California: General Construction to J. S. Hannah, 268 Market St., San Francisco, $99,900; Plumbing and Heating to Nottingham Heating & Ventilating Co., 1528 Market St., Oakland, $19,666; Electrical Work to Collins Electric Co., Stockton, $2983. 9-28

# OPPORTUNITY PAGE

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

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Garfield & Co.
Hackley Equipment Co., P. B.
Harron, Rickard & McCone Co.
Ingersoll-Rand Co.
Jenison Machinery Co.
Leitch & Co.
Rix Company, Inc., The
Schramm, Inc.
Sullivan Machinery Co.

**Asphalt**
Gilmore Oil Co.
Standard Oil Co.
Union Oil Co.

**Asphalt, Emulsified**
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**Asphalt Plants and Equipment**
Bacon Co., Edward R.
Harron, Rickard & McCone Co.
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Link-Belt Meese & Gottfried Co.
Madsen Iron Works
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**Asphalt Paving**
Warren Bros. Roads Co.

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

**Bars, Steel**
Pacific Coast Steel Co.

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

**Bins, Storage and Hopper**
Bacon Co., Edward R.
Butler Bin Co
Harron, Rickard & McCone Co.
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Madsen Iron Works

**Blacksmithing—Drop Forgings**
Payne's Bolt Works

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

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

**Bonds, Street and Road Improvement**
Elliott-Horne Co., The

**Bonds, Surety**
American Surety Co.
Globe Indemnity Co.

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

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

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

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

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

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

**Camp Supplies**
Thomson-Diggs Company

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

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

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

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

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

**Cement**
Portland Cement Association

**Cement Guns**
Cement Gun Const. Co.

**Chemicals**
Great Western Electro-Chemical Co.

**Chlorinators**
Wallace & Tiernan
Water Works Supply Co.

**Chlorine**
Great Western Electro-Chemical Co.

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

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

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

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

**Concrete Curing**
Concrete Curing Co.

**Concrete Forms**
Harron, Rickard & McCone Co.

**Concrete Roads**
Portland Cement Association

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

**Conveyors, Elevating and Conveying**
Bacon Co., Edward R.
Bodinson Mfg. Co.
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**Cranes (Electric, Gasoline Locomotive)**
Bacon Co., Edward R.
Bucyrus-Erie Co.
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Hackley Equipment Co., P. B.
Harnischfeger Sales Corp.
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**Cranes, Traveling**
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
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Jenison Machinery Co.
Thew Shovel Co., The

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

**Culverts, Concrete**
Portland Cement Association

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

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

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

**Curing—Concrete**
Concrete Curing Co.

**Dams**
Ambursen Dam Co., Inc.

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

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

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

**Drain Tile**
Gladding, McBean & Co.

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

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

**Dump Wagons**
Le Tourneau Mfg. Co.

**Engineers**
Ambursen Dam Co., Inc.
Burns-McDonnell-Smith Engr. Co.
Hunt, R. W., Co.

**Engineering Instruments**
American Paulin System, Inc., The

**Engines, Gasoline and Steam**
Bacon Co., Edward R.
Continental Motors Corp.
Clyde Iron Works Sales Co.
Harron, Rickard & McCone Co.
Hercules Motors Corp.
Ingersoll-Rand Co.
Jenison Machinery Co.

**Excavating Machinery**
Bacon Co., Edward R.
Bodinson Mfg. Co.
Bucyrus-Erie Co.
Caterpillar Tractor Co.
Cleveland Tractor Co., The
Garfield & Co.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.
Jenison Machinery Co.
Link-Belt Meese & Gottfried Co.
Marion Steam Shovel Co.
Northwest Engineering Co.
Ohio Power Shovel Co.
Orton Crane & Shovel Co.
Osgood Co., The
Owen Bucket Co.
Parsons Co., The
Sauerman Bros., Inc.
Speeder Machinery Corp., The
Thew Shovel Co., The
Universal Crane Co., The

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# OPPORTUNITY PAGE

CONTINUED



## OFFICIAL BIDS

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

### Surfacing

San Francisco, Calif., September 27, 1929

Sealed bids, in single copy only subject to the conditions contained herein, will be received during February or March, 1930, and then publicly opened, for furnishing all labor and materials and performing all work for surfacing project 3A, B, C, D, on the North Rim of the Grand Canyon National Park.

The length of the project to be surfaced is 26 miles and the principal items of work are approximately as follows:

Fine grading subgrade and shoulders, 26 miles.
Crushed rock surfacing, 42,000 cu.yd.
Asphaltic oil, 330,000 gal.

Time of performance and definite date of opening bids will be given in a later Invitation for Bids which will be advertised on approximately February 1, 1930. As the country adjacent to the proposed work will soon be covered with snow, contractors who desire to furnish a bid this winter, are urged to go over the work not later than October 20, 1929. Prospective bidders may inspect the work and possible quarry sites by getting in touch with R. Thirion, Assistant Highway Engineer, Kaibab Forest, Arizona. Plans and specifications will be ready for distribution February 1, 1930.

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

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

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

Performance bond will be required as follows: In the amount of one hundred (100) per cent of the total contract price.

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. It is expected that $280,000 will be made available for this work. Award of contract will not be made unless and until the necessary funds therefor have been appropriated by Congress.

Envelopes containing bids must be sealed, marked, and addressed as follows: Bid for Road Surfacing. Project 3A, B, C, D, North Rim, Grand Canyon National Park, Arizona, 807 Sheldon Bldg., 461 Market St., San Francisco, California.

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



## HELP WANTED

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

TOPOGRAPHICAL DRAFTSMEN, not over 35. Only single men. Must be experienced in general and traverse survey, good letterers, and able to transcribe field notes and make their own calculations in the co-ordinate system. Sleeping quarters furnished by company. Apply by letter enclosing a recent photograph with sample of lettering and drafting on tracing cloth or a blueprint of the same. Salary to start, $150-200 a month. Location, Central America. X-9407.

STRUCTURAL STEEL DETAILER, experienced on this class of work, for fabricating shop. Salary $50 week. Apply by letter. Location, Northwest. R-2756-S.

ENGINEER, 26-35 years, preferably technical graduate, with experience in design and construction, for refinery work. Would probably start as designer with the expectation of developing into refinery engineer. Salary about $200 month to start. Apply by letter. Location, California. R-2759-S.

# THE BUYERS' GUIDE—*Continued from Page 64*

### 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.
Stamford Equipment Co.

### Filters
Water Works Supply Co.

### Fire Hydrants
Greenberg's Sons, M.
Industrial & Municipal Supply Co.
Rensselaer Valve Co.
United Iron Works
Water Works Supply Co.

### Floating Roofs
Chicago Bridge & Iron Works

### Floors, Mastic
Wailes Dove-Hermiston Corp.

### Flumes, Concrete
Portland Cement Association

### Flumes, Metal
California Corrugated Culvert Co.
Montague Pipe & Steel Co.

### Forms, Steel
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Lakewood Engr. Co.

### Freight, Water
American-Hawaiian Steamship Co.

### Frogs and Switches
Bacon Co., Edward R.
United Commercial Co.

### Gas Holders
Chicago Bridge & Iron Works
Western Pipe & Steel Co.

### Gates, Cast-Iron
California Corrugated Culvert Co.

### Gates, Radial
California Corrugated Culvert Co.

### Gates, Sheet Metal
California Corrugated Culvert Co.

### Governors, Steam Engine
Gardner-Denver Co.
Young Machy. Co., A. L.

### Governors, Turbine
Pelton Water Wheel Co., The

### Gravel Plant Equipment
Bacon Co., Edward R.
Bodinson Mfg. Co.
Bucyrus-Erie Co.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Link-Belt Meese & Gottfried Co.
Smith Engineering Works
Young Mach. Co., A. L.

### Gunite Lining
Cement Gun Const. Co.

### Hammers, Steam Pile
Bacon Co., Edward R.
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.

### Hardware, Shelf and Heavy
Thomson-Diggs Company

### Hoists, Hand and Power
Bacon Co., Edward R.
Clyde Iron Works Sales Co.
Gardner-Denver Co.
Garfield & Co.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.
Ingersoll-Rand Co.
Jaeger Machine Works, The
Jenison Machinery Co.
Link-Belt Meese & Gottfried Co.
Sullivan Machinery Co.
Willamette-Ersted Co.
Young Machy. Co., A. L.

### Hoppers, Steel
Bacon Co., Edward R.
Harron, Rickard & McCone Co.
Jenison Machinery Co.
Lakewood Engr. Co.
Link-Belt Meese & Gottfried Co.
Madsen Iron Works

### Hose (Steam, Air and Water)
Gardner-Denver Co.
Ingersoll-Rand Co.
Leitch & Co.
Rix Company, Inc., The

### Hydro-Tite
Industrial & Municipal Supply Co.

### Jacks, Lifting
Jenison Machinery Co.

### Kettles, Tar and Asphalt
Bacon Co., Edward R.
Harron, Rickard & McCone Co.
Littleford Bros. Co.
Montague Pipe & Steel Co.
Peerless Mchy. & Mfg. Co.
Spears-Wells Machy. Co.
Young Machy. Co., A. L.

### Leadite
Water Works Supply Co.

### Lighting Standards
United Iron Works

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

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

### Meters, Venturi
Water Works Supply Co.

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

### Mixers, Chemical
Dorr Co., The

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

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

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

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

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

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

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

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

### Paving Breakers
Gardner-Denver Co.
Harron, Rickard & McCone Co.
Ingersoll-Rand Co.
Leitch & Co.
Rix Company, Inc., The
Sullivan Machinery Co.

### Paving, Contractor
Warren Bros. Roads Co.

### Paving Plants
Bacon Co., Edward R.
Jaeger Machine Works, The
Jenison Machinery Co.
Madsen Iron Works

### Paving Tools
Bacon Co., Edward R.
Harron, Rickard & McCone Co.
Littleford Bros. Co.

### Penstocks
Chicago Bridge & Iron Works
Lacy Manufacturing Co.
Pittsburgh-Des Moines Steel Co.
Water Works Supply Co.
Western Pipe & Steel Co.

### Pile Drivers
Bacon Co., Edward R.
Bucyrus-Erie Co.
Harnischfeger Sales Corp.
Harron, Rickard & McCone Co.
Industrial Brownhoist Corp.
Ingersoll-Rand Co.
Jenison Machinery Co.
Northwest Engineering Co.
Orton Crane & Shovel Co.
Thew Shovel Co., The

### Piles, Concrete
Raymond Concrete Pile Co.

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

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

### Pipe Clamps and Hangers
Kortick Mfg. Co.

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

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

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

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

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

### Pipe, Lock-Bar
Western Pipe & Steel Co.

### Pipe, Preservative
Columbia Wood & Metal Preservative Co.

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

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

### Pipe, Sewer
Gladding, McBean & Co.
Pacific Clay Products

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

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

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

### Plows, Road
Bacon Co., Edward R.
Galion Iron Works & Mfg. Co.
Hackley Equipment Co., P. B.
Jenison Machinery Co.
Spears-Wells Machy. Co.

### Pneumatic Tools
Gardner-Denver Co.
Ingersoll-Rand Co.
Leitch & Co.

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

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

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

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

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

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# OPPORTUNITY PAGE

## CONTINUED

## OFFICIAL BIDS

NOTICE TO CONTRACTORS

### Valves, Fittings, Pipe, Steel, Etc.

Sealed proposals will be received at the office of the East Bay Municipal Utility District, 512 Sixteenth Street, Oakland, California, until 5:30 p.m., Friday, October 18, 1929, and will at that hour be opened, for furnishing 32 Gate Valves and Sluice Gates of sizes from 6-in. to 30-in. inclusive, 35 tons of standard cast iron fittings, 7,680 feet of 2½-in. wrought iron piping, structural steel operating tables and other items, for the enlargement of the San Pablo Filter Plant.

Specifications may be obtained upon application to the office of the District.

JOHN H. KIMBALL, Secretary.

Oakland, California, September 26, 1929.

UNITED STATES DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

### Grading

San Francisco, Calif., September 27, 1929

Sealed bids, in single copy only subject to the conditions contained herein, will be received during February or March, 1930, and then publicly opened, for furnishing all labor and materials and performing all work for grading from the North Park Entrance to Fuller Canyon, Route No. 4, Grand Canyon National Park Highway System, located on the North Rim of the Grand Canyon National Park, Arizona.

The length of the project to be constructed is 9.8 miles and the principal items of work are approximately as follows:

Clearing, 18 acres.
Excavation unclassified, 85,000 cu.yd.
Excavation for structures, 600 cu.yd.
Borrow, 3000 cu.yd.
Overhaul, 18,000 sta.yd.
Dry rubble masonry, 150 cu.yd.
C.M.P. (haul and place), 2900 lin.ft.

Time of performance and definite date of opening of bids will be given on a later Invitation for Bids, which will be advertised on approximately February 1, 1930. As the country adjacent to the proposed construction will soon be covered with snow, contractors who desire to furnish a bid this winter are urged to go over the work not later than October 20, 1929. Prospective bidders may inspect the line as staked and review the rough draft of the plans by getting in touch with R. Thirion, Assistant Highway Engineer, Kaibab Forest, Arizona. Plans and specifications will be ready for distribution on February 1, 1930.

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

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

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

Performance bond will be required as follows: In the amount of one hundred (100) per cent of the total contract price.

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. It is expected that $120,000 will be made available for doing this work. Award of contract will not be made unless and until the necessary funds therefor have been appropriated by Congress.

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

Bid for Road Construction. North Park Entrance-Fuller Canyon, Route No. 4, Grand Canyon National Park, Arizona, 807 Sheldon Bldg., 461 Market St., San Francisco, California.

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

UNITED STATES DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

### Grading

San Francisco, Calif., September 27, 1929

Sealed bids, in single copy only subject to the conditions contained herein, will be received during March or April, 1930, and then publicly opened, for furnishing all labor and materials and performing all work for grading project 1D on the Northwest portion of the Loop Route, Route No. 1, Lassen Volcanic National Park, California.

The length of the project to be graded is 8 miles and the principal items of work are approximately as follows:

Clearing, 40 acres.
Excavation unclassified, 110,000 cu.yd.
Class B concrete, 120 cu.yd.
Reinforcing steel, 10,000 lb.

Time of performance and definite date of opening of bids will be given in a later Invitation for Bids which will be advertised on approximately March 1, 1930. As the country adjacent to the proposed construction will soon be covered with snow, contractors who desire to furnish a bid this winter are urged to go over the work not later than October 15, 1929. Prospective bidders may inspect the line as staked and review the rough draft of the plans by getting in touch with J. L. Mathias, Associate Highway Engineer, Mineral, California. Plans and specifications will be ready for distribution on March 1, 1930.

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

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

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

Performance bond will be required as follows: In the amount of one hundred (100) per cent of the total contract price.

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. It is expected that $140,000 will be made available for doing this work. Award of contract will not be made unless and until the necessary funds therefor have been appropriated by Congress.

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

Bid for Road Construction. Project 1D, Loop Route, Lassen Volcanic National Park, 807 Sheldon Bldg., 461 Market St., San Francisco, California.

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

UNITED STATES DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

### Surfacing

San Francisco, Calif., September 27, 1929

Sealed bids, in single copy only subject to the conditions contained herein, will be received during February and March, 1930, and then publicly opened, for furnishing all labor and materials and performing all work for surfacing projects 1C3 and 1C4 and portion of projects 1C2 and 1C1 on Route No. 1, Loop Route, Lassen Volcanic National Park Highway System.

The length of the project to be surfaced is 7.9 miles and the principal items of work are approximately as follows:

Fine grading subgrade and shoulders, 7.5 miles.
Crushed rock surfacing, 15,000 cu.yd.
Supplemental crushed rock, 1750 cu.yd.
Watering, 900 M gal.

Time of performance and definite date of opening bids will be given on a later Invitation for Bids which will be advertised on approximately February 15, 1930. As the country adjacent to the proposed work will soon be covered with snow, contractors who desire to furnish a bid this winter are urged to go over the work not later than October 15, 1929. Possible quarry sites are found adjacent to Stas. 328 and 361 on Sec. C3, Sta. 607 on Sec. C4, and Sta. 467 on Sec. C2. Instructions as to which of these quarries shall be used will be given in the plans and specifications which will be ready for distribution on February 15, 1930. Prospective bidders may inspect the project by getting in touch with J. L. Mathias, Associate Highway Engineer, Mineral, California.

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

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

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

Performance bond will be required as follows: In the amount of one hundred (100) per cent of the total contract price.

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. It is expected that $62,000 will be made available for doing this work. Award of contract will not be made unless and until the necessary funds therefor have been appropriated by Congress.

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

Bid for Road Surfacing. Projects 1C3, 1C4, Loop Route, Lassen Volcanic National Park, 807 Sheldon Bldg., 461 Market St., San Francisco, California.

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

## SITUATIONS WANTED

**POSITION WANTED** — Construction accountant, bookkeeper, purchasing agent and general office manager. Fifteen years' experience; young man; married; thoroughly experienced, payrolls, timekeeping, materials, warehouse, both field and general office; best local references character and ability. Reply Box H.L.S., Western Construction News.

# THE BUYERS' GUIDE—*Continued from Page 66*

### Pumps, Dredging and Sand
Jenison Machinery Co.
United Iron Works

### Pumps, Hydraulic
Jenison Machinery Co.

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

### Pumps, Rented
Pacific Pumping Co., Inc.

### Pumps, Road
Bacon Co., Edward R.
Chain Belt Co.
Harron, Rickard & McCone Co.
Jaeger Machine Works, The
Jenison Machinery Co.
Woodin & Little

### Pumps, Sewage
American Well Works, The
Dorr Co., The
Fairbanks, Morse & Co.
Industrial & Municipal Supply Co.

### Pumps, Sewage Ejector
Industrial & Municipal Supply Co.
United Iron Works

### Pumps, Sludge
Dorr Co., The

### Pumps, Water Works
Fairbanks, Morse & Co.
Industrial & Municipal Supply Co.
Jenison Machinery Co.
Pelton Water Wheel Co., The

### Rails
Bacon Co., Edward R.
Claussen & Co., C. G.
United Commercial Co.

### Reinforcing Bars
Pacific Coast Steel Co.
Soulé Steel Co.

### Reinforcing Wire Fabric
Soulé Steel Co.

### Reservoirs, Steel
Chicago Bridge & Iron Works
Western Pipe & Steel Company

### Riveting Machines
Ingersoll-Rand Co.
Rix Company, Inc., The

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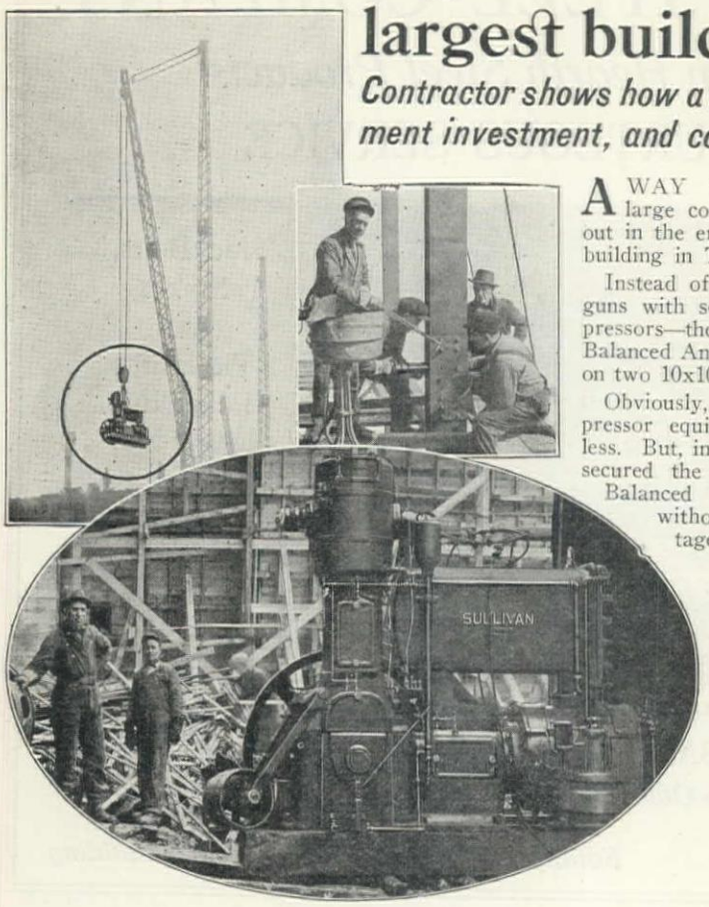
# Balanced Angle Compressors help erect largest building in British Empire

***Contractor shows how a Balanced Angle Compressor can reduce equipment investment, and combine lowest cost air power, with portability***




A WAY to increase profits on large contract jobs—was pointed out in the erection of the new Eaton building in Toronto.

Instead of backing up the riveting guns with several portable air compressors—the contractors used one Balanced Angle Compressor, mounted on two 10x10 timbers.

Obviously, the investment in compressor equipment was substantially less. But, in addition, the contractors secured the low-cost air power of Balanced Angle Compressors—without sacrificing the advantages of portability. A few hours after the compressor reached the job it was running smoothly, with only a couple of timbers for foundation. It was operated 24 hours daily, until completion of the work, without a moment's trouble. Since then the compressor has been used with the same simple skid foundation, on two other contracts.

Smooth operation made possible by Balanced Angle design saves foundation cost, power, and maintenance. Yet, it is only one reason why these compressors are saving money for leaders in every industry.

*Send for Catalog 83-J.*

**THE PICTURES**

Oval: The Sullivan Compressor is being moved out of the shed after completion of work on the Eaton building. The timbers which have been its only foundation, are still attached. Above, left: On completion of the job, the compressor was hoisted up one side of the building and let down the other side to a motor truck which hauled it to another job.

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