WESTERN CONSTRUCTION NEWS

WITH WHICH IS CONSOLIDATED
WESTERN HIGHWAYS BUILDER

PUBLISHED MONTHLY
VOLUME X, NO. 4

APRIL, 1935

25 CENTS A COPY
$2.00 PER YEAR

A 2,000 Gallon per Minute Flow of Water Encountered in West Portal of San Jacinto Tunnel, Colorado River Aqueduct. See Article Page 106.

PROVEN STRENGTH

SOUND construction should receive first consideration in any structure built to endure. This includes the selection of building materials of recognized standing and *proven* merit.

GOLDEN GATE cement has been the standard of quality in the West for a quarter of a century. Bridges, dams, tunnels, highways, dry-docks and monolithic structures up and down the Coast are lasting monuments to its permanence

Behind its *proven strength* stand the highest technical authorities in the land, the United States Bureau of Standards and the American Society for Testing Materials, whose exacting requirements it meets in full.

No matter what the structure, large or small, you invest in certainty when you specify time-tested GOLDEN GATE *True* Portland Cement.

PACIFIC
PORTLAND CEMENT COMPANY
San Francisco

GOLDEN GATE
PORTLAND CEMENT
FOR SOUND CONSTRUCTION

In writing to PORTLAND CEMENT ASSOCIATION, *please mention Western Construction News.*

Again NORTHWEST *leads the way!*

MODEL **85** DRAGLINE

HANDLES A 3 YD. BUCKET

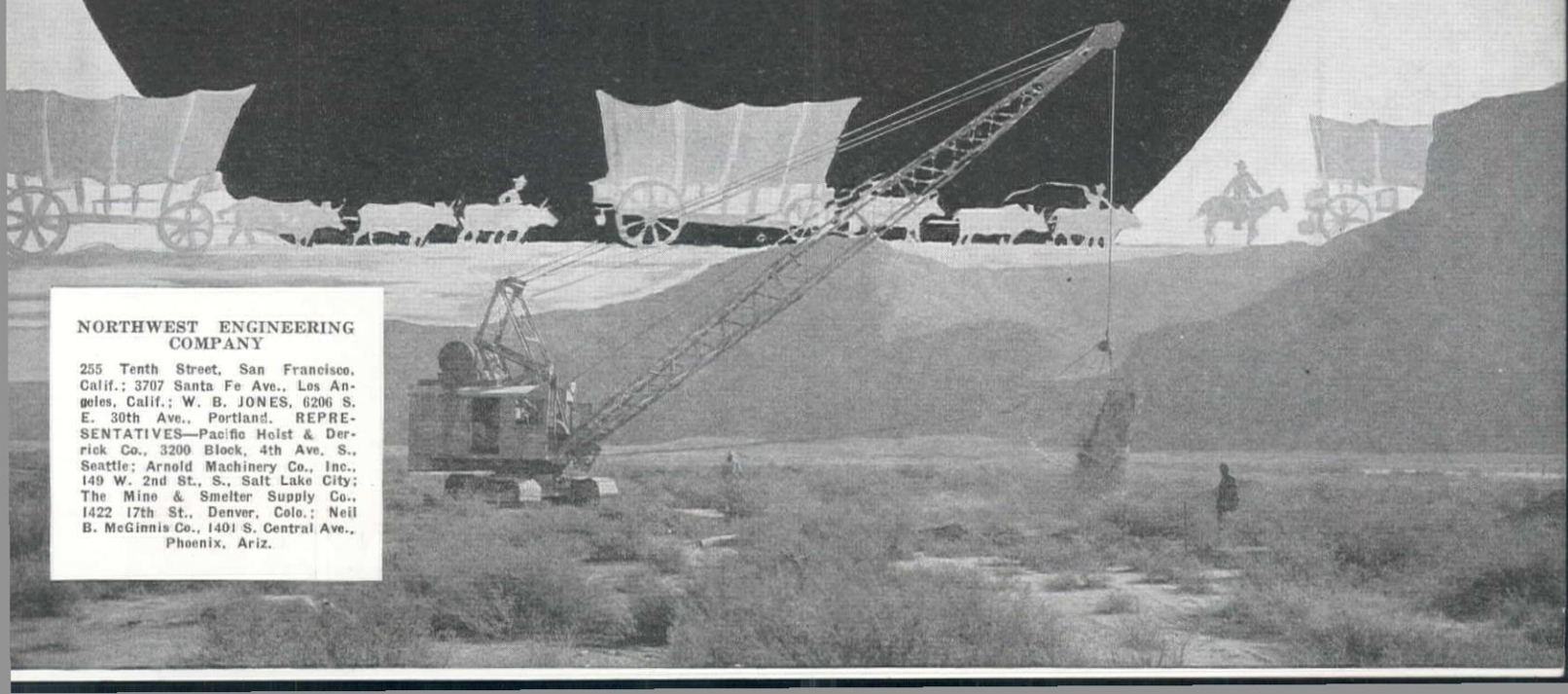
David H. Ryan completes the first section of Grand Coulee Railroad two months ahead of schedule!

This speedy conclusion of a successful contract is in a large measure the result of the high output of a Model 85 Northwest Dragline, equipped with a 3-yard Northwest bucket and powered with a Northwest Oil Engine.

NORTHWEST ENGINEERING COMPANY

The world's largest exclusive builders of gasoline, oil, diesel or electric powered shovels, cranes, draglines, pullshovels and skimmers

1727 Steger Building, 28 East Jackson Boulevard, Chicago, Illinois, U. S. A.



NORTHWEST ENGINEERING COMPANY

255 Tenth Street, San Francisco, Calif.; 3707 Santa Fe Ave., Los Angeles, Calif.; W. B. JONES, 6206 S. E. 30th Ave., Portland. REPRESENTATIVES—Pacific Hoist & Derrick Co., 3200 Block, 4th Ave. S., Seattle; Arnold Machinery Co., Inc., 149 W. 2nd St., S., Salt Lake City; The Mine & Smelter Supply Co., 1422 17th St., Denver, Colo.; Neil B. McGinnis Co., 1401 S. Central Ave., Phoenix, Ariz.

• strength
• rigidity
• capacity

Adams Motor Grader—8-wheel Tandem Drive—mixing oil and sand.

Adams Motor Grader—2-wheel Drive—reshaping a dirt road.

Adams Motor Grader—4-wheel Tandem Drive—reditching a gravel road.

● Whether it's an oil-mix job — a job of reditching — or the reshaping and maintenance of earth, gravel or stone roads, Adams Motor Graders have the strength, rigidity and capacity to do the work to your complete satisfaction.

The Adams frame—a strong, solidly-welded unit of distinctive design — provides unsurpassed strength and rigidity for smooth cutting. Adams machine-finished construction, with adjustability for wear, assures smooth operation and long life.

In soft or uncertain "going" you can depend upon Adams Tandem Drive (4 or 8 drive wheels) to take you through. The drive wheels grip the ground at four points five to six feet apart. Each wheel is independently driven; each helps to pull the others over soft or slippery spots. Adams Motor Graders are also available with dual-tired, two-wheel drive. They are powered by McCormick-Deering or Case tractors and are furnished with hand controls or Adams positive-acting, power-operated controls. Write for catalog completely describing the mechanical and operating advantages of these machines.

J. D. ADAMS COMPANY
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ADAMS MOTOR GRADERS

WESTERN CONSTRUCTION NEWS

WITH WHICH IS CONSOLIDATED
WESTERN HIGHWAYS BUILDER

G. E. BJORK, Acting Editor

Contents for April, 1935

What of the Future

Every now and then some manufacturer of construction equipment asks us what will happen to western construction activity when Government money runs out. The question is so frequently asked, in fact, that we have begun to wonder if a great number of manufacturers are not actually in doubt about the future. It might be a good idea, therefore, to stop just a moment and review the history of western construction activity.

When the Union Pacific railroad was put through, and later when it was joined at Ogden by the old Central Pacific (now part of the Southern Pacific system) the government participated heavily in the financing, through land grants. Most western railroads, even though they were privately built, secured huge land grants from the government, converting them at a later date into money. The Cedar river project, for Seattle's water supply, was public money, as was also Los Angeles' Owens River project and San Francisco's Hetch Hetchy. To be sure, the money was actually provided by the private underwriting of bonds; but in what way does the system then used differ from the Federal issuance of baby bonds, Treasury certificates and other Federal securities?

Public works have always been financed in some way by the Federal government, or its subdivisions; and with few exceptions western public works have been self-liquidating, even as they are at present. Boulder dam will pay its own way; so will Bonneville; so will the two great bridges in San Francisco; so will Grand Coulee, even, if the high dam is adopted. During the past fifty years the west has advanced in its planning. The day of isolated projects, completed without respect to their effect on neighboring sections, is past; and Federal planning is substituted. Instead of the catch-as-catch-can system we formerly followed, well-ordered planning methods now control development of public works.

The result is that construction activity in the west will go forward to greater heights. There will be no slacking off. No other region of the United States is growing as rapidly as the west; no other region provides such sound facilities for self-liquidating public works. Let there be no doubt about the future of the west, therefore. Horace Greeley, were he living today, could say with even greater accuracy, 'Young man, go West.'

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3225 N. E. Davis St., Portland, Ore.
G. E. Bjork, Manager

Chicago Office:
162 East Ohio Street
Stephen H. Babcock, Manager

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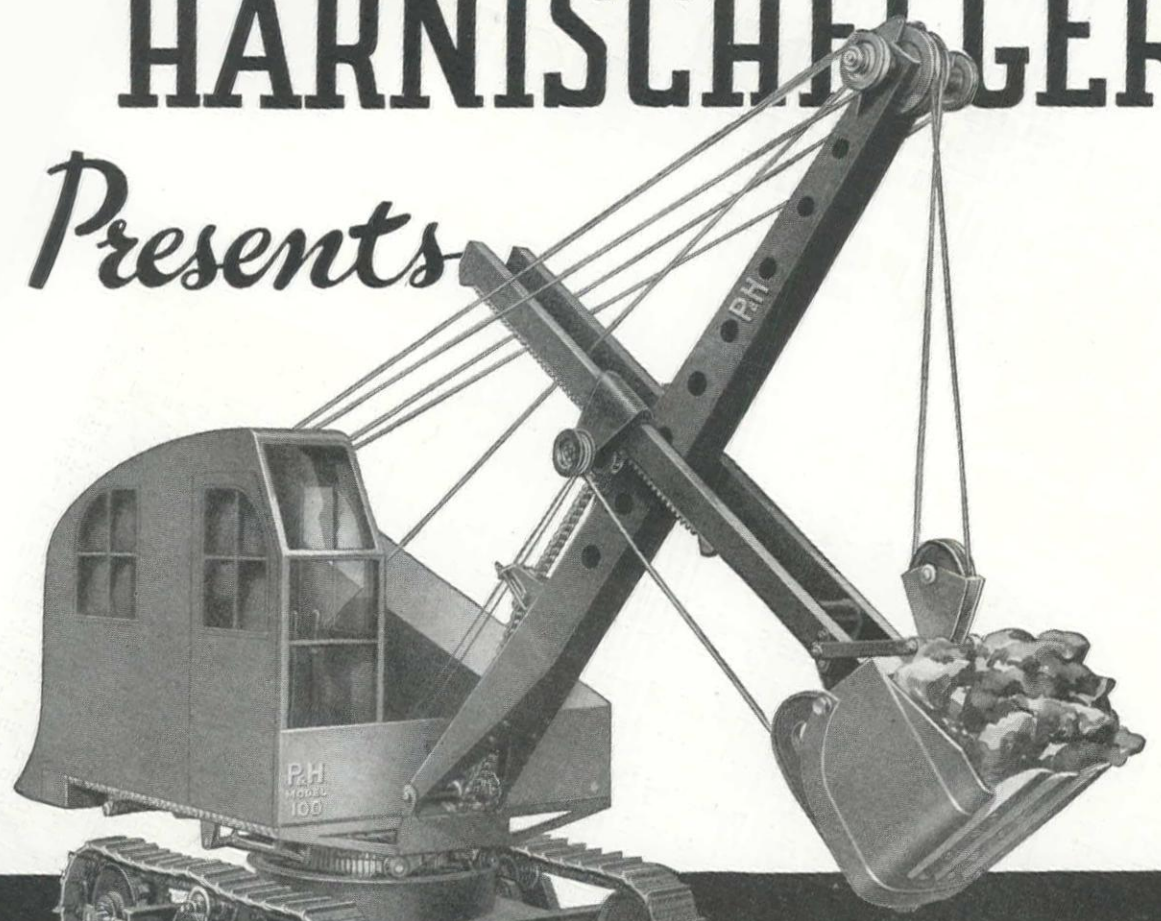
HARNISCHFEGER

Presents



The P&H BANTAMWEIGHT

(MODEL 100 - 3/8 - yd.)

A REAL CHAMPION

FOR LOW COST DIRT MOVING

IT'S HUSKY AND FAST

As new as tomorrow's champion! A fast-moving, hard digging excavator that tips the scales at only 15,800 lbs.! It's a full-revolving 3/8-yd. machine that steps a year ahead in excavator design . . . does more for less money. . . . Liberally Powered by the smooth Ford V-8 motor, swift travel combines with easy steering, climbing and quick turning ability to give you tractor mobility. Swing speed is 5 RPM. Add to this the Live Boom Chain Crowd, and Split Second Clutches and you have the industry's fastest digging cycle.

Fully Convertible — The light boom makes practical converting on the job. Simplified design gives full convertibility at the industry's lowest cost.

Modern All-Welded Construction—reduces weight and increases strength. High grade alloy steels eliminate waste pounds. Machinery units placed behind the center of rotation cut down dead counterweight.

Unit-built frame and side stands prevent weaving. Carbody is all-welded and cylindrical for greatest strength. First reduction gears operate in oil bath—helical gears are heat treated and double cut for long life and quiet operation. Anti-friction bearings are used at all vital points. The Bantam Weight can "take it" like a title holder.

HOW THE BANTAM WEIGHT MEASURES UP:

Capacity	3/8-yard
Engine	Ford V-8 (40 HP)
Weight	15,800 lbs.
Crowding Motion	P&H Rapid Reversing
Clutches	Split Second Control
Swing Clutches	Internal Expanding
Hoist Line Speed	162 F.P.M.
Dragline Speed	150 F.P.M.
Swing Speed	5 RPM
Travel Speed	1½ to 3 MPH
Tail Swing	7 Feet
Height to Top of Cab	10 Feet 4 inches

Bulletin No. 100 has complete specifications. Write for your copy

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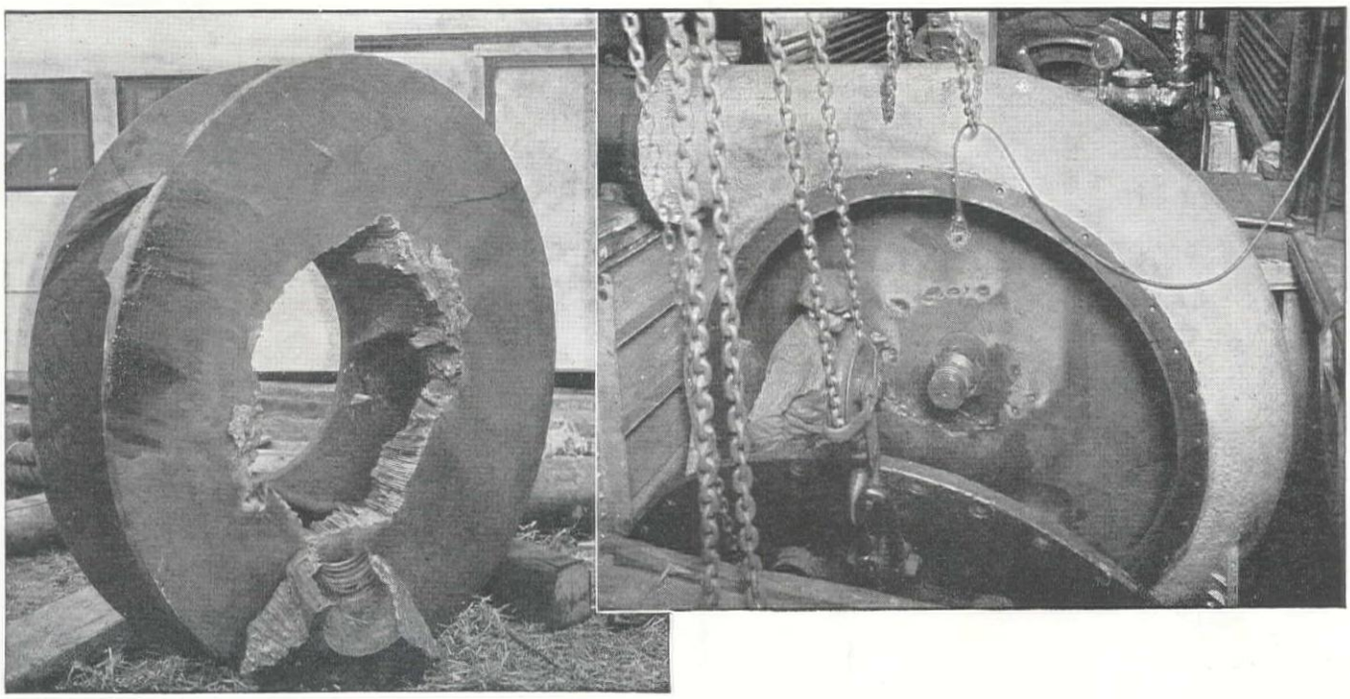
SEATTLE DALLAS LOS ANGELES SAN FRANCISCO

Dredge pump impeller broken..... Quick replacement imperative..... .....AIRCO solves the problem



A Contractor is in a jam. One of his dredges is out of commission. The 6-ton manganese-steel impeller of the main centrifugal pump has been broken beyond repair by a large stone. He needs the dredge urgently.

How to remove the broken impeller—that is the problem. It must be done without damaging the impeller shaft or pump housing, for to replace these parts would mean an indefinite delay, not to mention the very heavy cost. Threads on the end of the shaft add to the difficulties.

An attempt is made to back the impeller off the shaft, using a 50-ton crane, several 10-ton jacks and some oxyacetylene torches to heat and expand the hub. But it's no go.

Local job welding companies are consulted. They hesitate to tackle the job because of the complications involved. Then AIRCO is called upon — and AIRCO solves the problem.

FOLDER GIVES FULL DETAILS

How the impeller was removed in quick time and at a nominal cost is a story that will interest all those who may sometime be confronted with the problem of salvaging a damaged machine. A folder has been prepared which tells the story in detail. Write for your copy.

AIR REDUCTION SALES COMPANY

● WESTERN OFFICES and PLANTS ●

EMERYVILLE, Calif — PORTLAND, Ore.

LOS ANGELES, Calif. — SEATTLE, Wash.

A NATION-WIDE WELDING and CUTTING SUPPLY SERVICE

When writing to Air Reduction Sales Company, *please mention Western Construction News*

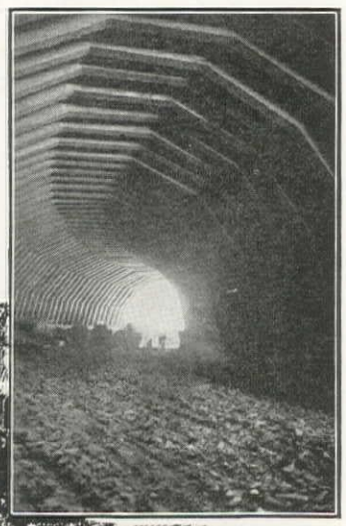
Control the Vital Factor in Building Roads Through National Parks

Roads through National Parks must be "a part of the picture." An ordinarily good highway job isn't good enough. To get the approval of public and park commissioners the park road must blend with nature. No unsightly grades, cuts or embankments are permitted to mar the beauty of woods or mountains. Scattered rock fragments cannot be tolerated.

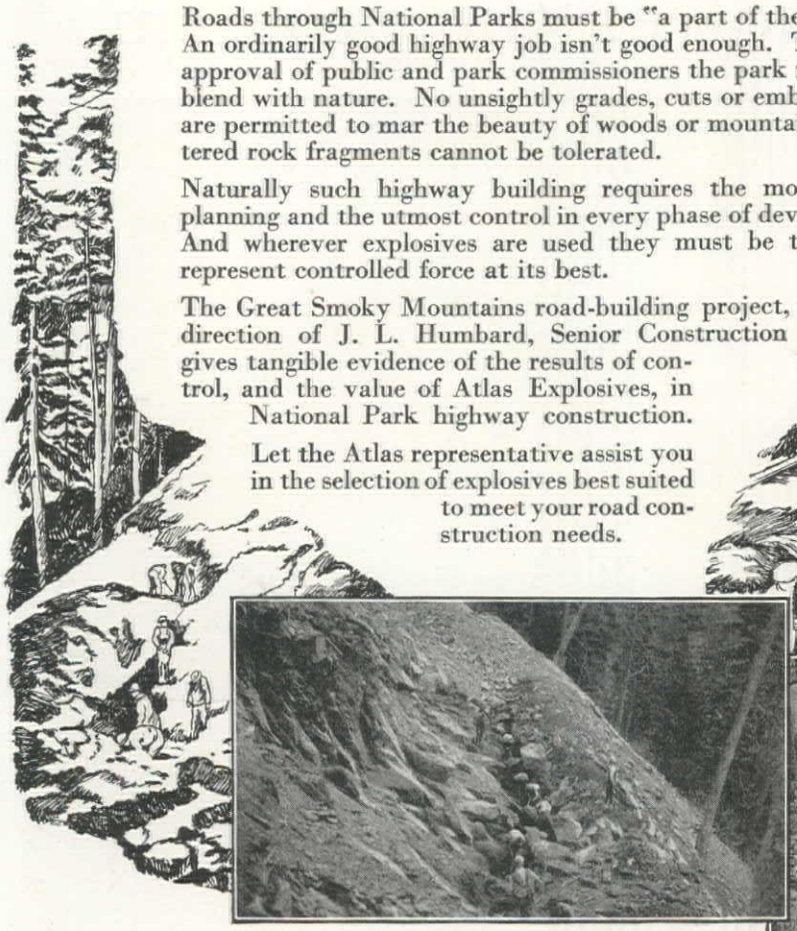
Naturally such highway building requires the most careful planning and the utmost control in every phase of development. And wherever explosives are used they must be those that represent controlled force at its best.

The Great Smoky Mountains road-building project, under the direction of J. L. Humbard, Senior Construction Engineer, gives tangible evidence of the results of control, and the value of Atlas Explosives, in National Park highway construction.

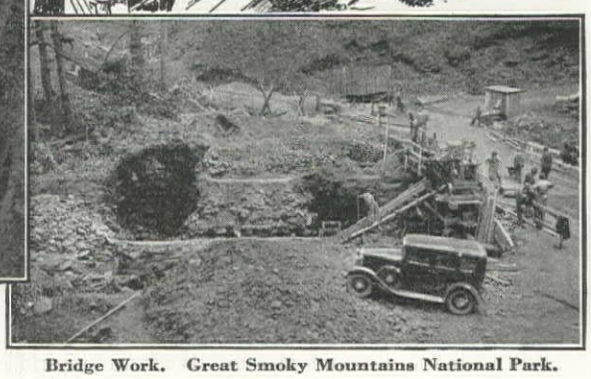
Let the Atlas representative assist you in the selection of explosives best suited to meet your road construction needs.



Tunnel looking west. Great Smoky Mountains National Park.



Excavation for rubble mason wall. Great Smoky Mountains National Park, U. S. Bureau of Public Roads. J. L. Humbard, Senior Construction Engineer, Gatlenburg, Tenn.



Bridge Work. Great Smoky Mountains National Park.

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THE ATLAS DIVISION

Everything for Blasting

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ATLAS EXPLOSIVES

ATLAS EXPLOSIVES

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Diesel LORAIN 77 & 75D

• The convincing performance of the 1½ yd. Diesel Lorain 77 may be summed up in its ability ***to increase output 10 to 20% and to reduce fuel costs 50 to 80%*** . . . but the Lorain 77 has many plus values such as proved Thew Center Drive design; modern power efficiency in the turntable; trouble-free simplicity in the crawler; greater reaches in the shovel boom . . . plus a new cable-saving fairlead . . . plus reversible, wider swing bands that more than double lining life . . . plus many other features, distinctively Lorain. They're described in the new L-77 bulletin. Write for it today!

THE THEW SHOVEL COMPANY • LORAIN, OHIO

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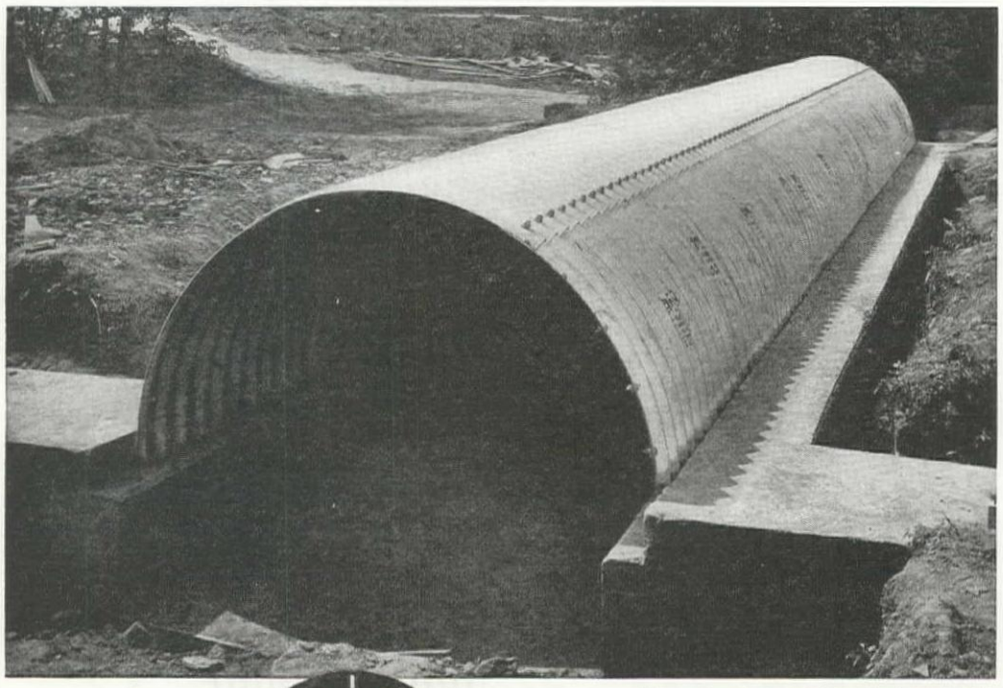
when SPEED is the Order of the Day



Toncan Iron Sectional Plate Arch installed in South Park, Allegheny Co., Pa. Clear span, 90 inches; rise above springing line, 47½ inches; length, 45 feet.

Remember . . .

this Toncan Iron Sectional Plate Arch was erected in less than . . .

5 hours . .

Here's the story. The Toncan Iron plates, bolts, nuts and washers were delivered to the bridge site at 10 a. m. By 3 o'clock that afternoon the structure was complete and ready for the fill.

Six men comprised the erection crew, and not one of them was familiar with this type of work. The only tools used were six structural steel wrenches, one drift pin and one sledge hammer.

This is a typical example of the ease and rapidity with which modern drainage structures such as this can be built. And made of Toncan Iron—the modern alloy of pure, open hearth iron with copper and molybdenum which has the highest resistance to corrosion of any material in its price class—years of long-lived, economical service are assured.

Let us send you a copy of the Handbook giving full description and engineering data.

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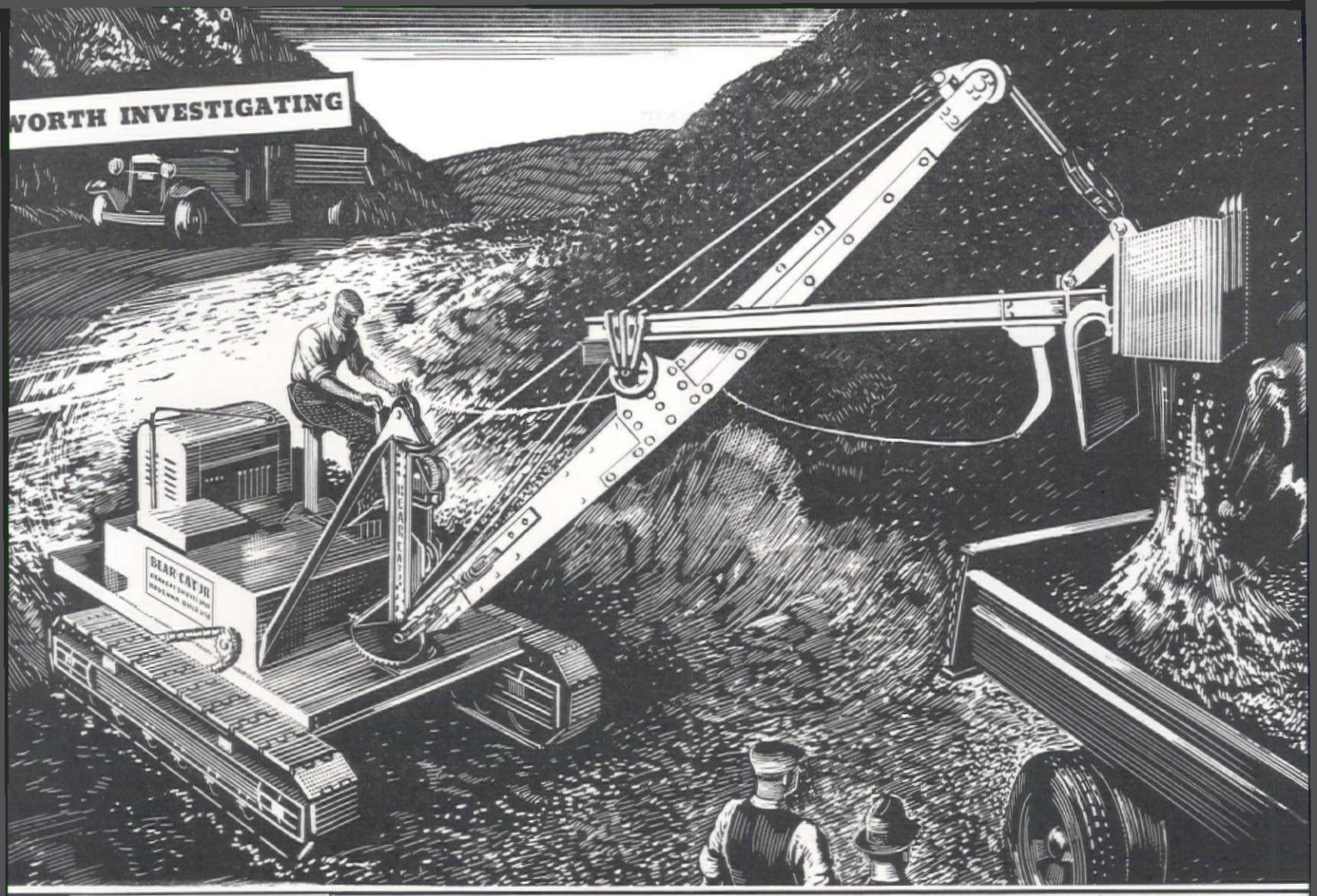
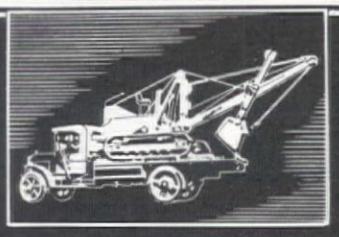
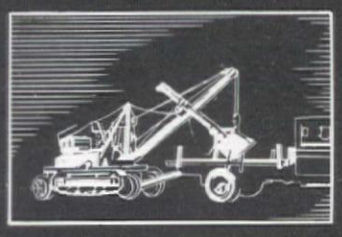




25 MILES PER HOUR
BY TRUCK OR TRAILER



YOU CAN'T BEAT IT
FOR PORTABILITY

$5.18 PER DAY

~an operating record!

This daily operating cost . . . furnished by 110 Bear Cat Jr. owners includes gas . . . oil . . . grease . . . depreciation . . . interest . . . maintenance, but not operator. Such a low operating cost is not surprising when you consider the Bear Cat Jr. excavates all day long on 9 gallons of gasoline and one quarter pint of oil . . . If you are interested in . . . digging 250 to 400 yards per day at 3c to 4c per yard . . . in a shovel that can be transported 25 miles per hour from job to job . . . in saving $500 on purchase price alone . . . Then—investigate the Bear Cat Jr.—It is the most outstanding shovel and crane value in the world today . . . Send for Free Illustrated Book—"BEAR CAT JUNIOR FACTS."

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BEARCAT SHOVEL WORKS · RAVENNA · OHIO

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BEARCAT JR. SHOVEL CO.
Ravenna, Ohio

Please send me, without obligation, your interesting book entitled "FACTS"

Name_____

Address_____

City_____ State_____

1-B.C.

660 yards per hour!

On the three million yard excavation for the spillway of the Fort Peck Dam, four Lorain 1½ yard shovels each moved 165 yards per hour of earth and fairly hard shale during the first month — an hourly total of 660 yards. These shovels are all equipped with AMSCO Manganese Steel Renewable Lip Dippers, which helped to establish this splendid performance.

AMSCO Renewable Lip Dippers (U.S. Patent No. 1,945,064) cut digging costs! The thin cutter edge lip, correct placement of dipper teeth at the lip corners, smooth dipper interior and correct body taper make for faster, easier filling and instantaneous dumping.

Lips are quickly and easily changed in the field—no trouble—no delay. Simply knock out four keys, loosen two U-bolts and the lip is off! No rivets to punch out or renew!

Furnished with double wall lip and teeth for hard digging and rock handling; single wall cutter type lip and teeth for loose material digging, stock piling and rehandling; and a thin, serrated edge cutter lip for mucking and clay digging; in all sizes from ¾ yard up. Without separate lips in ⅜, ½ and ⅝ yard sizes. Made with or without bail and with back lugs to fit any shovel.

Don't repair your old, worn dippers! Get the facts on the new AMSCO Renewable Lip Dipper. They'll save you time and money. Write your shovel manufacturer or our nearest office for complete details!

AMERICAN MANGANESE STEEL COMPANY

Division of American Brake Shoe & Foundry Company

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Foundries at Chicago Heights, Ill.; New Castle, Del.; Denver, Colo.; Oakland, Calif.; Los Angeles, Calif.
Offices in Principal Cities

AMSCO

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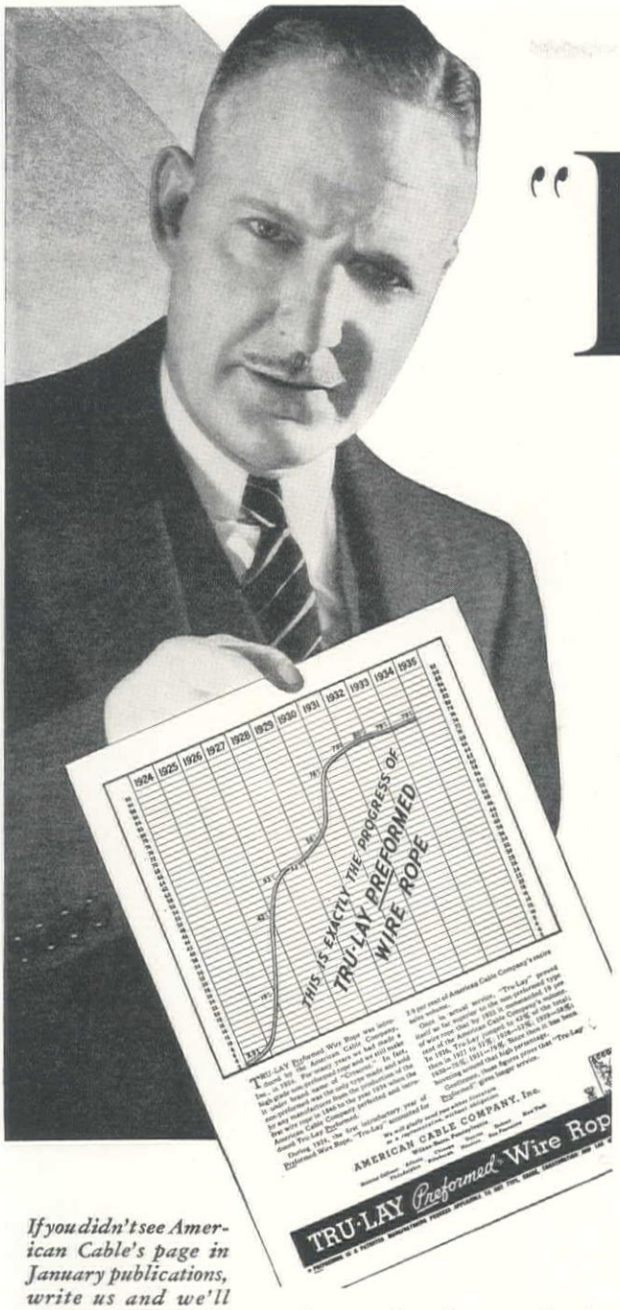

If you didn't see American Cable's page in January publications, write us and we'll send you a reprint. It tells a story you should know.

"Longer service MAKES TRU-LAY most economical"

A WIRE rope buyer recently made the statement that: ... "They are asking a premium for Tru-Lay, and no one can convince me it gives that much longer service."

To which we replied: "You surely haven't seen the Tru-Lay message for January because, if you had, you would realize that more and more rope users are coming to realize that the increased service given by Tru-Lay Preformed is all out of proportion to the price differential.

"... Here—look at this chart. It shows exactly the progress of Tru-Lay Preformed Wire Rope—since its introduction in 1924.... And remember, please, five of those years were depression years—when prices were scanned as never before. ... In 1924 Tru-Lay Preformed absorbed only 3.9% of American Cable Company's entire volume. Now—after a steady climb—it commands 79 or 80 percent of our entire plant production. A product has to be right to command that buyer acceptance.

"Tru-Lay Wire Rope *is* right—because it is preformed. Preforming eliminates all the internal stress characteristic of non-preformed rope—with the result that it gives you *much more* trouble-free service than any other brand. ... The chart in this 'ad' proves it by revealing buyer acceptance.... You know how everyone has been trying to buy cheap. Well, this chart proves that Tru-Lay Preformed Wire Rope must be cheapest in the long run."

AMERICAN CABLE COMPANY, Inc.

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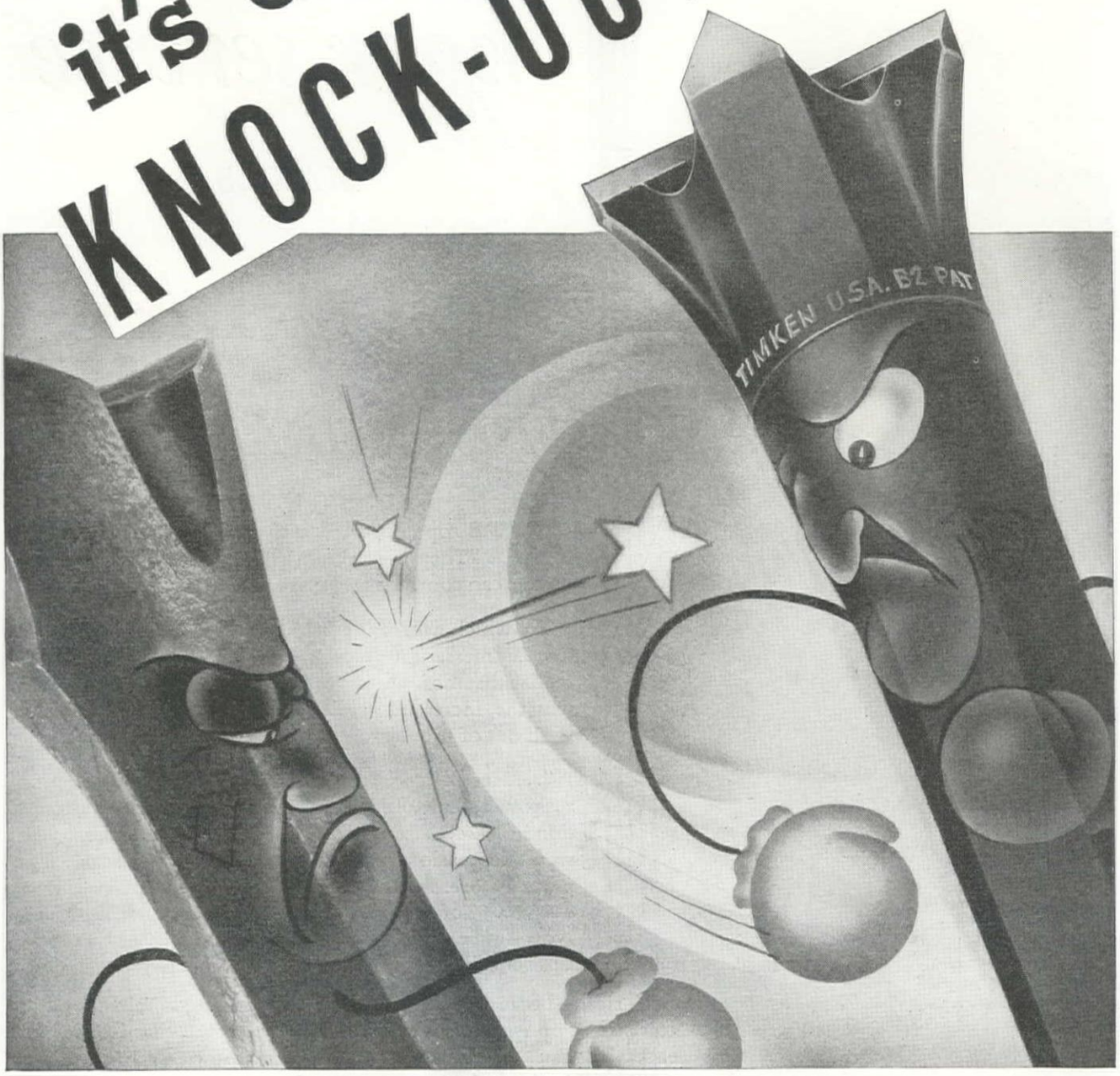
NRA CODE

ACCO

TRU·LAY * Preformed Wire Rope

* PREFORMED ROPE IS MADE IN ALL TYPES, GRADES, CONSTRUCTIONS AND LAYS

it's a KNOCK-OUT!



THE removable feature of the Timken Rock Bit has taken a heavy fall out of rock drilling costs by eliminating reforging and its attendant expenses. The new champion packs a terrific punch, keeps boring in from start to finish and has proved its ability to "take it". The Timken Bit has been picked to win by every contractor who has ever seen it in action against tough opposition. It will win for you—just give it a chance and see. Write for the Timken Rock Bit booklet.

Complete Stocks Maintained in Principal Distributing Centers

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN BITS

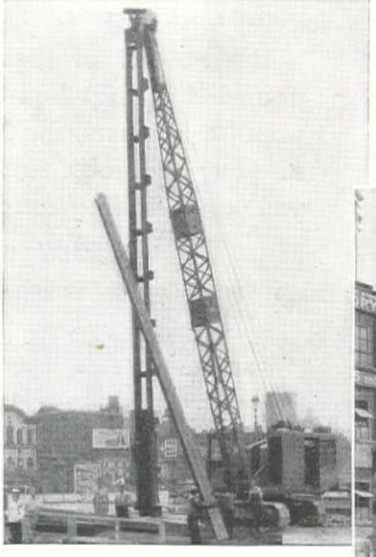
When writing to TIMKEN ROLLER BEARING CO., *please mention Western Construction News.*

KOEHRING

11 KOEHRING CRANES on this job

BUILDING THE APPROACHES AND SUBWAYS FOR PHILADELPHIA-CAMDEN HIGH-SPEED LINE » » »

Contractors, engaged in the construction of the subways and approaches for the High-Speed line of the Philadelphia-Camden Bridge — chose Koehring Equipment, to reduce costs and increase production.



KOEHRING HEAVY DUTY

KOEHRING COMPANY

Pavers · Mixers · Shovels · Cranes · Draglines · Dumptors · Mud-Jacks

3026 WEST CONCORDIA AVENUE, MILWAUKEE, WISCONSIN

HARRON, RICKARD & McCONE CO., San Francisco, Calif. - Los Angeles, Calif. L. A. SNOW CO., Seattle - Spokane CRAMER MACHINERY CO., Portland

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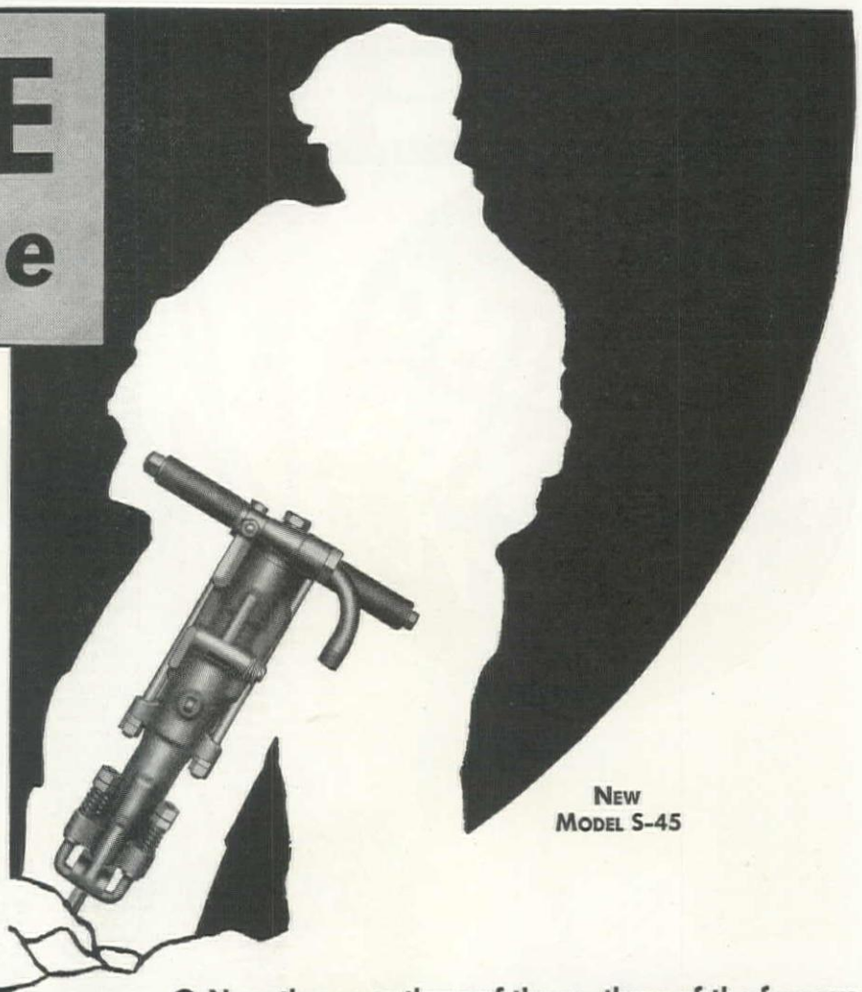
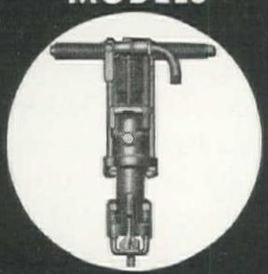
PROVE *It Here*



NEW MODEL S-45

GET THE TIME-SAVING, MONEY-SAVING *FACTS* *about the* Gardner-Denver "5" SERIES SINKERS *Right on Your Own Job*

OTHER "5" SERIES MODELS



S-55 Sinker—the most popular 55-pound sinker on the market

S-35 Sinker—the preferred drill for block-holding (weighs only 28 pounds)

● Now there are three of them—three of the famous Gardner-Denver "5" Series Sinkers that definitely *prove* their superiority by increasing your daily footage . . . shortening your overall drilling time . . . and cutting your maintenance costs.

The newest of these better sinkers is the S-45, a 45-pound drill that has all of the advanced features of its popular brothers, the S-55 and S-35. See the S-45 in action on your own jobs. Find out what it can do for YOU, under your own drilling conditions.

"5" SERIES FEATURES

- Far greater drilling capacity—unusually low air consumption
- Rugged construction assures utmost dependability
- Powerful blowing device assures clean holes always
- Easier riding—due to perfectly synchronized valve action

GARDNER - DENVER COMPANY, 102 Williamson Street, Quincy, Illinois

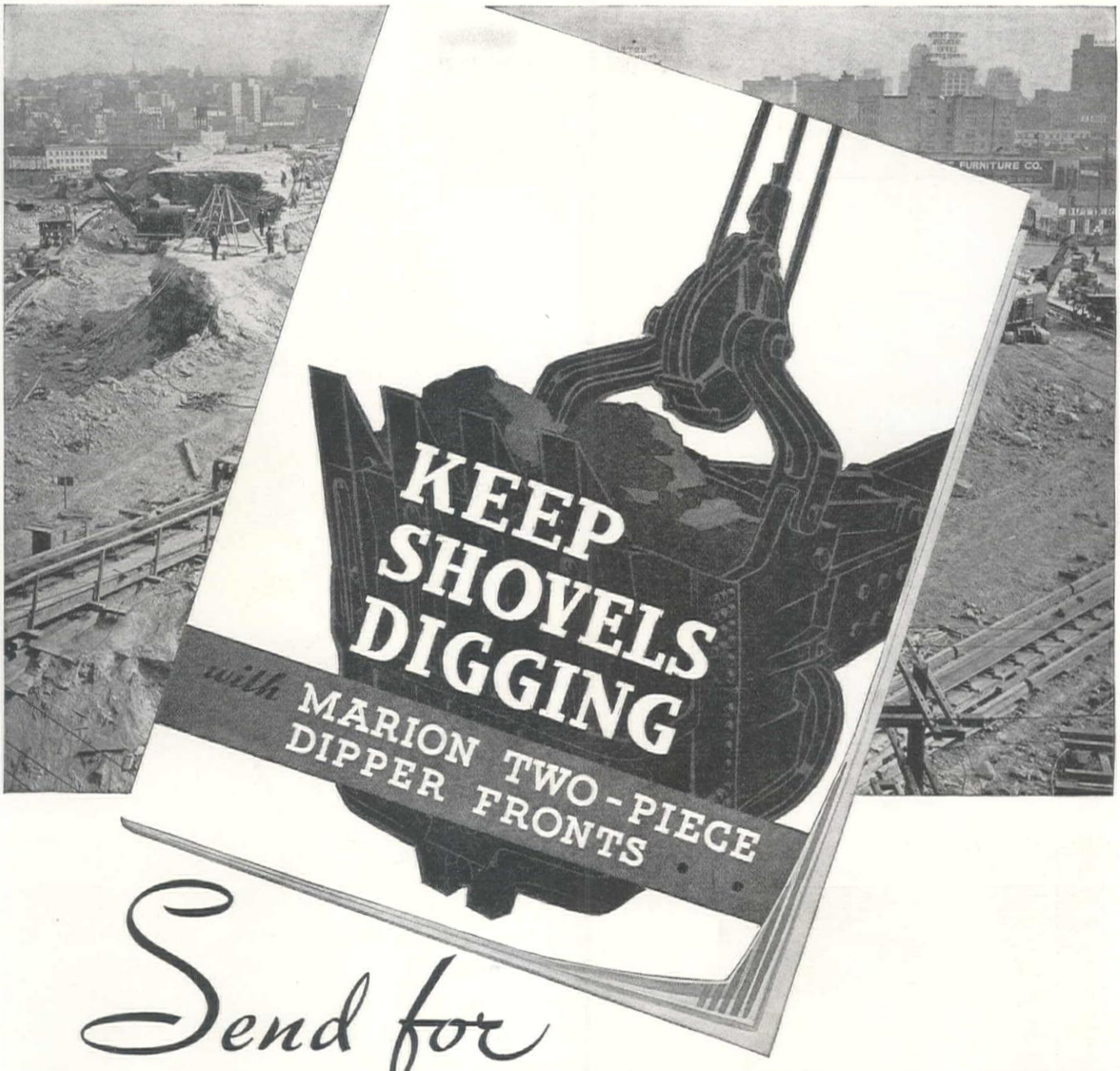
ANNOUNCEMENT

We are pleased to announce that Harron, Rickard and McCone, with offices in San Francisco and Los Angeles, are now included among our distributors on the West Coast.

Western Branch Offices: Butte, Mont.; Denver, Colo.; Los Angeles, Cal.; Portland, Ore.; Salt Lake City, Utah; San Francisco, Cal.; Seattle, Wash.; Wallace, Idaho

GARDNER-DENVER

MAKES AIR DO MORE AND COST LESS



Send for

THIS FOLDER OF DIPPER FACTS

Every Marion owner is keenly interested in keeping dipper replacement and maintenance costs to a minimum. Marion Two-Piece Dipper Fronts (Black Patent) have a splendid reputation for accomplishing this very thing. To write for a free copy of this timely and enlightening folder on the subject is to be prepared to save money on future dipper replacements.

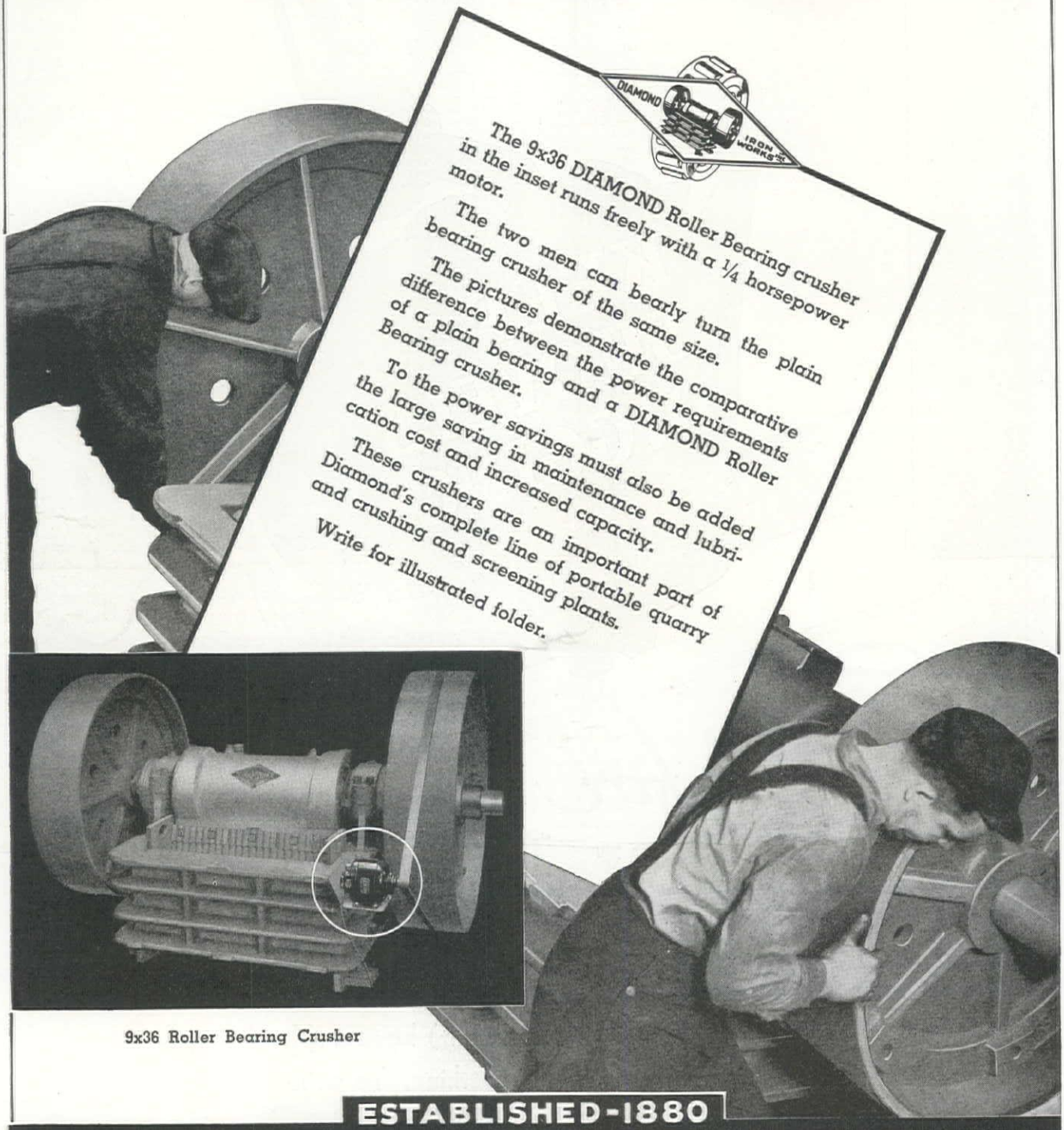
THE MARION STEAM SHOVEL CO. *Marion·Ohio*

SHOVELS • CLAMSHELLS • DRAGLINES • CRANES • GAS • DIESEL • ELECTRIC • GAS ELECTRIC • DIESEL ELECTRIC • STEAM

AN EXCAVATOR FOR EVERY MATERIAL HANDLING NEED

When writing to MARION STEAM SHOVEL CO., *please mention Western Construction News*

WHY DIAMOND BUILDS ROLLER BEARING CRUSHERS



The 9x36 DIAMOND Roller Bearing crusher in the inset runs freely with a ¼ horsepower motor.

The two men can bearly turn the plain bearing crusher of the same size.

The pictures demonstrate the comparative difference between the power requirements of a plain bearing and a DIAMOND Roller Bearing crusher.

To the power savings must also be added the large saving in maintenance and lubrication cost and increased capacity.

These crushers are an important part of Diamond's complete line of portable quarry and crushing and screening plants.

Write for illustrated folder.

9x36 Roller Bearing Crusher

ESTABLISHED-1880

Diamond Iron Works, Inc.

MINNEAPOLIS, MINN. U.S.A.

Pratt-Gilbert Hardware Co.
Phoenix, Ariz.
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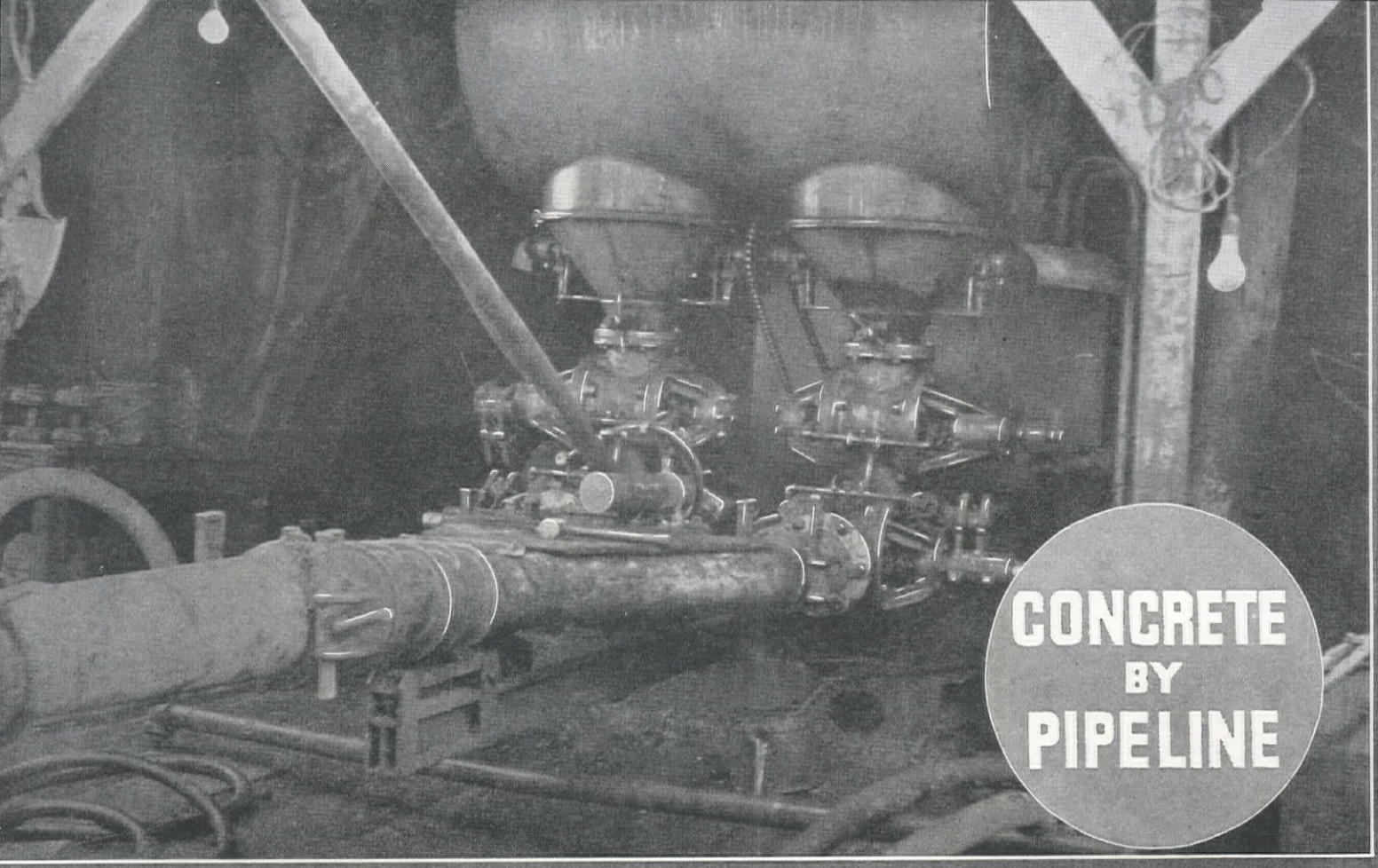

THE REX PUMPCRETE *means something* TO EVERY CONTRACTOR IN AMERICA

The Rex Pumpcrete is the greatest advance in placing concrete since man first built with cement.

Concrete by Pipe Line has a national background—on Boulder Dam—on Bonneville Dam—on the Mississippi River Development—on the Metropolitan Water District of Southern California—on San Francisco-Oakland Bay Bridge—on tunnels, sewage plants, post offices, hospitals, docks—and on every one of those jobs the Rex Pumpcrete was used by men who had never heard of it three years ago.

It's Coming—IT'S HERE

The facts are known—costs are known—conditions of operation are known—pipe line practice—every angle of operation, aggregates, water ratios—have been thoroughly tested and checked. When the Chain Belt Company says the Pumpcrete is O. K. for your jobs, you know that the Pumpcrete is O. K.—that it will place concrete in your forms at lower cost than any other way.

Before you bid any job, know what the Pumpcrete will do on it—if it's a Pumpcrete job, you'll be a whole sight better off bidding with the Pumpcrete than against it.

Don't go into this season without knowing about the Rex Pumpcrete—don't listen to grapevines—get the facts on the Rex Pumpcrete—the biggest thing in construction in many years. Send for the book, "Concrete by Pipe Line" now.

CHAIN BELT COMPANY

Home Office—Central and Northwest Divisions:

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A. H. Cox & Co., Inc.,
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REX
PUMPCRETE

The Lowest Cost Way of Placing Concrete

TAKE THE RED INK OUT OF YOUR *Oil*

CORRECT lubrication methods produce sure lubrication profits. General Petroleum makes available two necessary factors for correct lubrication.

First — a nearby warehouse carrying a complete line of world-famous Gargoyle Industrial Lubricants always assuring you of the right lubricant for each job.

Second — the advice of General Petroleum's Socony-Vacuum trained engineers to recommend the lowest priced correct lubricant consistent with economy.

Take the red ink out of your oil. Send for the G. P. man.

GARGOYLE
Lubricating Oils

GENERAL PETROLEUM CORPORATION

A Socony-Vacuum Company

PACIFIC COAST MARKETERS OF GARGOYLE INDUSTRIAL LUBRICANTS

When writing to GENERAL PETROLEUM CORPORATION, *please mention Western Construction News*

HOW NEW TRUCK TIRES END COSTLY ROAD DELAYS AND BREAKDOWNS

AS TOLD BY Willard D. Jacobson of Delmar, New York

W. D. Jacobson (standing) and James D. Jacobson of the Willard D. Jacobson and Son Company, Delmar, New York.

"Our six dump trucks are on the go most of the time hauling crushed stone. Our loads are exceptionally heavy so that it's pretty tough work for tires.

"The total mileage in the last year is well over 300,000 miles, yet we did not have a single sidewall failure or delay due to tires.

"All this means a great saving to me as now I do not have costly breakdowns on the job."

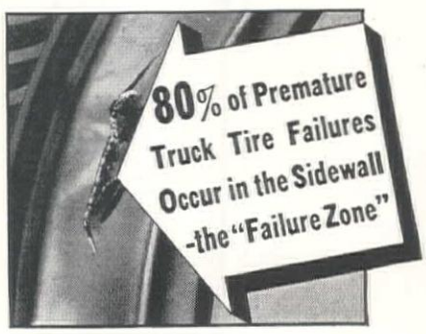
Those are the words of Mr. W. D. Jacobson. His experience has been duplicated hundreds of times since Goodrich introduced Triple Protected Silvertowns. You can save, too, with these amazing new tires.

This new invention positively checks 80% of premature failures:

1 **PLYFLEX**—a *new*, tough, sturdy rubber material with greater resistance to stretch. A layer of Plyflex in the sidewall prevents ply separation—distributes stresses—checks local weakness.

2 **PLY-LOCK**—the new Goodrich way of *locking* the plies about the bead. Anchoring them in place. Positive protection against the short plies tearing loose above the bead.

3 **100% FULL-FLOATING CORD**—Each cord is surrounded by rubber. With ordinary cross-woven fabric, when the cords touch each other, they rub—get hot—break. In Silvertowns, there are no cross cords. No friction.



Don't take our word for it. Try a set on a job that's really a tire-killer. Prove to your own satisfaction that Triple Protection will save you money. You don't pay one cent extra for the extra service you are bound to get.

FREE! 44-PAGE HANDBOOK FOR TRUCK OPERATORS

Every truck owner, every driver should have this big 44-page handbook. Gives commodity weights, tire load capacities, inflation schedules, dual spacing chart, load analysis and other useful information. No obligation. Write for free copy. Dept. T-40, The B. F. Goodrich Company, Akron, Ohio.

Goodrich *Triple Protected* Silvertowns

SPECIFY THESE NEW SILVERTOWN TIRES FOR TRUCKS AND BUSES

HERCULES PLANNED BLASTING

A WAY TO CUT BLASTING COSTS

Offers Advantages in Correct Selection and Use of Explosives for Quarrying

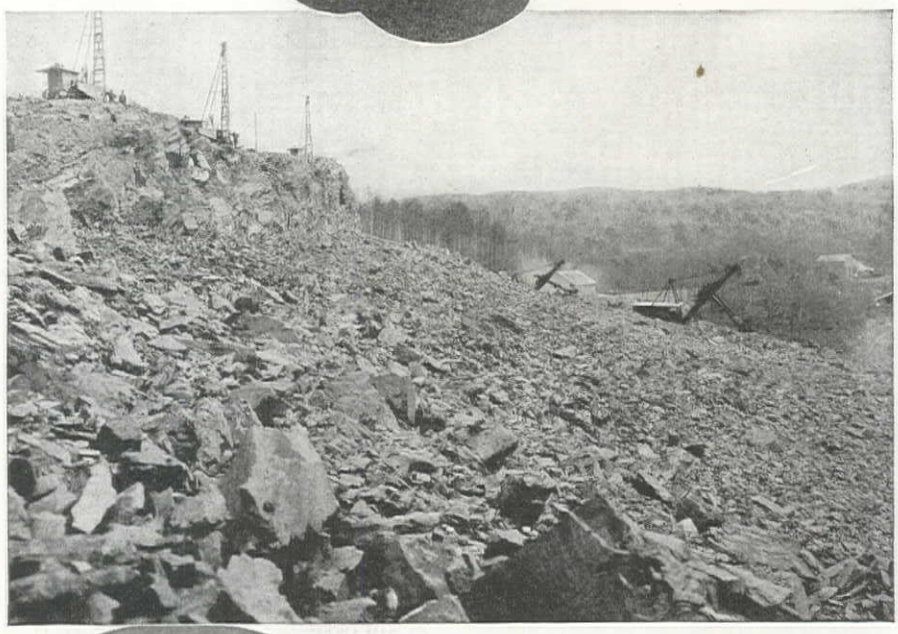
TWIN VALUES In many quarries, the Gelamites can replace gelatins—at a substantial saving. Likewise, Hercomites continue to replace older types of dynamite because of their economy, performance, and *proved* safety.

Hercules Planned Blasting cuts costs and improves results. Through it you secure:

1. Explosives exactly suited to your work.
2. Information that enables you to use them to the best advantage.

Selecting Explosives

Certain modern explosives can replace the older types on many operations at lower cost, and they give equal or better results. As many Hercules customers have learned, some of these newer Hercules explosives offer far greater values than the old standard grades. When you select the right explosive from the complete Hercules list, the first step has been taken in lowering blasting costs.



GOOD BREAKAGE. Hercules Planned Blasting for quarrying and open-pit mining aids in getting rock or ore properly broken for speedy handling by the shovel.

FREE BOOK. Send for the booklet, "Making Better Explosives." From it, you will learn how Hercules makes its explosives to exacting standards.

CORRECT LOADING. Hercules Planned Blasting helps you to select the right explosives for your work. It also gives you authoritative data on the correct loading of the explosives selected

Using Explosives Correctly

Selecting explosives is important, but Hercules Planned Blasting also involves a study of your operations by qualified explosives engineers to help work out the best blasting plan for your job. Such studies usually result not only in more efficient blasting practice and important savings in costs, but also in greater efficiency, faster production, and increased safety.

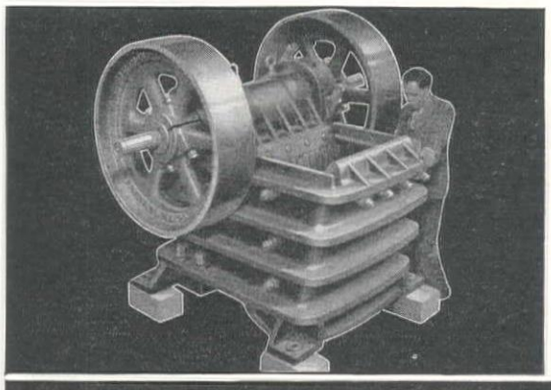
How to Get Planned Blasting

If you wish to profit through Planned Blasting, tell the Hercules serviceman who calls on you. He will be glad to assist you in securing full details.

HERCULES POWDER COMPANY
INCORPORATED
Standard Oil Bldg., San Francisco — Fidelity Bldg., Los Angeles
910 Kearns Bldg., Salt Lake City, Utah

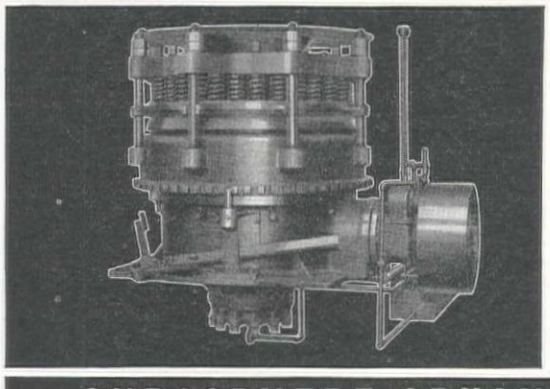
3 WAYS TO BETTER THE PRODUCT AND CUT OPERATING COSTS

Modern in every sense of the word . . . . designed to enable you to meet today's conditions and operate at a profit . . . . this 3-piece combination of Telsmith equipment is a striking example of group efficiency.



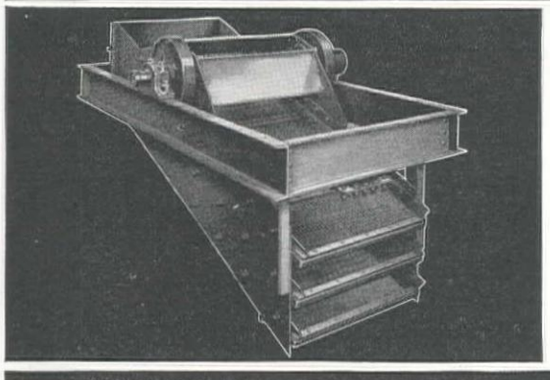
● With its compact but massive steel structure, cylindrical roller bearings and high speed crushing action, the Telsmith-Wheeling Jaw Crusher is ideal for coarse crushing. The roller bearings and higher speed almost double the capacity without any greater expenditure for power. Simple adjustment allows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

WHEELING JAW CRUSHER—FOR COARSE CRUSHING



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

GYRASPHERE CRUSHER—FOR FINER CRUSHING



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

M-1

PULSATOR—FOR EFFICIENT SCREENING

California Equipment Co. . . . . Los Angeles, Calif.
Jenison Machinery Co. . . . . San Francisco, Calif.
Clyde Equipment Co. . . . . Portland, Oregon
A. H. Cox & Co., Inc. . . . . Seattle, Washington
General Machinery Co. . . . Spokane, Washington
Hall-Perry Machinery Co. . . . . Butte, Montana

SMITH ENGINEERING WORKS
4010 NORTH HOLTON STREET, MILWAUKEE, WIS.

TELSMITH

When writing to Smith Engineering Works, *please mention Western Construction News*

100% PURE PARAFFIN-BASE OIL

made from California Crudes by the **PROPANE** *Solvent Process*

TRITON HAS THESE DEFINITE ADVANTAGES OVER "EASTERN" or "WESTERN" OILS

1. OUTLASTS
2. REDUCES MOTOR WEAR
3. FORMS LESS CARBON
4. FORMS LESS SLUDGE
5. MORE STABLE IN USE

EVERY TRITON advantage has been proved by over 250,000 miles of stock car road runs, and by months of exhaustive laboratory tests and comparisons.

In one of these tests a car was driven *60,183 miles in 60 days* with TRITON motor oil. Its cylinders and pistons were measured before and after the run by Prof. R. L. Daugherty, of the California Institute of Technology, who found the wear to be *less than one-half of normal for that distance!*

A "dynamometer" engine, run in a series of 1000 mile tests showed 22% less wear with TRITON than with high-grade "Eastern" oil, and 43% less wear than with high-grade "Western" oil!

Thousands of miles run with popular makes of cars at Ascot Speedway, comparing performance of leading brands of oils, showed that TRITON forms less carbon, less sludge, lasts longer, and is more stable in use.

Made by the PROPANE Solvent Process

TRITON's amazing qualities are made possible by Union's patented PROPANE solvent process, which removes all undesirable low-grade, low-gravity materials from the finished oil—leaving in TRITON *only 100% pure paraffin-base material!*

Try TRITON

Compare it with any oil you have ever used. Comes in 1 and 5 quart cans, and 53 gal. barrels.

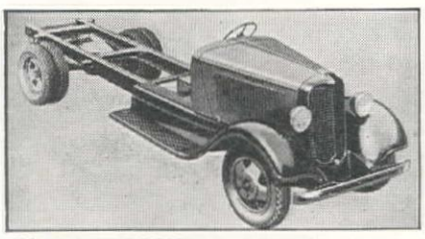
UNION OIL COMPANY

Outlasts **EASTERN OR WESTERN OILS!**

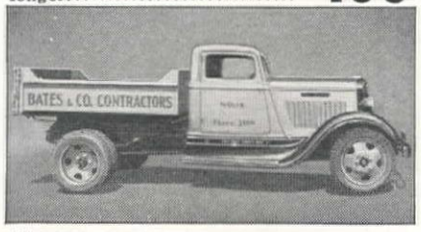
When writing to UNION OIL COMPANY, *please mention Western Construction News.*

*1½-Ton Stake 136" Wheelbase $670**

DODGE TRUCKS..*Built to Last Years Longer*
Now PRICED WITH THE LOWEST!



1½-TON CHASSIS—6-cylinder, 131-in. or 136-in. wheelbase, with 18 high-priced, quality features that save gas, oil, tires, upkeep—make truck last far longer!..... $490*



1½-TON CHASSIS AND CAB—6-cyl.—136" w. b.—Full-floating rear axle, hydraulic brakes, valve seat inserts, roller-bearing universals—18 recognized, money-saving features. (Body, hoist and special equipment extra)..... $640*

No Wonder Thousands Who Have Tried All Three Lowest-Priced Trucks Are Switching To Dodge

Valve Seat Inserts

"WE NEVER dreamed we could get a long-life truck like this, priced with the very lowest"... Everywhere, buyers who check the three lowest-priced 1935 trucks are expressing amazement. Dodge leads the other two by a tremendous margin, they find, in known, acknowledged, recognized, high-priced truck features.

Hydraulic Brakes

You know a truck with an oil filter is better. Yet only Dodge of the three lowest-priced trucks gives you an oil filter. You know that 4 piston rings or 4 main bearings must be better than only 3—yet Dodge alone gives you 4 of each, the others 3.

Full-Floating Rear Axle

Dodge perfected hydraulic brakes stay equalized, save tires, brake linings and adjustment expense. Yet only Dodge of the three lowest-priced trucks gives you hydraulic brakes.

Oil Filter

Before you buy any truck, get a "show-down" of these money-saving facts about the 1935 Dodge. Go to your Dodge dealer . . . or mail the coupon for big, profusely illustrated, "Movie Shots" truck book.

DODGE DIVISION—CHRYSLER MOTORS

**All prices f. o. b. factory, Detroit, subject to change without notice. Special equipment, including dual wheels on 1½-ton models, extra. Ask for the official Chrysler Motors Commercial Credit Plan.*

FREE!

To Dodge Division—Chrysler Motors
Detroit, Michigan
Dept. WCN-4
Please send me FREE your big, illustrated "Movie Shots" book.

Name_____
Address_____
City_____ State_____

Dependable DODGE TRUCKS

When writing to above advertisers, please mention Western Construction News.

CONCRETE SAVES STATE Millions of Dollars a Year in Maintenance

ACTUAL experience of two great American states proves the economy of concrete. In one of these states, concrete was used almost exclusively in building its state highway system. The second state relied more upon other paving materials. These states are comparable in geography and climate. Each state segregates surface maintenance costs and these figures are available for identical periods.

Here are the truly amazing figures in which comparative costs reveal the economy of concrete:

This is only one case. For summarized maintenance costs in 18 states, send this coupon.

PORTLAND CEMENT ASSOCIATION

Please send me without obligation your new publication: "Road Maintenance Costs as Told by Available State Highway Records."

Name.....

Street.....

City.....*State*.....

8 Years of Surface Maintenance

1925-1932—latest published maintenance figures

	State "A"	State "B"
Average state built mileage maintained	5,670	4,405
Concrete—% of total . . .	99	33
8 years maintenance . . .	$4,173,465	$23,084,765
Average maintenance per mile per year	$92	$655

Observe, please, that State "A"—the state that stuck to concrete—pays one-seventh as much per mile.

And if State "B" had followed a policy of building with concrete and thereby held its maintenance costs per mile down to those of State "A", it would have saved $19,800,000 in upkeep expense during this 8-year period. This could have built about 730 miles of concrete roads.

And this does not take into account the vast savings to motorists on concrete compared with inferior surfaces—less for gas, oil, tires and car repairs—and at the same time greater comfort and safety.

Concrete is the standard by which all roads are judged because:

1. Original cost of concrete is less than that of any other pavement of equal load carrying capacity.
2. Maintenance costs are less—far less.
3. Driving costs are less.
4. Comfort, safety, visibility are all greatest on concrete.

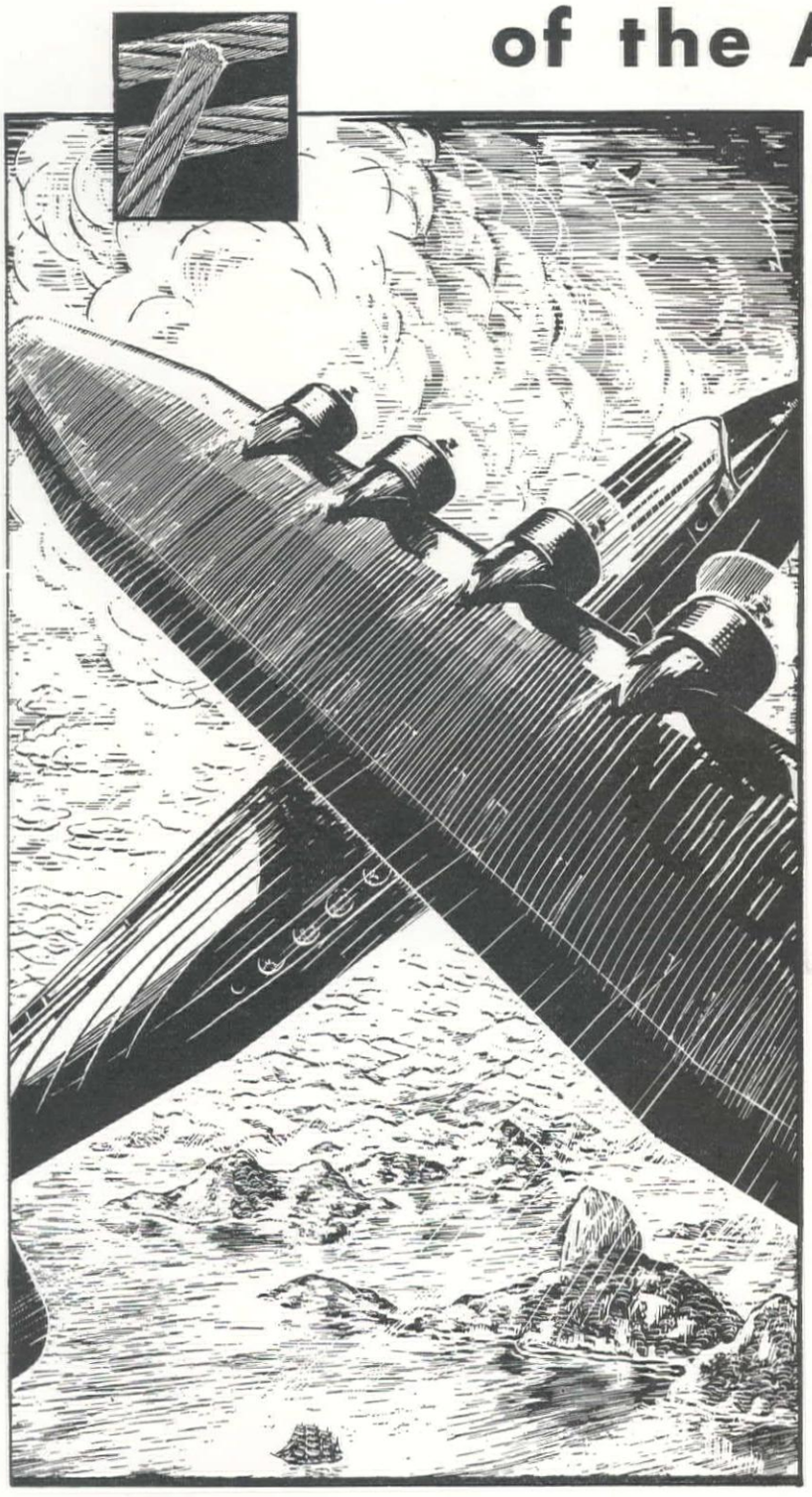
Write for new publication "Road Maintenance Costs as Told by Available State Highway Records"—just off the press—summarizing data from 18 states.

PORTLAND CEMENT ASSOCIATION

Dept. 104

816 W. Fifth St. LOS ANGELES, CAL. | 564 Market St. SAN FRANCISCO, CAL. | 903 Seaboard Bldg. SEATTLE, WASH.

The Clipper King of the Air!

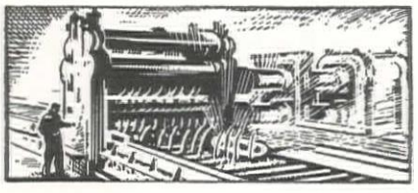


TO MAKE CERTAIN that Roebling Wire Rope will give the user the highest obtainable degree of safe, economical service, Roebling has enlisted the aid of the finest and most complete research, testing and manufacturing facilities. Roebling Equipment for making acid open-hearth steel is an example. John A. Roebling's Sons Co. of California. San Francisco, Los Angeles, Portland, Seattle.

MUST HAVE CONTROL ROPE THAT IS UNFAILINGLY SAFE

Imagine a mammoth flying boat...carrying 32 passengers, a crew of six, over a ton of mail and express...and capable of flying 1250 miles without refueling. That's the "Brazilian Clipper"...holder of all ten world's records for transport seaplanes. It is one of three identical new Pan-American Airways' ships built by Sikorsky...the greatest of all trans-Atlantic type planes so far developed.

Designers selected Roebling Wire Rope for controls of all three ships. Almost a half mile of rope per ship.



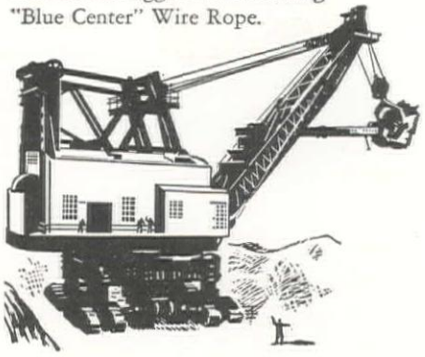
ROEBLING ROPE STEEL

It is acid open-hearth steel...made specifically for wire rope purposes...by Roebling's custom methods. Generally acknowledged to be the finest rope steel produced.

Roebling controls every process in making Roebling Wire Rope...from steel refining to finished product.

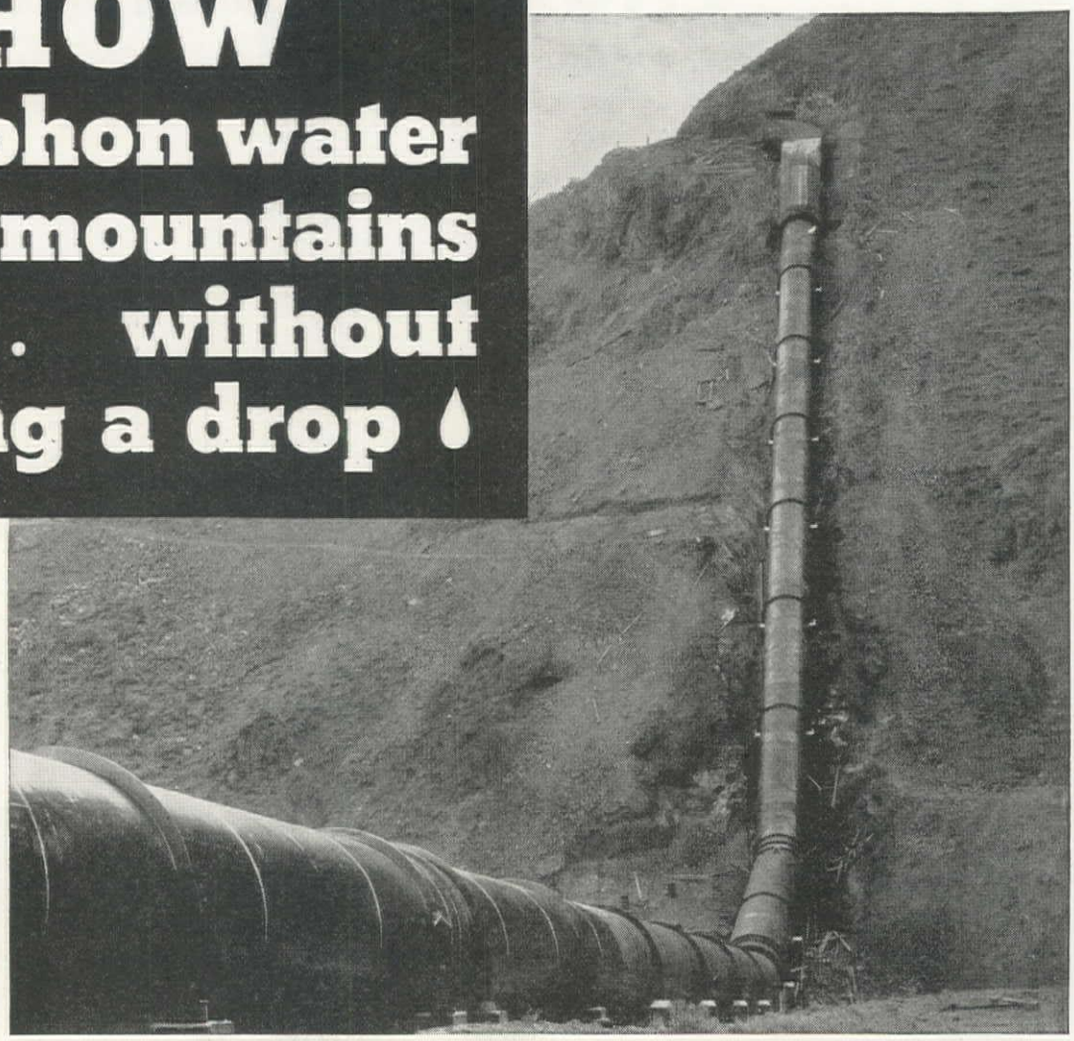
ONE OF THE WORLD'S LARGEST ELECTRIC SHOVELS...

an 18 cu. yd. "Marion", operated by Clemens Coal Co....is rigged with Roebling "Blue Center" Wire Rope.



ROEBLING ...THE PACEMAKER IN WIRE ROPE DEVELOPMENT

HOW to siphon water over mountains . . . without losing a drop



This 9 ft. diameter siphon, one of two on the Owyhee project, climbs a 42° slope. Field welded with "Fleetweld" electrodes by the Olson Mfg. Co., Boise, Idaho. Pipe fabricated by shielded arc welding in plant of Chicago Bridge & Iron Works, Chicago, Ill., with Lincoln equipment.

HUGE steel pipes, fabricated by automatic shielded arc welding and joined in the field by the manual shielded arc process have solved this problem, on the Owyhee project in eastern Oregon, for the Bureau of Reclamation.

Thirty days of pressure testing could reveal no leaks in the thousands of feet of shielded arc welds contained in these modern water carriers. In strength . . . in ductility . . . in density . . . and in resistance to corrosion, the welds are equal to or greater than the pipe metal. To obtain these high quality welds, it actually costs less than for any other method of welding—provided you use the Lincoln "*Shield-Arc*" welder. For it is the only machine which will allow you to get the most out of welding . . . the most in welding speed . . . the most in weld quality and the most welding per dollar.

Find out now how much better . . . how much faster . . . and how much cheaper you can weld pipe lines, or structures, with "*Shield-Arcs.*" Ask for proof from The Lincoln Electric Company, Cleveland, Ohio. Largest Manufacturers of Arc Welding Equipment in the World.

W-105

LAD "S'matter, Pop? Got ants in your pants?"

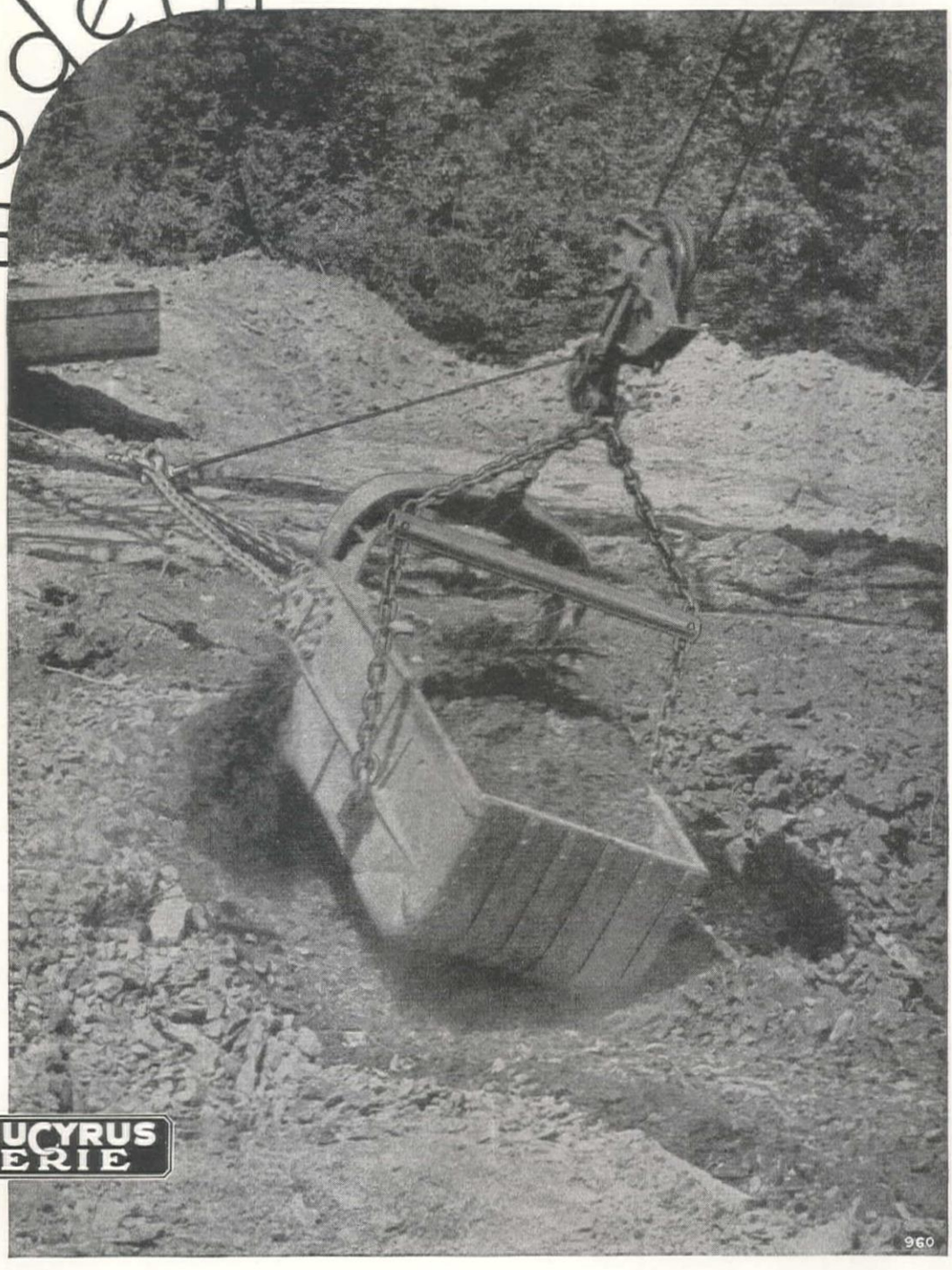
POP "I've got more trouble than putting pants on ants. Gang 3 ran out of 'Fleetweld' so they used some other kind of rod . . . now we have to chip out about thirty feet of weld metal because it does not test up to the standards set by 'Fleetweld.'"

LINCOLN

"SHIELD-ARC" WELDERS

RED ARCH buckets give "streamlined" performance. All excess weight has been eliminated, every pound of steel carefully placed to give maximum strength and balance. Fittings are of special steels, specially designed to give long service, can be replaced easily, inexpensively. These modern dragline buckets fill quickly . . . carry a heaping load swiftly, surely . . . dump cleanly. Try their "streamlined" speed, their modern endurance, on your jobs.

modern



BUCYRUS-ERIE

EXCAVATING, DRILLING, AND MATERIAL-HANDLING EQUIPMENT...SOUTH MILWAUKEE, WISCONSIN

SAN FRANCISCO OFFICE: 989 Folsom Street. Tel. GArfield 8192. CROOK COMPANY, 2900 Santa Fe Avenue, Los Angeles, Tel. KImball 5137
CLYDE EQUIPMENT COMPANY, 17th and Thurman Streets, Portland, Ore. Tel. BRoadway 0885. 3410 First Ave. So., Seattle, Wash. Tel. MAin 1235

When writing to above advertisers, please mention Western Construction News.

Double Duty in Washington

...TALK ABOUT HARD USAGE!

● This Case-powered motor patrol BUILDS as well as MAINTAINS highways for Grant County, Washington.

The operator reports: "We're handling all new construction on county roads in our district with this motor patrol — everything except ditching. It moved thousands of yards of material, scarified hard pan and Badger rock in building a new road from the town of Hartline to the Grand Coulee dam. The motor stands up. Never have any trouble. When patrolling, I drive the outfit 28 miles a day."

Case engines are equally well regarded among engineers and highway officials. Last year three times as many selected Case power as during 1933. Remember, Case service is quickly available.

CASE

The Modern **POWER** *for Road Maintenance*

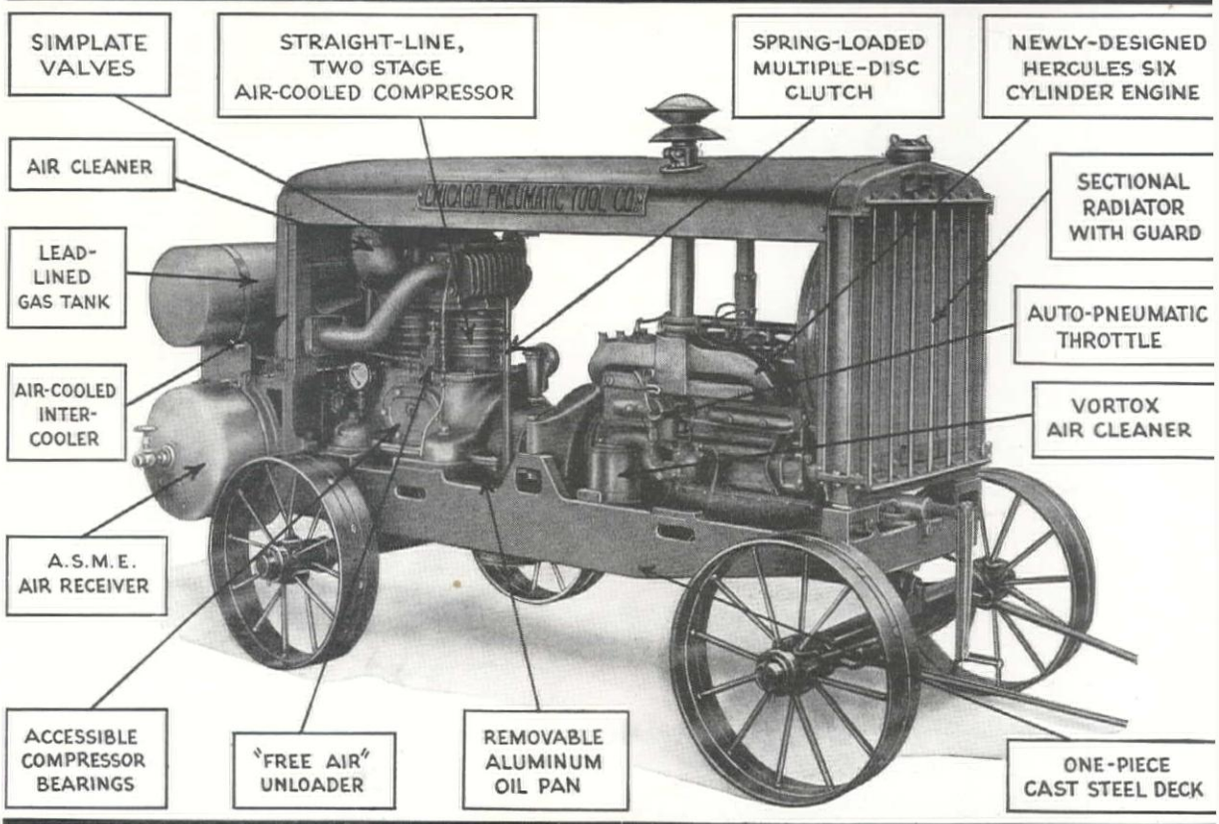
J. I. CASE COMPANY, Oakland, Los Angeles, Salt Lake City, Portland, Spokane, Billings

When writing to J. I. CASE COMPANY, please mention Western Construction News

NEW... and BETTER

TWO-STAGE AIR-COOLED PORTABLE COMPRESSOR

THE GREATEST COMPRESSOR VALUE EVER OFFERED!



BORN OF THIRTY YEARS COMPRESSOR-BUILDING EXPERIENCE

NEW... and BETTER because of:

- **GREATER ECONOMY**
  Two-stage compression with perfect intercooling; low air velocities through enlarged valve areas; economical force-feed lubrication; improved engine fuel economy.
- **SIMPLICITY**
  No more parts than single-stage type; only one connecting rod on each crank pin.
- **ACCESSIBILITY**
  Large crank case doors for access to bearings; all cylinders, valves, etc., conveniently located.
- **SIX-CYLINDER ENGINE GASOLINE OR DIESEL**
  Extreme smoothness of operation; easy starting.
- **LOWER MAINTENANCE**
  Fewer parts to maintain; full floating pistons (no seizures or cylinder scoring); superior valve design; force feed lubrication.
- **INLET VALVE UNLOADING SYSTEM**
  Most economical; lowest temperature.
- **SIMPLATE VALVES**
  Simple, durable, efficient.
- **FULL FORCE FEED LUBRICATION**
  Positive, economical, no "oil pumping".
- **SELF-ADJUSTING TROUBLE-FREE CLUTCH**
  Spring-loaded, multiple-disc type; requires no adjustments.
- **CAST STEEL DECK**
  Unequalled for rigidity and security.

IN every phase of operation... NEW and GREATER ECONOMY! In every detail of design... NEW and GREATER SIMPLICITY! In every point of construction... NEW and GREATER RUGGEDNESS! Economy... Simplicity... Ruggedness... combined in this new and better Two-Stage Air-Cooled Portable Compressor to produce THE GREATEST COMPRESSOR VALUE EVER OFFERED! Proof... in part... is given briefly in the adjoining column. Proof... in detail... is available for the asking... in Bulletin No. 758. Send for your copy... now!

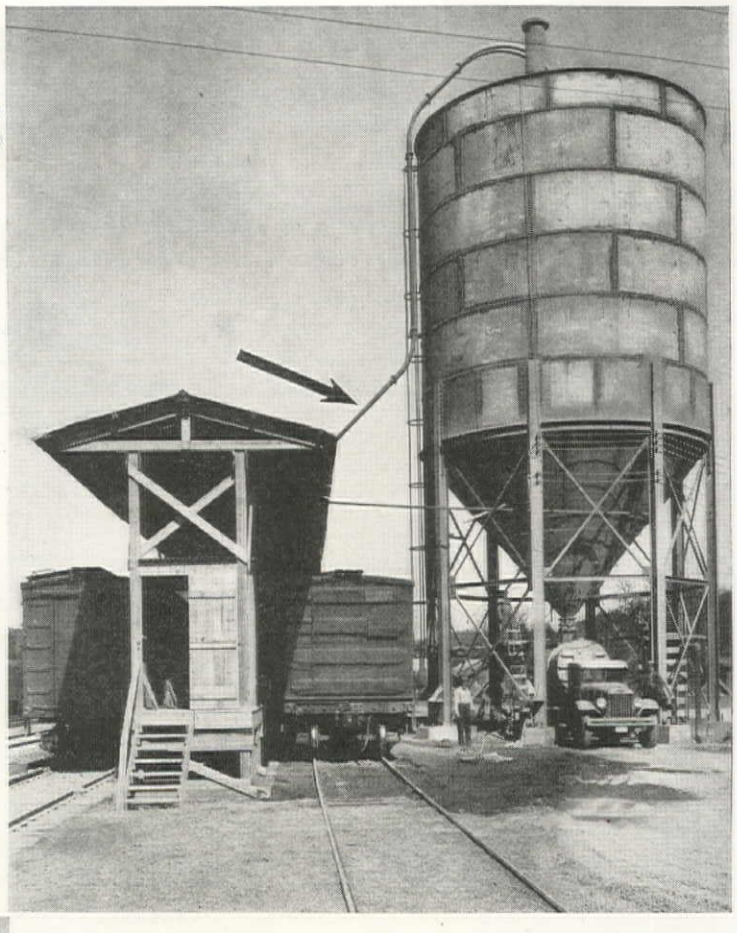
AVAILABLE in sizes of 60, 105, 160, 210 and 315 c.f.m. actual capacity; and five types of mountings... Steel Wheels, Rubber Tired Wheels, 4-Wheel Trailer, 2-Wheel Trailer, and Skid-Mounted. Can also be mounted on Motor Truck.

CHICAGO PNEUMATIC TOOL COMPANY

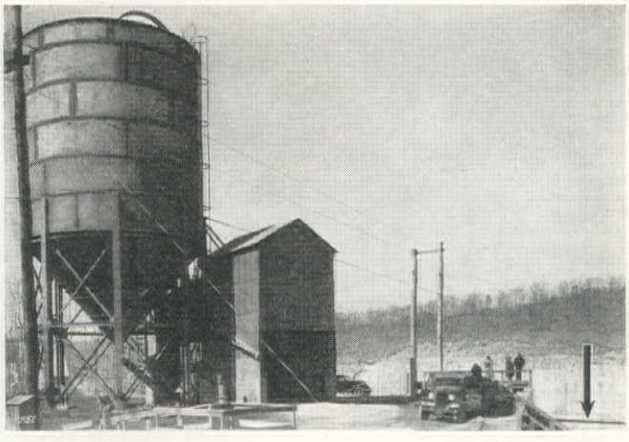
6 EAST 44TH STREET
NEW YORK • N.Y.

Manufacturers of
AIR & GAS COMPRESSORS • ROCK DRILLS • DIESEL ENGINES
ELECTRIC TOOLS • PNEUMATIC TOOLS • VACUUM PUMPS & CONDENSERS

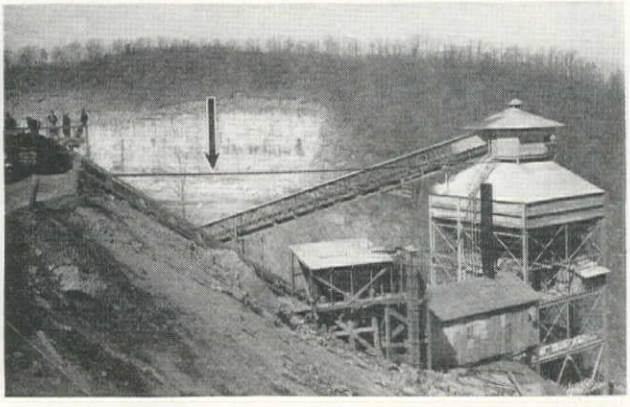
FULLER-KINYON CEMENT PUMPS AT NORRIS DAM



THE BULK CEMENT UNLOADING PLANT



TRUCK-HOPPER AND BIN AT THE DAM



THE CEMENT LINE TO MIXING PLANT

Two types of Fuller-Kinyon Systems handle the cement for this great project. Two portable pumps, unload box-cars and convey through independent pipe-lines to a truck-loading bin at the railroad siding. The arrangement, shown above, provides for the unloading of four cars without shifting. Special trucks transport the cement five miles to the mixing plant where the loads are dumped into a hopper above two stationary pumps. One of these pumps is for stand-by service, but is connected to the pipe-line system for instant use. Cement is conveyed either directly to the mixing plant, or through a branch line to storage. When trucks are not discharging, the cement is spouted to the same hopper for transfer to the mixing plant.

Fuller-Kinyon Pumps offer the contractor speed with reliability, economical long distance conveying and unequalled convenience in plant layout. Our bulletin fully illustrates the use of these interesting conveyors in all classes of concrete construction service. For preliminary information, write for a copy.

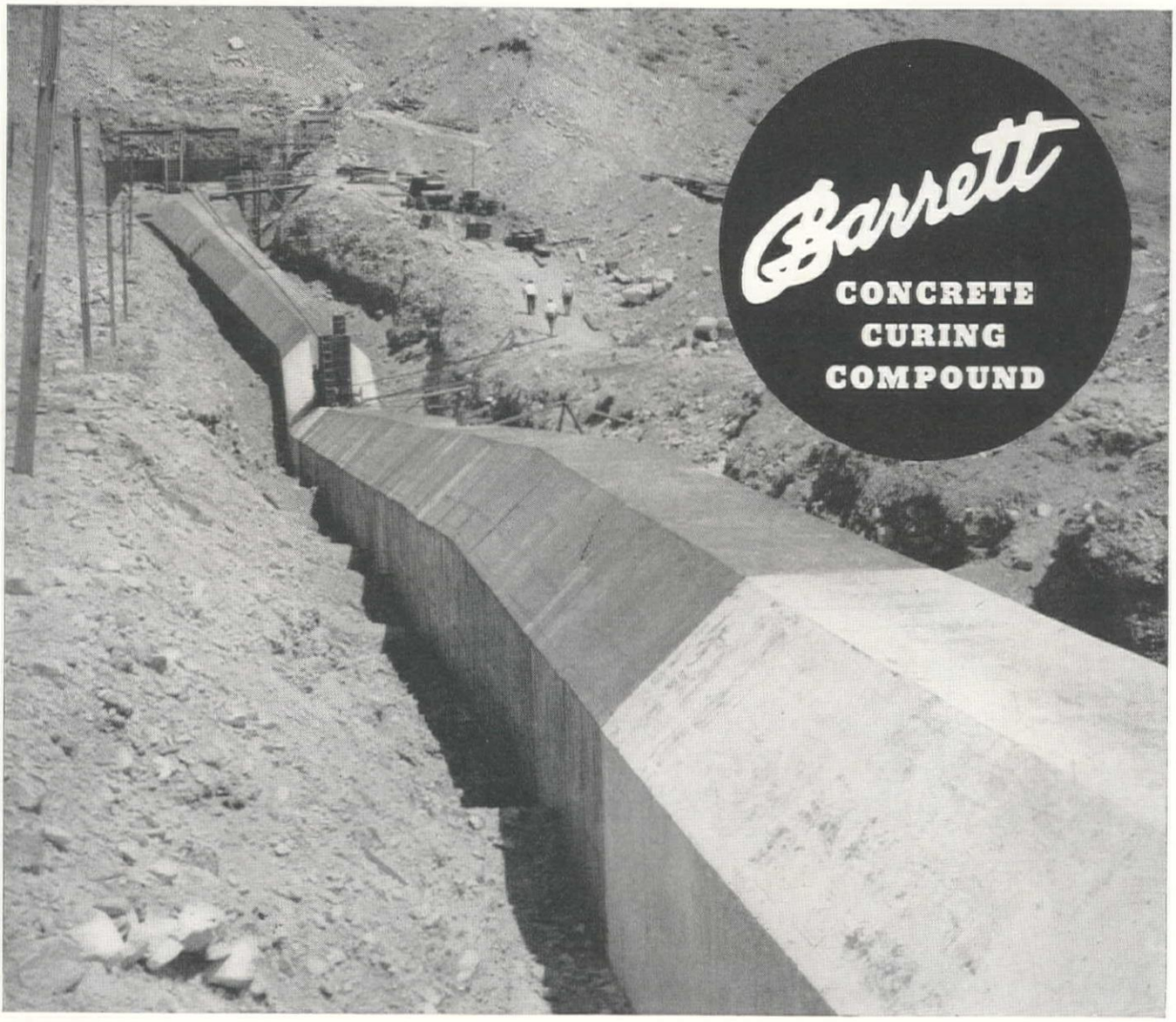
Fuller Company
CATASAUQUA, PENNA., U. S. A.

Pacific Coast Representative:
WILLIAM S. WEAVER

1041 S. Olive St.
Los Angeles

742 Phelan Bldg.
San Francisco

81 YEARS of experience produced this COAL-TAR CURING COMPOUND



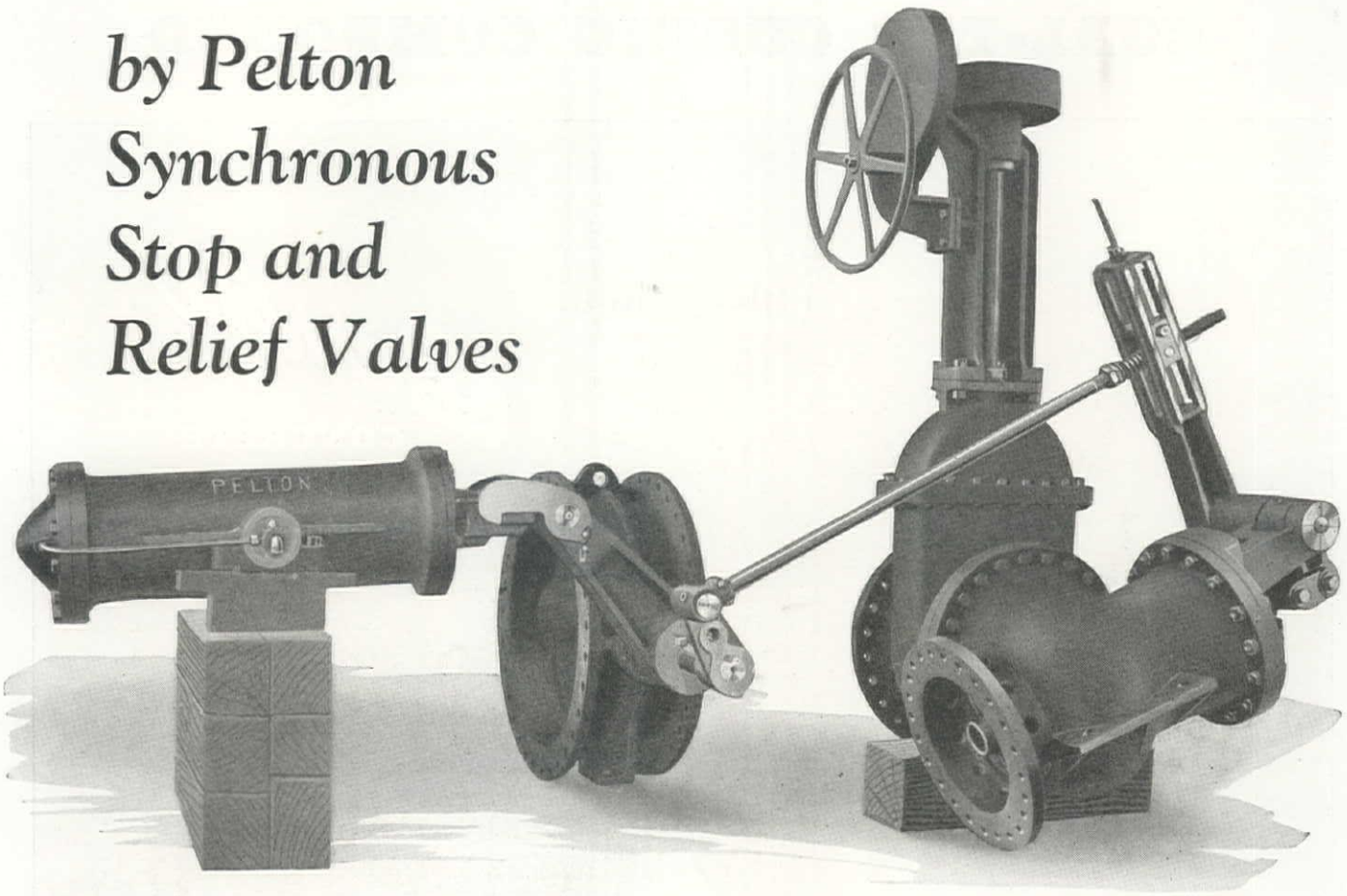
Fan Hill Siphon, Metropolitan Water District, Los Angeles, Calif. Barrett Concrete Curing Compound was applied here under conditions which made water curing impractical.

Barrett Concrete Curing Compound is the result of 81 years of experience in the manufacture of coal-tar products. It provides an effective moisture seal, which can be easily and economically applied and requires little equipment and no highly skilled operators. It permits proper hydration of the cement and slow curing in spite of low humidity, high temperatures or high winds, and it protects surfaces against abrasion and active waters. An experienced Barrett technical staff is at your service. Wire or write for complete information.

THE BARRETT COMPANY, 40 RECTOR STREET, NEW YORK, N. Y.

Hetch Hetchy Aqueduct Protected

by Pelton Synchronous Stop and Relief Valves



THIS unique but highly important valve arrangement is a special Pelton design for the Hetch Hetchy aqueduct, its purpose being to shut off flow in the event of rupture, and prevent rise of pressure beyond that for which the line was designed. Two units are installed, one each at the Cashman Creek and the San Joaquin river crossings.

These valves, operated by hydraulic cylinders with control mechanism sensitive to excess flow conditions, operate automatically in case of pipe-line break, the butterfly valve closing in synchronism with relief valve opening. Thus the broken section is immediately isolated from upstream flow as pressure rise is prevented by release of water into natural stream beds pending closure of the head gates. Diversion of water into natural stream beds eliminates flood damage to surrounding property. Oil pressure is provided by Pelton water motors and specially designed tanks.

These units, similar to those furnished for the Mokelumne aqueduct, typify the service available through Pelton engineers. Consultation is freely offered on any hydraulic problem.

THE PELTON WATER WHEEL COMPANY
HYDRAULIC ENGINEERS

120 Broadway	**2929 Nineteenth St.**	**Paschall Station**
NEW YORK	**SAN FRANCISCO**	**PHILADELPHIA**

Pacific Coast Representatives for BALDWIN-SOUTHWARK CORPORATION, DE LA VERGNE ENGINE CO., CRAMP BRASS & IRON FOUNDRIES CO., and LARNER ENGINEERING CO., of Philadelphia, Pa.

PELTON

In writing to THE PELTON WATER WHEEL CO., *please mention Western Construction News.*

Everything Had Changed

. . . *Except the Pipe*

Twenty-three years changes a good many things . . . the houses . . . streets . . . the clothes . . . everything . . . except the pipe. It's Federal Wood Pipe.

Seattle laid it way back in 1906, when the city was just beginning to come into prominence. It supplied water to a portion of Magnolia Peninsula . . . continually . . . for 23 years, without a sign of a leak or trouble. It wouldn't be possible to reduce maintenance costs below that figure. *Changing conditions was the only element that put this Federal Pipe out of service. For, in fact, this pipe was as good as new when it was uncovered.

The Federal Wood Pipe you buy today protects your investment for generations to come. Its normal life is 40 to 50 years. Federal Pipe represents an investment in (1) Lowest first cost (2) Cool, fresh, healthful water supplies and (3) Lowest upkeep, with *dependable* service. It is most economical to transport—labor costs are lower because trenching need be only deep enough to bury Federal Wood Pipe . . . there is little danger of freezing.

Expert counsel and advice is yours for the asking. Our skilled engineers have a solution to your water transportation problems. Address: FEDERAL PIPE & TANK COMPANY, 5332 24th Avenue, N. W., Seattle, Washington, P. O. Box 5055, Ballard Station, Seattle, Washington.

If this is the kind of trouble-free, cost-saving service you are looking for to solve water transportation problems, why not give Federal a trial? Ask for more details. Our engineering department is ready with expert counsel. There is no obligation. FEDERAL PIPE & TANK CO., 5332 24th Avenue, N. W., Seattle, Washington. P. O. Box 5055, Ballard Station, Seattle, Washington.

F. P. & T. CO.

* This Pipe was re-sold by Seattle Water Department, and is now operating under a 100-foot pumping head for a private irrigation system.

FEDERAL DOUGLAS FIR PIPE

But They Both Use The Dorr Sifeed Clarifier

Square sedimentation tanks or round ones are all the same to the Dorr Sifeed Clarifier. It works equally well in both.

Siphon feed, an exclusive Dorr feature, just seems to have those advantages that appeal to intelligent reasoning—Efficiency, Capacity, Appearance, Compactness.

Feed enters quietly at the center below the surface. Flow through the tank is in radial direction. Overflow is collected peripherally across a weir of maximum length. That's "Sifeed" in a nutshell.

We aim to furnish each engineer with the type of Dorr Sifeed Clarifier—square or round—which he believes best fits his own particular needs.

A Complete Line of Sanitary Engineering Equipment

Bar Screens	Aerators
Fine Screens	Distributors
Detritors	Flocculators
Clarifiers	Mixers
Digesters	Pumps

46 Cities Use 101 Dorr Sifeed Clarifiers

Here are a few of them

Cleveland, Ohio	Sioux Falls, S. D.
Kohler, Wis.	Boulder, Colo.
Los Angeles, Cal.	Annapolis, Md.
Birmingham, Ala.	Baker, Ore.
Springfield, O.	Dearborn, Mich.
Chicago, Ill.	Madison, Wis.
Williamsburg, Va.	Fargo, N. D.
Springfield, Mo.	Iowa City, Ia.
Cedar Rapids, Ia.	Cedarhurst, N. Y.

THE DORR COMPANY, INC.

ENGINEERS • 247 PARK AVENUE, NEW YORK

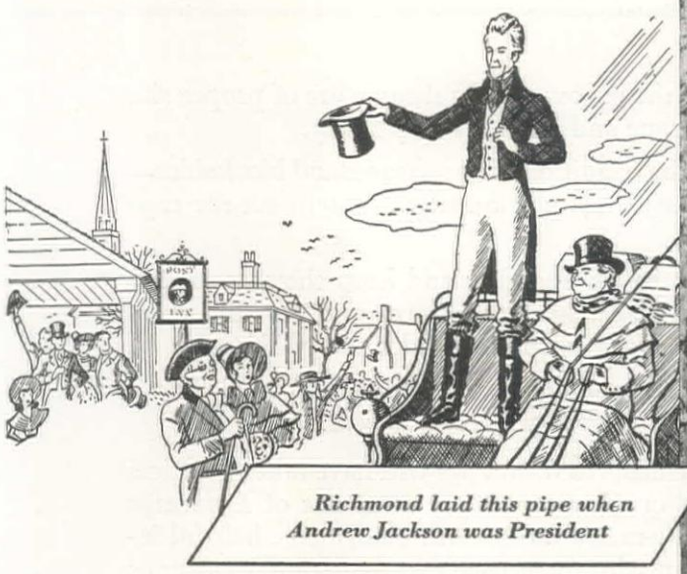
DENVER CHICAGO LOS ANGELES TORONTO

Dorr technical services and equipment are available from the following companies:

HOLLAND: Dorr-Oliver N. V. The Hague
ENGLAND: Dorr-Oliver Company Ltd., London
GERMANY Dorr-Oliver Gesellschaft, m. b. H. Berlin
FRANCE: Soc. Dorr-Oliver, Paris
AUSTRALIA: Crossle & Duff Pty. Ltd., Melbourne
JAPAN: Andrew & George Co. Inc., Tokyo
SOUTH AFRICA: Edward L. Bateman Pty. Ltd., Johannesburg

When writing to above advertisers, please mention Western Construction News.

Still resists rust *after* 105 *years*



Richmond laid this pipe when Andrew Jackson was President

AFTER 88 years of service in its original location, this cast iron main was taken up in 1918 to be replaced by a larger line of cast iron pipe, and relaid elsewhere. In 1931, after 101 years of service, it was again uncovered, inspected and photographed. Officials of the Department of Public Utilities of Richmond, Va., report that this old pipe is still rendering satisfactory service and good for many more years. It is another confirmation of the fact that the useful life of cast iron pipe with bell-and-spigot joints is more than a century.

The four major economies resulting from the long life of cast iron pipe are due to its effective resistance to rust. Cast iron is the one ferrous metal for water and gas mains, and for sewer construction, that will not disintegrate from rust. This characteristic makes cast iron pipe the most practicable for underground mains since rust will not destroy it.

The 4 Economies of Cast Iron Pipe

1. Official records of cast iron pipe laid 100 to 200 years ago and still in service, prove that it is *cheapest in the end.*
2. Official reports on file in the office of a prominent technical publication, prove that cast iron pipe is *cheapest to maintain.*
3. Long-lived pipe obviously causes less street-opening for replacements and repairs. Therefore, cast iron pipe *saves money on street-openings.*
4. When replaced by larger pipe, or a main is abandoned or rerouted, cast iron pipe *pays a final dividend in salvage value.*

For further information, address The Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, 1015 Peoples Gas Bldg., Chicago, Ill.

CAST IRON PIPE

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

How Excavator Operators can get MAXIMUM ROPE SERVICE

In the first of this series we gave a few pointers regarding new ropes and spares—in this second advertisement we make a few suggestions on installation of the rope

For Every Job there is a

TIGER BRAND AMERICAN WIRE ROPE

Supplied, in either Excellay (Preformed) or in Standard lay, whichever is the best construction for the job.

With our own wire rope plant and large stocks of rope wire and wire ropes of all grades—our Engineering staff—our own modern testing equipment—all right here on the Pacific Coast, we have a perfect set-up to give prompt and efficient service.

Tiger Brand American Wire Ropes are made on the Pacific Coast by the Columbia Steel Company—in the East they are made by the American Steel and Wire Co.

1—See that the grooves in the sheaves are of proper size for the rope and that they turn freely.

2—Watch the condition of the sheaves and block sides—if not kept in good condition they will cut the rope wires.

3—Run the ropes smoothly and keep them as taut as possible. Slackness in any line causes "crossing over" and extra wear from block sides and guides.

4—Keep all ropes lubricated except the "drag" line—proper lubrication will reduce wear.

In advertisements to follow we will have other practical suggestions on how to get the most out of Excavator Ropes. In the meantime we will gladly give helpful information on wire ropes used on any lifting, pulling or hauling job.

COLUMBIA STEEL COMPANY

Pacific Coast Distributors for
AMERICAN BRIDGE CO.
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AMERICAN STEEL & WIRE CO.
CARNEGIE STEEL CO.
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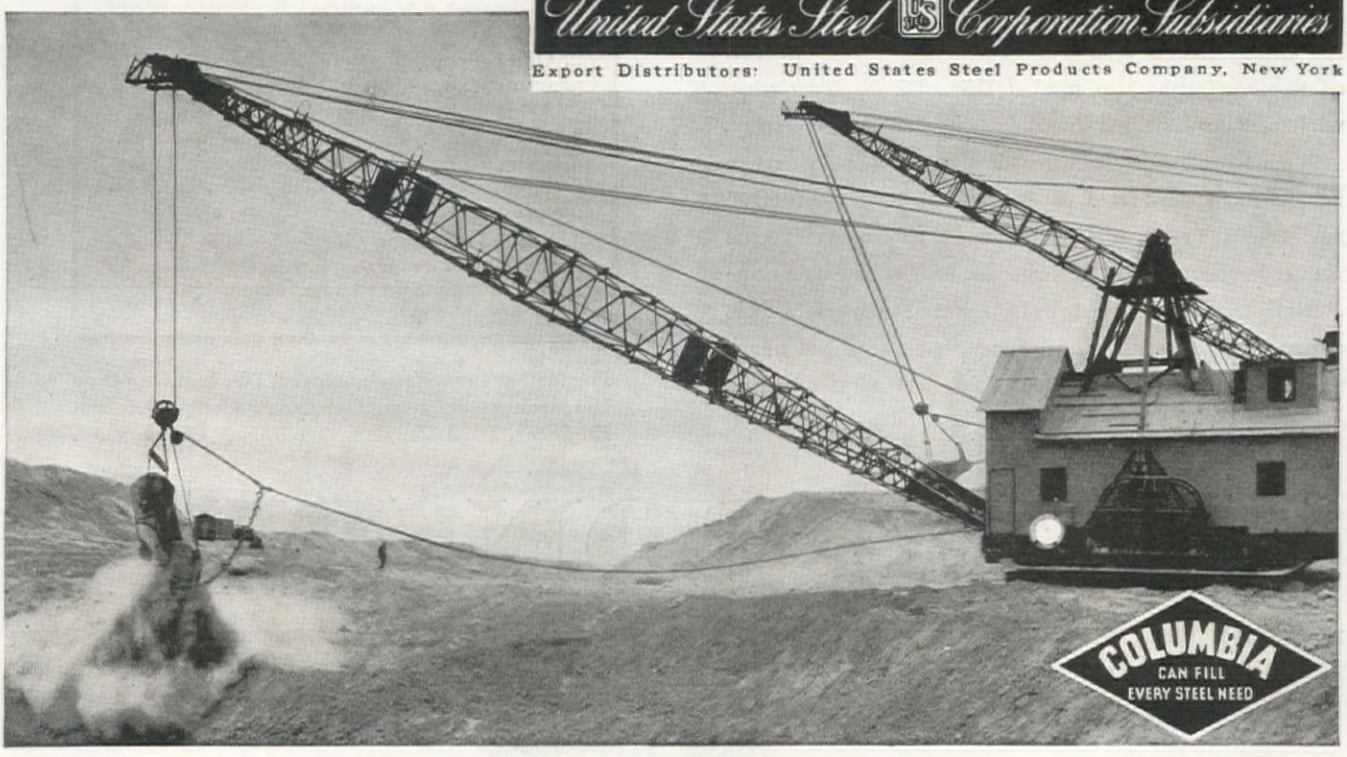
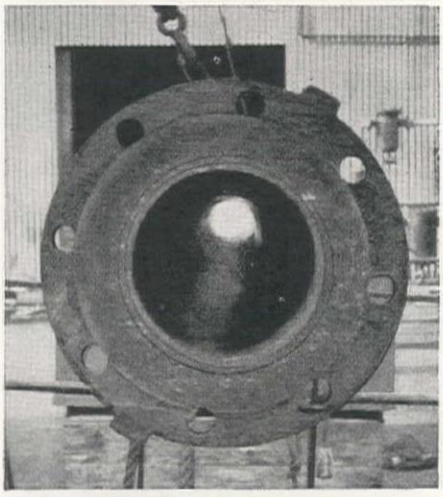
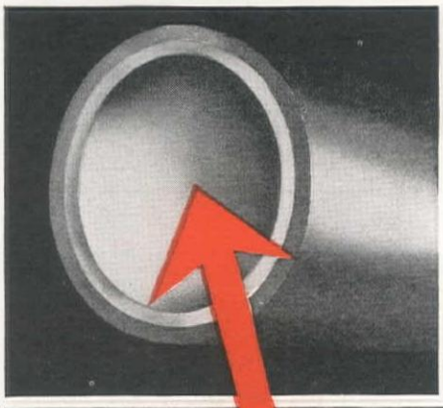


UNAFFECTED!—after a year's service in a boiling salt water line—

View of Duroline Pipe Installation in the Emeryville, California, plant of The Paraffine Companies, Inc., Leland S. Rosener, Consulting Engineer.





. . . various types of unlined pipe used in this line developed leaks in less than five months.

Durolining again proves its worth as an actual preventive of corrosion in carrying liquids that have destructive influence on pipe metal. In this large western plant of The Paraffine Companies, Inc., is a line that carries boiling salt water and for which various types of unlined pipe had been tried without success. Leaks had developed in less than five months. Finally DUROLINE was installed. After over a year's service it was opened up and found to be entirely unaffected — in as perfect condition as when installed, indicating further satisfactory service for a long time to come. The same was true of the Durolined fittings.

DUROLINE has been scientifically developed to resist the destructive action of waters that rust and corrode unprotected pipe metal in municipal and industrial service. The special cement lining prevents corrosive waters from attacking the pipe metal — no corrosion takes place. And remember, along with this special interior protection you get the long lengths, uniform high strength, convenient joints and other desirable features of NATIONAL Steel pipe. Put DUROLINE in when your line must carry corrosive waters and you can forget corrosion worries once and for all. COLUMBIA STEEL COMPANY engineers will gladly furnish further information on the merits of DUROLINE for any unusual corrosive condition.

Write today for an interesting bulletin describing the development and practical advantages of this modern product.

COLUMBIA STEEL COMPANY

Pacific Coast Distributors for AMERICAN BRIDGE CO., AMERICAN SHEET & TIN PLATE CO., AMERICAN STEEL & WIRE CO., CARNEGIE STEEL CO., ILLINOIS STEEL CO., LORAIN STEEL CO., NATIONAL TUBE CO., TENNESSEE COAL, IRON & R. R. CO.

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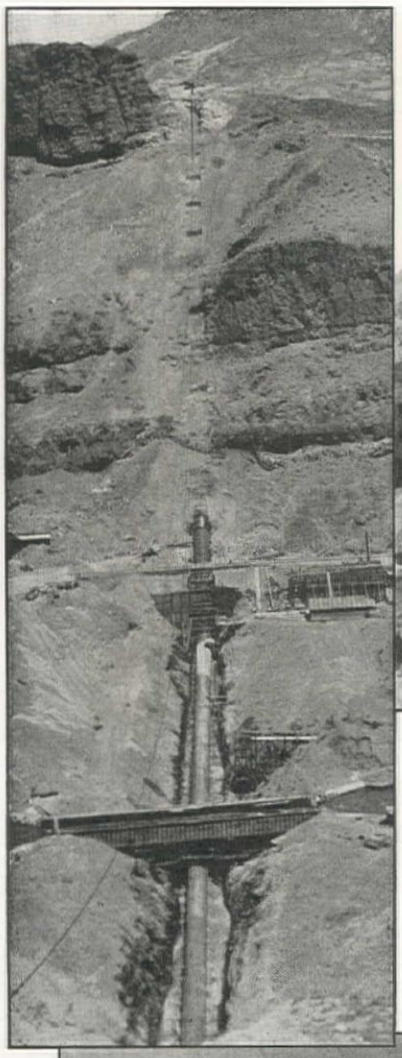
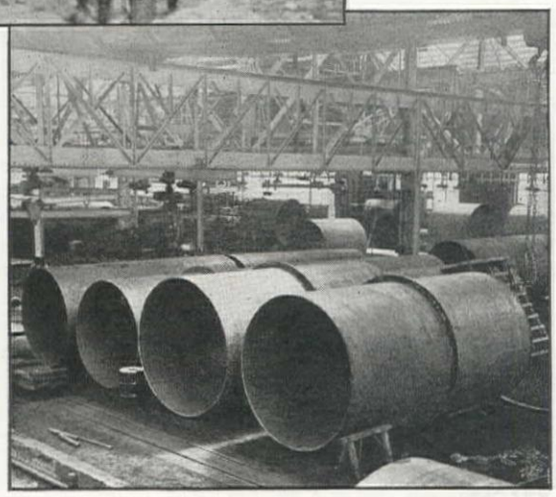
NATIONAL DUROLINE PIPE

When writing to Columbia Steel Co., *please mention Western Construction News.*

STEEL PIPE SIPHONS



for Reclamation Projects . . .



Upper Right: Snively siphon in Owyhee Irrigation project. It is 10½ ft. diameter. Upper left: Owyhee River siphon in same project. This one is 9 ft. in diameter and 1630 ft. long.

•

Above: Shop view showing sections of these two steel siphons during the process of fabrication.

TWO welded steel siphons have recently been installed on the Owyhee irrigation project in Eastern Oregon. One is 905 ft. long and 10½ ft. in diameter. The other is 1630 ft. long and 9 ft. in diameter.

The pipe for both these siphons was welded in our shop in 20-ft. lengths (except for shorter connecting sections). Each length was tested hydrostatically to twice its working pressure. No leaks were found. In addition to the hydrostatic test, sections from welds were given tension and nick-break tests. The same perfection of joint was indicated by these tests.

Special equipment was used in the shop for both the welding and testing operations. The automatic welding machines will handle pipe from 3 to 30 ft. in diameter.

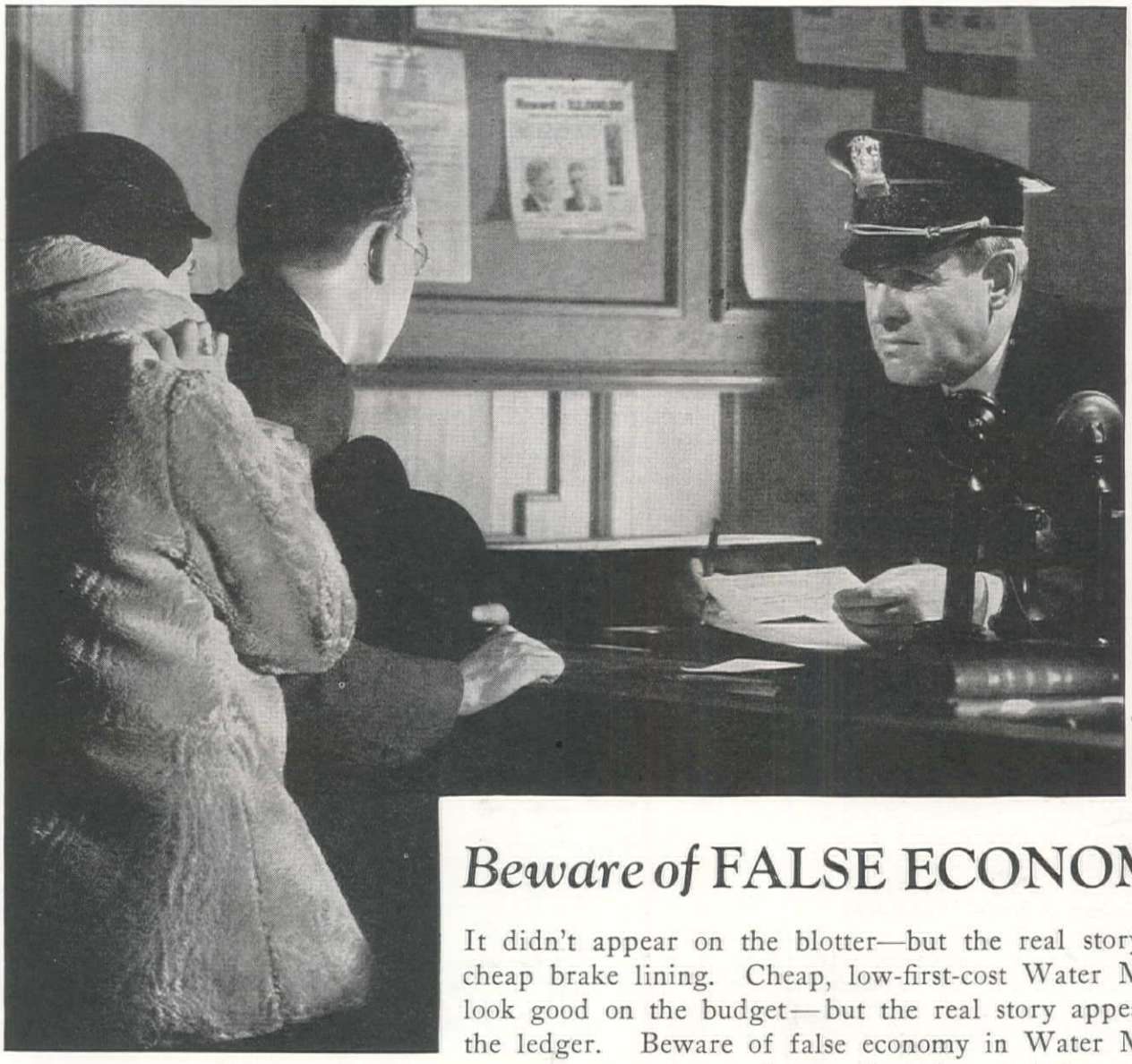
This is only one of the many types of steel platework which we fabricate in our shops. We build steel tanks for municipal, industrial or institutional use and special plate work such as bins, caissons, etc. Write our nearest office for information or quotations.

CHICAGO BRIDGE & IRON WORKS

San Francisco	1013 Rialto Bldg.	Chicago	Old Colony Bldg.	New York	165 Broadway Bldg.
Los Angeles	1444 Wm. Fox Bldg.	Detroit	LaFayette Bldg.	Boston	Consolidated Gas Bldg.
Houston	2919 Main Street	Birmingham	1500 North Fiftieth Street	Philadelphia	1700 Walnut Street Bldg.
Tulsa	Thompson Bldg.	Cleveland	Rockefeller Bldg.	Havana	Edificio Abreu 402

Plants at BIRMINGHAM, CHICAGO and GREENVILLE, PA.

When writing to CHICAGO BRIDGE & IRON WORKS, *please mention Western Construction News.*



LITTLE LESSONS IN FALSE ECONOMY No. ONE

Beware of FALSE ECONOMY

It didn't appear on the blotter—but the real story was cheap brake lining. Cheap, low-first-cost Water Meters look good on the budget—but the real story appears in the ledger. Beware of false economy in Water Meters . . . it pays to pay for quality, dependability, proper design and workmanship, low maintenance, for INTERCHANGEABILITY that eliminates obsolescence and scrapping . . . It pays to buy TRIDENT and LAMBERT Water Meters. A type for every service. Catalogs from Neptune Meter Co. (Thomson Meter Corp.), 50 West 50th Street, New York City . . or . . Neptune-National Meters, Ltd., Toronto, Canada.

Here are modern new interchangeable parts in a Trident Meter casing installed in 1899. Forty years from now the parts may look different (improved); but the principle of INTERCHANGEABILITY *will be the same; and as long as the meter casing lasts—they'll fit!*

THE SYMBOL OF SUSTAINED ACCURACY

OVER 6 MILLION MADE AND SOLD

PIONEERS IN METER PROGRESS
YESTERDAY - TODAY - TOMORROW

Trident
and LAMBERT WATER METERS

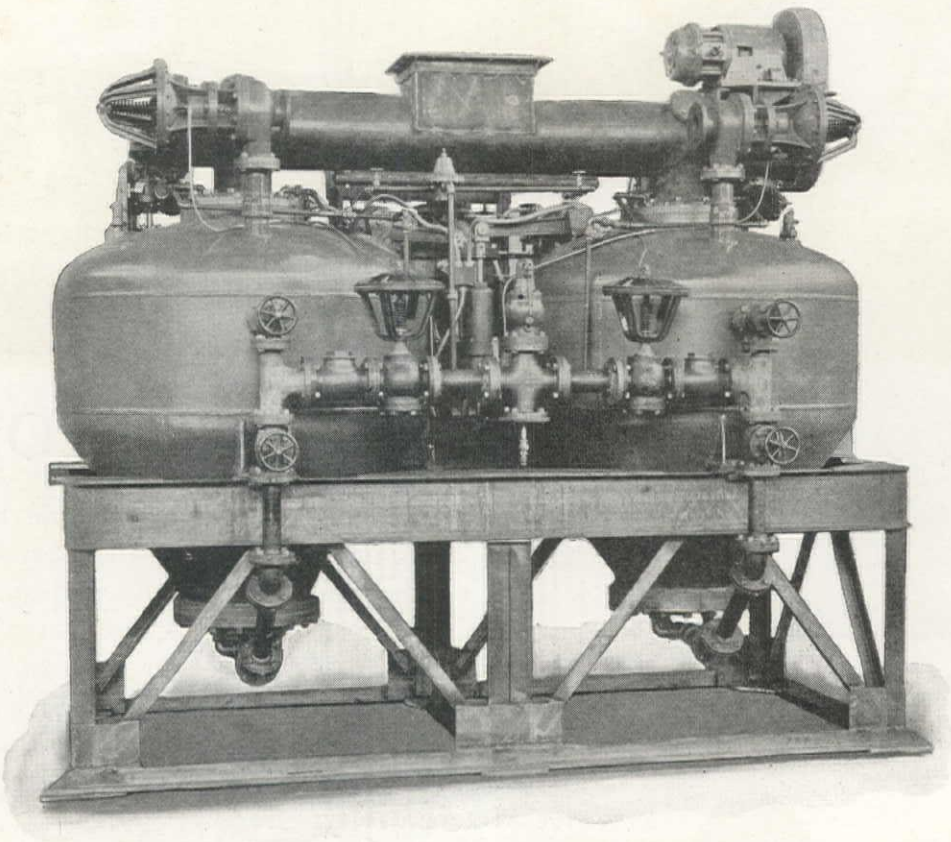
When writing to Neptune Meter Co., *please mention Western Construction News.*

FOR TRANSPORTING BULK CEMENT

and other pulverulent materials, pneumatically, over
short or long distances, in small or large quantities

. THE FLUXO PUMP .

At Boulder Dam, a large size Fluxo Pump has transported cement more than one mile at the rate of about 85 tons per hour; and for a distance of 200 feet with vertical lift of 130 feet, at the rate of about 250 tons (1350 barrels) per hour.



Single or double tank. Stationary or portable. Gravity or suction feed. Automatic and flexible, low power consumption, minimum attention. No operating parts in direct contact with the moving material. Economically transports cement, pulverized dry cement raw mix, dry clay, gypsum, hydrated lime, phosphates, soda ash, etc. — from grinding mills to storage—dust collected at packing machines to silos—loading and unloading silos, storage bins, blending bins, etc. The suction-feed Pump permits cheaper silo construction by elimination of tunnels and deck slab.

●

F. L. SMIDTH & CO.

Engineer Specialists in Designing and Equipping Cement Making Factories

225 BROADWAY NEW YORK, N. Y.

When writing to above advertisers, please mention Western Construction News.

Ours is an era of change. Forward thinking is reflected in political, economic and industrial phases of the nation.

In 1930 a new idea in blasting powders was conceived. Today the organization responsible for its development offers this powder for sale under the trade name "Halafax."

During the past five years ton after ton of Halafax Explosives has been produced but never sold. Mines, quarries, construction projects have tested this powder with exhaustive and rigid tests. It has been viewed with the supercritical, sceptical eyes of the product's severest critic,—the user. One by one, miners, contractors, explosive engineers have proven for themselves the revolutionary explosive advantages exclusive with Halafax. Critics have become disciples.

The Halafax Explosives Co. is concentrating on the manufacture and sale of one thing. To that end every energy, every effort of their entire personnel will be devoted.

Halafax Products will be offered for sale not as "cheaper" powders,—not as "better" powders,—but as the most economical disruptive forces of commercial practicability that may be purchased by the pound.

HALAFAX EXPLOSIVES

FEATURES OF HALAFAX EXPLOSIVES:

Chemical Stability:
—No leaking fluids, no bleeding, creeping or separation of ingredients in storage.

Physical Stability:
—No change of consistency or efficiency due to temperature variations. Uniform combustion in every cartridge.

HALAFAX EXPLOSIVES CO.

Executive Offices: Los Angeles, Calif. Plant and Magazines: Saugus, Calif.

When writing to Halifax Explosives Company, *please mention Western Construction News.*

Working almost continuously in earth and shale frozen to a depth of two to three feet, and sometimes more, LIMA shovels owned by Spillway Builders, Inc., Kansas City, Missouri, have been reeling off the yardage steadily and economically on their section of the ten million yard spillway job at Fort Peck Dam in northern Montana.

Through tough digging and severe winter conditions the LIMAS are constantly producing satisfactory yardage at low cost.

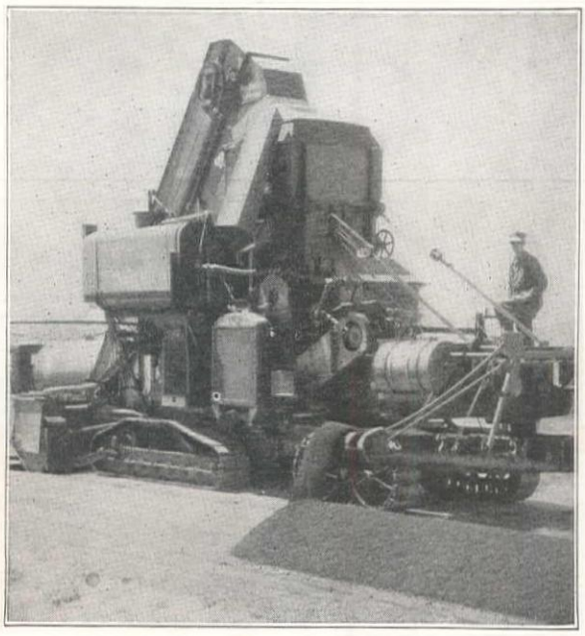
For reliability and economical operation you can't beat a LIMA.

LIMA LOCOMOTIVE WORKS, INCORPORATED
SHOVEL AND CRANE DIVISION LIMA, OHIO, U. S. A.

DISTRICT OFFICES: Smith-Booth-Usher Co., 2001 Santa Fe Ave., Los Angeles. A. L. Young Machinery Co., 26-28 Fremont St., San Francisco, Calif. H. J. Armstrong Co., 2244 First Avenue S., Seattle, Wash. Western Steel & Equipment Corp., 338 First Ave. S. W., Portland, Oregon. General Machinery Co., East 3500 Block Riverside Ave., Spokane, Wash. C. H. Jones Company, 134 Pierpont Ave., Salt Lake City, Utah.

LIMAS ARE BUILT IN ¾ YARD CAPACITY AND LARGE

TRAVEL PLANTS and Low Cost, Road Mix Types of Pavements



THE country is now "low- cost road" conscious. The ever increasing service demands on roads have pointed out to the public and engineers the necessity of paving a greater mileage of good roads with the limited funds available. It is impossible to obtain the desired mileage through A-1 class construction alone. On the other hand, the public demands a quality pavement. Hence the search for a quality pavement at the lowest possible cost.

The lower cost of road mix types of bituminous pavement is well established. It allows flexibility to the construction methods, permitting the contractor to work ahead with his aggregate producing plant and trucking. It permits the use of aggregates already on the road, utilizes the sun and wind for drying agents instead of the far more expensive mechanical methods necessary at a central plant. This method does not tie the mixing plant to the aggregate plant, which permits the use of more small pits and a resultant reduction in length of haul. It eliminates the problems involved in trucking the mix from central plants to the road. Thus the advantages of the road mix are desirable if the *quality of the road can be maintained.*

Engineers are pretty much agreed as to what constitutes a good road mix pavement. The foundation, the aggregate, and the bitumen are the important factors, but the mechanical processes of proportioning, coating, mixing, and finishing are also very important factors. Here is where the travel plant has a most important function. *It builds more quality into a low cost road mix type of pavement.*

There was a time when grain was threshed on the barn floor by driving horses over it. Those days are over. Does it not occur to you that dragging materials back and forth over the road is a rather crude way of mixing? The travel plant is a modern machine which picks up the materials and does the processing under control, and does it thoroughly and uniformly; also economically. Many roads fail in "spots". This indicates a lack of uniformity. *If part of the road is good, it can all be good.*
The travel plant is built around the idea of mechanical control and the elimination of the human element with its uncertainties and hazards. It produces accurate proportioning of aggregates and bitumen. The bitumen pump and aggregate feeder are synchronized so that once set, the proportion is maintained regardless of variations in the volume of the windrow, speed of travel, or fluctuations in the speed of the engine. A twin pug mill gives thorough mixing so that each particle is evenly coated before it is deposited on the road. This eliminates rich and lean spots and loss of bitumen on the base, weaknesses that so often occur in blade mixes or comparative methods. Compared to a cycle counted in hours in blade mixing, the travel plant mixing cycle is less than two minutes which has many outstanding advantages. First, it permits the use of quicker setting bitumens; second, it permits working in lower atmospheric temperatures thereby lengthening the paving season and allowing night mixing; and finally, it reduces the rain hazard, that is, the danger of rain ruining a partly mixed windrow. The travel plant mixes the entire windrow in one pass, gixing a clean pickup, greatly reducing base agitation, and relieving traffic congestion. By working on one-half the road, the remaining half may be primed and the completed mix deposited on the primed section without disturbing its bond.

Besides these outstanding quality advantages, the travel plant is a high production unit. Machines have mixed two and three miles of road day after day, and have operated continuously on twenty-four hour schedules. They have successfully handled the different types of asphalts, tars, and road oils. They have mixed aggregates containing up to 15% of 200 mesh fines. The travel plant is particularly adapted to handle powdered asphalts, the latter being proportioned and fed directly into the pug mill, eliminating the difficulties of spreading it on the windrow.

Travel plant is not just a manufactured product or a patented process; it is a construction method. It is a method that has proven its ability to produce a higher quality pavement and still remain consistent with present day "low cost road" principles. It is a method that should not be classed with other methods which only go part of the way and produce pavements of less quality. The mechanics of road building are all important.

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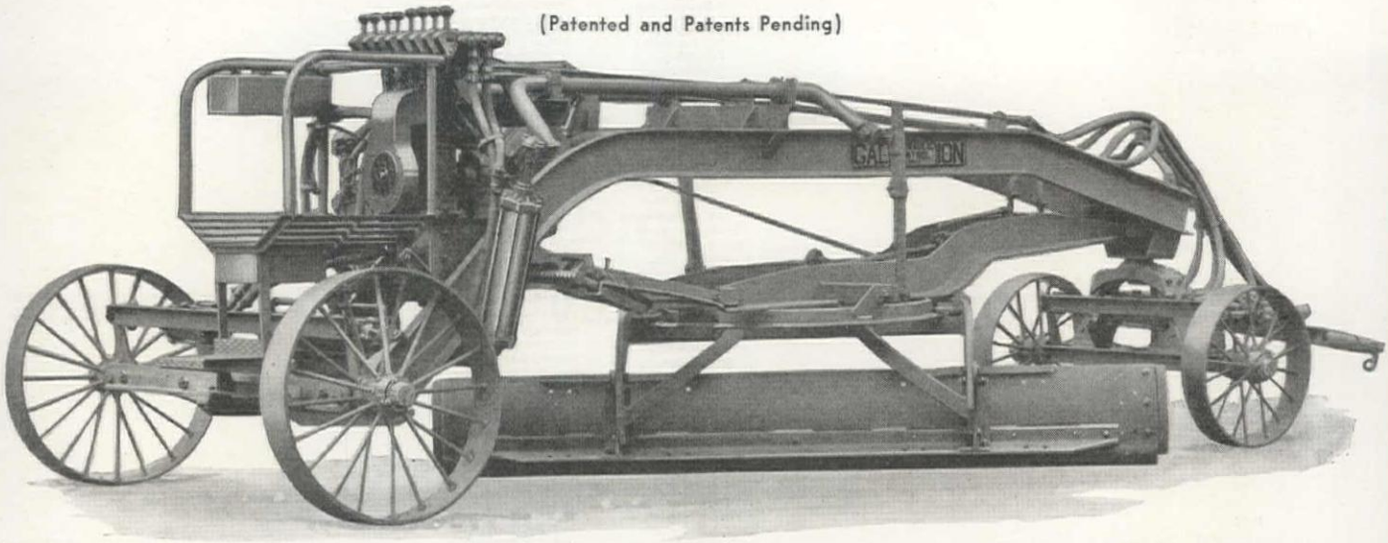
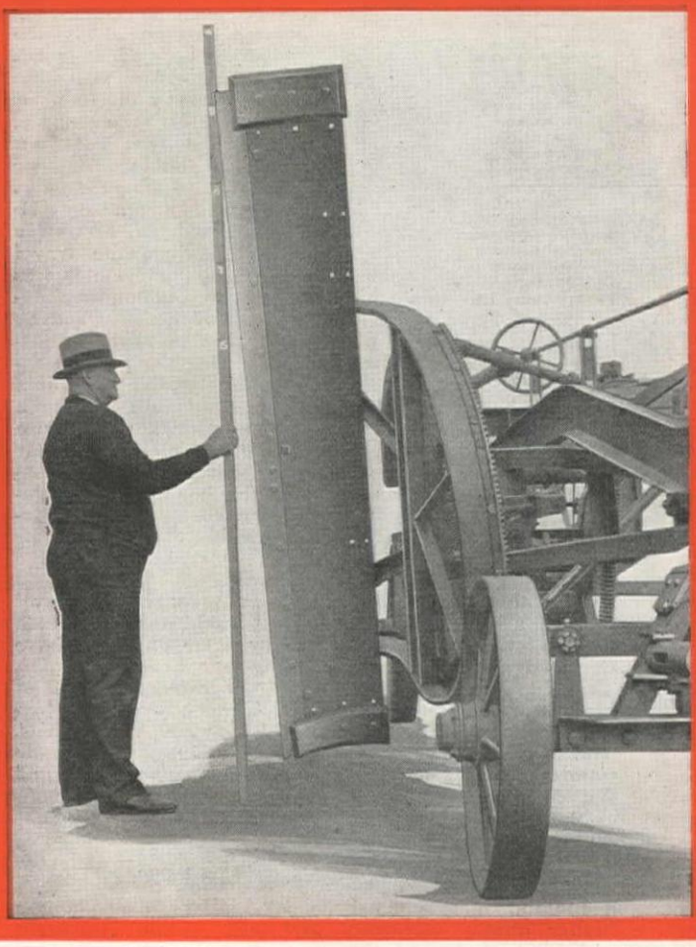
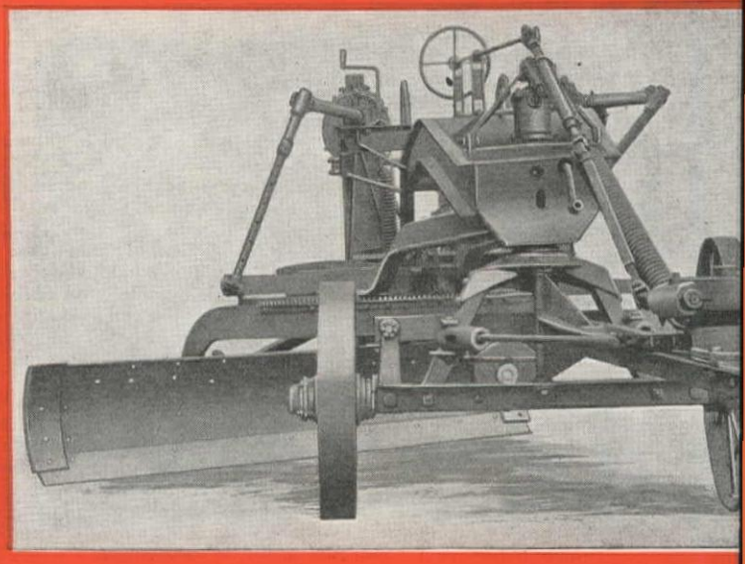
(Patented and Patents Pending)



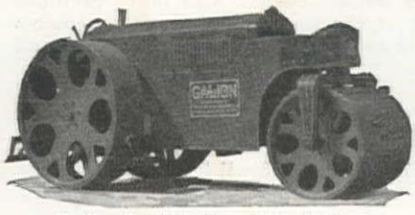
Make a "Show Down



A Wide Range of Blade Adjustment

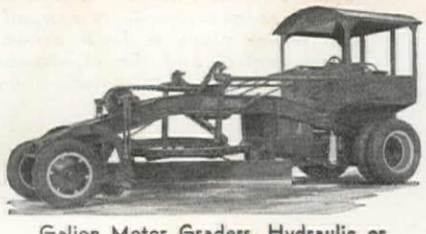


Without using any special attachments, the blade on all Galion Leaning Wheel Graders can be quickly adjusted for trimming shoulders (see illustration above). Moldboard is adjustable to any angle (see photo at left) for bank cutting. Where required an efficient eleven-tooth Scarifier and a Bank Sloper can be furnished.



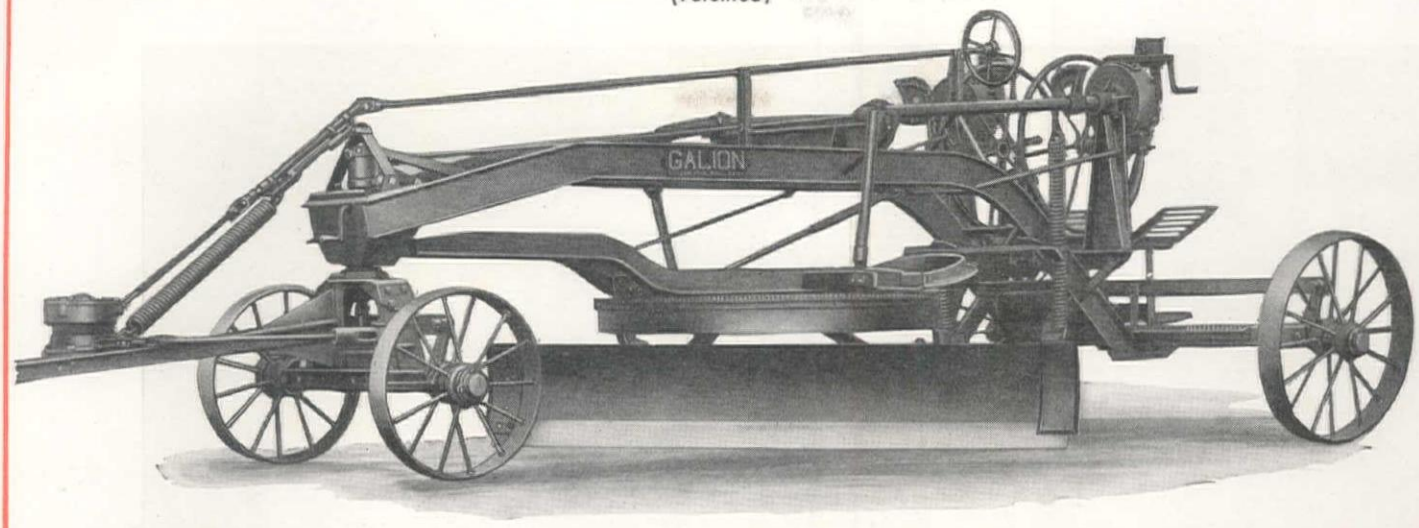
Galion Road Rollers, 5 to 12 Tons

Galion Mixing and Leveling Drags



Galion Motor Graders, Hydraulic or Manual Control

[Patented]



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The superior construction and the "priced right" features of Galion Graders give them an added value over other makes. YOU GET MORE THAN YOU PAY FOR WHEN YOU BUY A GALION.

In the Galion line there is a Leaning Wheel Grader of the proper size and weight to perform any blading job you may have. Illustrated above are the No. 12 Leaning Wheel Grader with Hydraulic Power Control and the No. 112 (right) with E-Z Lift Manual operation.

We invite your investigation of Galion Leaning Wheel Graders. Make a "Show Down" comparison of these machines with other makes of similar size and see how much more you get for your money in a Galion. Complete information on request.

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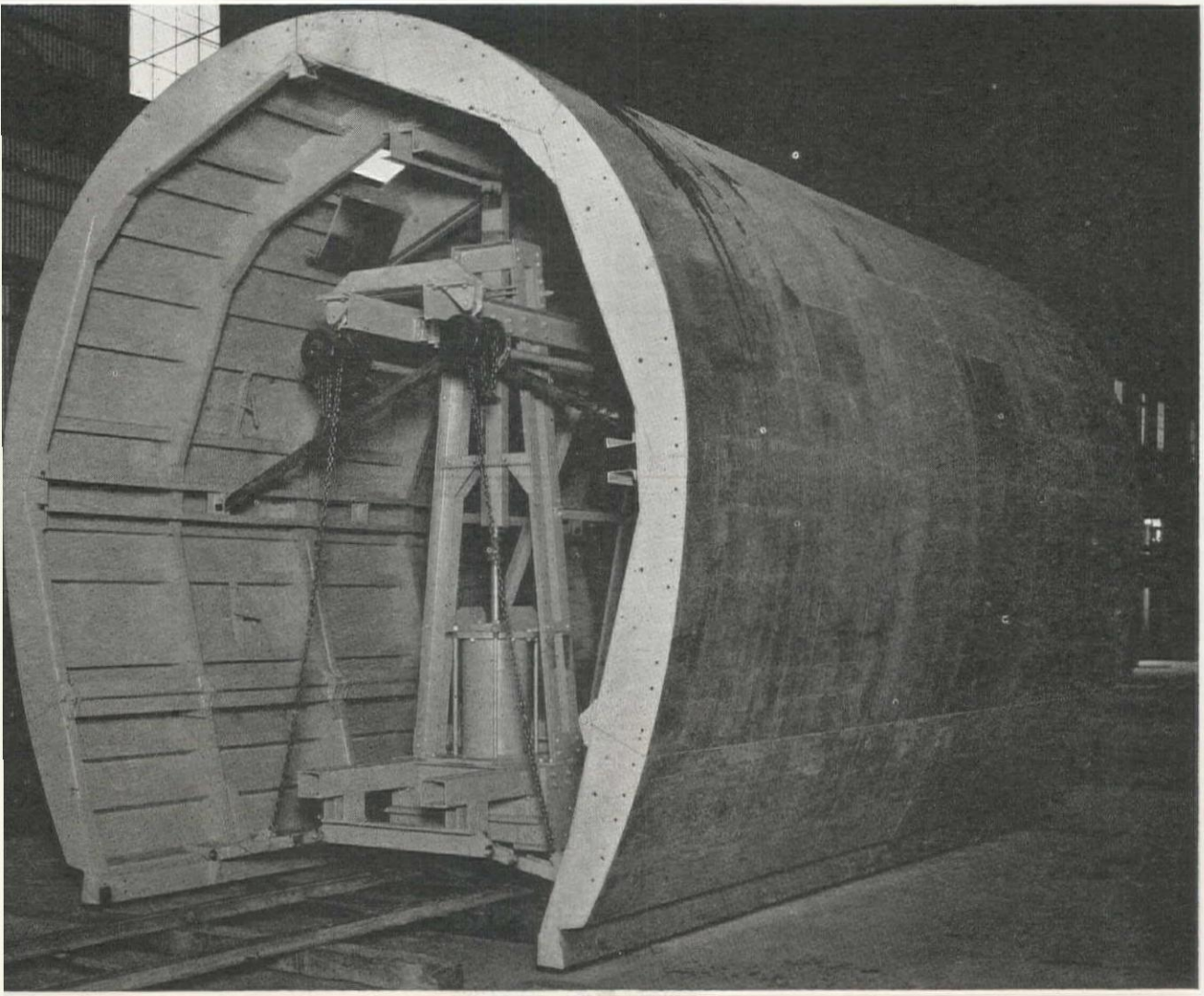
GALION



THERE

is a Chinese proverb which says that one picture is better than a thousand words. Above is shown a 24 ft. unit, 16 ft. diameter steel tunnel form built for the Metropolitan Water District, Coachella Tunnels. Opening shows traveler in place. Traveler is equipped with hydraulic cylinders operated by oil pump with 15 h.p. motor to generate pressure. Top section made in 8 ft. panels, lower apron in 24 ft. lengths. Sides of form are drawn into moving position when form is lowered by means of folding arms. Aprons are folded by chain hoists. There is a toggle arrangement to provide direct pull between apron and traveler.

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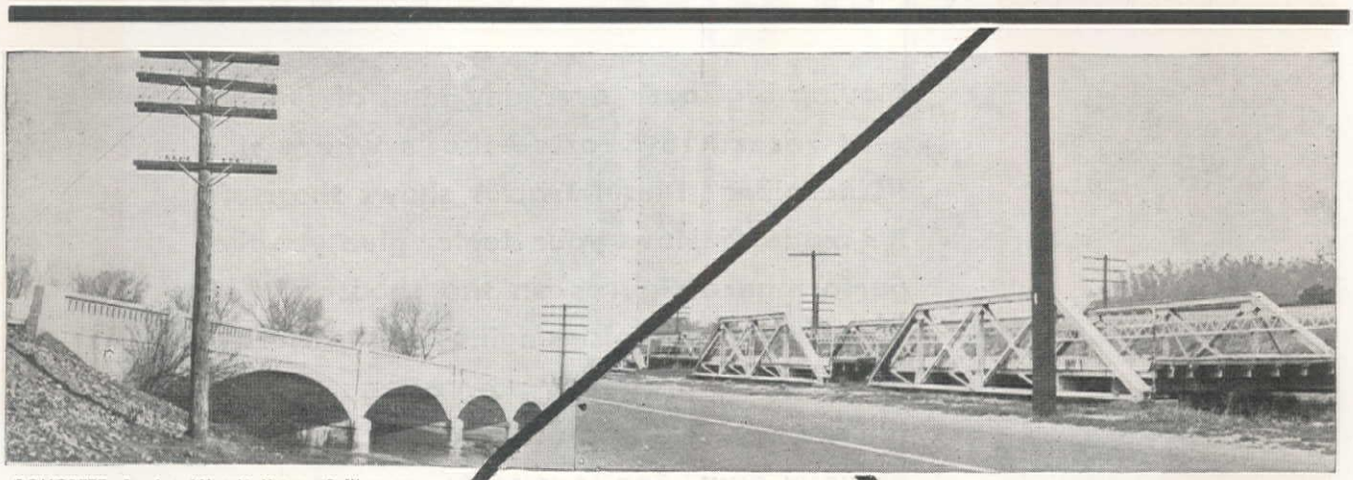

CONCRETE—Service Life—12 Years. Built in 1917, highway realignment in 1929.

STEEL—On Main Highway—Service Life—18 Years. Built in 1911, relegated to secondary San Bernardino County roads in 1929.

REDWOOD—Service Life—19 Years. Lower bridge built in 1915, replaced in 1934 because of curve elimination and grade improvement.

REDWOOD—Service Life on main Highway—15 years. Built in 1917, highway relocated in 1932.

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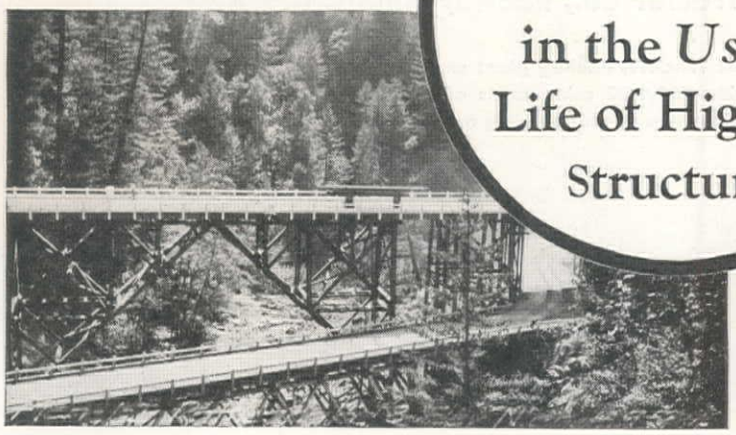

REDWOOD (below)—Service Life—Over 40 Years. Built about 1890, replaced in 1933. New highway required. Wider roadway, heavier loadings.

The life of each bridge shown on this page was less than the life of the material from which it was built. The low first cost of Redwood bridges permits replacement at minimum sacrifice of the original investment. In other words, Redwood costs are in proportion to the normal service life . . . . with years to spare in service value. Redwood Bridges may be economically widened or strengthened. At the end of service life, they are easily removed and often have a real salvage value. Keep abreast of changing highway demands . . . . look ahead 40 years in making bridge investments . . . . specify, and use dependable structural grades of Redwood.

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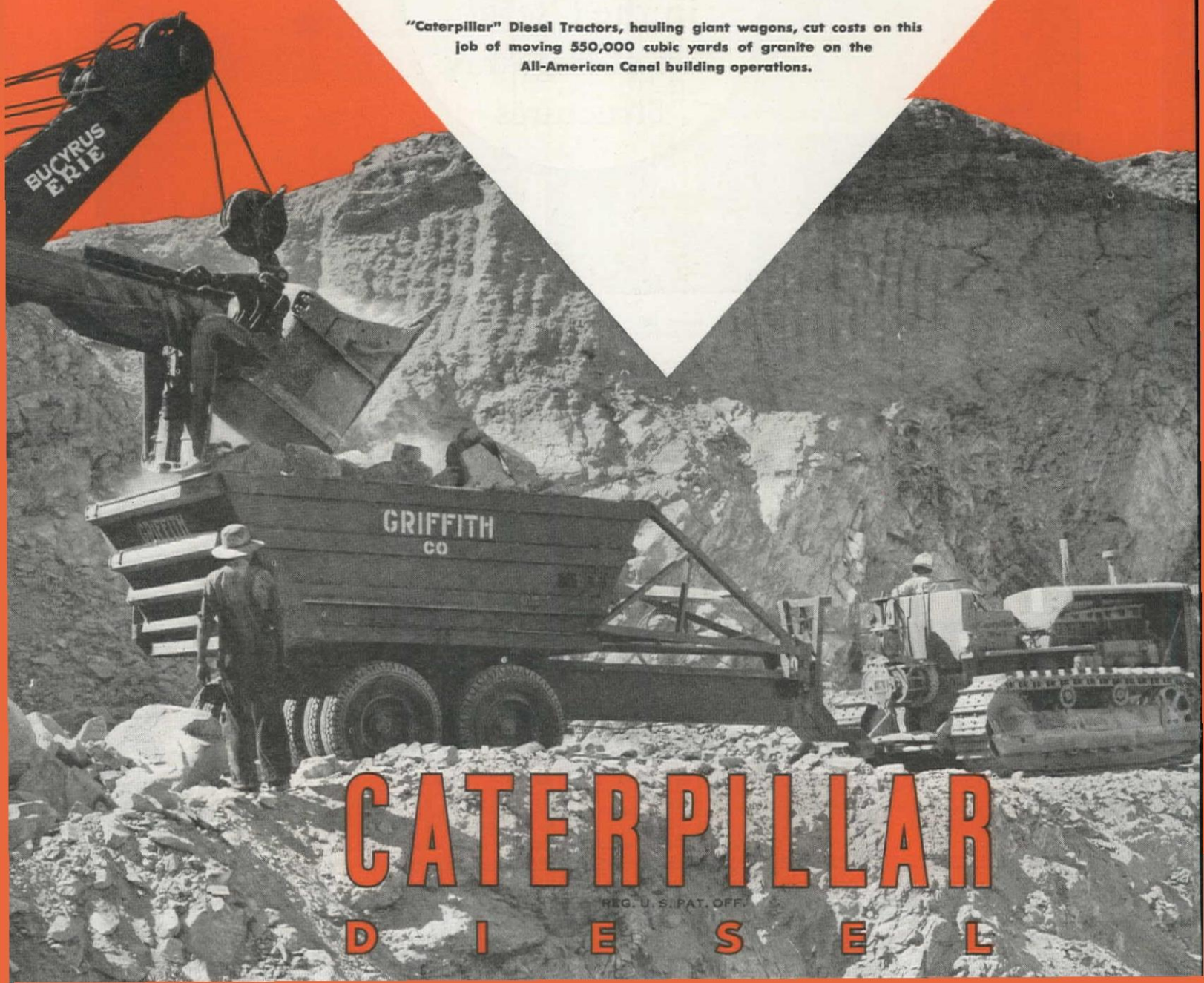
"Caterpillar" Diesel Tractors, hauling giant wagons, cut costs on this job of moving 550,000 cubic yards of granite on the All-American Canal building operations.



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WESTERN CONSTRUCTION NEWS

WITH WHICH IS CONSOLIDATED WESTERN HIGHWAYS BUILDER

April, 1935 — Vol. 10, No. 4

G. E. BJORK, Acting Editor
H. W. PYERITZ, News Editor
R. P. BRYAN, News Editor

The Menace of Force Account Construction

AT the time of this writing the $4,880,000,000 relief bill has been passed by the Congress, and awaits the President's signature. By the time this publication is in the mail, the President undoubtedly will have signed the bill, making it a law of the land. How all the money for public works will be spent, now becomes the question. Shall it be spent on a force account basis, or by the contract system? The bill instructs the President to favor private enterprise wherever and whenever possible; but during the debate on the subject, Congress clearly indicated a predilection for the day labor, force account system. We believe the force account principle has a definite place in the civil engineering industries, but its general employment on public works under this relief bill will, in our opinion, defeat the very purposes for which the bill was framed, and result in an economic waste to the great discredit of the men who are to administer it.

During a recent hearing by the House Committee on Roads, Thomas H. MacDonald, Chief of the Bureau of Public Roads, stated that force account methods on highway construction were 30% more expensive, on the average, than contract methods. His figures were not based on theory or opinion, but were obtained from actual test projects sponsored by the Bureau during the past year in typical sections of the United States. Under instructions from Secretary Ickes, the Bureau required that every state, on at least one contract financed by NIRA funds, should call for bids in the regular way, then reject all bids and do the work by force account. The cost figures thus obtained are of great interest to western contractors and engineers, and particularly to the men and women who will in the long run pay the bill for this new $4,880,000,000 program.

In Lyon county, Nevada, a highway grading project was chosen as one of the test cases. Bids on the work were advertised in May, 1934, and the job was subsequently completed under the force account system. In this case the low bid, by a reliable contractor, was $35,053, whereas the total cost under force account methods was $53,260. In other words, on this Nevada grading project the force account system proved more than 50% more expensive than contract methods. The following comparative cost figures on a California project which involved 6.1 miles of highway grading between Sivert and Havpress canyon in Kern county give forceful proof of the fallacy of day labor methods.

On this project the California Division of Highways had little equipment available for the work; consequently most of the major machinery items, such as power shovels, road rollers, and compressors, had to be rented. The condi-

1. Sharp & Fellows Contr. Co. (low bid submitted)
2. Engineers preliminary estimate
3. Force account work (actual construction) *

	(1)	(2)	(3)
240,000 cu.yd. rdwy. excav....	$ .235	$ .27	$ .363
2,660 cu.yd. str. excav.....	.80	.95	1.00
2,500,000 sta.yd. overhaul	.003	.003	.007
7,076 M.gal. water	.60	.95	2.42
17.3 M.ft.BM Redw. tbr...	83.00	95.00	92.34
97.2 M.ft.BM Redw. tbr...	77.00	90.00	93.53
910 ft. piles	.55	.50	.64
36 drive piles	14.00	40.00	23.01
Lump sum, rem. tbr. bridge...	400.00	660.00	243.02
940 cu.yd. riprap	2.00	2.00	
250 bbl. fuel oil.....	2.20	1.65	2.83
40 cu.yd. 'A' conc.....	32.00	20.00	52.54
2,000 lb. reinf. steel.....	.06	.05	.08
21 spillways	15.00	11.50	11.71
232 ft. 8" CMP	.80	1.00	1.07
836 ft. 18" CMP.....	1.50	1.85	1.63
718 ft. 24" CMP.....	2.30	2.80	2.57
268 ft. 30" CMP.....	3.25	3.55	2.85
350 guide posts	1.00	1.40	2.22
320 ft. tbr. gdrail.....	1.00	1.30	.83
4 cu.yd. rem. conc.....	4.50	1.50	10.40
43 culv. markers	1.50	1.80	1.90
1.1 mi. new fence.....	480.00	550.00	919.13
10 fence gates	20.00	18.00	23.74
5.5 mi. reset fence.....	240.00	315.00	421.04
324 sta. finish rdwy.....	6.00	5.00	8.68
160 monuments	3.00	2.70	4.08
	$ 93,929	108,229	141,729

*Quantities varied on actual force account work from the bid items shown.

tion of the equipment was average for work of this kind, and the rental prices were not excessive. Rentals on the earth moving equipment were comparatively high, but in spite of this fact the machinery showed an operating profit on the work done. The superintendent and foremen, all good men, were transferred from state prison camp work, and had to build an organization from the men who were furnished for the job. The labor in this instance was recruited from idle cotton pickers.

The typical contractor, bidding on a job of this kind, usually owns a reasonably complete line of construction equipment, in sound operating condition. In most cases, as a matter of fact, essential items of equipment are a pre-qualification to contract bidding. Any necessary additional items can easily be rented or bought by a contractor, without the delay which usually attends purchases by Federal or state bureaus or commissions. More vital than construction plant, however, is the contractor's organization. Every contractor maintains a skeleton organization of trained construction experts, including a superintendent, foremen, timekeepers, master mechanics and equipment operators. Through years of training under the profit system such men have acquired the knack of organizing construction gangs quickly and effectively. Under their direction, a construction job gets off to a flying start, with every phase of the work effectively coordinated. Moreover, because such men have learned the value of efficiency, they employ laborers who show promise of a dollar's work for a dollar's pay; and they naturally discharge from the job the drones and the loafers who develop.

Herein we have the fundamental differences between the force account and the contract systems. The contractor wants to make a profit, and although in recent years competition has driven contractor profits to painfully thin margins, the profit principle does result in efficiencies that are impossible under the force account system. It is important to bear in mind, also, that in the case of this California grading project, few more men were employed by force account methods than would have been employed by a contractor. On this project, $50,000 would have been saved by the contract system, which sum employed on still further grading work would have given employment to idle hands. In other words, $141,729.00 spent under the contract system would have resulted in more employment than the same amount used under the force account system. Moreover, more mileage of highway would have been graded, to the commercial advantage of more highway users.

It would not be fair to say, in this case, that the California Division of Highways was at fault. They did the best they could; but sound results are difficult to attain when relief workers want "relief," not work. We have the keenest interest in the problems of unemployment, and the deepest sympathy for unemployed; yet we are convinced that the force account system, using day labor, is not the sound or permanent solution to the unemployment problem. Our potential wealth, and our possibilities for balanced development, are too great to run the risk at this time of developing habitual relief workers. We therefore come out squarely for the contract system on public works under the relief bill, in the firm belief that it will result in more employment, and a greater good to a greater number of people.

Our New Editor

The readers of Western Construction News will be glad to learn of the appointment of James I. Ballard as editor, effective today.

Ballard is well known in the civil engineering industries of the West, having been western editor of *Engineering News-Record* for several years, and more recently associate editor of the same publication in New York.

He is a westerner, having been educated here, and having secured his engineering training in the West. Under his direction we are confident the editorial pages of Western Construction News will become increasingly interesting and helpful to its more than 8000 readers throughout all the West.

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Engineers are discovering new values in the principle as more and more Roll-A-Planes are put into service. Contractors and highway officials are discovering a new conception of levelness and a new low cost for quality roads. The industry is accepting as its standard the Roll-A-Plane, or Austin-Western Rollers on which the Roll-A-Plane feature can be added later. A new booklet now on the press describes the Roll-A-Plane process. Send the coupon.

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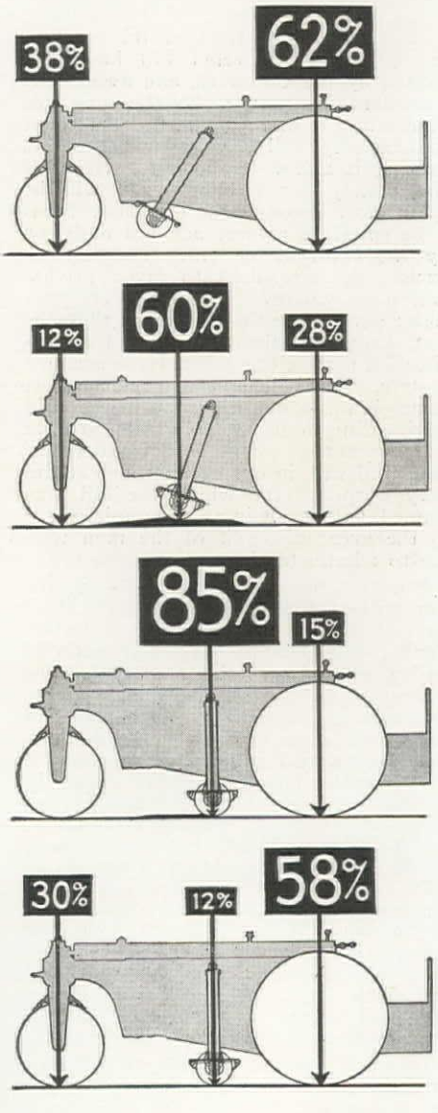

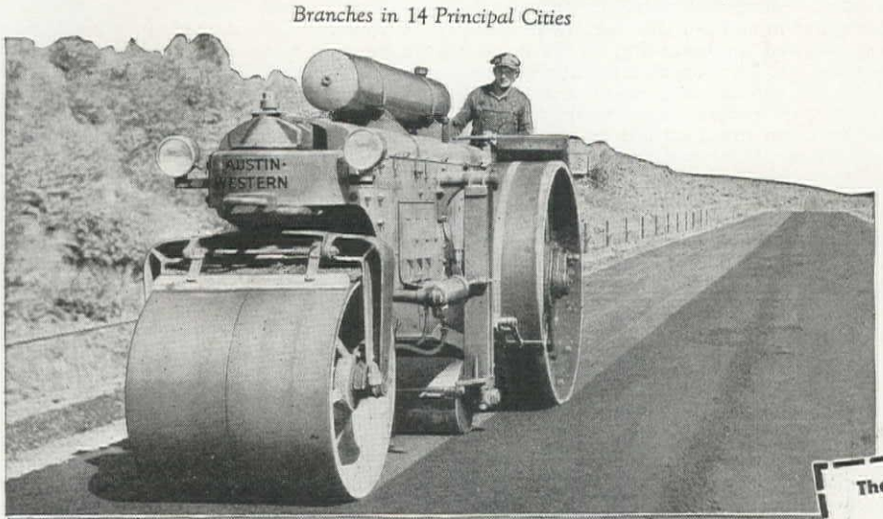

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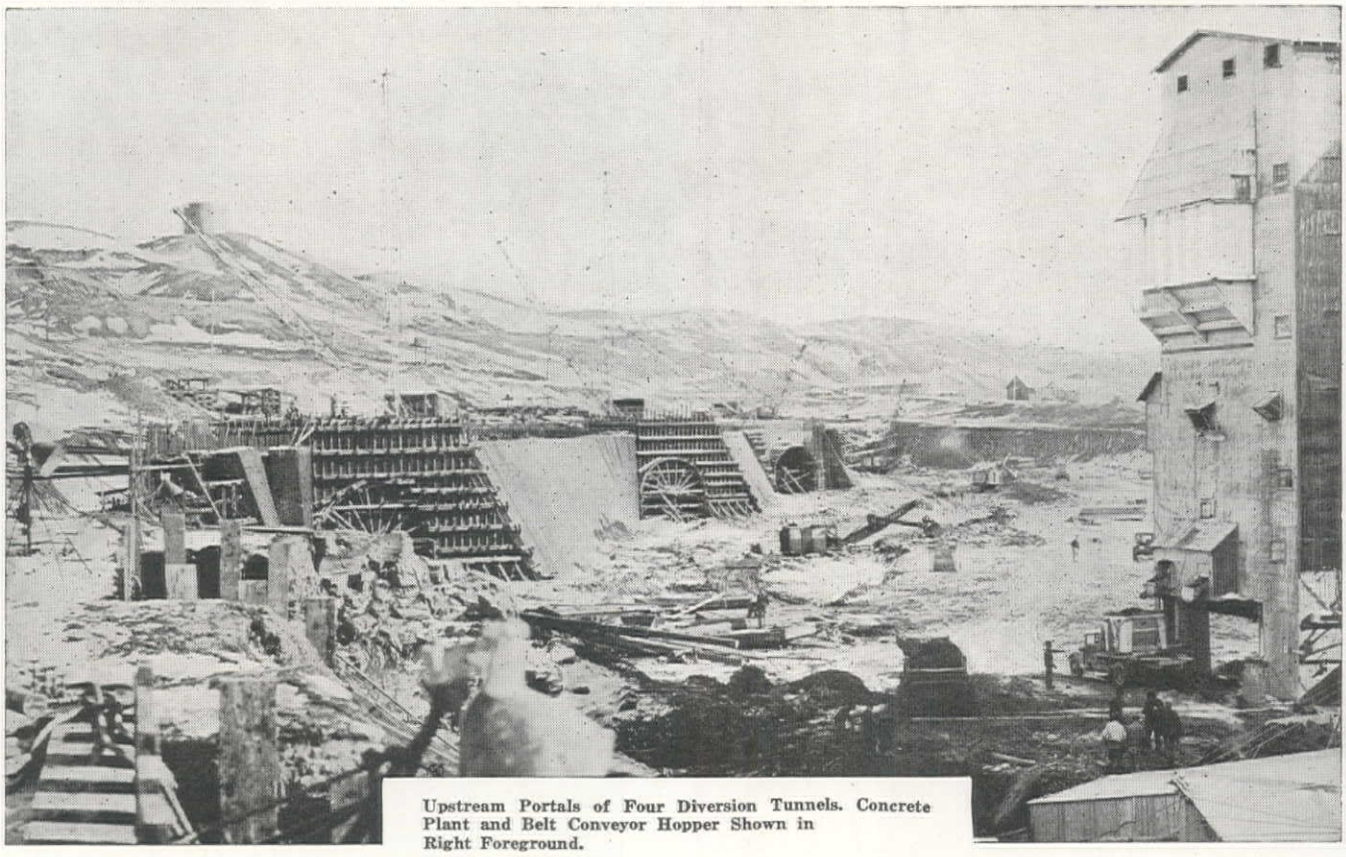
WESTERN CONSTRUCTION NEWS

APRIL, 1935



Upstream Portals of Four Diversion Tunnels. Concrete Plant and Belt Conveyor Hopper Shown in Right Foreground.

Fort Peck Shale Requires Special Method For Excavating and Lining Tunnels

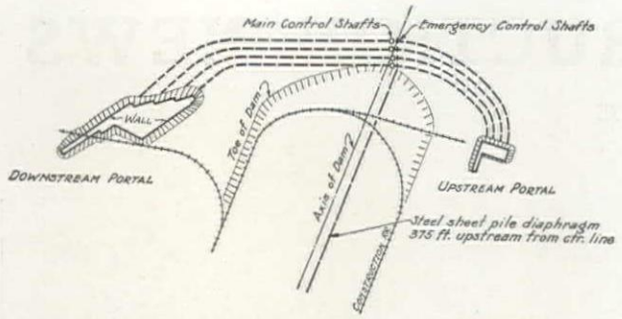
The Use of Tunnel Saws, Mechanical Muckers and Belt Conveyors Has Made Possible a Record Breaking Pace Being Set in Tunnel Driving.

By A. W. PENCE*
Captain, Corps of Engineers

THE Fort Peck Project, located in eastern Montana, 11 mi. above the confluence of Milk and Missouri rivers, will control the flow of Missouri river by means of the largest earth dam in the world. This dam, rising 230 ft. above the flood plain, will extend 9,000 ft. across the main river valley and be continued as a dike having a maximum height of 130 ft. for 11,500 ft. on the left bank. The dam will contain 100,000,000 cu.yd. of material pumped from the alluvial deposit in the main river bottom by four 12,500 hp. dredging units, each consisting of a 5,000 hp. 28-in. dredge, a 5,000 hp. floating booster and a 2,500 hp. land booster. The reservoir will form the second largest artificial lake in the world, extending 180 mi. upstream. It will have a surface area of 245,000 ac. and will impound 19,412,000 ac. ft. of water.

The project is being constructed under supervision of the Corps of Engineers, U. S. Army, as PWA project No. 30, partly by hired labor and partly by contract. It was authorized October 14, 1933, and 20 days later 500 men were at work preparing the site. To date, a town capable of housing 5,000 people has been built to withstand comfortably the rigors of the climate; a 50,000 kw. power line, 288 mi. long, has been built from Great Falls; dredges and boosters have been built; the initial power distribution system for dredges has been installed; the site has been stripped of 4,116,000 cu. yd. of material; 800,000 cu. yd. of dredge fill have been placed; 750,000 cu. yd. of gravel have been placed in the upstream and downstream toes; and construction on the steel cut-off wall, tunnels, and spillway is well under way. Plans call for the completion of the entire project in 1939.

A branch railroad, 12.2 mi. in length, has been built from Great Northern R.R. at Wiota, Mon., to classification yards constructed at Fort Peck. A steel and con-



Abutment of Main Dam Showing Relation of Four Diversion Tunnels.

crete bridge, constructed at the downstream toe of the dam to dump the gravel toes also carries the railroad across Missouri river. Spurs extend to upstream and downstream tunnel portals and to the upstream toe.

The main purpose of the project is to store up the excess flow of Missouri river during the winter and the usual floods occurring in April, May, June and July, and to release it during the navigation season on the lower Missouri so that an 8 to 9-ft. channel may be assured between Sioux City, Iowa, and Kansas City, Mo. Operation of the dam will afford a means of regulation of flood flows that will appreciably lessen peak discharges throughout the lower Missouri river, resulting in material flood control benefits and lessening of soil erosion along the river banks. It will permit development of 180,000 ac. of potentially irrigable land. A power house with a tentative installation of 50,000 hp. is planned at the lower tunnel portal. This installation can be expanded to 400,000 hp. should future demands require complete development of the available head and the potential storage of Missouri river above the dam. One of the reasons for undertaking the project at this time is to give employment. Over 7,200 men were working at the peak of activity last summer, while 5,000 were employed during the winter.

Diversion Tunnels

Four diversion tunnels will provide for the permanent diversion of the river during and after closure of the dam. These tunnels will be 32 ft. 2 in. diam. in the rock, lined with mass concrete to 28 ft. 8 in. diam. and will later be lined with a 1-in. steel tube imbedded in an average of 6 in. of grout. There will be a 9-in. inner lining of reinforced concrete, making a finished diameter of 26 ft. Various locations for the tunnels were studied by a group of consultants, consisting of: Thaddeus Merriman, New York City; Louis C. Hill, Los Angeles; D. C. Henny, Portland, Ore.; William Gerig, head engineer, Office Chief of Engineers, U. S. Army, Washington, D. C.; and W. J. Mead, professor of geology, Massachusetts Institute of Technology. A passage through the earth dam or the underlying alluvium was considered too hazardous because of leakage. The left abutment consists of Bearpaw shale over-laid with 50 to 100 ft. of glacial till. The right abutment consists of Bearpaw shale, also the top 30 ft. of which is weathered. After considerable study and preliminary drilling, a location around the right abutment was adopted. Portals are located to assure a foundation on firm shale with a minimum of excavation and length of tunnel. The tunnels are 125 ft. apart on centers except where they are spread at the lower end and range in length from 5,379 to 7,254 ft. with a total of 25,268 ft.

The Bearpaw shale lies in a layer about 1,000 ft. thick with a slight regional dip to the east, the material apparently being laid down when this portion of Montana was an arm of the sea. Fossils of shell fish and eel-like fish abound. Pressure has formed a soft, slippery, blue-gray

Tunnel Saw Designed by Sullivan Machinery Co. Especially for Diversion Tunnel Excavation. This Saw Now Cuts a Pilot Tunnel to a Diameter of 16-ft. 4-in. and With an Extension Arm the Saw Will Cut to a Diameter of 32-ft.

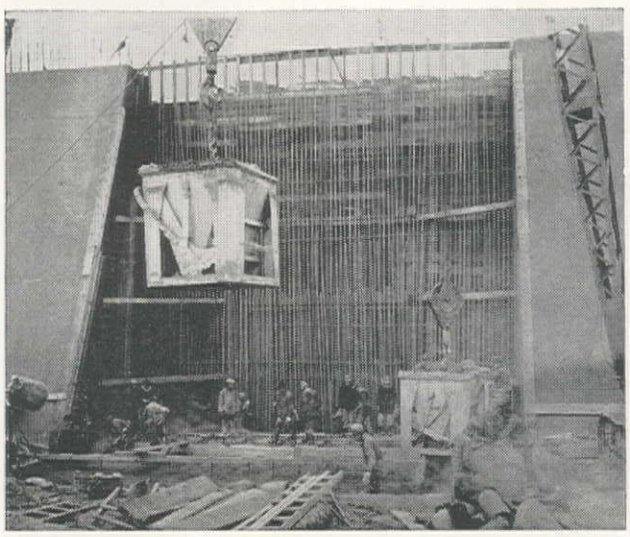
Excavating Through Bearpaw Shale with Air Drills and Chippers for Foundation of Unit Block in Concrete Headwall.

rock of dense, even texture, weighing 140 lb. per cu. ft. Seams of bentonite, ¼ in. to 1.3 ft. thick band the shale at vertical intervals varying from a few inches up to 26 ft. and indicate periodic falls of volcanic ash as the shale was being deposited. Limestone concretions from the size of a pebble to 10 or 15 tons are scattered through the formation. Joint planes and the low coefficient of friction of both shale and bentonite make it necessary to brace vertical cuts.

Below the weathered area, the natural rock contains about 16% moisture. The loss or addition of water in the presence of air immediately deteriorates the shale. If allowed to dry it cracks and falls apart and if wetted it turns to mud. This presents a serious problem in construction. Specifications provide that the final rock surface is to be painted with a sealing solution within 6 hr. of exposure underground and within 3 hr. of exposure on the outside. Concrete must follow final excavation within 14 days outside and 20 days underground. To help preserve the moisture balance in the rock, specifications further provide that the relative humidity in the tunnels must be maintained at 90% or above. As the

average relative humidity in this part of the country is low, water and air sprays are placed at 200-ft. intervals in the tunnels to maintain this required condition. These measures have proved effective in delaying deterioration.

A contract was let, on April 18, 1934, to the Silas Mason Co., Inc., of New York City, and Walsh Construction Co. of Davenport, Ia., for construction of portals, tunnels and shafts, including the lining of the tunnels to 28-ft. 8-in. diam. with concrete and lining of the shafts with steel plate and concrete. This work will require 1,800,000 cu. yd. of open cut excavation; 1,025,000 cu. yd. of tunnel

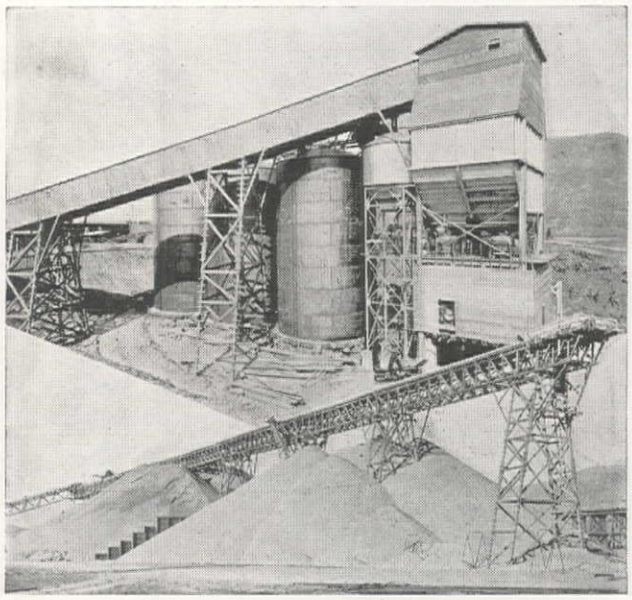


Pouring Concrete in Unit Block of Upstream Portal Headwall. Vertical Keyway Shown at Right.

and shaft excavation; 600,000 cu. yd. of concrete and 18,000 tons of steel. Contracts will be let at a later date for lining the tunnels and installation of control gates and for the power house.

Work was started May 20, 1934. At the present time (March 1, 1935) both portals have been excavated, over 20,000 ft. of pilot tunnel have been completed, 8 pilot shafts have been sunk to grade, and 60,000 cu. yd. of concrete have been poured in the lower portal. Enlargement of the tunnel and shaft has not been started, nor has any concrete at the upper portal been poured.

Both upper and lower portal floors are 30 to 40 ft. below the level of the surrounding valley floor to give access to the tunnels. Tunnel center lines are approximately 208 ft. below maximum pool level. The first operation was the removal of alluvial overburden and shale in and above the portals to permit entrance to tunnel level. The remainder of the alluvial valley floor out to the river will be removed in dredging operations. The open cut was roughed out with a 1-yd. Northwest, two 2-yd. Marion, two 2-yd. Bucyrus-Erie diesel shovels, loading into trucks which moved 1,437,889 cu. yd. in 141 days. Light blasting was necessary in firm shale. Part of the material was trucked to the dump and the remainder was handled by belt conveyor. About 2,800 ft. of 30-in. Barber-Greene conveyor is used at the upper portal and 2,000 ft. of 36-in. Jeffrey conveyor at the lower. Material is first passed through a Jeffery 150 hp. sheep nose toothed coal crusher to reduce it to a size which can be carried by the belt. The conveyor line is built in 500-ft. units with a grade not to exceed 20% and is now completely housed for protection against the elements. On top of the dump, a spreader with belt conveyor boom is used to build out the pile. This unit can advance 50 ft. by telescoping action before it is necessary to install a permanent extension to the conveyor line. The dumps are now about 80 ft. high. These conveyors have given dependable service

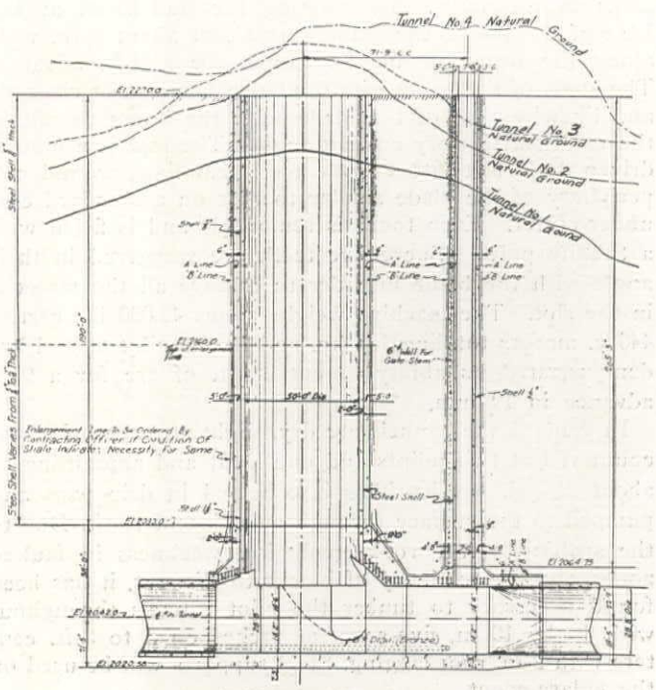


(Upper) Aggregate Storage and Mixing Plant of Mason-Walsh Company at Lower Portals. (Lower) Aggregate Distribution Trestle at Lower Portals. Materials Are Delivered to the Tripper by Means of Belt Conveyor Shown at Left.

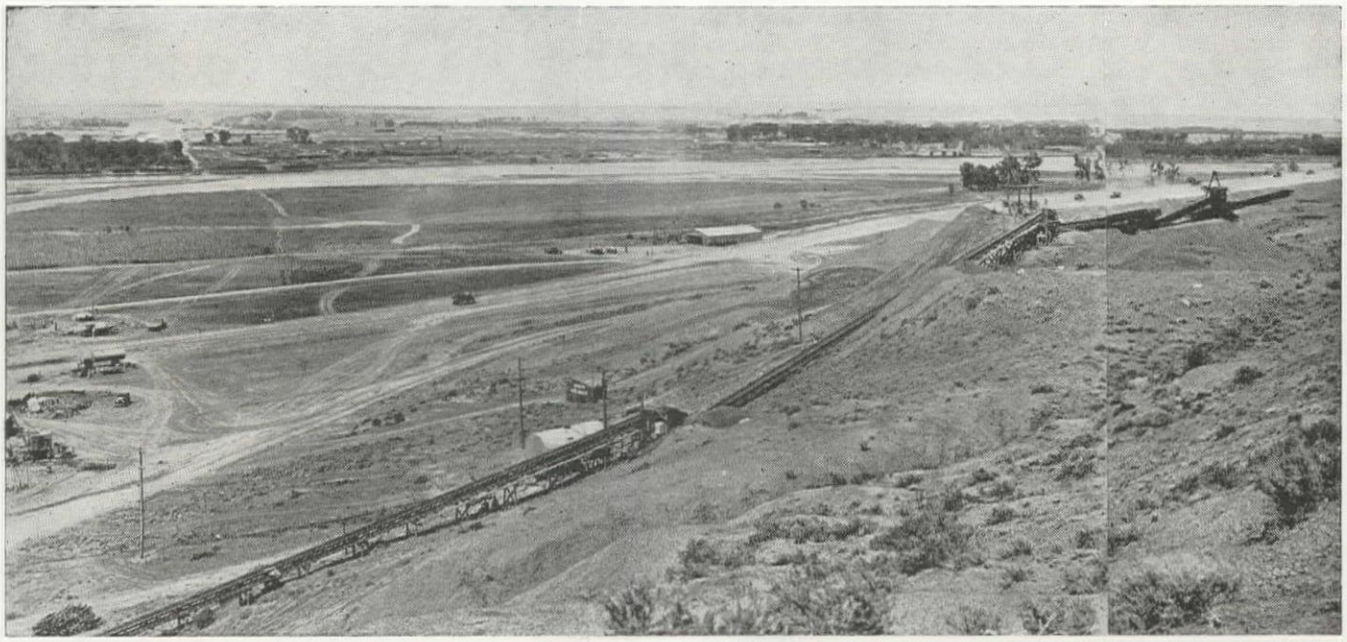
regardless of temperature, weather, or ground conditions.

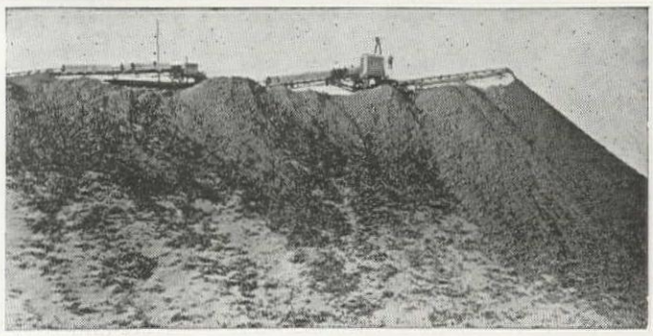
In the portals, final vertical faces are line-drilled with jackhammers or wagon drills before blasting. Pneumatic pavement breakers and chippers are used for final finish on horizontal floors and for loosening rock in confined foundation excavations.

Pilot tunnels are 14 ft. high by 16 ft. wide with arch roof and vertical sides. They are centrally located with respect to the enlargement and are being driven full face from temporary wooden portals at the upper end. An average of forty-two 1-⅞ in. holes per round are hand drilled with four I. R. No. 48 drills, top and center holes being worked from a 'jumbo.' Drill penetration averages 3 f.p.m. using auger type bits and two men per drill. Forty-six pounds of 30% gelatin dynamite, fired with 6 delays, will pull an 8-ft. round giving an average powder factor of 0.95 lb. per cu. yd. Ventilation is furnished by blower fan discharging continuously through 22-in. canvas pipe from the portal to the face. Temper-



LONGITUDINAL SECTION THRU SHAFTS





(Upper) Barber-Greene Belt Conveyor for Disposal of Muck Removed from Downstream Portion of Tunnels. (Right) Stacker End of Barber-Greene Conveyor, Extending 2800 ft. from Lower Portals, Dumping Material in Spoil Bank More Than 80 ft. High.

ature in the tunnel averages 50° F., both summer and winter. There is practically no seepage water.

The heading is excavated with a 75-hp. Conway mucker. This unit feeds a belt conveyor carried on a gantry frame which runs on a wide gauge track. The conveyor carries the material up near the top of the tunnel and back far enough so that a train of five 6-yd. side dump cars can be run underneath the belt and loaded without switching. The front end of the belt conveyor is lifted by an air hoist to permit the passage of equipment to and from the face. Loaded muck trains running on 60 lb. rail set at 3-ft. gauge, are hauled to the portal by combination storage battery and trolley locomotives and are dumped into the hopper of the crusher leading to the conveyor.

A tunnel saw for use on the enlargement from pilot to full size has been developed especially for this job by Sullivan Machinery Co. This machine was tried out in the pilot tunnel, operating from the tracks and with jacks to the walls. By rotating the bull-wheel at the base of the boom, the blade cuts a slot about 4 in. wide along the neat line of the tunnel for a 9-ft. advance. The angle of the boom with the bull-wheel can be changed and likewise that of the blade with the boom to obtain the most satisfactory cutting angle. The saw is a motor-driven link belt fitted with teeth running around the periphery of the blade similar to that on a standard coal under-cutter. Each tooth is removable and is fitted with a Stellite point. Successive teeth are staggered in their angle with the blade in order to remove all the material in the slot. The machine weighs about 42,000 lb., carries 440 v. motors totaling 135 hp. and in the pilot tunnel has demonstrated its ability to cut 26 ft. of arc for a 9-ft. advance in 19 min.

In general, the tunnels are dry, slight seepage being encountered at two points and one shaft and amounting to about 25 gal. per hr. This is collected in drip pans and pumped to the surface through an adjacent shaft. Due to the spalling of the rock, geological weakness in faulted zones, and the tendency of blocks to slip out, it has been found necessary to timber the pilot tunnels throughout with 10 by 10 in, five-segment arches on 3 to 8-ft. centers with 2-in. roof lagging. Steel supports will be used on the enlargement.

Each tunnel will be intercepted near the axis of the dam by a circular shaft having a 60-ft. diam. in the rock. This shaft will later contain ring gates for control of the flow of water from the reservoir. A 33 by 14-ft. rectangular shaft centered 71 ft. 9 in. upstream from the circular shaft, will house an emergency control gate. The shafts are to be lined with 5 ft. of reinforced concrete. A steel liner plate will be embedded in the concrete, varying in thickness from ⅝ to 1-⅛ in. depending on the depth. Pilot shafts, 8 by 8-ft. with smooth wood linings have been driven in the center of each of the 8 shafts and fitted with hoppers at the bottom. The shafts will be enlarged from the top down, muck being bulldozed into the pilot shafts and carried by train from the hoppers to the upstream conveyor. Liner plate units approximately 2 by 9-½ ft., consisting of ⅛-in. plate with angles welded to the edges will be used to support the shale in the 60-ft. circular shaft. These will be backed by vertical wales supported by ring trusses. Corrugated sheets backed by I-beam wales with one cross strut and 8 knee braces will support the rectangular shaft wall. To give an even bearing for the supports, the space between the rock and both liner plates and corrugated sheets will be filled with grout as the shafts are sunk.

Due to the nature of the material, it has been found advisable to construct the lower end of each tunnel by open cut methods. A 30 by 50 ft. concrete headblock, pierced by a hole for the tunnel, has been cast in a shaft about 200 ft. upstream from the lower portal of each tunnel. The portion of the tunnel between the portal and the headblock shaft will be constructed by excavating and bracing successive short sections, casting the tunnel, and back filling.

The lower portal consists of a heavily reinforced concrete headwall 70 ft. high from top of wall to the bot-

tom of the key trench, and 1,000 ft. long, pierced by the tunnel openings at 4 points. The raceway is bounded by side retaining walls, 620 ft. and 870 ft: long respectively, and floored with a 3-ft. reinforced slab of concrete. 153,000 cu. yd. of concrete and 4,145 tons of steel will be required for these structures. Concreting continued throughout the winter with placement in temperatures as low as —10 deg. Forms are protected with paulins on scaffolding and heated with steam coils supplemented by salamanders. Concrete is placed at 50 to 80 deg. F., depending on the outside temperature and the nature of the work, and is cured with Hunt Process concrete curing compound.

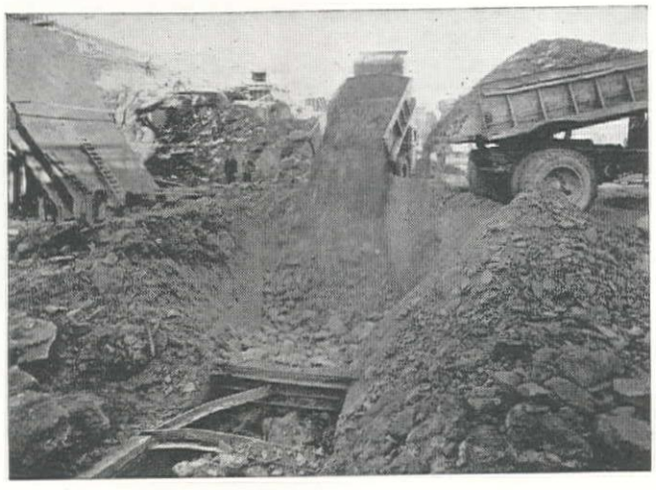
Sand and ¾ and 1½-in. gravel are procured from glacial deposits at Cole, Mont., 60 mi. away and are shipped in bottom dump cars. J. L. Shiely Co. has the supply contract for this material. Due to extreme low temperatures, no aggregate can be shipped in winter time and 130,000 cu. yd. of storage were built up at the lower portal during last fall. Cars are dumped into a Jeffrey belt conveyor of 300 tons per hour capacity, which, by means of an airplane tripper, stacks aggregate in a pile 70 ft. high. Two 9 by 9-ft. tunnels under the pile contain belt conveyors which carry aggregate to hoppers on top of the mixer as needed. Pipe work in the aggregate pile over the draw-off gates permits heating the pile with steam and breaking up any arch which may form.

Cement is of special high iron, high silica, and low alumina content to counteract the effect of sulfates prevalent in this locality. Bulk cement in closed railroad cars is obtained from Ash Grove Lime and Portland Cement Co. at Louisville, Neb., Universal Atlas Cement Co. at Steelton, Minn., and Three Forks Portland Cement Co. at Trident, Mont. It is unloaded by Fuller-Kinyon pumps to three 8,000 bbl. steel silos. A simple movable sheet steel entrance bridge with sides, placed outside the door of the car obviates the usual transverse bulkheading of cars. Silos are drawn off to a screw conveyor from which cement is carried by bucket conveyor to the mixer.

Water is furnished by the government filtration plant on the left bank which obtains its supply from the river. Two pipe lines have been laid under the river from the filtration plant to insure continuous supply to the tunnel operations. The contractor has constructed a 150,000 gal. tank on the hill above the lower portal for emergency needs.

A mixing plant containing three 2-yd. Ransome mixers with room for a fourth is located at the lower portal. Weighing and batching is fully automatic with Blaw-Knox equipment. Concrete for the lower portal work is delivered by truck in 2-yd. Blaw-Knox bottom-dump buckets which are handled by cranes at the forms. A

Trucks Dumping Tunnel Muck Into Hopper of Barber-Greene Conveyor at Lower Portals of Diversion Tunnel.



Disposal End of Jeffrey Belt Conveyor System Extending 2000 ft. from Upper Portal Showing Method of Extending Stacker Unit Over Dump by Mounting Last Section of Belt Conveyor on a Track Carriage.

Pumpcrete unit is now being installed. A smaller mixing plant will soon be erected at the upper portal to serve that structure and the shafts.

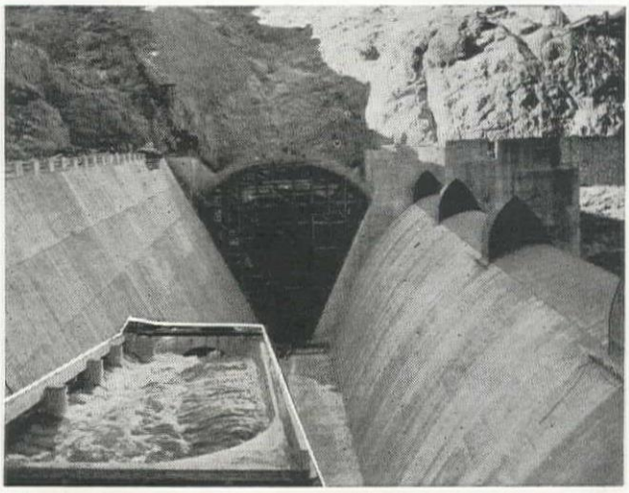
The tunnels will be enlarged from the downstream end and due to the nature of the rock, specifications require the concrete lining to be completed within 20 days after the enlargement and at all times to follow within 340 ft. of the heading. This restricts working space and plans for concrete placement have not yet been fully worked out. The invert will be poured first, followed by the arch and sidewalks combined using Blaw-Knox steel forms. Provision is made for steel water stops in all circumferential and longitudinal construction joints, for grouting throughout behind the lining, and for the placement of concrete collars around the tunnel at intervals to prevent flow along the outside.

During December and January, daily temperatures ranged between + 20 deg. F. and —40 deg. F., with one period of 11 days continuously below zero. Tunnel excavation has progressed without interruption and except for a few days in the most severe weather, outside work has not stopped. An average of 1,000 men are employed in three 8-hr. shifts and a swing shift.

A new world's record for driving tunnels of all sizes in any type rock, with or without supports, was established by the crew in No. 3 tunnel from January 24 to Feberuary 23, 1935, when 1,508 ft. of timbered tunnel was completed in 89 eight-hour shifts, or an average for the month of 16.9 ft. per shift. The four tunnels averaged 1,353 ft. per heading for the same period, or 15.2 ft. per shift. The record day was set by No. 3 on February 23, when the face was advanced 64 ft. All four pilot tunnels have been driven to date without a fatal accident underground. The contractor's tunnel superintendent is E. H. Hatch.

The project is under the supervision of the division engineer in Kansas City, Mo., Col. R. C. Moore, Corps of Engineers. T. B. Larkin, Major, Corps of Engineers, is district engineer in charge locally. Clark Kittrell, Major, Corps of Engineers, is chief of operations. A. W. Pence, Captain, Corps of Engineers, is in charge of the tunnels, assisted by mining engineer O. F. Brinton and engineer George J. F. Carey. W. A. Durkin is general superintendent for the contractor, assisted by Sam Mason III, Ed. Walsh, and Earl Heber. Francis Donaldson and H. M. Buck are the contractor's engineers.

*** Captain Pence was born at Fort Monroe, Va., and was graduated from the U. S. Military Academy at West Point in 1918 and from the Army Engineer School at Fort Humphreys, Va., in 1921. Military duties include 3rd Corps Area Headquarters in Baltimore, the Office Chief of Engineers in Washington, the 14th Engineers (Philippine Scouts) and 4 years in charge of the Engineer R.O.T.C. unit at University of Alabama. He has handled mapping work in the Philippine Islands, and construction work in Baltimore Harbor and at Wilson Dam. For 2 years prior to coming to Fort Peck, he was in charge of the Greenville, Mississippi Area of the Vicksburg U. S. Engineer District engaged on flood control work—The Editor.**



(Insert) Model of Nevada Spillway of Boulder Dam Discharging at Full Capacity of 200,000 c.f.s. Model scale is 1:20. Large illustration Shows the Completed Arizona Spillway with the Diversion Tunnel Portal in Background.

Determining Designs Through Use of Hy-

In the Design of Spillways of All Dams Designed by the U. S. Bureau of Reclamation Model Studies Play an Important Part in Decreasing Costs and Improving Hydraulic Qualities.

By E. W. LANE
Research Engineer
U. S. Bureau of Reclamation, Denver

THE last few years have seen a remarkable growth in the application of the hydraulic laboratory to the design of hydraulic structures. The use of hydraulic models in spillway design has proved so advantageous in decreasing the cost and improving the hydraulic action that it is now applied to the spillways of all dams designed by the U. S. Bureau of Reclamation. In the past 4 yr. it has been used in the design of the spillways of 15 dams and a number of others are in prospect.

Boulder Dam Project

The most extensive experiments were those for Boulder dam on Colorado river. The design worked out and adopted provides for two spillways, one on each side of the river. Each spillway has a capacity of 200,000 c.f.s. and the water will fall nearly 500 ft. under maximum flow. Should these structures ever discharge to capacity, the energy to be dissipated will be 22,700,000 hp., or about seven times that at the falls at Niagara. To safely handle so much potential power required thorough study, and experiments were carried on over a 3-yr. period. Four distinctly different forms of spillway were tested, many of them with a great number of minor changes. The first experiments were upon a model of a glory hole or shaft spillway which was constructed on a scale of 1:60. The experiments showed that it would be very difficult to get the water to flow over the crest of this spillway at equal depths over the entire length, and to obtain smooth conditions of flow down the shaft and through the tunnel. This type was soon abandoned, and various forms of a side channel spillway discharging into an inclined tunnel were tested.

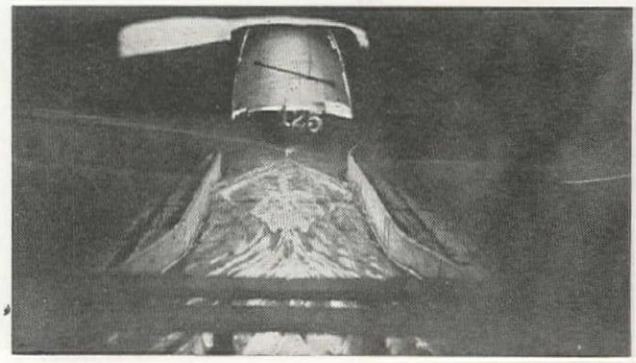
The first model of the side channel type had a free crest representing a length of 700 ft. This was soon replaced by a shorter side channel spillway with a large Stoney gate at the upper end. This was followed by another side channel with drum gates on the crest but no gate at the end. A number of different models of this type on a scale of 1:60 were experimented upon. Simultaneous experiments were carried out on models having a scale of 1:20. To investigate the reliability of model results, similar models on 1:100 scales were also constructed. The comparisons of results showed remarkable agreement of all sizes, and led to considerable confidence in the accuracy. The action of the final design is shown above. In addition to spillway tests, experiments were also made on the penstocks, gate towers, and needle valves of the Boulder Dam project, and extensive studies of the hydraulics of rounded crest weirs were made.

Grand Coulee Dam

The most thorough experiments excepting Boulder dam were those for the design of the Grand Coulee dam on the Columbia river in Washington. This project was planned to be carried out in two stages. The first stage contemplates a dam approximately 300 ft. high, which is later to be increased to about 500 ft. Studies were made for protection at the toe of the low dam. In connection with the initial stage, however, it was planned to build a part of the bucket of the high dam, to serve later as a downstream cofferdam for the construction of the higher dam and it was therefore also necessary to make final designs of the shape of the toe for the high dam.

In the case of the low dam, the fall at assumed maximum flood of 1,000,000 c.f.s. will be reduced to only 99 ft. The depth of tailwater under these conditions will reach more than 100 ft. It was found from tests on a 1:100-scale model that a simple curved bucket of 24-ft. radius at the toe of the low dam, with a lip turned upward at an angle of 48 deg., was sufficient for the protection of this structure. The high dam, however, presented a more difficult problem. Although the tailwater depth will be the same as for the low dam, the drop at maximum flow will be 278 ft. and the total energy dissipation will be 31,700,000 hp. Preliminary experiments on this dam were performed on a 1:184 scale section of the crest representing 4 gates. A section of the crest was constructed on a 1:40 scale and a model of the complete dam and power houses was built on a 1:120 scale. A spillway section on a 1:15 scale was tested at the Montrose, Colo. laboratory. This is shown on page 97.

Model of Preliminary Design of Spillway for Cle Elum Dam Showing Severe Stationary Waves Developed Using a Narrow Throat. Scale Model 1:50.



# of Dam Spillways draulic Models

Experiments on the Grand Coulee dam are still under way and no decision has been reached regarding the final design of this feature, but sufficient progress has been made to justify the conclusion that a satisfactory solution will be worked out.

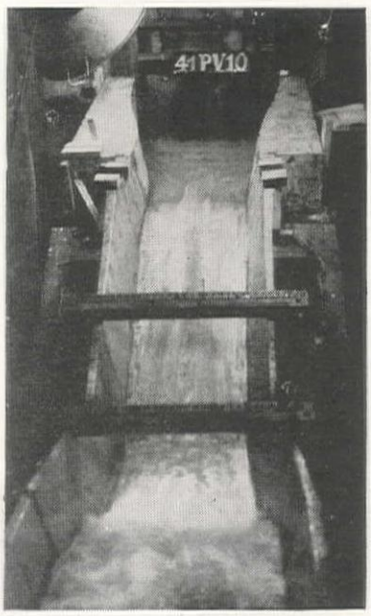
Madden Dam—In connection with the design of the Madden dam on the Chagres river, which will store water for the Panama canal, extensive experiments were carried out for the canal authorities on a 1:72 model, pg. 98. This structure was of the overfall type, 200 ft. high and was designed for a maximum flow of 260,000 c.f.s. As it was founded on a soft rock foundation extensive protection against scour was necessary. The design developed consisted of an apron with a slope of 4.3:1 with a slight upward sloping section at the extreme downstream end. The necessity of obtaining ample security against earthquake shocks made it possible to build this form of apron with little additional expense.

Norris and Wheeler Dams—Model tests of the spillways for the Norris and Wheeler dams now under construction by the Tennessee Valley Authority were also carried out for the Authority. Norris dam is a high overfall dam, somewhat similar to Madden dam. It will provide for a discharge of 240,000 c.f.s., and have a fall of 167 ft. under these conditions. In this case an apron depressed below stream bed level was used. Wheeler dam will be a long, comparatively low structure, and a model of only a short section of it was constructed. In this case a depressed pool was also used with a baffle of unusual form, developed from the tests, being placed at the lower edge of the apron.

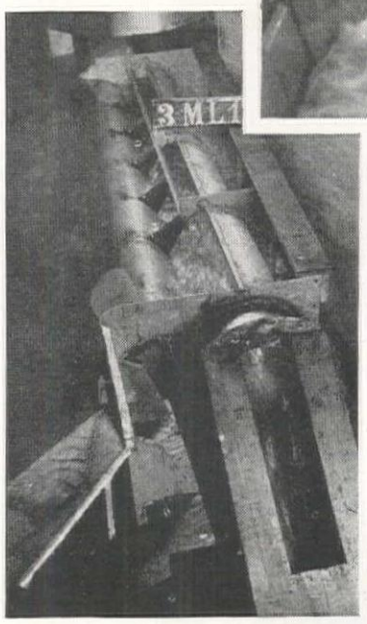
Chute Type Spillways

Six of the spillways investigated were of the chute or trough type. The first one studied, was for Cle Elum dam on Cle Elum river in Washington. It provided for a flow of 40,000 c.f.s. and a fall of about 110 feet. Very thorough studies were made on this spillway, both of the action of the chute and of the stilling basin at the lower end. The preliminary design of the chute developed severe stationary waves, as shown in fig. 5a but by trying out a large number of trough shapes, and by the use of flexible sides, these waves were largely eliminated, as shown below.

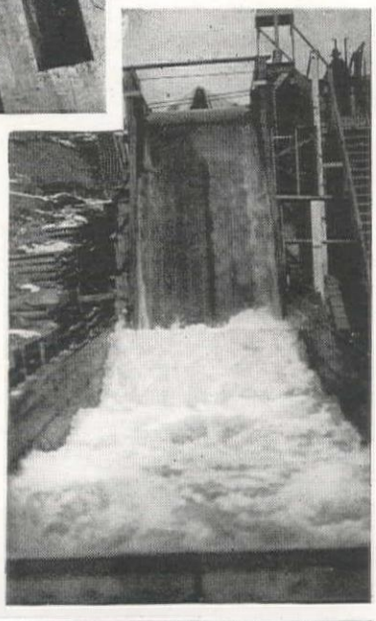
The spillway for Alcova dam on North Platte river in Wyoming provided for a flood of 55,000 c.f.s. with a fall of



Model of Spillway for Pine View Dam of the Ogden River Project, Utah, Showing the Maximum Discharge of 10,000 c.f.s. with a Fall of 53-ft. Scale 1:30.



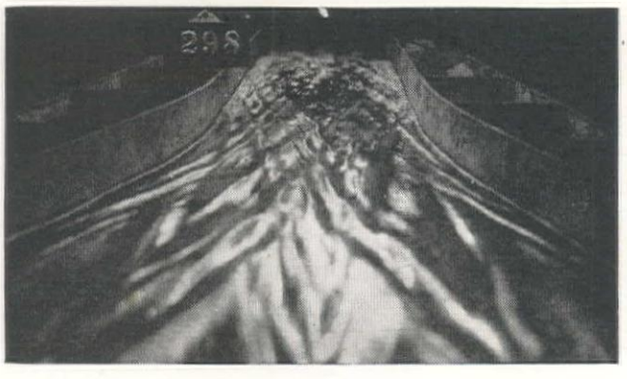
Model of an Unusual Type of Spillway Developed for Moon Lake Dam in Utah. This Consists of a Side Channel Spillway of Circular Cross Section Which Discharges Into the Inclined Tunnel in Foreground. Scale 1:40.

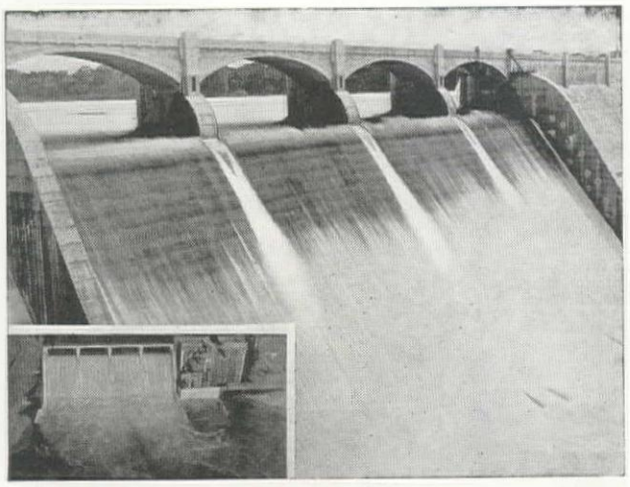


Model of Grand Coulee High Dam Under Assumed Maximum Flood of 1,000,000 c.f.s. and a Drop of 278-ft. The Model Represents 150 ft. of Spillway and Is Built to a Scale of 1:15.

Model of Spillway for Rye Patch Dam on Humboldt River in Nevada Providing for a Discharge of 20,000 c.f.s. with a Fall of 38 ft. Scale 1:50.

Model of Final Design of Cle Elum Spillway Showing Elimination of Unsatisfactory Wave Action by New Design of Throat.





View of Spillway of Madden Dam Located on Chagres River Near Panama Showing Flood Occurring in December, 1934. (Insert) Model of Madden Dam Spillway Operating at Maximum Capacity of 260,000 c.f.s. Note Similarity of Action.

146 ft. Below the control gates at the top of the spillway there was a gradually expanding channel with a stilling pool at the lower end. There was a step down in the floor at the entrance to the pool, as the experiments showed that this caused an action in the water which assisted in the dissipation of energy of the water. At the down stream edge of the apron a Rehbock dentated sill was used.

The spillway for Rye Patch dam on Humbolt river in Nevada provided for a discharge of 20,000 c.f.s. with a fall of 38 ft. This one was the simplest spillway experimented upon, and consisted only of a trough of uniform width, the approach channel, spillway, and discharge channel back to the river being all in a straight line. A great many forms of the sill at the lower end of the stilling pool were experimented upon and also of steps at the upper end of the pool. The pool was shaped much like that of Cle Elum and Alcova dams.

The spillway for Pine View dam on the Ogden river in Utah was designed for a discharge of 10,000 c.f.s. with a fall of 53 ft. This spillway was developed to have two stilling pools, the first, a small one, just below the control gates and the second at the bottom of the chute. The one below the control gates served to dissipate the energy of the water flowing underneath the gates and to enable a transition to be made between the wider section required for the gates and the narrower one which it was possible to use in the chute section which would not produce undesirable wave action. The main stilling pool at the bottom of the chute is of relatively simple design, the junction of the incoming sloping bottom and the bottom of the pool being made by a simple curve without a step. There is a slight expansion of the channel as it enters the pool but the sides of the pool are parallel. At the downstream end of the pool a modified form of the Rehbock sill has been used.

The spillway of Agency Valley dam (fig. 9) on Malheur river in Oregon was somewhat simliar to that of Pine View dam, in having the stilling pool just below the control gates at the head of the chute, and the step in the floor at the entrance to the spillway. A sill of triangular cross section with upward sloping face was located at the downstream edge of the stilling pool. This spillway provided for a discharge of 12,000 c.f.s. and a fall of 73 ft.

The spillway for Hyrum dam located near Hyrum, Utah was designed for a discharge of 6,000 c.f.s. with a drop of 90 ft. It consisted of a long narrow chute controlled by 3 radial gates. Below the gates was a transition section followed by a 770-ft. chute leading into a trapezoidal pool, beyond which the bottom sloped upward on a 1½:1 slope to a junction with the channel leading back to the river.

Shaft or Glory Hole Spillways

Two models of spillways of the shaft or glory hole type were tested in addition to the one for Boulder dam. One of these was for the Owyhee dam recently completed on the Owyhee river in Oregon. In this spillway the glory hole discharges into a vertical shaft which is directly above the horizontal tunnel used for diversion of the river during the construction of the dam. The maximum discharge provided for in this spillway is 30,000 c.f.s. and the total fall is 300 ft. The model was constructed on a scale of 1:48.

The second spillway of the shaft type was for Seminoe dam, on the North Platte river in Wyoming, and was designed for a maximum discharge of 50,000 c.f.s. and a fall of 210 ft. This spillway differed in design from that of the Owyhee dam in that the shaft did not extend vertically for the entire drop, but turned to a 45 deg. inclined shaft just below the glory hole intake, and joined at a 45 deg. angle the outlet tunnel, which was also used as the construction by-pass. The model was constructed on a 1:60 scale.

Unusual Spillway Types

One of the most unusual types of spillway developed was that at Moon Lake dam in Utah. This consisted of a side channel spillway of circular cross-section, set in the side of a hill in a tunnel. The water discharged into the tunnel from the reservoir, through openings in the side of the hill (pg. 97). The side channel discharged into an inclined tunnel, similar to that at the Boulder dam, which in turn discharged into the construction by-pass tunnel. The ordinary form of side channel spillway at this site would have required a very deep cut, on account of unstable nature of the shale and flat side slopes.

Another unusual form of spillway was that developed for the Seminoe dam. As it was both cheaper and better from the hydraulic standpoint than the shaft spillway previously described, it was adopted. This spillway was

The Use of X-Rays in Defects in Welding and

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MOST of the tests of construction materials sanctioned by codes and usage, are destructive in nature. In tensile, bend, impact, and compression tests which determine the physical properties and potential usefulness of materials which are believed to be of uniform structure and quality, the part or sample tested is not that which is used in the finished product.

Further tests of non-destructive nature are required if exact information is needed where materials have been submitted to processes and fabrication methods which may effect the uniform structure and quality, not only at the time of manufacture, but also after long periods of use. For ferrous (iron) metals, the use of touch, sound, surface visual inspection, and magnetic fields or photographic processes by means of X-rays or gamma rays are necessary to furnish needed information concerning the prop-

designed for a maximum discharge of 50,000 c.f.s. with a fall of 180 ft. The design consisted of 3 gate openings in the side of the hill, discharging into an inclined tunnel which lead directly to the costruction by-pass tunnel. The topography at this site was such that the gates, inclined tunnel, and construction by-pass tunnel were all in the same straight line, so that the water passed through without a change in horizontal direction.

Imperial Dam and Sluices—Experiments were also carried on for the design of Imperial intake dam on Colorado river at the heading of the All-American canal which leads to Imperial valley. This dam will be about 30 ft. high and 1,400 ft. long. As it will be founded on extremely fine sand, it was necessary to make a careful study to prevent erosion by water passing over the dam and through the sluice gates. Below the spillway section a depressed pool with sloping entrance was developed, similar to that for Norris dam. At the lower end of the apron was an unusual form of sill, developed as a result of tests on a great variety of shapes.

In addition to the foregoing spillways, tests will be conducted on Island Park, Caballo, and Taylor Park dams.

Acknowledgements—Models of Cle Elum, Wheeler, Norris, and Owyhee dams were tested at the hydraulic laboratory of Colorado Agricultural Experiment Station, at Fort Collins, as were also a large part of tests for Boulder and Grand Coulee dams. The Experimental Station, and employees of the U. S. Bureau of Agricultural Engineering stationed there, cooperated in doing this work. The remainder of the experiments were carried out at the Bureau's laboratories at Montrose and in Denver. Tests of all of these models were conducted by the hydraulic research section of the Bureau's engineering staff, under the direction of the author. All designs and investigations of the Bureau of Reclamation are under the direction of J. L. Savage, chief designing engineer. All engineering and construction work is under the general direction of R. F. Walter, chief engineer, with headquarters at Denver, and all activities of the Bureau of Reclamation are under the direction of Elwood Mead, commissioner, Washington, D. C.

Detecting Riveting

erties of the parts under question, as a necessary check on the original material after processing.

In the case of castings and welds, the X-ray and gamma ray pictures appear to furnish the best means of determining, without destruction, the internal condition of the metal. These pictures are shadow pictures cast on photographic film due to the fact that X-rays and the more penetrating gamma rays are stopped by thicker parts and more dense materials more readily than by those which are thinner and less dense. Accordingly, a thin section of the penetrated substance will be indicated by a heavy blackening of the film placed behind it as compared to the film density shown by a thicker section. The films are, therefore, negatives from which positive prints may be taken, if desired, with some loss of detail.

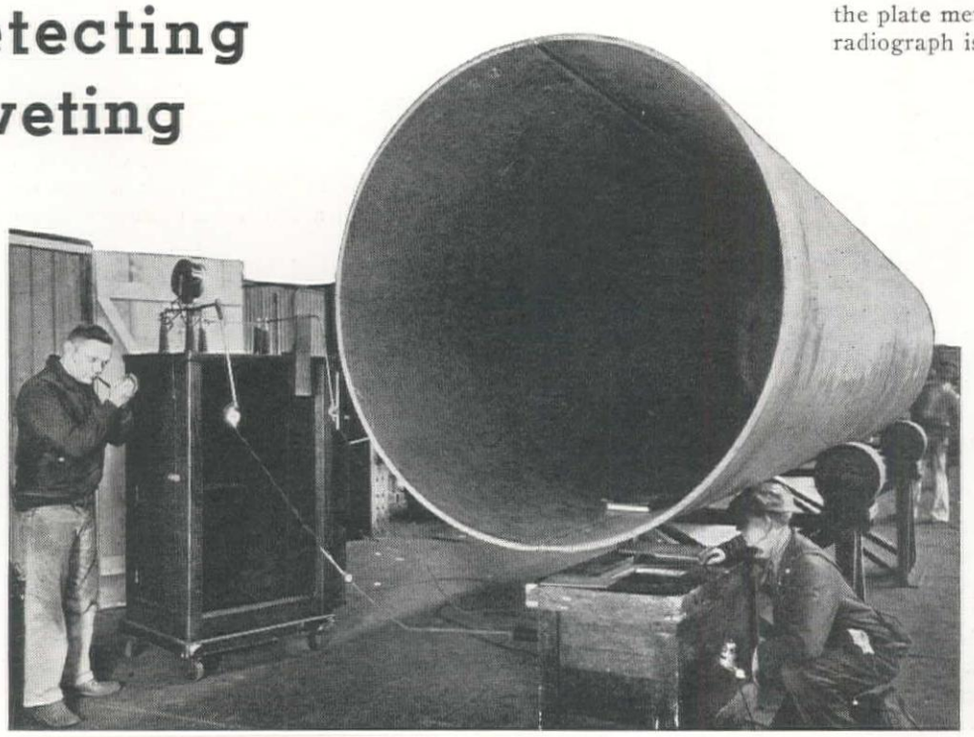
For castings these shadow pictures indicate the location, shape, and size of blow-holes, cracks, hot and cold tears, and nonmetallic inclusions. Where strength is necessary as in gear blanks, it often pays to reject the casting before defects are brought to light after a part of the machining operation is completed. For welds this process indicates the more serious of the characteristic defects: namely, lack of fusion, undercutting, gas and slag pockets and inclusions, cracks, and unfilled chipping tool scores.

Cracks at right angles to the direction of the rays cause so little difference in thickness that they are not brought out. However, recent practice has determined that if the direction of the crack is within 24 deg. of the direction of the ray on any side, it will register on the film.

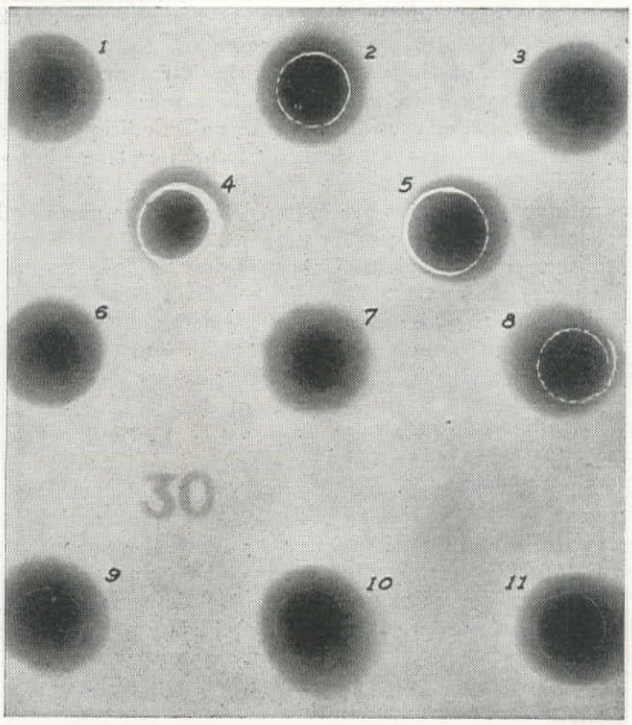
X-rays are useful up to 3 or 3½ in. of steel or iron and perhaps 15 in. of aluminum. Beyond that thickness the X-ray is not of as much practical value as the gamma ray from radium or its emanation. The latter may be used on steel up to, perhaps, a 12-in. thickness. The exposure time for gamma ray pictures is much longer than for X-ray pictures, requiring days for thick sections of metal. The gamma ray pictures are, as a rule, flatter in tone and show less contrast than the X-ray radiographs. Use of the gamma ray is not recommended for thicknesses of metal under 3 in. and the use of X-ray should be limited to a thickness of 3½-in. steel or brass.

In considering welds the thickness here referred to includes the welding bead as well as the plate metal. If the bead is left on when the radiograph is taken, at least a part of the detail in the radiograph is obscured by flow lines of the bead. Where close and accurate examination is desired, it is recommended that the bead be ground flush with the plate. This is especially desirable when sample plates are being radiographed for the purpose of qualifying welders, developing new technique, or testing new welding rods and equipment.

When the bead is left on, a very accurate gage of the thickness of imperfections is shown on the film by means of a strip of steel, called a penetrameter, of about the thickness of the height of the average bead, having slots of graduated depth milled in it varying from 0.007 to 0.078



Set-up of Equipment for X-raying a Welded Seam. The Film Is Placed Inside the Vessel on the Welded Portion and the X-ray Tube Is Placed in a Lead-Lined Box Under the Vessel.



A Portion of an X-ray Film Showing 3 Riveted Steel Plates. The Figure 30 Indicated in Light Letters Is the Identification Number. The Film Indicates the Following Conditions for Each Rivet: (1) Off-set Head, (2) Cold Driven, (3) Satisfactory, (4) Loose and Improperly Driven, (5) Rivet Too Long, (6) Satisfactory, (7) Satisfactory, (8) Loose and Poorly Driven, (9) Off-set Head, (10) Off-set Head, (11) Off-set Head. A Faint Ring Appears on Several of the Rivets Indicating a Film or Scale Around the Rivet.

in. By radiographing the penetrameter alongside the bed, the different film densities corresponding to the various depths of the slots compared to the densities shown by imperfections in the weld, furnish an accurate index of their depth. Although all codes do not require it, the shadow picture of the penetrameter should appear on each film, as it aids considerably in the interpretation of the picture. It is customary to number the radiographs serially by placing a lead number marker on the work, which shows on the radiograph. The work is then stamped at the location of the lead number. The developed film may be laid over the identical spot on the work and show exactly where any imperfections occur.

Briefly, X-rays are generated when high potential current drives a cathode stream against a metal anode target in a vacuum. If the cathode is a heated filament, the effect is increased. As the impressed voltage increases across the gap between the cathode and anode, the X-ray wav length decreases and the penetration becomes greater. For 2-in. penetration of steel, a voltage of about 180,000 v. is required. The current used is extremely small and the necessary high voltage is obtained by transforming 220 volt A. C. and then rectifying the current.

The X-rays are given off in all directions from the surface of the target and their intensity falls off in proportion to the square of the distance. This makes distance a very important factor for use as a protection against the harmful physical effects of the rays.

The danger of working with X-rays and gamma rays lies in the burning effect on the skin by both the rays themselves and their secondaries, or in the effect which the rays themselves and their secondaries, have on the blood, glands, and the breaking down of internal tissue. Protection against these dangers is best effected by extensive use of lead shielding and keeping at a respectful distance from the source of the rays.

All substances are not penetrated to an equal degree by the rays, the atomic number being an index of the stopping power of a substance. Lead, gold, molybdenum, and similar high atomic number elements are hard to penetrate with rays ordinarily used. Lead, for the sake of cheapness, is used as a shield to limit the direction of the beam and for the protection of the operator. Secondary rays are generated when X-rays strike hard substances. These secondaries are of comparatively long wave length with little penetrating power.

In contrast to the X-rays, gamma rays require no electrical power for their generation. They are given off spontaneously by radium, uranium, and several other elements, some of which continue their output of rays for centuries. The gamma ray wave length is very short, corresponding roughly to that of X-rays generated under a potential of one million or more volts. Consequently the penetrating power is high and the gamma rays may be used for radiographing thick sections of material.

High cost of radium and subsequent high rental fees, together with the long exposure time for taking the pictures, make the expense of taking gamma radiographs a serious drawback. This is to some extent offset by the fact that the rays are emitted in all directions equally from the source so that where radium can be placed in the center of an object or group of objects, a large number of films can be exposed at the same time.

The insulation of high potential leads is a common matter of electrical practice, but the necessity for dryness is most forcibly brought to the attention of anyone who attempts X-ray operations in a fog in the Pacific coast region, using anywhere from 130,000 to 250,000 v. The

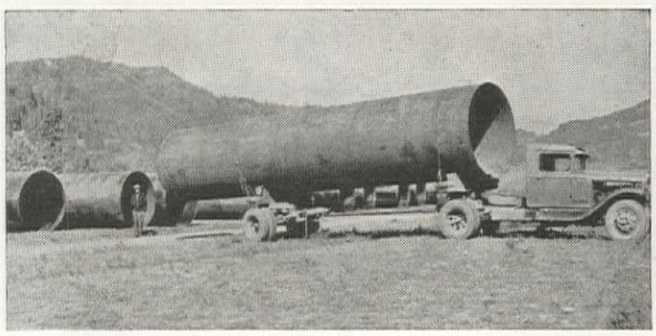
New Pipe Inlet Com Irrigation Reservoir

By G. H. GARRETT
Vice-President and Chief Engineer Thompson Manufacturing Company

THE largest irrigation construction project to be completed in Colorado in recent years was the reconstruction of the inlet to Santa Maria reservoir, which was completed in the late fall of 1934. The work was made possible through execution of a PWA loan amounting to approximately $300,000.

Santa Maria reservoir, located about 30 mi. west of Creede, Colo., near headwaters of the Rio Grande, was

A 35-ft. Pipe Section Transported 30 mi. Over Mountain Roads from Creede to Site of Installation.



resultant fireworks are interesting but not recommended for high priced equipment.

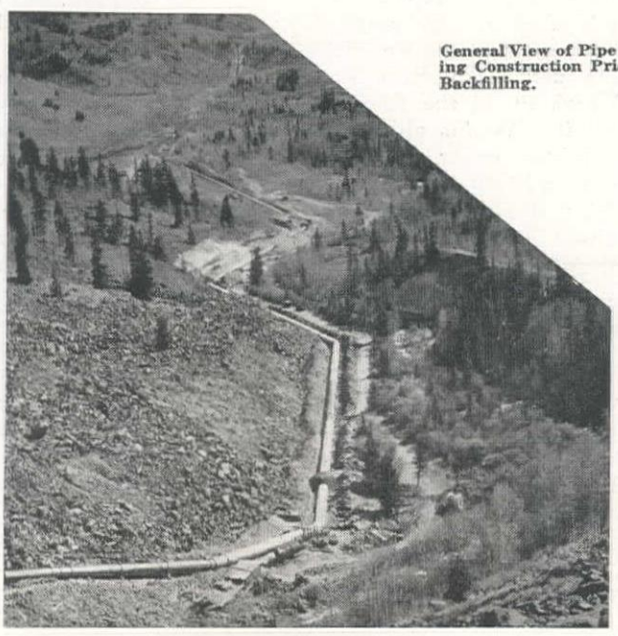
The many and varied causes of welding defects such as porous or damp rod coating, spreading a welding pass across too wide a vee, employing a single rather than a double pass along the seam, and failure to fill the bottom of a sharp-angle vee, all show characteristic markings on the radiograph.

Code standards for aid in interpreting radiographs are usually in the form of pictures of radiographs indicating passable, acceptable and not acceptable welds. These are not of great assistance to an inexperienced inspector in determining borderline cases, what welds to reject and what to pass, since much detail is lost in reproduction from the radiographic film. In some codes, the number per inch and size of gas pockets and inclusions are given as a standard, and this is somewhat more satisfactory. However, only experience and knowledge of the intended use of the finished product can decide whether or not cracks are apt to develop along a line of indicated inclusions. Nearly all codes specify the quantitative determination of the size of defects with a thickness equal to and greater than two per cent of the base metal.

In any case it is a safe rule to reject any part of a seam in which the radiograph shows a dark line in the middle of a weld or at either side of the bead, as a dangerous lack of fusion is indicated. In Class I welding any part of the seam which shows defects below the code standard must be cut out and rewelded regardless of the condition on either side of the bad part, as cracks, once started, have a tendency to spread.

pleted For Colorado

The Installation of a New 84-in. Welded Still Pipe Inlet to Santa Maria Reservoir Provides Supplemental Supply for Irrigation in San Luis Valley Near Monta Vista, Colorado.



General View of Pipe During Construction Prior to Backfilling.

built in 1912. It has a storage capacity of 40,000 ac. ft. and is used for storing water for irrigation. The intake to this reservoir as originally constructed, consisted of 8,100 ft. of 48-in. diam. pipe, approximately 2 mi. of canal, and the same amount of stream bed. Diversion is made from North Clear creek, a tributary to the Rio Grande, the diversion dam spillway being at elev. 9,785 ft. The drainage area above the point of diversion amounts to 90 sq. mi. Reservoir water released during the irrigation season is carried by Willow creek and the Rio Grande, a distance of 75 mi. to Del Norte where it is diverted for irrigation at the main diversion dam of the irrigation company. This reservoir water is used as a supplemental supply to the direct flow rights to irrigate 110,000 ac. in the San Luis valley near Monte Vista.

On account of other prior storage and direct flow rights during the irrigation season in the lower part of the valley, the period for storing water is very short. The runoff peak usually occurs in May, and lasts only from one to two weeks. During this peak in wet years, there is available for storage in Clear creek at the point of diversion 600 to 700 c.f.s of water. The system as originally constructed could divert less than half this amount of water with the result that several thousand acre feet of needed water was lost annually. The intake as reconstructed has a capacity to divert 618 c.f.s.

In redesigning the project, the enlargement of the existing canal required the most careful study. The velocity in the new and enlarged canal, if placed on the same grade as the old canal, would be high enough to cause erosion. In the design of the new canal the velocity was reduced to a safe point by flattening the grade and taking up the excess elevation by a series of drops. A concrete box about 3 ft. square, used to convey the small amount of water available for storage in winter, and prevent it from freezing, was not disturbed in the new design and construction. This box was below the grade of the canal.

The concrete diversion and intake structure which was located in a slide rock canyon was the most tedious structure to build for its size on the project. All materials had to be hauled in track cars a distance of about 1,000 ft. up a steep grade with the aid of a tractor-winch and cable. Cut-off walls for the diversion dam were placed 6 ft. below the stream bed into slide rock and stream deposited debris which provided a satisfactory seal at this depth. Two 10 by 10-ft. radial gates were installed in the diversion dam to pass the stream and 3 vortex tubes for automatically removing rocks, silt, and other rolling debris were placed across the floor of the pipe intake structure.

The new pipe line as constructed is 84 in. diam. and 8,108 ft. long, of welded construction. At the intake end of the line, 703 ft. of pipe, made of ¼-in. plate, was supported on concrete piers with stiffener rings and rollers. It was impossible to bury this portion of the line

(Lower) Pipe Laying Operations Showing Bucyrus-Erie 1¾-yd. Shovel Holding Pipe in Inclined Position Until Upper Side Has Been "Tacked" On Top with Electric Welder.

because of slide rock conditions, but the balance of the line was buried with a minimum cover of 3 ft. Of the buried pipe, 4,561 ft. was made of 5/16 in. plate and 2,844 ft. was fabricated from ⅜-in. plate. Expansion joints were provided at the intake and outlet and for the exposed pipe on rollers.

The pipe was manufactured in Denver by Thompson Manufacturing Co. from plates, 84 in. wide which were rolled into cylinders having one longitudinal seam. In general, 5 of these cylinders were welded together to form pipe lengths of 35 ft. In the process of rolling the plates into cylinders, the curvature was made continuous from the edge so that the usual flat spots near the seam were entirely eliminated. Longitudinal seams of these cylinders were tacked manually at intervals of about one foot and were then welded both inside and outside by a Lincoln automatic tractor type welder which was self propelled along the seam. The length of arc was automatically controlled and the bead formed by the last pass of the automatic welder penetrated the bead previously placed. The flux and wire feed and speed of travel of the machine were all motor controlled and constant for each setting of the rheostats.

For both longitudinal and girth seams the edges of the plates were square so that when placed together a tight butt joint was obtained. The automatic welder melted these edges together, fluxed the metal, and added the proper amount of metal to make a finished bead which was slightly higher than the surface of the pipe. With the automatic welder as well as with manual welding, the materials and equipment used on this job were such as would exclude the atmosphere from proximity of the weld. This produced good grained structure seams which were very ductile with a greater tensile strength and more resistant to corrosion than the parent metal.

All welding was required to conform to paragraph U-69, covering class 2 welding, of the current 'Rules for Construction of Unfired Pressure Vessels of the ASTM Boiler Construction Code.' All welders were 'certified' under the rules of the Code by inspectors representing the engineer for the Reservoir Company.

For every third length of pipe, test samples were obtained by welding two small plates to the end of a pipe cylinder. The seam of these two plates was a continuation of the longitudinal seam and was welded in exactly the same manner as was the seam of the pipe and at the same time. In preparing the specimens they were made to break in the weld, thus giving the tensile strength of the weld metal itself and also showing the grain structure. Some of these tensile specimens tested as high as 80,000 lb. per sq. in. and all were higher than the tensile strength of the parent metal.

After longitudinal seams were welded, the cylinders were assembled in the girth-seam tacking pit and tacked into standard pipe lengths. They were then rolled into the rotating machine which turned the pipe at the proper speed under the Lincoln automatic welder for welding the outside girth seams. As the pipe was rotated and before the girth seam was automatically welded, it was backed up manually on the inside using 'Fleetwood' rod. The weld made by the automatic welder penetrated the bead laid down manually. Girth seams on elbows were all manually welded.

Every length of pipe was hydrostatically tested to at least twice its working pressure indicating that the test pressure for the ⅜ in. plate pipe was 186 lb. per sq. in. In testing the entire 8,108 ft. of pipe, only two small sweats were observed. Four large screws tied together the stationery head and movable head on which was mounted a 6-in. centrifugal pump for filling the pipe, a pressure pump, an electric motor for operating the pumps and the head, and necessary piping. It required 12,000 gal. of water to fill each of the 35-ft. pipe sections, the water being reclaimed in a 15,000-gal. concrete tank under the testing machine.

Each finished and tested length of pipe was cleaned of all loose mill scale, welding flux, or other foreign material, and was sprayed inside and outside with a coal tar pitch base primer, before shipping to Creede, 320 mi. from Denver. From Creede the pipe was hauled 30 mi. by truck and unloaded by winch truck and two timber skids in a central paint yard adjacent to the pipe trench. Each length of ⅜ in. pipe weighed 6 tons, a heavy truck load for mountain roads especially in wet weather.

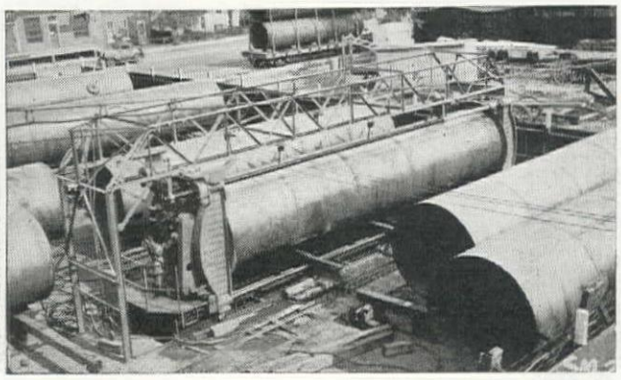
A 35-ft. Span Over Willow Creek Showing Anchor and Pipe Support.

The installation site was 30 mi. from the nearest town and high up in the Rockies, the elevation being nearly 10,000 ft. At this altitude it rains nearly every day of the short summer season and this was a considerable hindrance in this work.

The first field operation was that of coating the pipe, specifications requiring a coat of coal tar pitch base primer inside and outside followed by a coat of coal tar pitch base paint inside and a coat of coal tar pitch base enamel outside. The primer and the paint were sprayed on and the enamel was applied hot to a thickness of at least 1/32 in. with swabs. All surfaces had to be thoroughly dry before either the primer, paint or enamel could be applied, and rain caused considerable lost time in this operation.

After the pipe was coated in the paint yard it was reloaded with the winch truck and timber skids and taken to the side of its installation. On account of the extremely brittle nature of the enamel a great amount of care had to be exercised in handling the enameled pipe. Skids and bolsters were covered with rubber belts and

Testing a 35-ft. Pipe Section at a Pressure of 186 lb. per sq. in. in the Fabrication Plant at Denver.



Intake Structure on Clear Creek Showing 10 by 10-ft Radial Gate, the Right One Being Partially Open.

cables used for handling pipe into the trench were incased in rubber hoses. Leather belts were placed around the pipe for the rubber encased cables to rest on.

A Bucyrus-Erie 1-¼ yd. shovel which was used to excavate the pipe trench was also used to lay the pipe. The pipe was lowered into the trench and held in an inclined position until the pipe was tacked on top with a bead about a foot long. The pipe was then gradually lowered while the joint was worked together with pieces of automobile springs. The pipe was then thoroughly tacked all around before the next length was added.

Bell and spigot field joints which lapped 2 in. and were welded inside and outside with a 45 deg. fillet weld, using 'Fleetwood' 3/16 in. V rods. This grade of rod is designed particularly for overhead welding, but it gave excellent results for all positions. Three passes inside and outside were required for the ⅜ in. field seams and two passes each side for the 5/16-in. and ¼-in. seams. The beads were thoroughly cleaned after each pass and before the next bead was laid down.

Four Lincoln gasoline engine driven 300-amp. generators equipped with 300-ft. welding cables, were used for field welding, working two shifts per day. At the intake end of the line, however, it was necessary to weld 800 ft. from the generator. The line loss with this condition was, of course, quite high but no great difficulty was experienced. Pipe couplings, 1-¼ in. diam., were welded into the top of the pipe at 300-ft. intervals so that welding cables could be passed through to the inside of the pipe. In general, pipe exteriors were welded on the day shift and interiors on the night shift. Each side required about the same length of time to weld. Bell holes 3 ft. wide and 2 ft. deep were dug at each joint for welding underneath the pipe. These were dry except for about 1,000 ft. where a stream of water flowed under the pipe delaying progress considerably. One side of the pipe trench was lowered sufficiently to carry this underground stream away from under the pipe and in addition bell holes had to be bailed continuously.

After field seams were welded inside and outside, oxygen was released at a pressure of 100 lb. per sq. in. into the space between the two welds. The outer shell on each belled end was tapped with an ⅛-in. pipe tap at the factory before shipping through which the oxygen was admitted. Both the outside and the inside beads were painted with soap suds while the oxygen pressure was maintained and the slightest pin hole could be detected from the bubbles. Oxygen was used instead of compressed air due to its availability and only a few cubic feet were required to test the entire line.

Backfilling and tamping was done by hand up to the spring line, above which it was done with a caterpillar bulldozer. In the backfilling operations, either by hand or machine, rocks were not allowed to fall or be placed against the pipe.

Field testing consisted of welding a dished head into the pipe at the outlet and filling the pipe with water. This test subjected most of the pipe to pressure of approximately 100 lb. per sq. in. This test lasted 24 hr., during which time the water surface in the intake to the pipe was marked and observations made. The test showed no leakage in the 9 mi. of shop and field welded seams.

Construction of the canal, intake structure, pipe anchors and piers, trench excavation and backfill, and other structures was separate for the pipe contract and was let to E. H. Honnen Construction Co. of Colorado Springs.

Engineering personnel for the project included: R. J. Tipton, consulting engineer, who prepared plans and specification and was in charge of the work for Santa Maria Reservoir Co.; E. H. Carter, resident engineer; Percy J. Richards, soil chemist and coating engineer; and John E. Field, PWA resident engineer inspector. The writer was in charge of factory and field operations for Thompson Manufacturing Co.

Additional Reservoir Planned for New Mexico Irrigation Project

TENTATIVE plans have been made by Carlsbad Irrigation District in New Mexico to construct an additional reservoir on Pecos river near Fort Sumner, New Mexico. This project was originally built by private capital in 1890 and operated as a private company until 1905 when it was taken over by the U. S. Reclamation Service and operated by reclamation personnel since that time. The water right owners of the district are all members of the Carlsbad Irrigation District which represents the water users in all their dealings with the government. The contract now existing between the district and the Bureau provides that complete charge of operations of the project will pass to the district, January 1, 1938. The project has one of the best repayment records among all the propects financed by the Bureau of Reclamation and the government will have very little equity in the project by the time it is turned over to the district.

The present irrigation plant consists mainly of two storage reservoirs, one of which is also used as a diversion plant, and about 45 mi. of main canals. The effective storage capacity in the two reservoirs now amounts to about 45,000 ac. ft. and provides irrigation for 25,000 ac. now under cultivation. During the summer months it has been necessary to depend on the flow of Pecos river to mature crops. The project has a water right vested in the United States government to divert annually 300,000 ac. ft. The small reservoir capacity has accounted for several severe water shortages during the past few years, the most injurious being that of the summer of 1934 when a loss estimated at $500,000 was incurred.

Tentative plans provide for building another reservoir on Pecos river about 170 mi. north of the present project and to line with concrete several miles of canals and laterals. The work is expected to be constructed by PWA funds allotted to the Bureau of Reclamation. The additional reservoir will have a capacity of at least 70,000 ac. ft. of effective storage which will provide sufficient water for the project for the acreage now developed. The dam will be an earth-fill provided with tunnel spillways which will also be used for diversion during construction. The project is estimated to cost about $2,225,000. From records of the Carlsbad Irrigation District the 1933 average production per acre in cultivation on this project was slightly over $50.

On the Western

1—Widening a Forest Service road in San Diego county, Calif., with an Adams No. 22 power-controlled grader drawn by a Cletrac '55' tractor.

2—Downstream gravel toe of $75,000,000 Fort Peck hydraulic-fill Dam. The aggregate and concrete mixing plant for diversion tunnel lining is located in background on left.

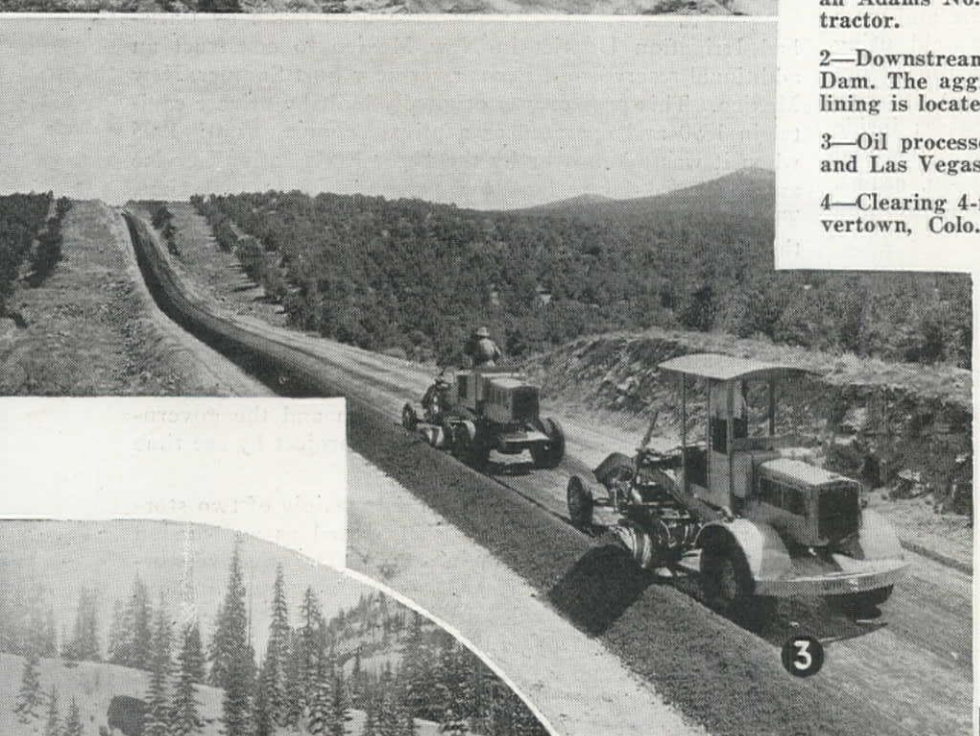
3—Oil processed road surface under construction between Santa Fe and Las Vegas, N. M., with Caterpillar auto patrols.

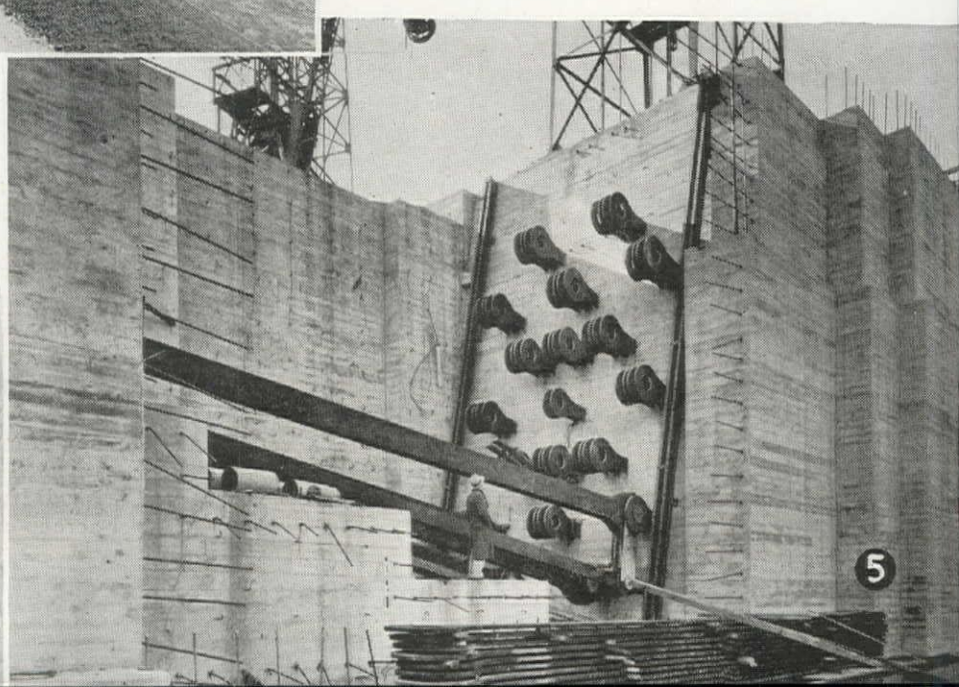
4—Clearing 4-ft. deep snow from highway between Durango and Silvertown, Colo., with a Caterpillar Diesel tractor and Snow Blade. The elevation at this point is about 11,000 ft.

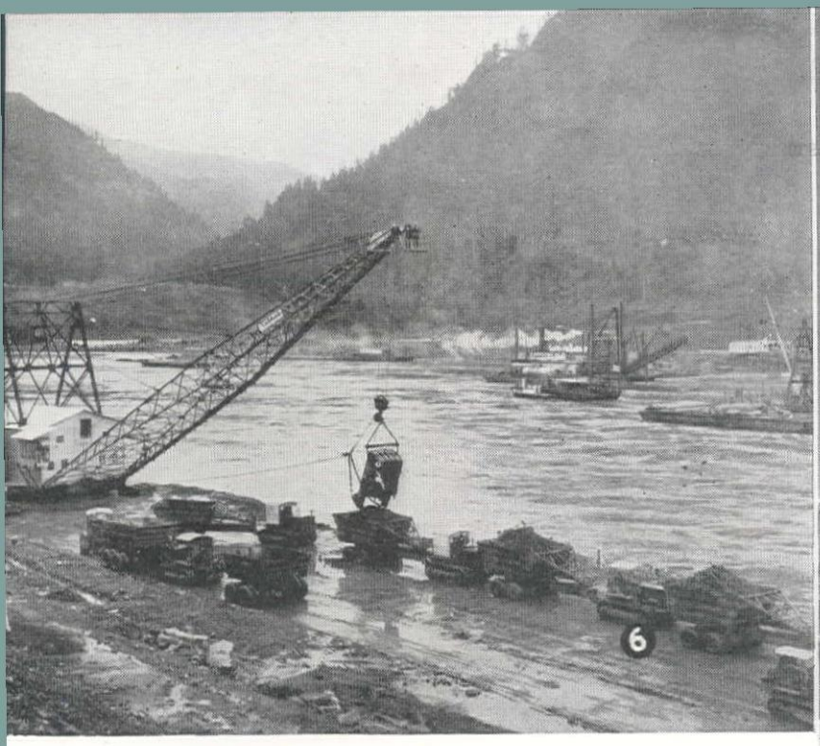
5—San Francisco anchorage of 4-mile long Trans-bay bridge, showing 30-ft. steel eyebars for holding a west bay main suspension cable. The embedded eyebars are 65-ft. long and will resist a pull of 40,000,000 lb.

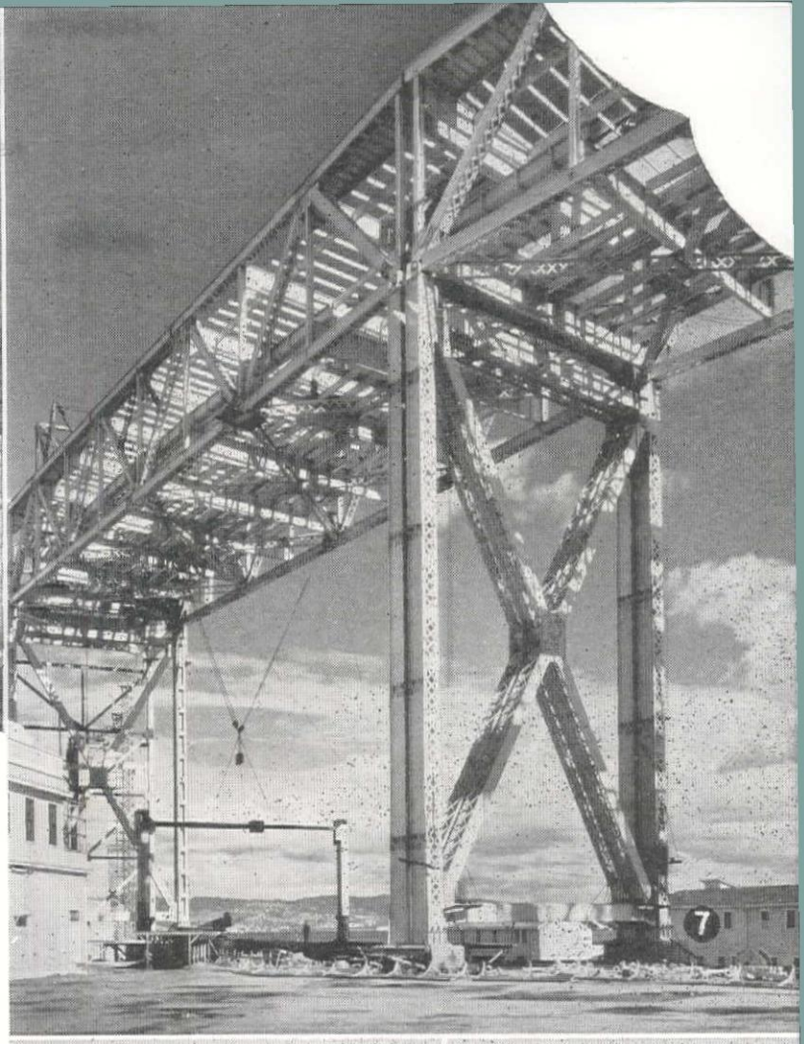
6—Channel excavation at Bonneville project on north bank of Columbia River with an 8-yd. Bucyrus-Monighan 'walker' and six 25 and 35-yd. Le Tourneau wagons equipped with Timken bearings. This enlargement is necessary to carry floods in early summer due to cofferdamming of river on opposite side.

7—Viaduct of San Francisco-Oakland Bay bridge crossing Yerba Buena island. Note expansion joint which extends through columns, bracing, and upper and lower decks, permitting a maximum movement of 9 in.









Construction Front

8—A portable, motor driven, Gardner-Denver compressor unit, designed and built by Barrett & Hilp and Macco Construction Co. for use on their Colorado River aqueduct canal work.

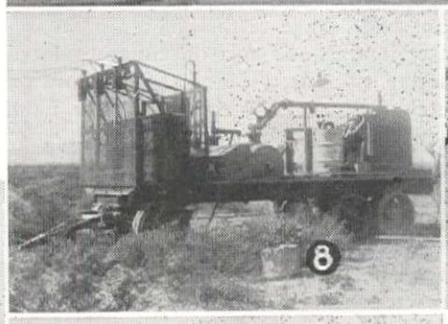
9—A specially built concrete finishing machine for canal lining designed and operated by C. W. Wood and M. J. Bevanda on schedule 8 of the Colorado River aqueduct.

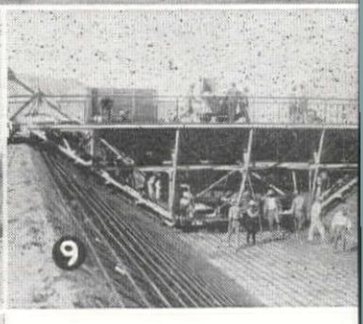
10—Cleaning out irrigation ditches in Kern county, Calif., with a Byers Model 70 dragline equipped with a Page automatic bucket.

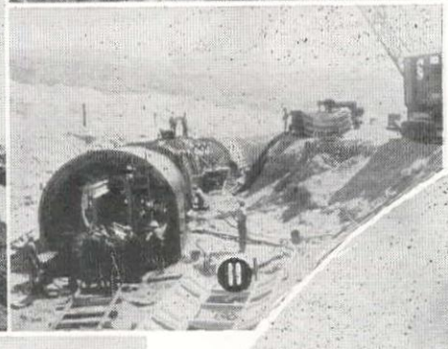
11—The first 12-ft. monolithic concrete siphon cast on San Andreas siphon project of Colorado River Aqueduct. Morrison-Knudsen Co. contractors.

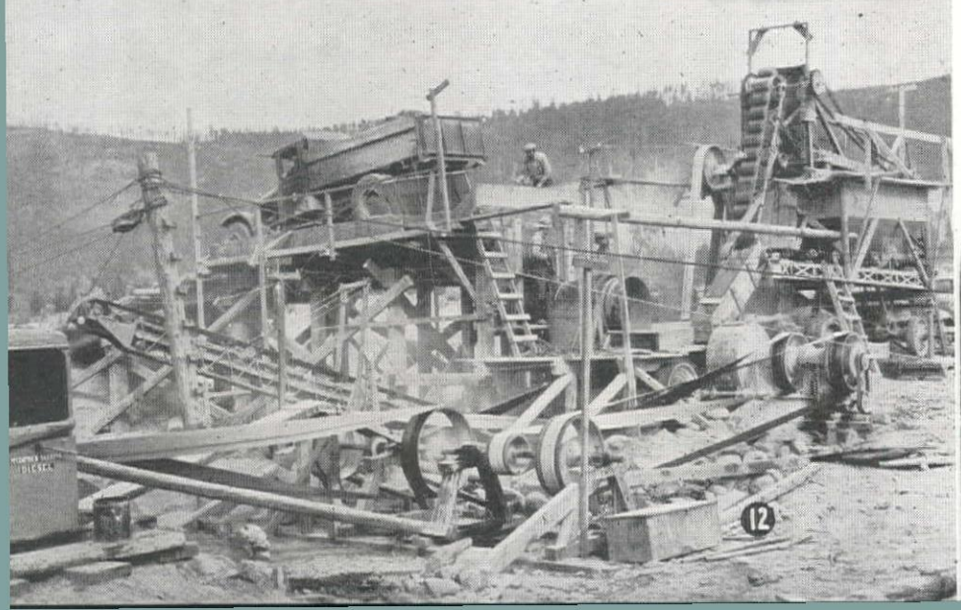
12—A crushing plant, located 40 mi. from the Canadian border and operated by the State of Washington, preparing Pend Oreille river gravel for road surfacing material. The plant is driven by a McCormick-Deering PD 40 diesel plant and has a capacity of 20 cu. yd. per hr.

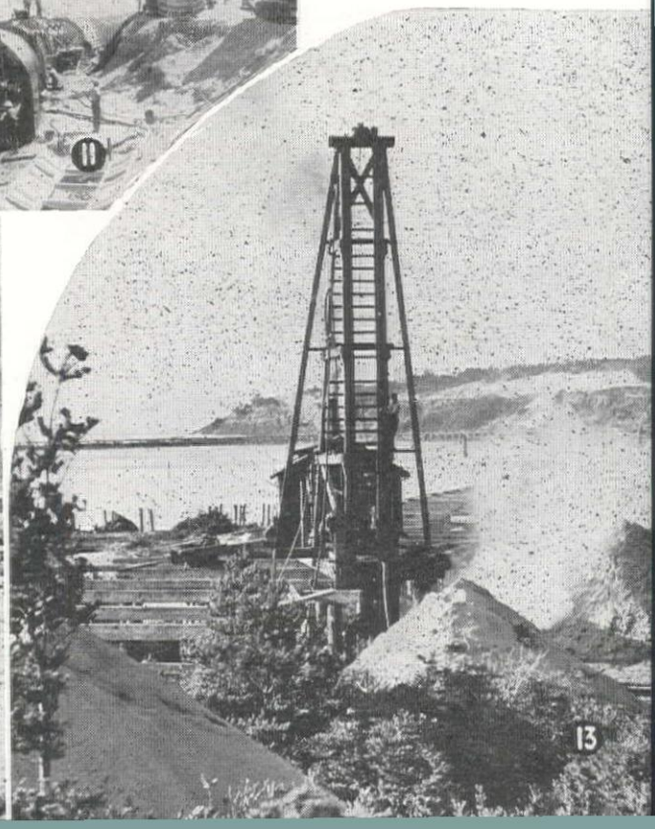
13—Preliminary trestle for Yaquina Bay bridge in Oregon with government jetty and Pacific Ocean in background. General Construction Co. and Gilpin Construction Co. are contractors on this $1,357,587 structure which is one of 5 large bridges under construction with PWA funds.

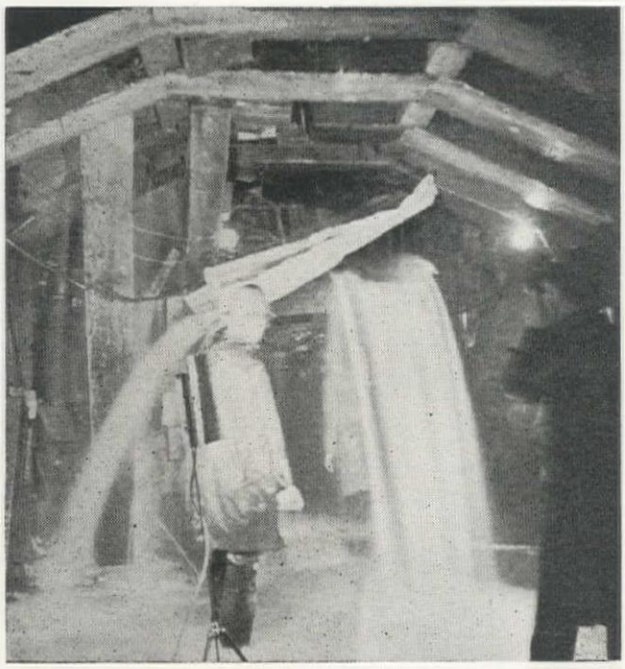












East Heading at Potrero Shaft Showing Timbered Pilot Drift in Background and a Flow of More Than 3,000 g.p.m. of Water.

Excessive Water and R Hazard in San Jacinto

One of the most difficult jobs on the Colorado River Aqueduct has been the driving of San Jacinto tunnel. On three occasions Potrero shaft, 800 ft. deep, was flooded within a short distance of its top.

By S. M. JARRETT
Safety Engineer

With the exception of East Coachella tunnel which is 18.3 mi. long, the longest single bore of the Colorado River aqueduct is San Jacinto tunnel. This aqueduct, consisting of 92. mi. of 16-ft. diam. tunnel, 55 mi. of horseshoe shaped concrete conduit, 62 mi. of concrete lined canal, 29 mi. of concrete siphons, (150 mi. of distribution system), will ultimately deliver 1,500 c.f.s. of water from Colorado river, 155 mi. below Boulder dam, to 13 cities of the Metropolitan Water District of Southern California in the vicinity of Los Angeles. This tunnel, nearly 13 mi. in length, enters San Jacinto mountains two miles southeast of Cabazon and emerges about three miles north of the town of San Jacinto. This mountain, rising nearly two miles above the surrounding desert country, is a sprawling rock mass of varied formation lying just south of the towns of Banning and Beaumont. The rich Coachella valley lies at the base of this range.

In contrast to the rapid progress made on nearly all of the tunnels of the aqueduct, excavation of San Jacinto tunnel has proceeded rather slowly. According to F. E. Weymouth, District general manager and chief engineer, on January 15, only 17% of the work had been completed with 30% of the contract period being expired.

The contract for San Jacinto was awarded on February 10, 1933, to Wenzel and Henoch Construction Co. of Milwaukee, Wis., on their bid of $7,339,000 which was second low, Metropolitan Engineering Corp. of Los Angeles submitting a bid only $5,785 lower. The latter's bid was rejected by the District because of unsatisfactory surety bonding arrangements. Other bids ranged from $8,395,225 to $13,625,850.

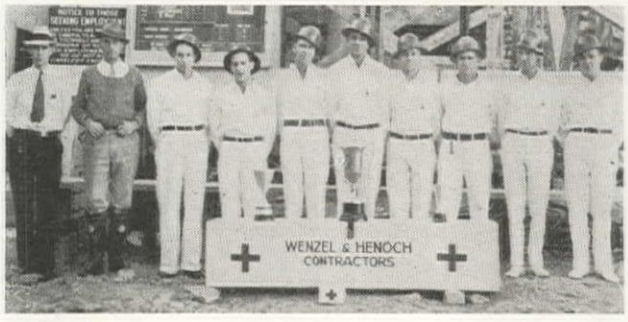
On January 15, 1935, at which time 11,818 ft. of tunnel had been excavated exclusive of side drifts and shafts, the District suspended the contract of Wenzel & Henoch. Judgment was refused on the suit filed in federal court against the contractors, in which the District declared the contract suspended and restraining Wenzel & Henoch from further interfering with the work. This suit was dismissed and, on February 12 the work was taken over by the District when three crews of 90 men assumed control of the entire operations. An injunction later filed by Wenzel & Henoch against the District was dismissed from federal court, the opinion being the grievance was a matter to be settled in a civil court. The District's crews are now actively engaged in driving the tunnel at several headings.

Recently, plans were made for a study of problems in connection with San Jacinto and a group of engineering consultants have been chosen to report upon the work. These include: D. H. Reddinger, Los Angeles, who was in charge of Florence tunnel and other major bores for Southern California Edison Co.; J. Fred Johnson, Salt Lake City, consulting engineer for U. S. Bureau of Mines, and widely known contractor for mining shaft and tunnel work; W. R. Fontaine, San Francisco, consultant for Six Companies Inc. on tunnel work at Parker and Boulder dams, and Broadway tunnel in Oakland; and Thaddeus Merriman, for many years chief engineer of New York City Board of Water Supply and nationally known consultant on engineering problems.

Tunnel excavation has been carried on from three points of access. The westerly end of the tunnel was opened by means of a drift but due to topographic conditions, it was necessary to sink two shafts about 8½ mi. apart. Cabazon shaft is located 1½ mi. from the east end of the tunnel and Potrero shaft is situated 3 mi. from the west portal.

West Portal—This portal connects with the main tunnel line through a 5% inclined adit 237 ft. long. Exploratory work at this point revealed a fault formation of shattered schist and granite interposed with wide mud seams and water, amounting, at times, to 2,500 g.p.m. Due

The Well-Trained First-Aid Team at Cabazon Shaft, Winners of the District 1934 Red-Cross Contest.

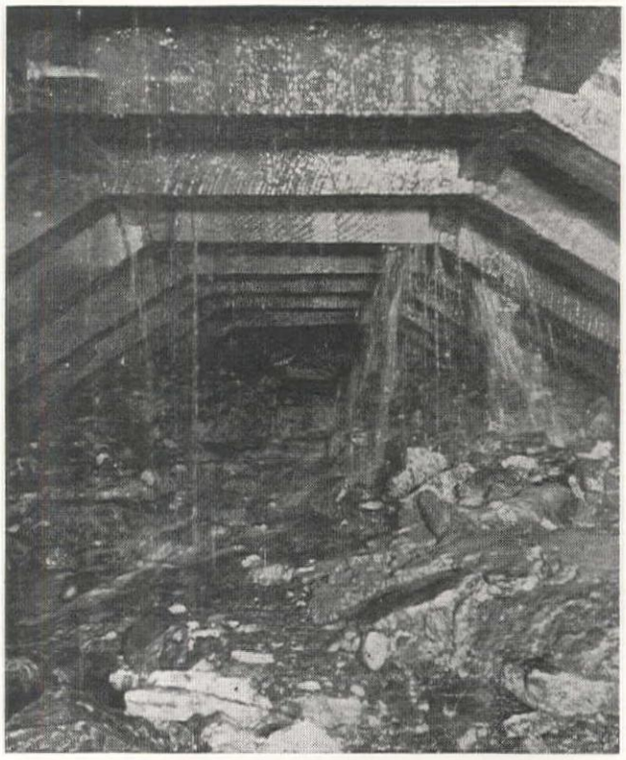


unning Ground Presents Tunnel Construction

to the treacherous nature of the ground, it was necessary to advance with the top heading only for a few hundred feet installing steel liner plates as the excavation was pushed forward. It was then necessary to return and excavate the material after blasting and support the lower part of the tunnel to full section. A self contained drill 'jumbo' carrying 6 self feeding pneumatic Worthington drifters was used for the full tunnel heading.

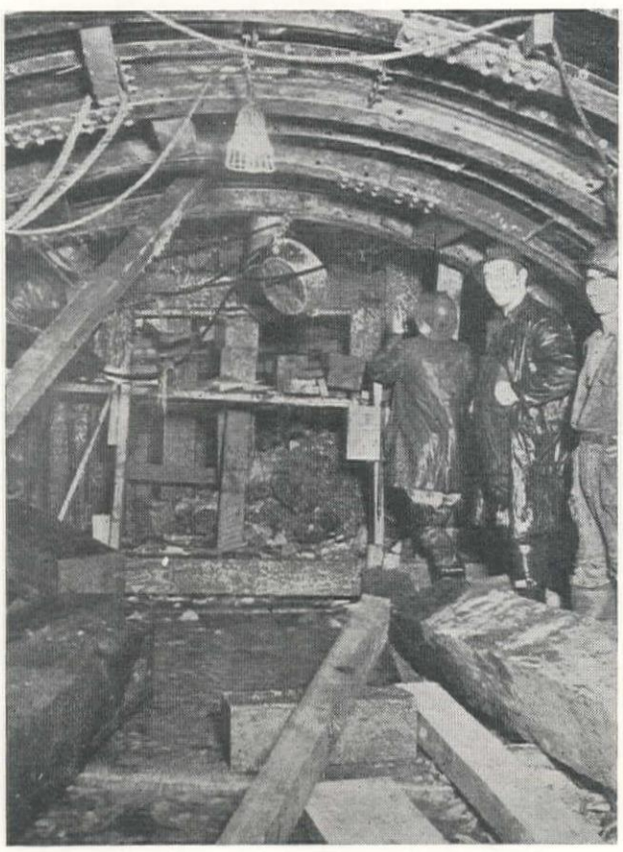
Potrero Shaft—This shaft is 16 ft. in diameter inside the concrete lining and over 800 ft. deep and is set 6 ft. off the center line of the tunnel at the only point where the tunnel deviates from a straight line. The shaft has three compartments, one being used entirely for lowering of equipment while the other two are maintained for running the combination, balanced, 5-yd. skip with man cage above. The main hoist at Potrero shaft is a 400 hp. Allis-Chalmers equipped with a Lily hoist control and has a rope speed of 740 f.p.m. During the sinking of Potrero shaft, many difficulties were encountered. Water and running ground were encountered from a depth of 125 ft. to nearly 300 ft. due to a fault zone which cut through the shaft at a sharp angle. In May, 1934, this shaft was completed and the pump station cut was made two months later.

On July 1, 1934, when the headings were advanced only about 200 ft. and preparations were being made to install the permanent tunnel driving equipment, a flow of water estimated at 7,500 g.p.m. broke in at the east heading. A few days prior to this time a flow of about 1,800 g.p.m. was encountered and this was readily handled by the permanent pumping station of 2,500 g.p.m. capacity at the bottom of the shaft. The inrush of water from the east heading came at 2:40 a.m. on July 1, 1934. Pumps were immediately inundated and by 10 a.m. water had risen 434 ft. in the shaft and continued to rise in the shaft at a retarded rate until July 12 when a 1,200-g.p.m. Byron-Jackson pump was installed in the shaft. By this time water had risen to a depth of 649 ft. about the tunnel invert or about 170 ft. from the collar of the shaft. A second 1,200-g.p.m. Byron-Jackson deep well pump was installed on July 17 and a 2,600 g.p.m. Peerless deep-well pump was added on August 14. Unwatering proceeded at the rate of about 2,600 g.p.m. in an endeavor to keep the water level in the shaft somewhere near the water level in the surrounding rock and thereby prevent sudden surges.



East Heading at Potrero Shaft Showing a Portion of 1200 cu. yd. of Muck Which Came In with Heavy Water Surge. Flow in Tunnel Amounts to About 3800 g.p.m.

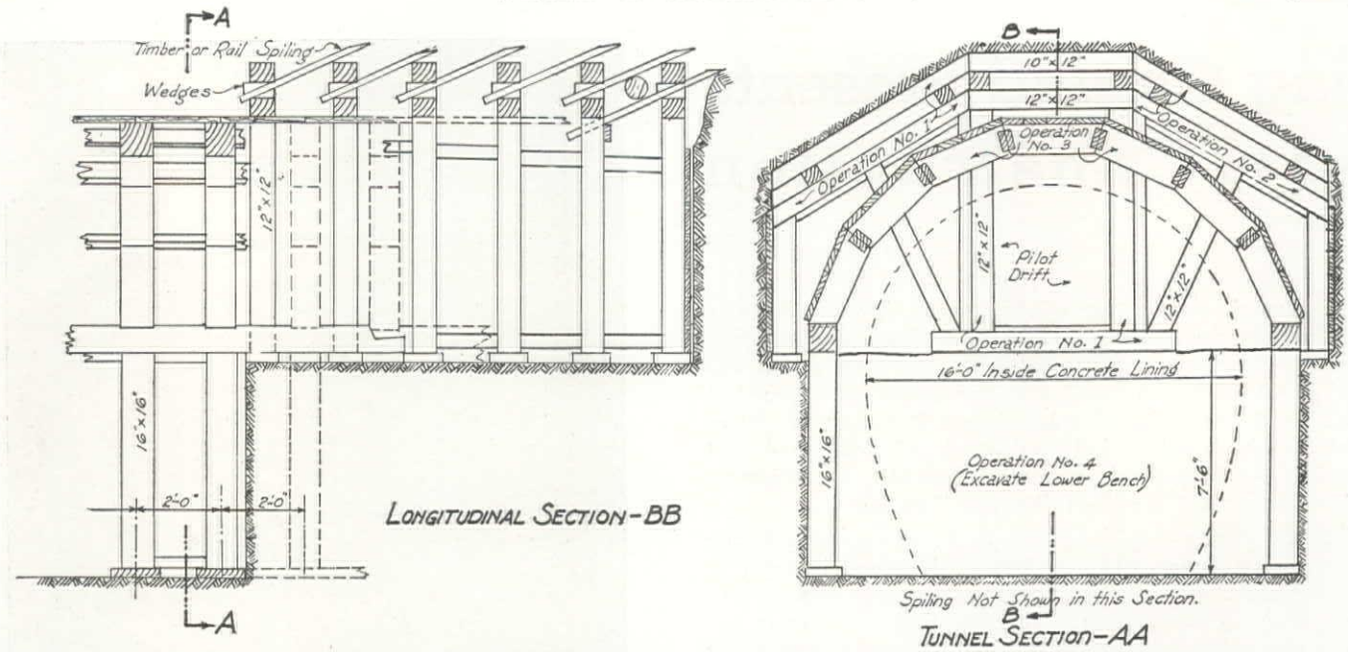
Heavy Ground and Water (about 1800 g.p.m.) in West Heading at Cabazon Shaft. Note Completed Steel Forms and Pilot Drift Requiring Heavy Timbering.



While the 2,600-g.p.m. Peerless deep-well pump was being manufactured, the contractors built a steel headframe inside the wooden frame originally constructed to handle the added weight of the heavy pumps and appurtenant piping. The Peerless pump designed for 850 ft. lift is considered one of the world's largest deep well turbine pumps, and weighed 30,000 lb.

On August 23, 1934, the water level was within 50 ft. of the bottom of the shaft when the discharge pipe on the Peerless pump broke causing this pump and one 1,200 g.p.m. pump to drop to the bottom. While the pumps were being fished out, repaired, and motors dried out, the water again rose in the shaft to within 225 ft. of the top.

Pumping commenced again on August 30 with the Peerless and one Byron-Jackson 1,200-g.p.m. pump in operation. The dewatering was completed on September 21. The flow at that time amounted to about 2,500,000 gal. per 24 hr. During the period since water was first encountered in Potrero shaft, it is estimated that 175,000,000 gal. or about 530 ac. ft. were pumped.



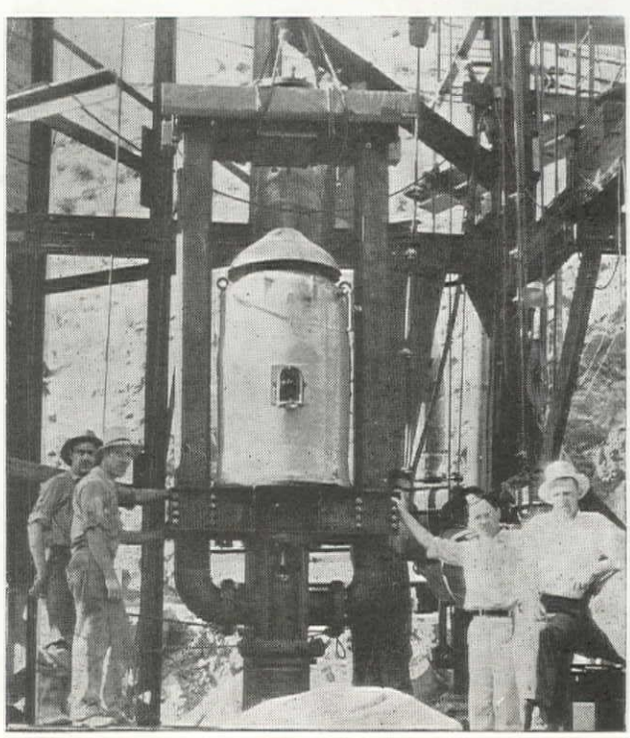
Typical Timbering Layout Used in Heavy Ground in East Heading at Potrero Shaft. A Pilot Drift Was Made First as Indicated by Operation No. 1. The Sides Were Then Stoped Out and Excavation and Timbering for the Full Tunnel Section Followed.

After the shaft was dewatered, motors dried out, pumps and equipment repaired, and muck cleaned up, driving operations were resumed in the West heading. In the east heading enlargement of the section about 75 ft. back from the face was started and timber support set to allow for additional thickness of concrete lining. This work had been carried to within 20 ft. of the east face by November 14th. At 6:30 p.m. on that date there was a heavy inrush of water (265,000 g.p.m.) and muck from the faulted zone located at the face. This flood put the station pumps out of commission, jammed the skips, and compelled the tunnel crews to take to the ladderway. The Peerless 2,600-g.p.m. pump which had been installed about 11 ft. above the floor of the tunnel continued in operation. At this time the west heading had been extended 434 ft. west from the shaft. The inflow of water was estimated at 3,000 g.p.m. Storage provided in the tunnel and the continuous operation of the 2,600-g.p.m. pump prevented the water from immediately flooding the shaft. The level rose to the base of the pump by 6:30 a.m. on November 15. By this time one of the Byron-Jackson 1,200-g.p.m. pumps had been lowered in the shaft and placed in operation. These two pumps assisted by some bailing decreased the water level slightly until 6:30 a.m. on November 18 when the motor on the Peerless pump burned out and the shaft was again flooded to within 340 ft. of the top. The two 1,200-g.p.m. Byron Jackson pumps were reconditioned and a tandem Peerless pump rated at 1,750 g.p.m. completed dewatering operations on December 10, 1934. Equipment was repaired, muck which had come in with the water was removed from the tunnel, and driving operations resumed on December 31, 1934.

Cabazon Shaft: This three-compartment shaft, which is 15 ft. diam. inside of the concrete lining and 256 ft. deep has been sunk just north of the tunnel line and connects with the main tunnel through an 8 by 10-ft. cross-drift 951 ft. long. While driving this cross-drift, a bad fault about 30 ft. wide was crossed but with little difficulty. A heavy clay-like formation, water laden, had to be slowly excavated and then supported by concrete lining reinforced with 12-in. H-beams to safely carry the tremendous weight. The cross-drift intersects the main tunnel at a 45-deg. angle from which point the main bore is to be driven eastward 1½ mi. to finally emerge on the floor of the desert a few miles northwest of Palm Springs, a famous winter resort. It is likely the west heading will meet the eastwardly advancing heading from Potrero shaft at about midway between the two shafts. Rock in the west heading has been of a schisty nature, fairly hard and blocky at times, but not requiring much steel or timber support. The east heading has been advancing through a heavy wet, broken-up granite formation containing much gouge which exerts considerable pressure on the steel supports making necessary the replacement of steel with timber supports at several points.

While all eyes were on the water conditions at Potrero shaft, the west heading at Cabazon struck water. This heading had been driven over 4,000 ft. without timber or steel supports. Test holes, 20 ft. deep, were drilled ahead for safety so as to give sufficient warning of water pressures. This method proved inadequate as water broke through 30 ft. back from the tunnel face. After pumping facilities had been installed to control this condition, water broke through the tunnel face at a rate of 6,000

A 1200-g.p.m. Byron-Jackson Pump Being Lowered Into Potrero Shaft for Unwatering Flooded Workings.

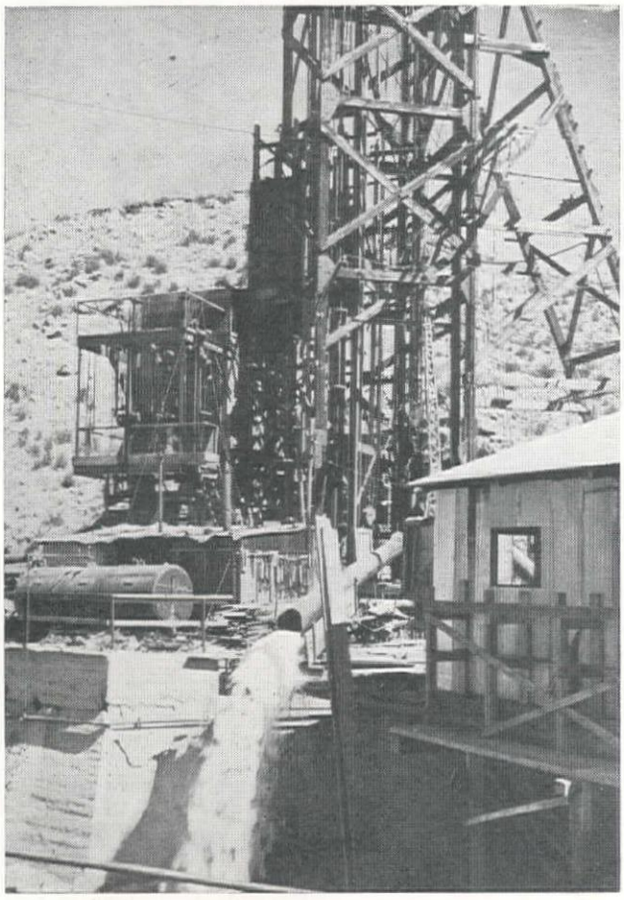


g.p.m. which temporarily shut down the work until more pumps could be installed. This water course cutting across the tunnel necessitated driving over 60 ft. of pilot tunnel through badly fractured ground consisting of gneiss, schists, and clay seams. Rail spiling had to be resorted to as 6 by 8-in. timber spiling would not stand up under the weight and pressures encountered.

Broken rock is loaded into 5-yd. side dump steel cars having safety link couplers with a Conway type 60 mucking machine, and is then transported to the skip-loading station by 8-ton combination battery and trolley locomotives. Muck is dumped into the balanced skips at the bottom of the shaft which in turn dump into a storage bin built into the headframe. The rock is conveyed to the spoil area in 15-yd. self dumping motorized trolley type cars. Drilling is done from a self-contained two-deck drill 'jumbo' on which are mounted six Worthington No. 80 self pneumatic feed drifters.

Before drilling operations are started, the tunnel back, face, and sides are thoroughly scaled for loose rock from

Potrero Shaft Showing Headframe Construction and Pump Discharge Pipe During Unwatering Operation.



the jumbo. The drill jumbos are all equipped with safety lights to warn drillers on the lower deck and bottom when the top drillers are collaring holes. Before powder is taken to the heading face prior to blasting, which is done electrically, all electric lights are pulled back. To provide maximum safety during loading operations, a tripod with three flood lights is mounted on the motor which is spotted 50 ft. back from the face. Ventilation is provided by two Roots-Connerville blowers through 22-in. slip joint steel pipe leading from the blower direct to each heading. During blasting operations the fan operation was reversed, sucking the gases and dust from the heading. The transfer of muck cars underground at both Cabazon and Potrero is

(Upper) Two-deck Double Ended "Jumbo" Drill Carriage on Which Are Mounted 6 Worthington Pneumatic Self-Feed Drifters.

(Left) Motorized 15-yd. Side-dump Car for Conveying Muck to Spoil Area.

accomplished by the use of a portable switch which rests on the main line within easy operating distance of the Conway mucking machine. Although quite readily movable, this switch as a unit, double tracks the tunnel lines for about 60 ft. without disturbing the permanent track.

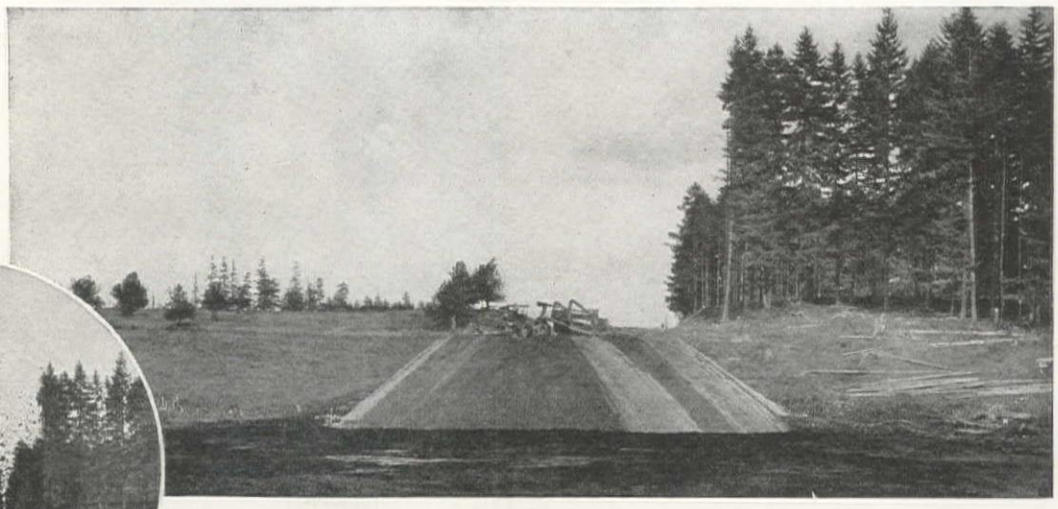
Safety—Due to the many hazards connected with the San Jacinto tunnel, safety has been one of the paramount features on this work. All locomotives are equipped with raised false bottoms and railings are placed around the motorman's compartment to prevent the operator from making flying switches. All switches have red lights above to indicate their locations, and all movement of cars is facilitated by a standard code of signaling with police whistles and bells or klaxons to eliminate any possibility of confusion.

A specially constructed all-steel enclosed man car is provided for transporting the men to and from the tunnel headings. In this way they are protected from injury by derailment or falling rock and excessive exposure and cold.

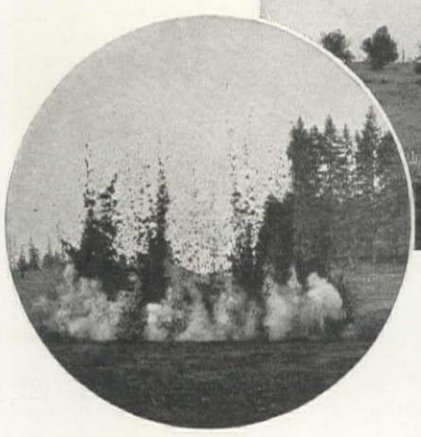
In addition to the regular requirements of daily inspections covering the use of hard hats, safety belts, goggles, etc., all men are given rigid physical examinations at the time of their employment and given a copy of safety and first aid rules. First aid teams are kept in constant training at each camp. The team at west portal won first honors in the mining division in the first aid meet sponsored by the California Safety Society held in Los Angeles about a year ago. Cabazon took first place in the Red Cross meet.

Personnel: The staff of Wenzel & Henoch prior to the time the District took over the work at San Jacinto included the following: Otto Seefeld, general manager; Walter Hoenecke, general superintendent; Walter L. Hart, chief engineer; W. A. Boyd, superintendent at Cabazon; Walter W. Baer, superintendent at Potrero; Jack May, superintendent at West Portal.

Since the District has had direct supervision of this work, the force account staff includes: C. R. Rankin, general superintendent; and E. E. McCabe, W. L. Taylor, and Jack Stone as tunnel superintendents. J. B. Bond is division engineer of divisions 5 and 6 which include San Jacinto, Bernasconi, and Valverde tunnels. F. E. Weymouth is general manager and chief engineer; J. L. Burkholder, assistant general manager; Julian Hinds, assistant chief engineer; James Munn, general superintendent for the Metropolitan Water District.



Material From Adjacent Cut Being "Nosed" Out Into the Swamp.



(Below) A Typical "Toe" Shot Which Heaves the Muck Into a Roll Ahead and Causes Fill to Settle.

Using Dynamite in Construction of Washington Highway

In Placing a Roadbed Across 40-ft. Deep Swamps Near Olympia a Novel Method of Blasting the Fill Material In to Place Was Employed

THE new route of the Pacific highway around the lower end of Puget Sound between Olympia and Fort Lewis will provide greater capacity and a better alignment than is now offered by the present road. Surveys were completed in the fall of 1933 by the Washington State Highway Department and construction was started on the first section in the early part of 1934.

The new location extends in a nearly straight line from the city limits of Olympia to the existing four-lane (double pavement) highway at the Fort Lewis military reservation boundary, a distance of 10.04 mi. This highway will replace the present two-lane (20 ft.) concrete road and provides a saving in length of 2.7 mi. and eliminates more than 1,000 deg. of curvature. In the area adjacent to the present Nisqually river crossing the roadway has been subject to overflow at extreme flood stage and mid-channel bridge piers have been a serious obstruction to the passage of driftwood and debris.

The new alignment will provide two 20-ft. pavement strips separated by 4 ft. of dirt and shoulders with a minimum width of 7 ft. About 1,200,000 cu. yd. of excavation will be required along the entire route, of which 305,900 cu. yd. has already been moved in the construction of the first section (approximately Sta. 13 to 348+35).

Several railroad and stream crossing structures and approach trestles are required along the total length of the new route. The bridge over Weyerhaeuser Timber Co. R. R. (Skookumchuck Ry.) consisting of a 58-ft. steel girder span and creosoted pile approach trestles, has been recently completed. The course of McAllister creek will be changed because it was deemed impossible to provide a structure at the original crossing of the creek. Approach trestles and a bridge will be necessary to cross Nisqually river and two railroad underpasses will be required near the Fort Lewis end of the new road. This crossing over Nisqually river will have a clear steel span of 300 ft. or more.

At Sta. 51 to 54 and 60+50 to 64+50 marsh or peat bogs extends to a depth of as much as 40 ft. Heavy rainfall (annual rainfall is 54 in.) profuse vegetation, and type of soil native to the area, are responsible for this condition. In building a highway across these swamps, it is necessary to have the fill rest on firm bottom. For a distance of over 4,000 ft. across the Nisqually Valley a treated timber structure with a reinforced concrete deck will be used across the bottom land.

Construction of the 6.4-mi. section, extending from the Olympia terminus, was under contract to L. Coluccio & Co. of Seattle. Near the beginning of the work, two swamps measuring 400 and 300 ft. in width, respectively, were encountered. These were separated by a ridge about 1,400 ft. long. The plan provided for a cut through the ridge using the material for fills across the swamps.

Preparatory to placing the fill material in the larger swamp, stripping of 3 or 4 ft. of peat off the top surface was attempted with a power shovel rigged as a dragline. The underlying material was so soft, however, that difficulty was experienced in providing a stable base for the dragline to work from and material which was piled on the sides began to sink. Consequently, this plan was abandoned.

A new method was employed in which the first step was to liquify the top matter by shallow blasting along a strip averaging 160 ft. wide. Charges were placed about 2 ft. apart along parallel rows 6 ft. apart, running at right angles to the center line of roadway. The holes were carried 15 to 20 ft. beyond at edges of the proposed fill so that this area would be liquified, permitting the muck under the fill to boil up there when the fill material was placed. These rows were connected by cross rows of holes, each about 3 ft. deep, thus following the cross section method of loading. On an average, 2 or 3 sticks of du Pont 50% straight nitroglycerine dynamite and 1 stick of 40% strength were placed in each hole, the last cartridge about 1 ft. below the surface. In firing, the propogation method was employed whereby the explosion of one cartridge primed with a single cartridge cap sets off all the other charges. In this manner as many of 600 holes were fired at one time. Following blasting of the top matter, a bulldozer was employed to move the fill material out across the resulting area of soupy muck, keeping the nose of the fill pointed and the fill built high as possible. As the material settled, the swampy muck began to roll up ahead and to the sides, and when this material began to fold over, a row of charges was placed along this ridge of muck. This line of holes in a semi-circular formation, was placed 10 to 15 ft. ahead of the toe of the fill and was called 'toe shooting'.

In placing these charges, a 1½-in. diam. pipe was forced down to the desired depth, varying from 8 to 20 ft.

Water was then poured in and a tamping stick worked up and down. Inside, a pocket from 2 to 6 ft. deep was formed at the end of the pipe to provide access for the dynamite. These holes were placed 15 to 20 ft. apart. Near the shoreline where the peat was comparatively shallow, about 50 lb. of dynamite were used per hole in shooting the toe of the fill. A number of charges were shot simultaneously, using electric blasting caps and a battery. Following these shots, the fill would slide down under the muck in front and to the sides. This settlement usually pushed the muck ahead into an even larger roll and caused the nose of the fill to flatten out.

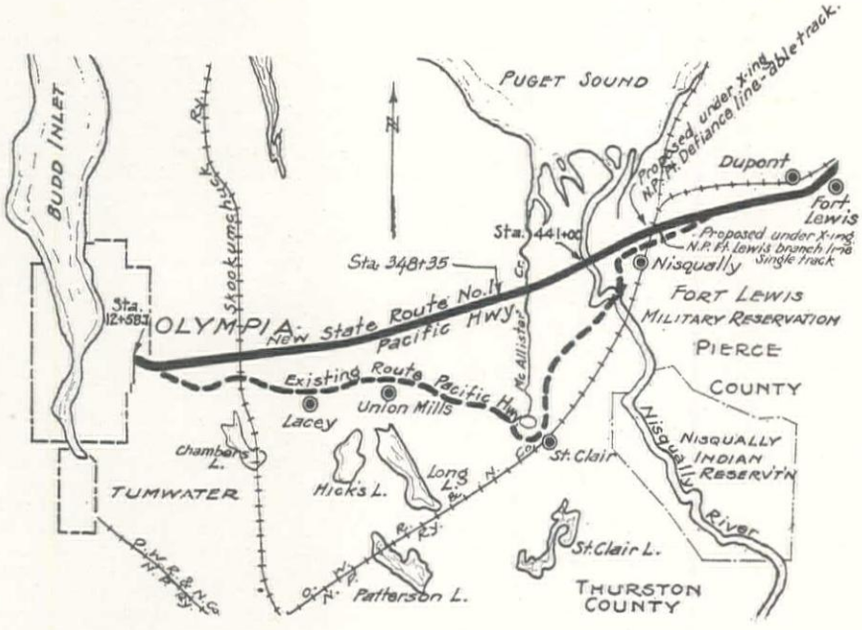
Material would then be placed on the fill to an elevation considerably higher than the normal road level. By consecutive shooting, this piled-up material

would settle down to grade. Soundings were periodically made by pushing a pipe down to make sure the fill had reached the bottom. These toe shots not only moved the swamp muck ahead of the fill, but also compacted the material already settled making a stable foundation for the fill.

As the process of building up the end of the fill and shooting the toe continued, muck ridges were formed to a maximum height of 5 to 8 ft. above the natural ground. This heaving action extended for a distance of 180 ft. on either side of the center line of the road and the material adjoining the fill was found to be free of water and very compacted, making it possible for a man to walk on it. After a few days the fill was carried across the swamp. The narrow fill built across the gap. When these shots were fired, the fill settled vertically, forcing the underlying material to move sidewise. The narrow portion was brought up to grade, and toe shots loaded in deep holes on either side were fired to shove the muck still further to the sides. This shooting and filling was repeated until the roadway was completed to full width.

From soundings taken along the toe, it was discovered that the edge of the fill below the ground line was almost vertical. To slope these edges outward, spreading the fill sidewise beneath the ground, a row of shots were placed on each side of the fill at the toe, with holes about 15 ft. apart and 50 lb. of dynamite loaded in each. When these were fired, the shoulders settled, leaving large cracks at the edge of the roadway. Additional material was hauled in on the fill to bring it to grade thereby completing the job.

The Extent of Surface Settlement Occurring When Under Fill Shots Force the Underlying Muck Out to the Side Is Shown by the Relative Size of Man Standing in the Depression.



fill across the larger swamp was joined by a similar section from the opposite side. This portion of the fill was made as narrow as possible and like the other, was kept pointed to divide the muck and push it to the sides, thus preventing a minimum of unstable material from becoming trapped between the two arms of the fill. The fill across the smaller swamp (Sta. 51 to 54) was carried forward from one side only.

At the junction of the two sections, a number of charges were placed and a

Loading Holes for Mat Shooting Along Line of Fill Indicated by Clearing in Timber Ahead.

In building the 300-ft. fill over the swamp occurring on the west side of the ridge, a somewhat different blasting procedure was used. This was due to the strata of sand about a foot in thickness that extended through the pit making it impossible to liquify the surface satisfactorily. Accordingly, a low fill of full width was built entirely across the area, then a core fill was piled up along the center line on top of the first. A well drilling outfit was used to drive down 1½-in. pipes with wooden plugs in the bottom. Two of these, spaced about 2 ft. apart were put down at one time along the center line. The twin holes were placed about 25 ft. apart and after the plugs were pushed out with a tamping stick, 5 sticks of dynamite were used per hole to spring a chamber. When these holes were shot, the underlying material would be pushed to the sides and the core fill would settle.

Following these center line shots, the fill was built up to two or three feet along the proposed grade line across the entire width. Twin holes, drilled in the same way and spaced 18 ft. on either side of the center line, were loaded and shot in a similar manner. These holes were from 24 to 40 ft. deep from grade line and required about 800 lb. of 40% dynamite for each double charge.

These two fills comprised one of the largest fill settlement jobs completed to date with explosives. 98,000 cu. yd. of embankment were placed requiring nearly 23 tons of du Pont straight dynamite. About 306,000 cu. yd. of excavation were required on the entire job for which the contract price was $91,998. Engineering personnel included: Fred C. Dunham, resident engineer; R. P. Newland, district engineer, of the Washington Highway Department; Jas. A. Davis, construction engineer; Lacey V. Murrow is director of highways.

Construction of the 1.75-mi. section (no. 2) extending from the end of section no. 1 to Nisqually river was started in January, 1935, by M. S. Ross, contractor (contract price $182,473). The major contract items include: 642,000 cu. yd. of excavation, all in one cut; 60,000 cu. yd. of excavation for changing channel of McAllister creek; two 115-ft. treated timber trestles with concrete decks; and four 84-ft. trestles across McAllister creek. The work is now about 10% completed and will be finished at the ond of 1935.

Bureau Investigates Idaho Dam Site

Investigations of reservoir sites on the north and south forks of Snake river in Idaho are in progress by the U. S. Bureau of Reclamation, Denver. Diamond drilling has been completed and shafts, test pits and test tunnels are being excavated to determine the character of foundations at Island Park site on the North fork. The Island Park Dam site is located on Henry's Fork of Snake River, about 25 miles southwest of West Yellowstone. Designs are under way by the Denver office for an earth and rock fill dam to store about 115,000 ac. f. of water for a supplemental supply for 116,000 ac. in Fremont and Madison counties. It is estimated that plans and specifications will be issued within the next few months. The dam will be 83 ft. high and is estimated to cost $1,300,000.

Los Angeles Water Supply Problem Solved by Construction of Aqueduct

By CARL WILSON

Consulting Water Technologist, Metropolitan Water District of Southern California

TO those who have intimately studied the available water supplies of southern California for the last 20 years, news of rapid progress on the Colorado River aqueduct will be received with joy, for it dispels some of their apprehensions over the future welfare of the territory. Tunnel sections of the great aqueduct which is to bring Colorado River water to southern California are already two-thirds excavated, which means that unless unforseen difficulties should arise the water will become available on schedule by 1938, or possibly sooner.

Except for imported water brought to Los Angeles by the Owens River aqueduct, the greater portion of the Metropolitan District, which is composed of 13 cities in the vicinity of Los Angeles, is dependent upon ground water for irrigation, industrial, and domestic uses. The story of a steadily-receding water table under ever-increasing demand is an old one with which all are familiar, and it is equally well known that in some restricted areas invasion of this underground basin by sea water, no longer held in check by counter hydrostatic pressure, has become a disastrous reality. Of late other changes have been observed in water pumped from deep wells in areas to which ocean water can scarcely be expected to penetrate, and chemical analysis of these waters has revealed a condition which is potentially much worse than sea-water invasion, for the threatened area is much greater than that which might be affected by the ocean.

The new menace is the entry of oil-field brines into the water-bearing strata, a danger which has been a nightmare to students of ground water in Los Angeles county for 20 years, but which until now has never been a proven reality, for its development has been insiduously slow. In one instance chlorides in a given well have risen during a 4-year period from 40 to 298 p.p.m., accompanied by an increase in total hardness from 110 to 350 p.p.m. When first noted the change was ascribed to the earthquake of March, 1933, but study of the history of the wells concerned shows that the effect of the brines was clearly apparent in analyses made more than 2 years ago, although not noticed or suspected at the time. These wells are still producing water which can be used for domestic purposes, but the quality of the supply is rapidly growing poorer and it seems doomed to complete ruination in the near future.

The area which has been affected, so far as known at present, is small, but there is every reason to expect it to increase. Several oil fields on the Coastal plain with a total of many hundred wells penetrating the water-bearing gravels and ending in brine-bearing sands are all cased with iron pipe, which in time is certain to become corroded and perhaps perforated. This will afford an opportunity for the brines, under artesian head in many instances, to enter the underground waters. Again, earthquakes easily might break the casings, or even shear them.

Were such accidents to occur in the various fields, as seems highly possible in the course of time, it is apparent that irreparable damage to the underground waters would result. True, it would be temporary damage, at least in the geologic sense, for the total amount of such brines is finite and they would eventually become exhausted, but perhaps not for several years. In the meantime, were no substitute water available, the affected areas would revert to desert. Unfortunately, because of the high content of sodium salts in the brines, especially sodium chloride, it would be impossible to treat the water in a way to make it acceptable except at prohibitive cost.

There is another possibility which may have been the cause of what has actually happened in the area mentioned. This is, that pressure upon the brine-bearing measures of the overlying fresh waters has become so diminished by a falling water table as to permit artesian pressure of the brines to become effective, releasing them through the earth instead of through perforated-well casings, to gradually pollute the ground waters. Observed facts which point in this direction are that the invaded wells originally carried hydrogen sulphide which has gradually decreased in amount, and were then found to produce methane in sufficient quantity to prove a fire and explosion hazard. No estimates of the amount of this gas have been made in any of the wells, so it is impossible to say whether it has increased in step with falling water levels. The relationships of cause and effect between falling tables and increasing pollution by oil-field brines have not yet been proved, but the two phenomena have progressed in reciprocal degree; hence the possibility must be kept in mind until disproved. The only salvation for those dependent upon wells so polluted would lie in the advent of Colorado River water.

In reply to often-asked questions as to the quality of Colorado River water, the accompanying analysis gives the best available information. It is the average of analyses made in the laboratory of the U. S. Geological Survey for the 7-year period from 1925 to 1933, weighted against stream flow. The weighted mean is believed to accurately represent the water as it will be when mixed and stored behind Boulder dam. Except for its slightly increased hardness it is quite like many city supplies at present in service within the confines of the district. No apology is offered, or needed, for Colorado River water, for it is perfectly satisfactory for all uses.

There has been much talk about its content of fluorine, the cause of mottled enamel of the teeth, but accumulated analytical evidence points to an average value for this element of considerably less than 0.5 p.p.m., an amount far below the minimum danger point at set by even the most cautious authorities. It is only fair to state that no really satisfactory analytical method for measuring fluorine in such small amounts is yet available, and widely differing results are obtained. Moreover, it is not yet certain what amount of fluorine marks the threshold of danger, some observers fixing upon 1 p.p.m., while others believe twice as much is not harmful. Under such circumstances the best criterion is the clinical evidence afforded by long-continued domestic use. Such evidence is abundant for Colorado River water, and it proves conclusively that there is no danger of contracting mottled enamel from its constant use.

COLORADO RIVER AT GRAND CANYON

Analyses by U. S. Geological Survey (in parts per million of water, by weight)

Year	Mean Annual Discharge in c.f.s.	Total Solids (Dissolved) Weighted means, p.p.m.	Total Hardness p.p.m.	Non-Carbonate Hardness p.p.m.	Sulphate SO_4 p.p.m.	Chloride Cl p.p.m.	Boron (at Yuma)
1925-26	19,900	523	251	121	201	56	
1926-27	23,800	569	285	152	235	53	
1927-28	22,200	491	254	121	187	48	
1928-29	26,800	555	281	146	229	48	0.13* p.p.m.
1929-30	18,500	622	311	160	252	62	
1930-31	9,280	813	371	206	325	..	
1931-32	22,000	531	270	126	202	..	
1932-33	13,900	569	282	143	249	..	
Weighted Means	19,500	565	282	142	227	55	0.13
Est. Means 1899-1933..	22,000	520	260	130	210	50	0.15

*Tech. Bulletin No. 264, p. 57-59, Unweighted arithmetical mean, 0.19 p.p.m., Colorado River at Yuma, Arizona, September 1, 1928, to August 31, 1929.

Reclamation Need Shown in Report

A REPORT based on an impartial survey of Federal reclamation in the West, made by F. E. Schmitt, Editor, Engineering News-Record; and John W. Haw, Director, Agricultural Development Department, Northern Pacific Railroad, was recently submitted to Secretary of the Interior, Harold L. Ickes. On the basis of inspection of typical projects and study of the conditions and problems of reclamation, the committee made the following findings:

1. Reclamation by irrigation of land in the arid and semi-arid western half of the United States is shown by its results to be a sound and desirable na-

tional undertaking. It represents a constructive policy of social development.

2. Reclamation should be continued by the Federal Government as available means may permit.

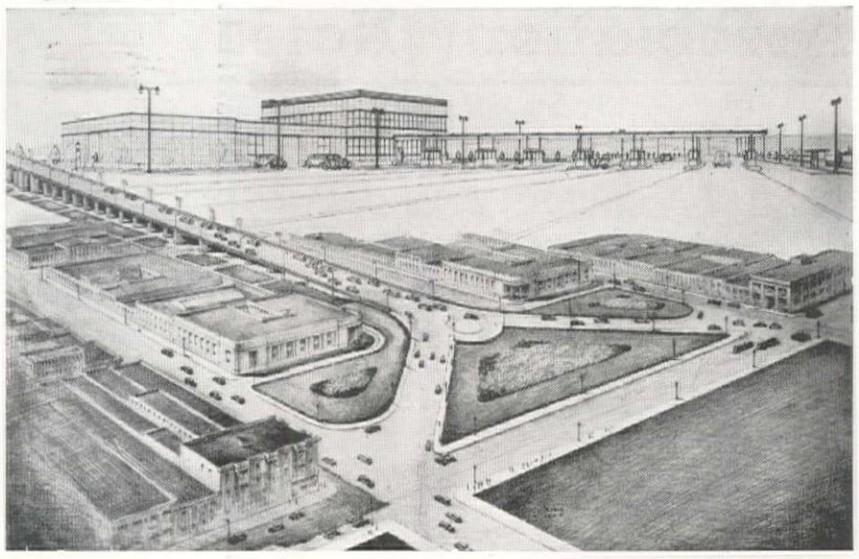
3. Except for the influence of the present depressed farming conditions the operating projects are in the main excellently developed and represent strong prosperous communities.

4. Present reclamation procedure encounters its most troublesome problems in the financial relations between the water user and the Government. The problems arise from the fact that the Reclamation Bureau, though not a banking agency, is required to carry out the banking function of collecting the installment payments on the cost of the works. The Bureau of Reclamation should be relieved of the responsibility for collection in the case of all future projects. If practicable, the revised collection system should be applied also to the operating projects.

5. In the interests of full and efficient utilization of stream waters, the best plan of development as between different regions in the basin and most efficient arrangement of the individual project, it is desirable that the selection and planning of projects be improved by establishing co-operation with States and by authorizing the Bureau of Reclamation to develop its project plans on the basis of best regional results.

6. For permanent security of irrigated agriculture, future reclamation should, if practicable, include measures that will prevent overdevelopment of land beyond the available water supply. Control of storage should remain in the hands of the Federal Government to assure equitable distribution.

7. A uniform policy to govern power developed or to be developed in connection with reclamation projects should be established by law.



(Upper) Toll House and Operations Building on East Bay Approach Fill. (Lower) San Francisco Terminus at Fifth Street.

Design Completed for Bay Bridge Plaza and Toll Station

THE architectural design of the plaza at Fifth st. between Harrison and Bryant st. which marks the westerly (San Francisco) end of the San Francisco-Oakland Bay bridge has just been approved by chief engineer C. H. Purcell.

The stream of fast moving traffic will flow on to the upper deck of the bridge on an easy grade, rising from elev. 11.57 ft. at Fifth st. to elev. 260.76 ft. at the high point of the bridge above the center anchorage in the west bay waters. The roadway of the upper deck at the westerly terminus will be 58 ft. wide.

Designs also have been approved for the toll house and operation building which will be located on the east bay approach fill near the eastern (Oakland) end of the bridge structure. This structure will provide 14 toll collection stations. The building will house the garage, machine shop, electric controls, toll collection and operations, police station, and general maintenance office of the bridge.

Preventing Erosion of Highway Shoulders

THE sandy nature of the soil along U. S. highway No. 80 east of the sand dunes between El Centro, Calif. and Yuma, Ariz., has led to considerable trouble from erosion, even during comparatively light rains. Few major washouts have occurred, but rains have created numerous rivulets coursing down the sides of fills, cutting through the shoulder at frequent intervals and occasionally threatening the pavement itself. An effective means of preventing this erosion has been found recently by maintenance crews by constructing oiled berms along the edge of shoulder fills, with oiled spillways for the escape of water, spaced about 200 ft. apart. The first berms and spillways were constructed on a large fill across the Colorado river bottom, near Winterhaven, Calif., two years ago, and have stood the test of time and weather so well that numerous other fills have received this treatment recently.

Maintenace Crews Building Asphalt Pre-Mix Berm Along Edge of Roadway Shoulder.

The berms are first built up 6 or 8 in. high with common soil from the edges of the fill and from 4 to 6 in. of asphalt pre-mix is then added, and tamped in place. By this method a yard of pre-mix is sufficient to build about 50 ft. of berm. Spillways are first hollowed out in the embankment and then surfaced with 4 to 6 in. of pre-mix, well tamped. This type of spillway can be constructed to fit the needs of that particular spot, including the height of the fill, curves, etc. Relocation of several miles of the highway east of the sand hills, two years ago, provided an economical source of material for building the berms. Asphalt surfacing on the old road is torn up with a scarifier and then disintegrated by driving a tractor over it. About 8 gal. of 60-70 road oil per cu. yd. of material is then added and it is turned in a windrow until well mixed. Three to four men constitute the berm building crew, using a 2-ton truck. Other equipment used by the sand hills maintenance station includes an Austin motor grader, two drags, an asphalt kettle, and a 1½ ton Dodge truck. Eight regular and six part time men are employed on the division, which includes 42 mi. of primary road and 23 mi. of secondary road. The division reaches from the high line canal, in Imperial valley, to the Colorado river.

Six miles of the highway, adjacent to the sand hills station, is in the sand dunes, where drifting sand is also a problem in windy weather, and this sector must be patrolled regularly during storms to prevent sand from drifting over the highway. J. A. Thomas is superintendent and Fred R. Brouse is foreman of the sand hills division. E. Q. Sullivan is district engineer for California Division of Highways at San Bernardino.

Association Notes . . . .

THE eighth annual meeting of the Arizona Public Health Association will be held April 23-24, at Phoenix, Ariz. A full program has been arranged which includes outstanding papers on sanitation, laboratory practice, public health, water works, and dairy inspection. An inspection trip to milk plant and dairies has been arranged by the Phoenix Health Dept. and a dinner and the annual business meeting will be held at the Adams Hotel, convention headquarters, on the evening of April 24. The officers include: President, L. H. Howard; vice-president, Esther Braddock; second vice-president, Dario Travaini; secretary-treasurer, Jane H. Rider; executive committee, J. L. Black, R. B. Durfee, D. W. Fountain, P. J. Martin.

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California Sewage Work Assc. Holds Convention in Fresno

The seventh spring conference of the California Sewage Works Association will be held at Fresno, Calif., April 26-27 at Fresno hotel. Six papers will be presented during the business session and an inspection trip will be made to the sewage treatment plants at Lemoore and Fresno. The papers to be presented are: 'The Status of Activated Sludge Patents Situation,' by A. K. Warren; 'Desirability and Feasability of a California Operator School' by L. B. Reynolds and C. G. Hyde; 'Some Newer Applications of Chlorine in Sewage Treatment' by A. C. Beyer; 'Production and Cost of Chemical for Water and Sewage Treatment' by J. F. Smith, discussion by R. A. Stevenson; 'The Probable Field of Chemical Treatment of Sewage' by R. F. Godey, discussion by B. D. Phelps and R. A. Stevenson; 'A Venturi Type of Metering Stations for Sewers' by H. K. Palmer and F. D. Bowlus.

Northwest A.W.W.A. Meets in Lewiston, Idaho, May 16

The eighth annual meeting of the Pacific Northwest Section of the American Water Works Association will be held in Lewiston, Idaho, May 16-18. A well-balanced program is being prepared by the committee and it will include many worth while papers on various phases of water works construction and practice. An inspection trip is being planned covering the Clearwater river development, which includes a power plant and one of the largest saw mills in the world. The business sessions and a portion of the entertainment will be held at Lewis-Clark hotel, the convention headquarters. Officers of this section are: W. P. Hughes, chairman; H. T. Judson, vice-chairman; Ernest C. Willard, secretary-treasurer; Ben S. Morrow, national director. The board of trustees includes the above officers and S. C. Watkins and J. T. Delaney.

W. P. Hughes, Chairman

Personally Speaking

FRED M. RANDLETT, Pacific Coast manager since 1926 for Robert W. Hunt Company, inspecting, testing, and consulting engineers with general offices in Chicago, was appointed vice president on April 1. Randlett began his professional career in 1900 when he became affiliated with Stone & Webster Co., of Boston, following his graduation from Tufts University in 1897.

Fred M. Randlett

From 1903 to 1904 he was with Massachusetts Electric Co. of Boston, and for the following year he was connected with Warren Bros. Construction Co. in Portland, Ore. In 1906 Randlett joined the Bureau of Water, Portland, Ore., as assistant meter engineer under D. D. Clarke and for the following 20 years he was connected with this Bureau, serving as chief from 1917 to 1925.

Randlett is a Mem., Am. Soc. C. E., A.S.T.M., A.W.W.A., and Engineers Club of San Francisco. In 1927 he was a national director of A.W.W.A. and was greatly responsible for bringing the national convention to San Francisco in 1928, the first national water works meeting ever held in the west.

Randlett will succeed James C. Ogden, recently promoted to president following the resignation of C. B. Nolte who accepted the presidency of Crane Co.

M. H. Merrill, consulting engineer of San Francisco, will succeed Randlett as Pacific Coast manager of Robert W. Hunt Co., in San Francisco. Merrill prior to entering his practice in San Francisco was in charge of sales in Boston for Westinghouse Electric & Manufacturing Co.

William F. Luning

Retires After 46 Yr. Service

William F. Luning recently retired from the office of county surveyor of Tehama county, Calif. Luning has a remarkable record in public service—with a record of 46 years in the Tehama county office, 36 of which he served as surveyor, and 10 years as a deputy.

Luning first served as deputy surveyor in 1882 and was elected surveyor in 1884. Luning was born in Red Bluff in 1857 and has resided for 77 yr. on Rio st. within a block of his birthplace.

A change in charter, providing for a county road engineer who will serve as ex officio surveyor, makes it necessary that he vacate the office. Under his supervision he constructed nearly all steel and concrete bridges in Tehama county. He also constructed three bridges across the Sacramento river, namely, Woodson, Tehama, and Bend bridges. All of these steel and concrete bridges are still standing except a few steel structures which have been replaced with concrete bridges.

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Nelson Taylor and Arthur Taylor, for many years members of the firm of Salisbury, Bradshaw and Taylor, consulting engineers, have announced the formation of the firm of Taylor and Taylor, consulting engineers, with offices at 725 South Spring st., Los Angeles. The new firm has assumed the employment contracts of the former firm with Beverly Hills, Torrance, and Arrowhead Lake Co. As a result of a prolonged illness of A. J. Salisbury, Jr., the former partnership has been dissolved.

Obituaries

J. J. Lumsden, 75, pioneer contractor of Colorado died in Boulder of injuries he suffered when he fell 80 ft. in a mine shaft. Lumsden was prominently identified with building and development in western Colorado, being contractor for a majority of public buildings in Grand Junction.

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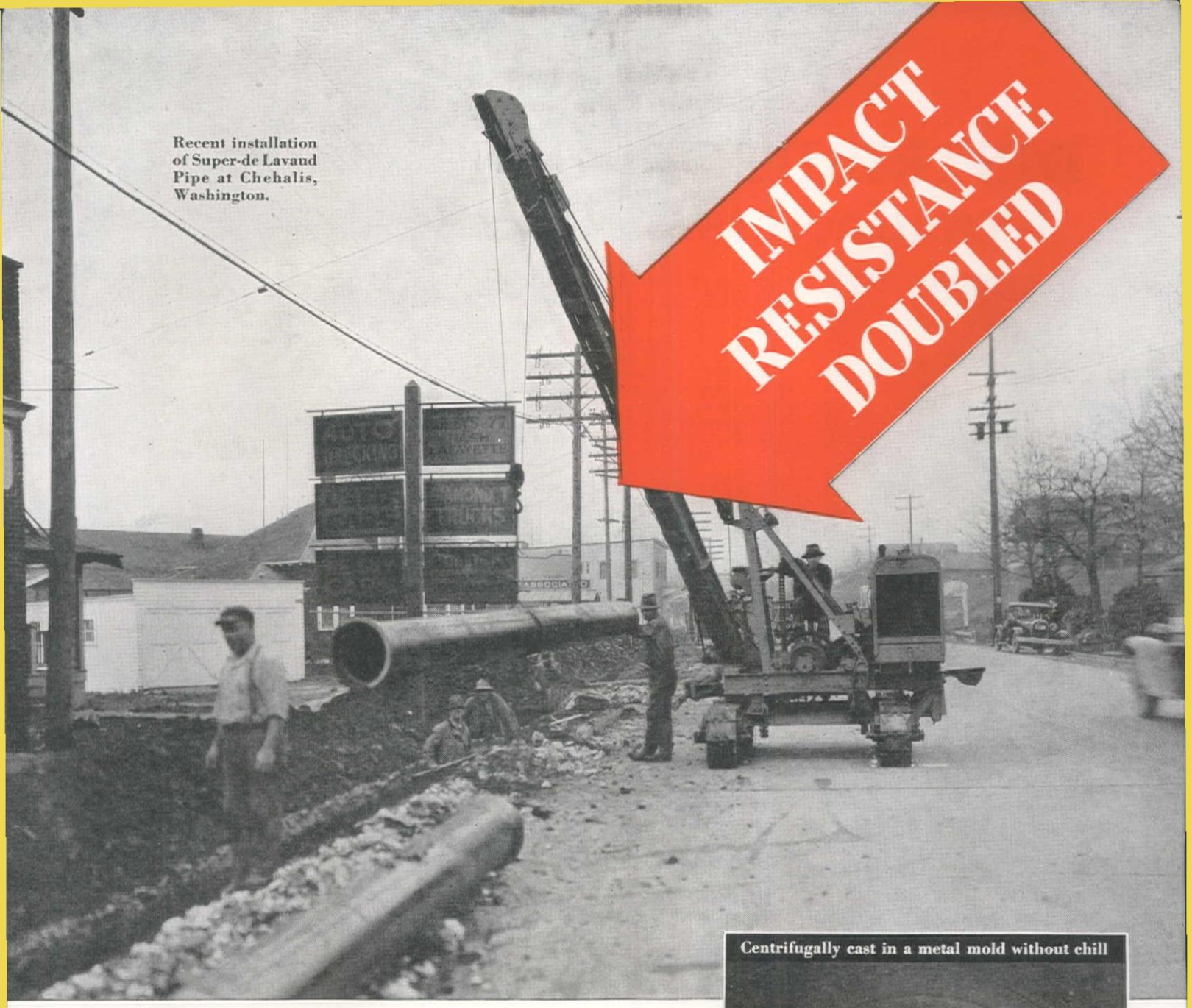
R. E. Branstad, 45, designing engineer for the U. S. Bureau of Reclamation, died in Denver of injuries he received in an automobile accident. With him at the time of the accident was J. L. Herwood of Pittsburg, Pa., of Aluminum Company of America who was killed almost instantly.



Recent installation of Super-de Lavaud Pipe at Chehalis, Washington.

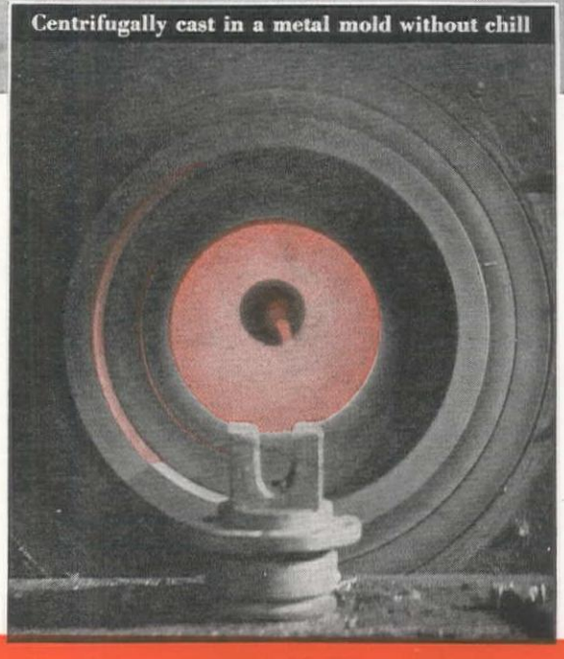
IMPACT RESISTANCE DOUBLED

MANUFACTURERS go to great lengths to protect their products from the hazards of transportation as evidenced by the development of specially designed trucks, cars and containers now in use. But in the case of cast iron pipe, increased protection from plant to underground must be inherent in the pipe itself. We have accomplished this by *doubling the impact-strength* of the pipe.

In seeking this maximum protection for our pipe, we have developed and patented a new method of manufacturing cast iron pipe, known as the Super-de Lavaud Process, which is regarded by metallurgists as an important advance in the art of casting gray iron.

Super-de Lavaud Pipe is centrifugally cast in a metal mold without chill. The result—as purchasers of nearly eight million feet of Super-de Lavaud Pipe already know—is a pipe with extraordinary impact-strength, toughness and ductility. The process is explained in a booklet we shall be glad to send upon request.

Centrifugally cast in a metal mold without chill



U.S. SUPER-de LAVAUD PIPE

CAST WITHOUT CHILL IN A METAL MOLD

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

Foundries and Sales Offices throughout the United States

DISTRIBUTOR and Manufacturer NEWS

Carl E. Baker

Three Join Liberty Sales Organization in Denver

James A. Macdonald, who is just entering the road equipment business, and Elmer A. Johnson, formerly with the Municipal Supply Co. of South Bend, have been appointed Colorado salesmen for the Liberty Truck & Parts Co., Denver. F. S. Thompson, formerly with Le Tourneau, has been assigned salesman serving the contracting industry for the entire state. The Liberty firm has also become Colorado and Wyoming distributor for the Ransome Concrete Machinery Co. of Dunellen, N. J.

Collier Gets Loadmaster

Collier Tractor & Equipment Co. have been appointed Loadmaster Distributor for the northern and western sections of the State of Nevada as well as the northeastern portion of the State of California. Their offices are located at 502 East Fourth St., Reno, Nev.

Tacoma Plant Refining Asphalt

Installation of an asphalt refinery in the J. E. Berkheimer Mfg. Co. plant was announced recently by W. T. Chappe, in charge of the operations. It is estimated that 25,000 barrels of crude oil will be required the first year, and 100,000 used by this plant in 1936. Berkheimer is the only Northwest plant manufacturing asphalt paving. Another plant is contemplated for Portland by this company.

Bates Co. Appointed Chicago Pneumatic Distributor

Sam Bates Co. has recently added the full line of compressors of Chicago Pneumatic Tool Co. for distribution in Northern California and Western Nevada. Included in this line is the new two-stage air-cooled compressor recently announced, which Bates will offer either for sale or rent. This firm is widely known throughout their territory, and is headed by Sam Bates and A. G. Lemcke. Service is available either through their plant at 1925 Dennison St., Oakland, or 666 Mission St., San Francisco.

Two Western Representatives to A.E.D. Elected to Board

The West is unusually well represented in the Associated Equipment Distributors, through the election of directors A. E. Sersanous, Treasurer and Assistant Manager, Loggers & Contractors Machinery Co., Portland, Ore., and Carl E. Baker, President, Smith-Booth-Usher Co., Los Angeles, Calif. Carl Baker is a past president of A.E.D.

A. E. Sersanous

Portland Concern Made Members of Quarter Century Club

Loggers & Contractors Machinery Co., Portland, Ore., were elected to membership in the Quarter Century Club of the Chain Belt Co., Milwaukee, Wis. They are the oldest Chain Belt distributors in the world, having been Portland distributors for more than 26 years. They have the distinction, too, of being the only distributors who are members of the club, the other 141 members being individuals in the employ of the Chain Belt Co.

Rome Grader Business Begins Independent Operations

The Rome Road Grader business, formerly owned by Rome Mfg Co., Div. of Revere Copper & Brass, Inc., has been purchased by a group headed by J. M. Patterson, formerly manager of this department. The new company will be known as Rome Grader and Machinery Corp. Operation under the new regime went into production about March 15th with a full line of high lift drawn graders, Rome motor graders, and Rome mowers. New lines will be added later, it is announced.

Pacific Coast Steel Opens Salt Lake City Offices

Pacific Coast Steel Corp., subsidiary of the Bethlehem Steel Co., has opened offices at 924 Kearns Bldg., Salt Lake City. D. W. Stephens is the district manager in charge. All products of Bethlehem and subsidiary companies will be handled from this point.

Pacific Coast Factory Opened by Universal Form Clamp

Universal Form Clamp Co., manufacturers of reinforcing accessories, Uni-Form panel forms and general line of construction products, has opened a plant and offices at 130 Hooper St., San Francisco. This division, in charge of McGregor S. Anderson, Pacific Coast Division Manager, will manufacture and distribute to the entire Pacific Coast. First hand engineering service in connection with the use of their products is available at this point. These new facilities will speed service, give a personal service to coast customers, and add to coast industry.

Halafax Opens Powder Plant

Halafax Explosives Co., near Saugus, Southern California's first explosives plant, will be opened to the public the week of April 22d. At that time engineers and users of explosives will be afforded an opportunity of inspecting a complete powder plant.

The plant, now completed, is producing a full line of explosives. It represents an investment of close to one-quarter of a million dollars. It is financed by western capital, directed by western executives, and employs local labor. Halafax powders are declared by the manufacturers to be an outstanding advance in explosive chemistry. By reason of the fact that the explosive is a departure from any previous type insofar as its field application is concerned, preliminary design of the factory units brought to light many problems. The Halafax factory contains many plant methods and equipment new to the industry. Prior to plant erection, five years were spent in testing Halafax explosives.

Plans for the week of April 22 to 27 include open house every day for those who are interested in seeing how a powder plant operates. Prominent state officials, will participate in the opening.

Consolidated Lumber Appoints Kelly Manager

J. Walter Kelly, formerly sales manager, Chas. R. McCormick Lumber Co., San Francisco, left Feb. 15th to become manager of Consolidated Lumber Co., at Wilmington, Calif.

Sherman Gets Pueblo Territory

George Sherman, formerly with the New Mexico Construction Co., Denver, has been made salesman in the Pueblo territory for the Ray Corson-Elkins Co.

Marion Introduces New Coast Manager

Harry Fies, who has been with the Marion Steam Shovel Co. since 1901, comes to the western states to manage the field work. No definite headquarters have been established, and Fies will make his home in Los Angeles, San Francisco, Portland, and Seattle. Seldom is a man so well qualified for his duties. Fies has served in almost every branch of the shovel business.

Hercules Names New Distributor

The Hercules Co., Marion, Ohio, have made Harron-Rickard & McCome Co., 2205 Santa Fe Ave., Los Angeles, their distributors in Southern California for the complete line of Hercules road rollers and ironer rolls.

Illustrations at left and center show equipment operated by W. E. Callahan Construction Company and Gunther & Shirley, who have contracts for Sections 1 to 6, inclusive, of the All-American Canal. At right is a bucket operated by Boyce and Igo, a sub-contractor on Section 3. "HERCULES" (Red-Strand) Wire Rope is on the job.

There Is Action On the All-American Canal

And In the Midst Is "HERCULES" (Red-Strand) Wire Rope

Big jobs, hard jobs, and "HERCULES" (Red-Strand) Wire Rope are well known combinations in the construction industry, for contractors have found that the remarkable dependability of this wire rope helps to keep their costs on a lower and more uniform basis.

There are reasons why this is so, and we would be glad to give full particulars to every one interested in reducing and stabilizing their wire rope expense.

And the qualities that make "HERCULES" (Red-Strand) Wire Rope a money saver on the big jobs enable it to work with like economy on the smaller jobs. It is not only able to handle a large tonnage for each dollar of its cost, but its long life makes renewals less frequent.

We invite your inquiries. Feel free to consult us regarding any wire rope problem that may be bothering you.

Made Only by **A. LESCHEN & SONS ROPE CO.** **Established 1857**

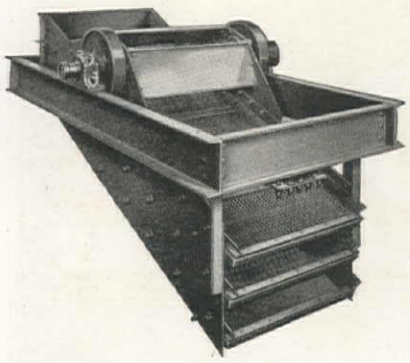
5909 Kennerly Avenue, St Louis, Mo.

Pacific Coast Office and Warehouse: 520 Fourth St., San Francisco
Portland Warehouse: P. O. Box 175. Telephone ATwater 7425

Western Distributors

Billings	Connelly Machinery Company
Boise	Olson Manufacturing Company
Glasgow	Wm. H. Ziegler Co., Inc.
Idaho Falls	Westmont Tractor & Eqpt. Co.
Los Angeles	Garlinghouse Brothers
Missoula	Westmont Tractor & Eqpt. Co.
Phoenix	Pratt-Gilbert Hardware Co.
Salt Lake City	Z. C. M. I.
Seattle	H. J. Armstrong Company
Spokane	Nott-Atwater Company

NEW Materials and EQUIPMENT



Smith Heavy Duty Pulsator

The Smith Engineering Works has recently developed a new heavy duty Pulsator; designed to screen sand, gravel, and crushed rock; wet or dry all uniformly. The eccentric action of the pulsator produces a circular movement which makes the aggregate dance over the wire uniformly.

The frame is horizontal, more compact, rigid and easy to install. The shaft is journalled in a complete, self-contained independent unit, mounted on the frame, with the screen decks easily unbolted therefrom. The vibrator unit may be removed and taken apart in the field so that repairs may be made with convenience.

The nested springs are located to assure uniform support at all points of the deck, and carry most of the load, thereby lengthening the life of the end bearings. The Telsmith Pulsator is made in 8 sizes from 2x6 to 4x12—single, double and triple deck.

●

Bearings for Fort Peck Dredge Pumps

Illustrated here are a group of tapered roller bearings which were built by the Bantam Ball Bearing Co. for use on 28″ dredge pumps. These bearings are 23½″ O.D. with a radial load carrying capacity of approximately 500,000 lb. at 100 rpm. Forty-eight bearings were required to equip the Ft. Peck dredge pumps.

Emergency Carbide Light Always Ready for Use

A new Carbide Emergency Light weighing only forty pounds when fully charged, and which burns for three hours, giving 8,000 candlepower, has recently been announced by the National Carbide Sales Corporation, Lincoln Building, New York City. Announced as a Police Emergency Light, it has many other applications in the municipal, aviation, railroad and construction fields.

The reflector is mounted on a universal swing joint, so that the light may be shifted to any angle and may be easily folded down for carrying by a convenient handle above the carbide hopper. The unit is three and one-half feet high when extended for use, and twenty-eight inches when folded. The light may be operated intermittently, as needed, without the waste of any of the charge.

●

First Aid Kit

A new type of first aid kit which is particularly adaptable for use on trucks and vehicles has been announced by E. D. Bullard Co., San Francisco. This kit measures only nine inches high and less than five inches in diameter. Mounts are provided to attach the kit in the cab of a truck, steam shovel, or any other convenient spot.

The first aid dressings and treatments are packed in unit cartons and are contained in a canvas roll-up, which fits snugly inside of the aluminum container. Each canvas pocket is clearly marked with the name of the dressing or treatment contained. The assortment of dressings has been carefully selected on the recommendations of leading industrial surgeons to meet the needs of construction crews.

It is pointed out by the manufacturer that the use of such a first aid kit will prevent infection of small cuts, splinters and bruises in the large majority of cases. A new circular, describing this first aid kit, has recently been printed, and will be sent without charge on application to the manufacturer.

New Novo 2-Inch Self Priming Pump

The new 2-inch Self-Priming Centrifugal Pump, known as the Model V-AS-2 has just been announced by the Novo Engine Company, Lansing, Michigan. This low-priced pump has a capacity of 8,500 gallons per hour at 10-foot head.

It is powered with a Novo 2½ HP Model AG, single cylinder engine, which is water cooled. The pump discharge pipe passes through the engine hopper, thus keeping the engine cooling water always at the proper temperature.

The pump has no packing. The seal is maintained by two leather seals on the impeller shaft, which require no attention and do not need replacing.

●

White to Build Low Priced Trucks

A new streamlined Indiana truck, in the low-priced field, is announced by The White Motor Company, builders of Indiana trucks and coaches. Volume delivery of the first of 10,000 units to be built this year started March 15.

The new model, of 11,000 pounds gross capacity, marks Indiana's entry into the lowest price field. It will be merchandised by White branches and dealers. The new model is designed to fit every requirement of light duty.

Modern streamline appearance is a striking feature of the chassis, achieved by the use of deep-skirted fenders, cadmium plated radiator grille and louvres, and a sedan type cab. The new truck features a powerful six-cylinder 263 cubic inch engine, hydraulic brakes and ventilated disc wheels.

●

New Synthetic Rubber-Like Product for Wide Use

'Koroseal,' although not the same as rubber in chemical composition, it may, like rubber, be varied from very hard to soft, doughy consistency and can be molded into any shape; also, in a variety of colors, and is odorless.

The resistance of Koroseal to swelling when exposed to many oils and greases and to disintegration in the presence of corrosive chemicals is noteworthy. It resists the action of chromic acid and hot, concentrated nitric acid. The new material also has been shown to be ideal for a piston packing because of the tight seal around the piston afforded by the Koroseal compound in the presence of oil. Additional information upon request to B. F. Goodrich Co., Mechanical Goods Div. ,Akron, Ohio.

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ELECTRIC TAMPER & EQUIPMENT CO.
LUDINGTON • MICHIGAN
PIONEER MANUFACTURERS OF
JACKSON
VIBRATORY
CONCRETE PLACEMENT EQUIPMENT
ANNOUNCES THE APPOINTMENT OF

CLYDE EQUIPMENT CO.
PORTLAND

KRATZ & McCLELLAND, Inc.
SAN FRANCISCO

A. H. COX & CO.
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BROWN-BEVIS EQUIPMENT CO.
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100% SERVICE to USER is assured

A complete stock of Vibrators . . . Parts and Portable Power Plants is now available in this territory.

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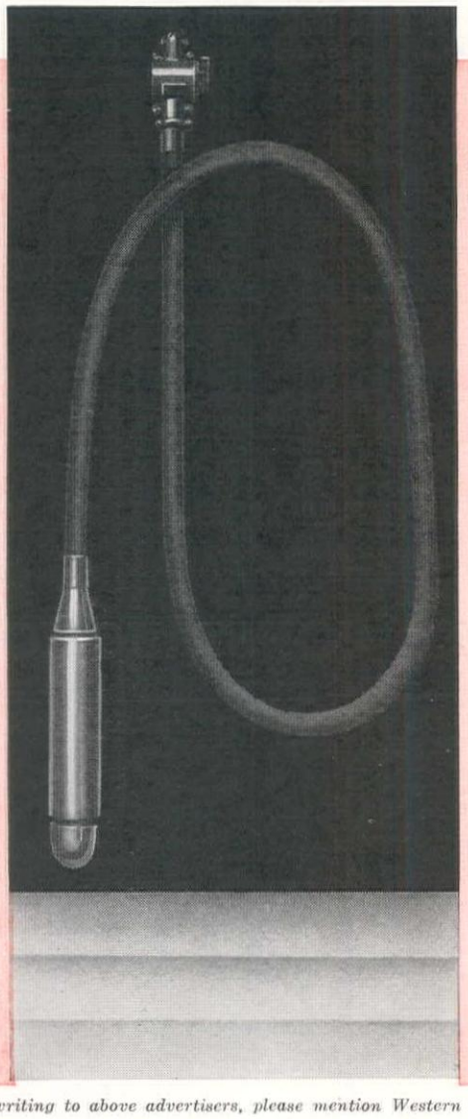

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. . . resulting from fifteen years' experience in the manufacture and application of vibratory motors is at your disposal.

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. . . of the vibratory equipment on major projects in the U. S. and abroad is of our manufacture.

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UNIT BID SUMMARY

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

DAM CONSTRUCTION

SAN JOSE, CALIF.—EARTHFILL—GUADALUPE DAM

Contract awarded to A. Teichert & Son, Inc., P. O. Box 1113, Sacramento, $216,175 (subject to P. W. A. approval) by Santa Clara Valley Water Conservation District, 62 Grant Bldg., San Jose, for constructing the Guadalupe Dam and Spillway on the Guadalupe Creek about 12 miles from San Jose, under Contract No. 6 (PWA Project 6051). Bids from:

(1) A. Teichert & Son, Inc. $216,175
(2) Peninsula Paving Co., S. F. 221,742
(3) Sharp & Fellows Contr. Co. 230,033
(4) A. J. Raisch, San Jose 237,865
(5) Macco Const. Co., Clearwater 239,095
(6) Frederickson & Watson Const. 239,869
(7) N. M. Ball, Berkeley $247,790
(8) Bechtel Co., S. F. 260,060
(9) Utah Const. Co., S. F. 275,452
(10) Mittry Bros. Const. Co., L. A. 286,702
(11) Engineers estimate 208,300

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
50,000 cu.yd. stripping	$.34	$.29	$.48	$.75	$1.00	$.40	$.60	$.60	$.40	$.60	$.20
515,000 cu.yd. embankm. in dam	.25	.25	.23	.24	.22	.285	.275	.30	.34	.30	.23
800 cu.yd. bacf. (tunn&shafts)	3.00	2.15	1.20	5.00	2.00	4.00	2.50	3.00	2.50	3.00	2.00
800 cu.yd. conc. (outlet wks. etc.)	14.00	16.40	16.80	15.00	14.00	15.00	14.00	15.00	18.00	20.00	16.50
140,000 sq.ft. conc. facing on dam	.16	.20	.27	.18	.18	.175	.18	.20	.20	.24	.20
40,500 sq.ft. conc. lining (spllw)	.34	.365	.355	.33	.34	.27	.34	.30	.34	.55	.35
265,000 lb. reinforcing steel	.043	.043	.039	.04	.045	.04	.042	.04	.042	.0525	.045
3,500 lb. struc. steel	.10	.08	.10	.10	.10	.07	.10	.15	.10	.15	.10
690 lin. ft. 36" steel outlet pipe	6.50	7.00	8.90	10.00	10.00	7.00	11.00	6.50	8.30	11.00	9.00
L. S. install outlet works	500.00	410.00	355.00	1,000.00	400.00	2,500.00	500.00	500.00	150.00	650.00	750.00
1 bronze tablet (furn.& install)	75.00	90.00	90.00	100.00	100.00	75.00	75.00	100.00	125.00	125.00	100.00
L. S. 1 engineers field office	300.00	325.00	215.00	250.00	150.00	350.00	400.00	500.00	250.00	225.00	250.00
L. S. premium on bonds	3,250.00	3,325.00	3,400.00	2,500.00	4,000.00	3,544.00	3,700.00	4,000.00	4,200.00	4,500.00	3,090.00

SAN JOSE, CALIF.—EARTH AND GRAVEL FILL—COYOTE DAM

Award recommended (subject to P.W.A. approval) to Peninsula Paving Co., 9 Main St., San Francisco, $388,362, by Santa Clara Valley Water Conservation Dist., 62 Grant Bldg., San Jose, for constructing the Coyote Dam and Spillway, located on Coyote Creek, 5 mi. east of Morgan Hill, in SANTA CLARA CO., Calif. Bids from:

(1) Peninsula Paving Co., S. F. $388,362
(2) Macco Const. Co., Clearwater 493,825
(3) Bent Bros., Los Angeles 495,535
(4) Bechtel Co., San Francisco 537,230
(5) Frederickson & Watson, Oakland 540,840
(6) Morrison-Knudsen & MacDonald & Kahn $585,365
(7) Mittry Bros. Const. Co., L. A. 598,997
(8) Geo. Pollock Co., Sacramento 626,150
(9) A. Teichert & Son, Inc., Sacramento 675,300
(10) Engineers Estimate 532,000

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
L. S. const. and main. access road	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000
45,000 cy. found. strip bel. 670	.41	.60	.27	.75	.45	.60	1.00	.60	1.10	.60
150,000 cy. all other stripping	.225	.25	.27	.40	.33	.28	.50	.20	.46	.35
10,000 cy. cutoff tr. excav.	.24	.60	.40	1.25	.23	.75	.25	.70	.50	.60
1,200 cy. backf. tunn. and shafts	2.00	2.00	2.00	3.50	3.50	2.00	4.00	5.00	3.50	2.50
875,000 cy. earth and grav. fill emb.	.18	.25	.26	.26	.305	.27	.28	.38	.35	.25
186,000 cy. rock fill	.54	.60	.68	.60	.57	.90	.70	.60	.75	.70
1,200 cy. concrete	10.35	$13	$12	$15	$15½	$16	$17½	20.00	18.00	$15
2,300 cy. conc. lining spillw.	10.60	$16	$14	$15	$15½	$15	$15	15.00	14.00	$15
235,000 lb. reinf. steel	.04	.04	.04	.04	.04	.05	.042	.05	.045	.04
5,500 lb. struct. steel	.09	.10	.08	.06	.06	.10	.10	.10	.10	.10
900 ft. 50" steel out. pipe	$14	$15	$12	$10	$14	$20	$15	$25	$20	$16
150 ft. 12" corr. culvert	1.55	1.00	1.20	3.00	2.00	1.60	2.00	1.00	2.00	1.70
4,000 ft. 12" half rd. dr. tile	.47	.20	.40	.40	.25	.70	.50	.50	.50	.50
L. S. install outlet works	$800	$1,000	$600	$800	$500	$1,500	$450	$1,000	$1,200	$1,000
L. S. one bronze tablet	$90	$75	$85	$100	$75	$100	$125	$100	75.00	$100
L. S. 1 field office building	$300	$200	$300	$350	$250	$175	$350	$500	350.00	$250
L. S. premium on sur. & perf. bond	$5,825	$7,500	$7,500	$8,250	$7,990	$9,000	$8,852	$10,000	$10,000	$8,000

TUNNEL CONSTRUCTION

SAN FRANCISCO, CALIF.—CITY—CRYSTAL SPRINGS PIPELINE TUNNELS

E. T. Lesure, 87 Ross Circle, Oakland, $171,170, low to Public Utilities Commission, San Francisco, for const. the Crystal Springs pipeline tunnel under S.F.W.D. Spec. 74. Bids from:

	Sec. A	Sec. B	Sec. A-B
(1) E. T. Lesure, Oakland	$ 74,581	$ 96,588	$171,170
(2) Barrett & Hilp, San Francisco	.....	.....	211,104
(3) Youdall Const. Co., San Francisco	97,397	131,718	215,262
(4) MacDonald & Kahn Co., Ltd., San Francisco	106,213	.....	217,483
(5) Case Const. Co., Alhambra	.....	.....	219,736
(6) W. A. Bechtel Co., San Francisco	111,429	155,726	255,690
(7) Chas. L. Harney, San Francisco	129,133	167,027	269,348

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1,775 lin. ft. tunnel excav. Sec. A	16.72	...	36.00	34.63	...	30.00	50.90
1,763 lin. ft. tun. line 60" ID st. pipe	25.47	...	19.00	25.38	...	33.00	22.00
2,293 lin. ft. tun. excav. Sec. B	16.72	..	36.00	...	...	35.00	50.90
2,287 lin. ft. tun line 60" ID st. pipe	25.47	...	21.50	...	...	33.00	22.00
4,068 lin. ft. tun. excav. Sec. A & B	17.72	28.00	34.00	29.19	35.10	30.00	46.30
4,050 lin. ft. tun. line 60" ID st. pipe	25.47	24.00	19.00	24.38	19.00	33.00	20.00

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MAKES COMPLETED JOBS COST LESS, LAST LONGER!

*** ARMCO MULTI PLATE IS MADE IN GAUGES UP TO 9/32″ AND IN DIAMETERS TO 12½ FEET AND LARGER, EITHER IN FULL CIRCLE OR ARCH DESIGN.**

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STREET and ROAD WORK

LOS ANGELES, CALIF.—STATE—GRADING & TUNNEL ARCH—LOS ANGELES COUNTY

Contract awarded to Sharp & Fellows Contr. Co., Central Bldg., Los Angeles, $190,723.00, by Calif. Div. of Highways Los Angeles, for construction of a reinf. concrete tunnel arch and 0.2 mi. grading and 0.2 mi. grading and asph. concrete paving at Ocean Ave., and Colorado Ave., in SANTA MONICA, LOS ANGELES COUNTY. Bids from:

(1) Sharp & Fellows Contr. Co., L. A. $190,723
(2) C. W. Caletti and M. B. McGowan 195,733
(3) Frederickson & Watson, Oakland 195,910
(4) Bannister Field and Fred E. Potts 196,491
(5) Bent Bros., Los Angeles 196,522
(6) Bodenhamer Constr. Co. 197,209
(7) J. F. Knapp, Oakland 197,850
(8) Clinton Constr. Co., Los Angeles 206,248
(9) Mundo Engineering, L. A. 206,921
(10) R. H. Travers, Chas. G. Willis and C. G. Willis & Sons, L. A. $207,585
(11) Bates & Rogers, Oakland 209,968
(12) United Concr. Pipe Corp., L. A. 219,670
(13) Daley Corp., San Diego 223,435
(14) J. E. Haddock, Pasadena 225,215
(15) Griffith Co., Los Angeles 227,479
(16) Mittry Bros., Los Angeles 249,701

(A) 8 sta. clear. and grubbing
(B) 38,000 cu. yd. excav.
(C) 1,200 cu. yd. rem. concrete
(D) 14,160 lin. ft. reinf. conc. piles
(E) 15,000 cy. backfill
(F) 7,400 sq. yd. subgr. pavem.
(G) 6,600 cy. 'A' conc. struct.
(H) 870 cy. 'A' conc. pavem.
(I) 200 cy. 'A' conc. curbs, etc.
(J) 880 tons asph. conc. base
(K) 25 tons asph. conc.
(L) 5 tons fuel oil
(M) 8 tons 'E' asph.
(N) 300 sq. yd. asph. pt. bind.
(O) 835,000 lb. reinf. steel
(P) 900 pavement dowels
(Q) 2,500 lb. misc. iron & stal.
(R) 1,400 lb. copper strips
(S) 260 lin. ft. 4" C. I. P.
(T) 4 lin. ft. 12" rein. C. P.
(U) 144 lin. ft. 18" R. P.
(V) 170 lin. ft. 8" met. P.
(W) 26 lin. ft. 8" CMP
(X) 44 lin. ft. 12" CMP
(Y) 570 sq. yd. tile wk.
(Z) 1 lot orn. ir. rail.
(AA) 700 M. gals. water
(BB) Lighting equipment
(CC) 12 sta. fin. rdway.
(DD) 1 lot misc. work

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(A)	$10.00	$ 5.00	$10.00	$ 5.00	$10.00	$50.00	$50.00	$25.00	$ 5.00	$20.00	$ 2.00	$10.00	$100.00	$10.00	$ 5.00	$10.00
(B)	.275	.45	.45	.50	.60	.40	.30	.40	.365	.485	.325	.50	.68	.50	.75	.75
(C)	3.00	3.00	3.00	5.00	2.50	2.50	4.00	4.00	3.00	2.00	4.00	2.25	5.65	3.70	4.00	2.00
(D)	2.08	2.00	2.10	2.15	2.20	2.25	1.75	2.10	2.27	2.10	2.06	1.85	2.25	2.12	2.10	2.60
(E)	.36	.20	.30	.26	.68	.30	.30	.31	.38	.21	.24	.35	.35	.20	.25	.50
(F)	.12	.10	.12	.15	.25	.10	.12	.10	.15	.14	.10	.15	.12	.15	.17	.14
(G)	12.95	13.00	12.50	12.25	11.00	12.50	14.00	12.50	14.00	14.00	15.75	15.50	14.00	16.50	15.85	16.60
(H)	8.75	7.50	7.60	7.20	9.00	10.00	9.00	10.00	8.50	8.50	8.00	9.50	9.80	8.50	7.75	11.00
(I)	14.85	12.00	13.00	11.30	12.00	12.00	16.00	14.00	12.00	14.00	13.00	15.00	14.00	14.00	11.00	14.50
(J)	3.55	4.00	4.25	3.35	3.50	3.80	3.50	4.50	3.50	3.55	3.75	3.65	4.25	4.00	3.50	4.25
(K)	3.85	4.00	4.25	4.00	3.50	3.80	4.00	6.00	3.50	3.55	3.75	4.00	4.75	25.00	3.50	4.50
(L)	12.00	10.00	11.00	12.00	12.00	12.00	15.00	15.00	10.00	32.00	12.00	10.00	7.00	10.00	13.00	12.50
(M)	19.50	15.00	18.00	27.50	20.00	25.00	25.00	22.00	20.00	37.50	18.00	30.00	12.00	20.00	25.00	26.00
(N)	.04	.10	.06	.04	.04	.20	.05	.10	.05	.05	.03	.05	.03	.05	.08	.12
(O)	.0375	.04	.04	.041	.038	.04	.04	.042	.0425	.0395	.038	.045	.042	.04	.04	.0425
(P)	.12	.15	.12	.12	.10	.12	.10	.20	.15	.14	.195	.12	.15	.14	.12	.12
(Q)	.10	.20	.15	.075	.10	.10	.10	.12	.12	.10	.11	.15	.11	.11	.09	.18
(R)	.24	.50	.50	.40	.50	.20	.25	.35	.45	.30	.40	.30	.40	.40	.40	.30
(S)	.85	1.50	.80	1.00	1.00	.75	.30	1.00	1.00	.27	1.00	1.00	.50	1.00	1.50	1.10
(T)	3.75	3.00	1.50	3.00	2.50	1.80	1.50	4.00	5.00	4.50	5.50	5.00	3.00	2.00	4.00	3.00
(U)	2.90	3.50	1.75	3.00	2.50	2.50	2.50	4.00	2.60	3.70	4.30	3.00	2.60	2.50	3.00	3.80
(V)	1.00	2.00	2.00	1.00	1.50	1.00	1.00	2.00	1.25	1.40	1.05	2.00	1.30	1.50	1.50	2.00
(W)	1.00	2.00	1.00	2.00	1.00	1.00	1.00	2.00	1.00	1.00	1.65	2.00	2.00	1.00	1.25	1.10
(X)	1.40	2.00	1.25	2.50	1.50	1.50	1.25	2.00	1.25	1.54	2.00	2.50	1.50	1.50	1.50	1.50
(Y)	7.70	7.00	7.25	6.35	7.00	7.75	7.50	7.70	6.50	5.50	6.75	7.00	6.60	8.00	6.10	7.10
(Z)	350.00	250.00	350.00	275.00	350.00	400.00	350.00	400.00	380.00	200.00	330.00	500.00	350.00	385.00	325.00	580.00
(AA)	.65	.50	1.00	.50	.75	.50	.50	.50	.50	1.50	.50	.50	1.00	1.00	.65	1.00
(BB)	$3,230	$1,000	$2,500	$1,936	$2,250	$3,000	$2,850	$3,400	$2,375	$1,714	$2,377	$2,500	$2,150	$2,500	$2,000	$2,750
(CC)	5.00	5.00	6.50	8.00	4.00	10.00	6.00	10.00	5.00	10.00	10.00	10.00	10.00	10.00	12.00	9.00
(DD)	950.00	$2,617	$1,000	880.00	300.00	$1,000	$1,500	$6,500	500.00	$5,440	$1,200	$1,000	$315	$500	$500	$1,250

SACRAMENTO, CALIF.—STATE GRAD & GRAV. OR STONE SURF.—SAN MATEO COUNTY

Contract awarded to Peninsula Paving Co., 9 Main St., S. F., $114,834, by Calif. Div. of Highw., Sacramento, for 1.7 mi. grad. & bitum. tr. cr. grav. or stone surf. on cr. run base betw. Thornton and Daly City in SAN MATEO CO. Bids from:

(1) Peninsula Paving Co., S. F. $114,834
(2) Bayshore Const. Co., Inc. 117,210
(3) Union Paving Co., S. F. 117,345
(4) N. M. Ball, Berkeley 117,868
(5) C. W. Caletti, San Rafael 118,265
(6) Frederickson & Wats. & Fred. Br. 119,246
(7) Hanrahan Wilcox Co., S. F. 119,330
(8) Granfield, Farrar & Carlin, S. F. $122,094
(9) Fay Improvement Co., S. F. 123,886
(10) Chas. L. Harney, S. F. 124,597
(11) A. J. Raisch, San Francisco 129,784
(12) A. Teichert & Son, Inc. 133,921
(13) Healy Tibbitts Const. Co. 139,084

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
244,000 cu. yd. rdw. exc.	.17	.17	.175	.17	.17	.17	.18	.19	.17	.16	.18	.24	.205
2,010,000 sta. yd. overh.	.003	.004	.004	.005	.0025	.003	.004	.003	.0055	.006	.007	.002	.005
2,650 cu. yd. str. exc.	.80	.75	.50	.90	.65	1.00	.65	.90	.87	.75	.50	.75	2.00
2,500 M. gal. water	.50	1.25	.40	.75	1.00	.50	1.00	1.00	1.45	.50	1.70	1.00	1.50
16,750 tons cr. run base	1.42	1.50	1.50	1.35	1.55	1.50	1.45	1.60	1.36	1.36	1.45	1.50	1.75
6,120 tons cr. gr. or st.	2.61	2.40	2.50	2.45	2.85	2.85	2.80	2.12	2.87	3.20	2.65	2.60	2.60
304 tons cutb. asph.	18.50	16.00	16.00	16.00	17.60	17.00	15.50	18.00	15.50	17.40	13.50	18.60	15.00
126 tons fuel oil	12.00	9.25	12.00	13.35	10.50	13.00	9.00	18.50	10.86	13.00	11.00	10.50	8.00
20,690 sq.yd. pr. mix&shp. shl.	.05	.05	.06	.09	.05	.06	.035	.05	.055	.145	.18	.07	.05
180 tons screenings	2.00	3.00	2.50	3.00	3.30	2.50	2.30	1.75	3.00	3.00	3.00	2.35	2.80
107 cu. yd. A concr.	19.00	20.00	18.00	21.00	18.00	20.00	19.00	20.00	17.75	20.00	18.40	20.00	25.00
5,200 lb. reinf. steel	.05	.05	.06	.05	.05	.06	.05	.05	.045	.06	.05	.05	.05
1,250 ft. 8" C.M.P.	.85	.88	.70	.90	.90	1.00	.70	1.00	1.13	.105	1.00	.90	1.00
520 ft. 12" C.M.P.	1.15	1.08	1.00	1.20	1.20	1.20	1.00	1.30	1.48	1.35	1.20	1.30	1.25
920 ft. 15" C.M.P.	1.35	1.28	1.50	1.35	1.50	1.50	1.25	1.45	1.66	1.55	1.50	1.50	1.50
1,800 ft. 18" C.M.P.	1.60	1.54	1.60	1.55	1.70	1.70	1.40	1.70	1.84	1.75	1.75	1.80	1.75
210 ft. 24" CMP riv.	3.10	3.30	3.00	3.00	3.60	3.50	3.00	3.05	3.61	3.30	3.00	3.40	4.00
150 ft. 24" CMP jacketed	3.60	4.10	4.00	5.00	3.85	3.75	6.00	2.60	4.63	4.00	4.00	7.00	4.00
650 ft. 30" CMP	3.00	3.14	3.00	2.90	3.15	3.25	2.80	3.15	3.74	3.55	3.50	3.35	4.00
160 ft. 72" CMP	19.50	17.00	20.00	17.50	18.50	20.00	18.30	17.70	19.98	21.50	18.00	19.00	18.00
23 spillw. assemblies	17.30	13.50	15.00	12.00	11.00	15.00	12.00	15.00	10.70	16.75	16.00	12.50	10.00
8 concrete joints	11.00	10.00	15.00	8.00	7.50	12.00	10.00	6.00	14.00	8.80	8.00	12.00	6.00
20 culvert markers	1.85	1.50	3.00	2.00	1.75	1.75	1.60	2.00	1.80	3.00	1.00	1.60	3.00
160 guide posts	1.05	1.50	3.00	2.00	1.75	2.00	1.35	2.00	1.60	2.00	1.00	1.50	3.00
20 monuments	3.00	3.00	3.00	3.00	3.00	3.00	2.50	3.00	2.75	3.00	3.00	3.00	4.00
90 sta. fin. roadway	5.00	4.00	5.00	5.00	4.75	6.00	5.00	5.00	4.00	5.00	3.00	5.00	4.00

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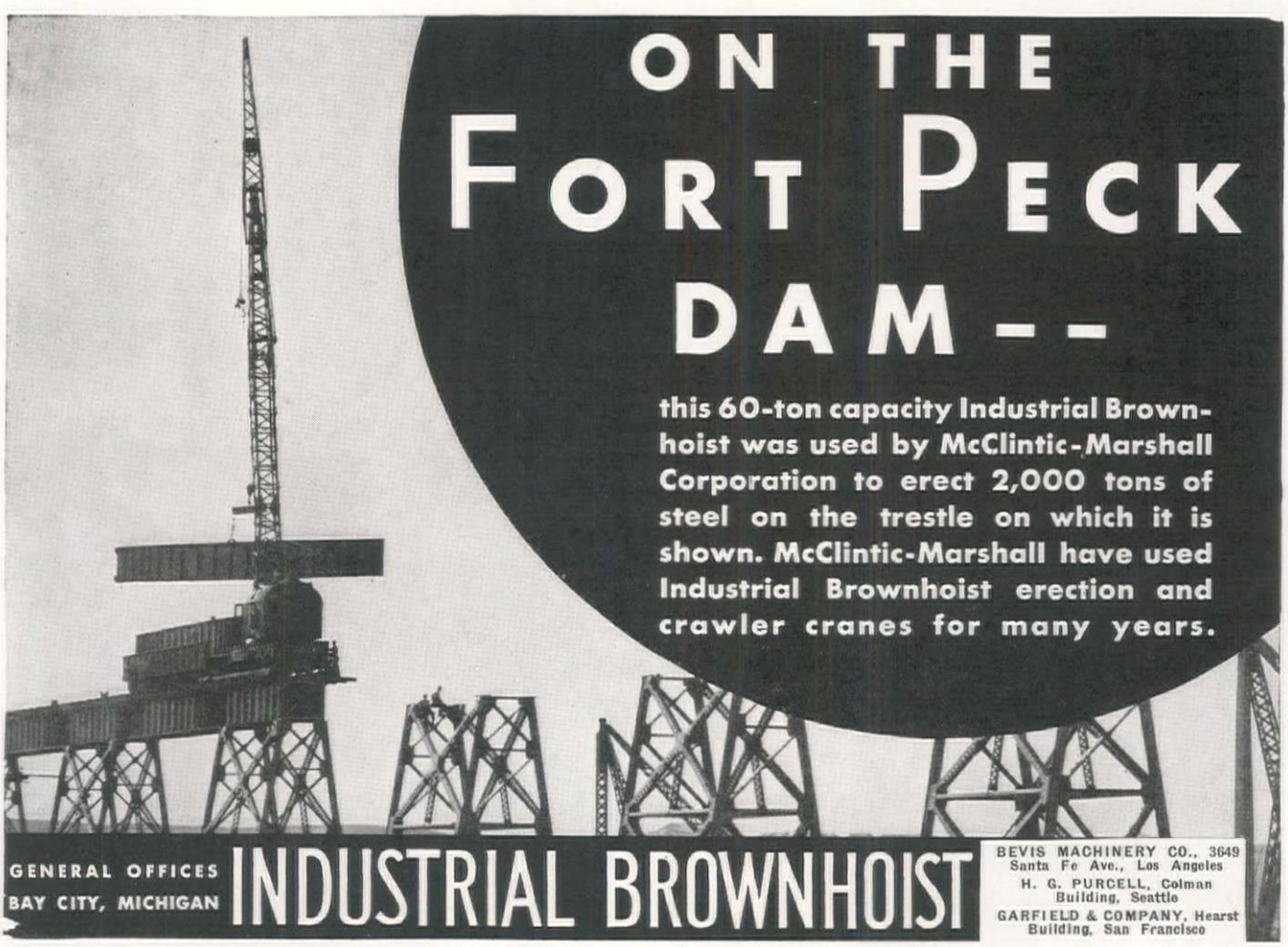
Name Address City W. C. N.



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BAY CITY, MICHIGAN

INDUSTRIAL BROWNHOIST

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H. G. PURCELL, Colman Building, Seattle
GARFIELD & COMPANY, Hearst Building, San Francisco

DENVER, COLORADO—GOVT.—BITUMINOUS SURF.—YELLOWSTONE NATL. PARK

Award recommended to A. H. Read Co., Cheyenne, Wyoming, $187,530.00 to Bureau of Public Roads, Denver, Colo., for 19.444 mi. bitum. surf. on the Grand Loop Highway, located in Yellowstone National Park, Proj. NR 1-G1, G2, part G3, Wyoming. Bids from:

(1) A. H. Read Co., Cheyenne $187,530.00
(2) Woodward Const. Co. Rock Springs 187,536.00
(3) J. L. McLaughlin, Gr. Falls 193,457.00
(4) Morrison-Knudsen & Taggart 194,926.00
(5) S. Birch & Sons Const. Co. 196,541.00
(6) S. J. Groves & Sons, Minneap. $197,450.00
(7) Olof Nelson, Logan, Utah 204,033.00
(8) Stevens Bros., St. Paul 214,628.00
(9) Hamilton-Gleason Co., Denver 223,368.00
(10) Engineers estimate 194,408.00

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
6,000 cu.yd. excavation	1.20	1.72	.75	$1.20	$.60	$1.00	$.75	$1.00	$.90	$.80
1,050 cu.yd. exc. for struc.	2.00	2.00	2.50	2.00	1.00	1.75	2.00	1.25	1.50	1.50
12,000 sta.yd. overhaul	.03	.05	.03	.04	.04	.03	.03	.03	.03	.03
1,600 cu.yd. subgr. reinforcement	1.50	2.34	2.50	2.00	2.00	2.25	1.00	3.50	2.00	2.00
6,750 tons cr. run surf. 'A'	2.00	1.60	2.25	2.00	1.60	1.80	2.00	3.30	1.25	2.00
Lump sum, prov. & maint. water pl.	150.00	300.00	500.00	300.00	300.00	50.00	300.00	1.00	2.00	250.00
150 M. gallons water	2.50	4.00	2.50	3.00	3.00	3.00	2.50	4.50	2.50	2.50
Lump sum, prov. and maint. roller	250.00	500.00	250.00	300.00	500.00	500.00	400.00	1.00	250.00	350.00
500 hrs. roller operation	3.00	2.80	2.50	3.00	3.00	2.80	2.50	3.50	2.00	2.50
30,500 tons pl. mix aggreg.	2.64	2.42	2.90	2.80	3.10	2.80	2.75	3.175	4.00	2.75
65,000 gal. liq. asph. rd. mtl. MC-1	.10	.10	.10	.12	.11	.1275	.12	.12	.1275	.12
420,000 gal. liq. asph. rd. mtl. MC-4	.10	.10	.09	.095	.10	.10	.11	.095	.10	.11
55 cu.yd. cem. rubb. masonry	19.00	20.00	22.00	25.00	27.00	30.00	25.00	25.00	23.00	20.00
4,100 lin.ft. 6" vitr. tile undr.	1.00	.775	1.00	1.00	.50	1.00	2.00	.25	1.25	1.00
3,600 ft. wood guardrail, Type 7	1.00	1.00	1.00	.90	1.15	.85	1.00	.75	.35	1.00
33,000 gal. liq. asph. rd. mt. RC1	.12	.125	.115	.12	.12	.1325	.12	.13	.135	.14
1,300 ton cover coat matl.	4.00	2.75	3.50	3.00	3.50	4.00	3.00	3.80	3.50	3.50
300 tons suppl. cov. coat mtl.	4.00	3.25	3.50	3.00	3.50	4.00	3.00	3.80	3.00	3.50
950 cu.yd. haul & pl. supl. surf.	1.50	1.20	1.50	1.00	1.50	1.50	1.00	1.35	1.25	1.50
L. S. extra work, misc. F.A. work	5,500.00	5,500.00	5,500.00	5,500.00	5,500.00	5,500.00	5,500.00	5,500.00	5,500.00	5,500.00
8 embankm. protectors	21.00	16.00	20.00	15.00	20.00	18.00	14.00	25.00	20.00	12.00
326 ft. 8" cor. met. pipe culv.	1.25	2.00	1.25	1.00	1.20	1.50	1.00	1.50	1.40	.75
14 mi. center line stripe	25.00	100.00	125.00	100.00	100.00	100.00	250.00	60.00	50.00	75.00
2,300 lin.ft. masonry curb	1.60	4.00	1.75	3.00	2.00	3.00	4.00	2.50	2.00	1.50
25 sq.yd. stone paving	1.60	5.50	3.50	5.00	10.00	5.00	10.00	5.00	5.00	3.50

PHOENIX, ARIZONA—GOVT.—GRADING—NAVAJO COUNTY

Award recommended to K. de Witt, Mesa, Arizona, $162,684, by Bureau of Public Roads, Phoenix, for 3.776 mi. grading Sec. A of the Federal Lands Highway Proj. No. 6, the Globe-Showlow Highway, NAVAJO COUNTY, Arizona. Bids from:

(1) K. DeWitt, Mesa, Arizona $162,684
(2) Lee Moor Contr. Co., El Paso 163,557
(3) Morrison-Knudsen Co., L. A. 179,334
(4) E. W. Everly, Albuquerque $180,695
(5) Hodgman & McVicar, Pasadena 182,064
(6) Armstrong & Armstrong 221,925
(7) Engineers Estimate 165,886

Bids received on:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
27 acres clearing	$150	$75	$125	$260	$150	$150	$75
149,200 cu. yd. unclass. excav.	.68	.74	.77	.77	.80	1.04	.75
2,480 cu. yd. structure excav.	2.00	1.25	1.50	2.00	2.00	2.00	1.75
6,000 cu. yd. borrow excav.	.30	.25	.40	.28	.35	.35	.35
110,000 sta. yd. overhaul	.04	.025	.025	.03	.03	.03	.02
1,900 cu. yd. mi. borrow haul	.30	.40	.40	.25	.35	.40	.25
3.776 mi. finish. earth graded rd.	$500	$250	$500	$200	$100	$200	$300
681 cu. yd. 'A' concrete	$30	$30	$36	$36½	$35	$37	$27
73,000 lb. reinforcing steel	.06	.055	.08	.06	.065	.065	.065
305 cu. yd. cem. rubble masonry	$19	$18	$20	$19	$22	$22	$17
1,628 lin. ft. 24" C. M. P.	3.00	3.00	3.00	3.05	2.50	3.40	3.25
344 lin. ft. 30" C. M. P.	3.80	3.60	4.00	3.85	3.50	4.00	4.25
1,104 lin. ft. 36" C. M. P.	6.00	5.50	6.20	6.00	5.50	6.25	6.00
210 lin. ft. 42" C. M. P. in place	7.00	6.50	7.40	7.10	6.50	7.20	7.50
134 lin. ft. 48" C. M. P. in place	8.00	7.50	$12	8.10	8.00	$10	10.00
1 cattle guard in place	$500	$750	$700	$900	$800	$800	$750
1,400 lin. ft. remove fence	.03	.04	.05	.04	.02	.03	.05
3,738 lin. ft. new fence in place	.10	.10	.10	.08	.10	.12	.10
10,312 lin. ft. type 'I' protection ditch	.20	.10	.10	.08	.15	.15	.10

LOS ANGELES, CALIF.—CITY—GRADE, PAVING, ETC.—SEPULVEDA BLVD.

Contract awarded to Southern Calif. Roads Co., 2145 E. 25th St., L. A., $271,664 by Board of Public Works, L. A., for improv. Sepulveda Blvd., between Ventura Blvd. and Beverly Blvd. Bids from:

(1) Southern Calif Roads Co., L. A. $271,664
(2) Griffith Co., Los Angeles 273,179
(3) United Concrete Pipe Corp. $298,124
(4) Engineers Estimate 290,787

	(1)	(2)	(3)	(4)
L. S. Grad. (35,856 cu. yd. oxc. & 30,562 cy. fill)	$24,000	$28,500	$20,000	$20,046
1,132,770 sq. ft. 8" Warron. Bit. pave base	.172	.17	.19	.191
445 sq. ft. same surf. variable thickness	.12	.13	.15	.13
3,319 sq. ft. 8" conc. pave, local depres.	.21	.25	.20	.19
494,237 sq. ft. rock & oil roadway	.03	.03	.04	.03
394 lin. ft. reinf. integral curb.	.50	.60	.70	.65
964 lin. ft. same, 1½" conc. curb.	1.00	.80	1.00	.75
828 lin. ft. unpl. heavy curb	.50	.50	.80	.46
805 sq. ft. conc. sidewalk, 3" thick	.12	.14	.14	.12
663 sq. ft. concr. gutter, 8" thick	.25	.25	.20	.22
39,158 sq. ft. 8" white conc. traffic line	.27	.30	.28	.25
10 sq. ft. 2" white, same	.25	.25	.25	.20
6,586 lin. ft. wooden guard rail	.50	.60	.80	.61
Lump sum, sanitary sewer	$750	$700	$ 1,000	$650
Lump sum, storm drain	$12,500	$11,000	$12,000	$14,365
Lump sum, concrete retaining walls	$ 8,000	$ 7,000	$10,500	$ 8,160
216 lin. ft. conc. baffle walls	1.00	1.00	11.00	.90
9 manholes, reset	50.00	50.00	270.00	50.00
141 sq. ft. 'C' resurfacing	.20	.18	.20	.25

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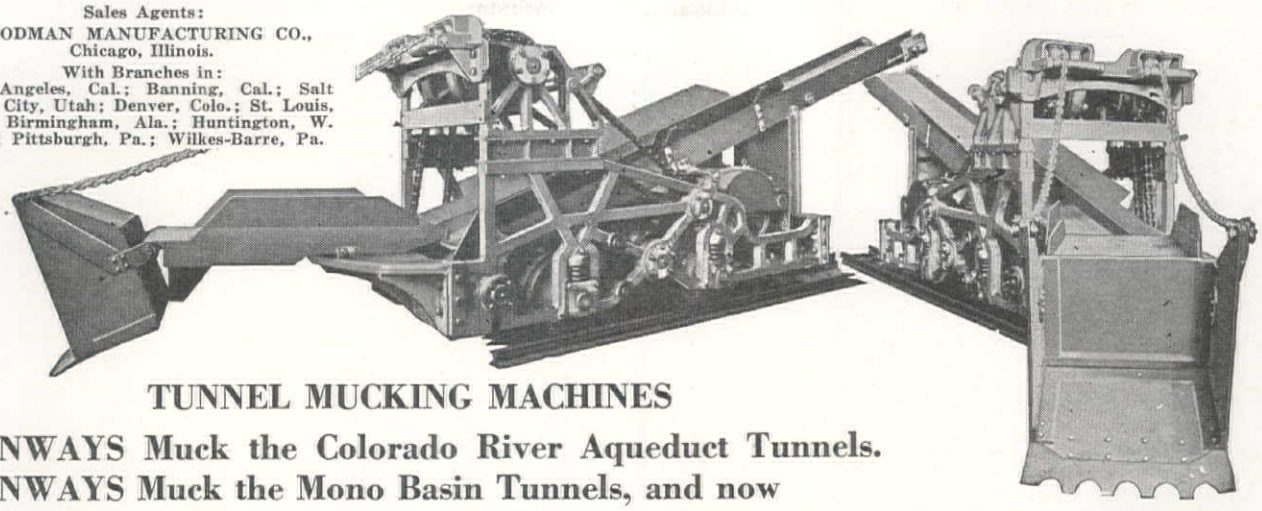

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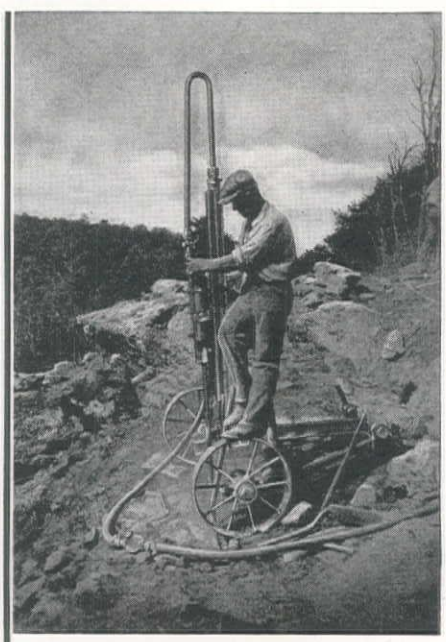

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The U-bar, adjustable to any position, in combination with the universal drill seat, assures the desired set-up. Peg legs, adjustable in length and position, assure rigidity.

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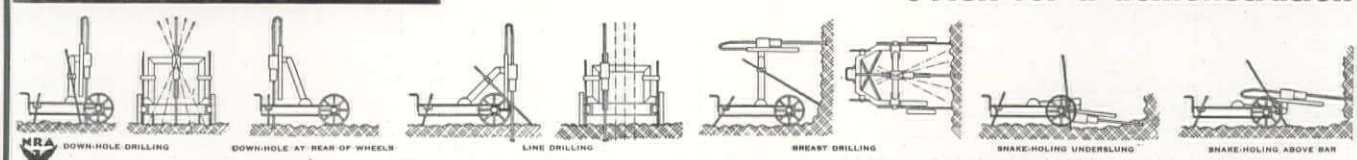

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CARSON CITY, NEVADA—STATE—GRADE & GRAVEL SURF.—LINCOLN COUNTY

Contract awarded to George French, Jr., P. O. Box 107, Stockton, $133,924.00 by Nevada State Highway Comm., Carson City, Nev., for 16.21 mi. grad. & gravel surf. from Alamo to 4 mi. east of Crystal Springs, Rt. 7 Sec. B1, LINCOLN CO, Nev.

(1) Geo. French, Jr., Stockton $133,924.00
(2) Dodge Const. Inc., Fallon 142,817.00
(3) Olof Nelson, Logan, Utah 145,160.00
(4) Jones & King, Hayward 149,198.00
(5) Utah Const. Co., Ogden 152,144.00
(6) Gibbons & Reed, Salt Lake City $155,944.00
(7) Union Paving Co., S. F. 167,580.00
(8) Isbell Const. Co., Reno 176,189.00
(9) A. Teichert & Son, Inc., Sacramento 189,093.00
(10) Engineers Estimate 148,655.00

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
19,135 lin. ft. remove fence	$.02	$.04	$.02	$.03	$.03	$.02	$.02	$.03	$.02	$.02
27 ea. remove trees	5.00	10.00	5.00	6.40	5.00	6.00	10.00	10.00	20.00	10.00
190,000 cu.yd. rdway excavation	.25	.28	.32	.28	.36	.35	.38	.45	.44	.30
152,655 sta.yd. overhaul	.03	.02	.03	.02	.02	.02	.02	.02	.02	.02
35,104 cu.yd. select borrow	.35	.30	.40	.35	.38	.35	.45	.40	.40	.40
1,930 cu.yd. struct. excavation	1.00	1.50	1.00	1.06	1.25	1.00	1.50	1.00	1.50	1.00
16.21 mi. subgrade	50.00	100.00	100.00	128.00	60.00	100.00	100.00	100.00	125.00	100.00
16.21 mi. finish roadway	100.00	100.00	100.00	160.00	200.00	150.00	100.00	150.00	250.00	100.00
53,900 tons cr. grav. or stone surf.	.50	.55	.50	.65	.52	.57	.60	.55	.72	.60
132 cu.yd. 'A' concrete	30.00	30.00	24.00	28.00	26.00	30.00	30.00	30.00	35.00	30.00
212 cu.yd. 'B' concrete	30.00	30.00	24.00	32.00	26.00	30.00	30.00	30.00	35.00	30.00
18,600 lb. reinf. steel	.07	.06	.06	.07	.08	.07	.07	.07	.07	.07
10 cu.yd. dry rubble masonry	10.00	10.00	10.00	7.70	5.00	9.00	15.00	10.00	10.00	12.00
2,852 lin. ft. 18" corr met. pipe	2.25	2.25	2.00	2.10	1.65	2.00	2.00	2.00	2.00	2.00
2,408 lin.ft. 24" corr. metal pipe	3.00	3.00	2.90	3.14	2.40	2.90	3.00	3.00	3.00	2.75
332 lin.ft. 30" corr. metal pipe	3.50	4.00	3.50	4.00	3.50	3.55	4.00	3.50	4.00	3.50
488 lin.ft. 36" corr. met. pipe	5.00	5.50	5.00	5.90	5.00	5.50	6.00	5.00	5.00	5.50
138 lin. ft. 48" corr. met. pipe	8.00	10.00	9.00	10.25	8.00	9.00	10.00	8.00	9.00	9.00
248 lin.ft. 42" corr. met. pipe	6.00	7.50	5.50	7.15	5.75	6.35	7.00	6.00	6.00	7.25
246 lin.ft. 30" metal flume	2.50	3.00	2.00	2.55	3.00	3.50	4.00	2.25	2.50	3.50
197 ea. monuments	3.00	3.00	5.00	3.20	3.00	3.00	4.00	3.50	3.50	4.00
16,990 lin.ft. const. fence	.15	.15	.12	.13	.11	.13	.12	.15	.15	.12
16,348 lin.ft. reconst. fence	.10	.10	.04	.06	.07	.08	.07	.10	.10	.07
Lump sum move buildings, etc.	500.00	1,000.00	300.00	640.00	300.00	500.00	100.00	500.00	1,000.00	350.00
14 cu.yd. riprap	5.00	5.00	3.00	3.85	3.00	5.00	5.00	10.00	6.00	4.00
1.7 M ft. BM redwood	125.00	120.00	130.00	128.00	120.00	140.00	120.00	125.00	150.00	120.00

SAN FRANCISCO, CALIF.—GOVT.—GRADING—MARIPOSA COUNTY

Award recommended to Morrison Kundsen Company, 1121 Title Guarantee Bldg., Los Angeles, $159,413 by Bureau of Public Roads, San Francisco, for 2.155 mi. grading Section A2 of Rt. 3, the Big Oak Flat Road, Yosemite National Park, MARIPOSA COUNTY, Calif. Bids from:

(1) Morrison Knudsen Co., L. A. $159,413.00
(2) Bodenhamer Const. Co., Oakland 164,851.00
(3) Bayshore Const. Co., S. F. $169,225.00
(4) Granfield, Farrar & Carlin, S. F. 188,175.00
(5) Engneers Estimate 167,837.00

	(1)	(2)	(3)	(4)	(5)
20 acres clearing	$790.00	$650.00	$600.00	$650.00	$800.00
107,400 cu.yd. uncl. excavation	1.05	1.10	1.10	1.20	1.10
6,200 cu.yd. excavation for borrow	.55	.60	.80	1.20	.55
1,020 cu.yd. structure excavation	2.25	1.75	2.00	2.00	2.00
45,600 sta. yd. overhaul	.02	.03	.01	.015	.02
8,500 cu.yd. mile borrow haul	.30	.20	.35	.40	.30
2,600 cu.yd. hand laid rock embankment	3.00	4.50	6.00	6.00	4.00
212 lin.ft. 12" corr. metal pipe	1.50	1.25	1.50	1.25	1.60
622 lin.ft. 18" corr. metal pipe	2.00	1.75	1.90	1.75	2.20
1,118 lin.ft. 24" corr. metal pipe	2.75	2.50	2.50	2.65	3.20
108 cu.yd. concrete	40.00	30.00	30.00	30.00	40.00
12,000 lb. reinforcing steel	.08	.08	.06	.07	.08
170 cu.yd. masonry	20.00	25.00	20.00	25.00	20.00
2,800 lin.ft. protection ditch	.20	.30	.50	.75	.15

LOS ANGELES, CALIF—CITY—GRADE SEPARATION

Contract awarded to John Strona, Chino, Calif., $149,962 (cast in place) by Board of Public Works, L. A., for constr. of the Gaffey St. bridges, including two structures; one a concr. girder bridge on Gaffey St., over Summerland Ave., and the other a reinf. concr. arch bridge on Elberon Ave., over Gaffey St. Bids from:

(1) Lynch Cannon Engr. Co.	$149,689	$151,689	(6) Griffith Co., L. A.	$160,489	$159,989
(2) John Strona, Chino	149,962	149,962	(7) L. E. Dixon Co., L. A.	165,263	165,263
(3) Bannister Field & Fred E. Potts, Los Angeles	154,437	154,437	(8) Byerts & Dunn, L. A.	167,951	167,951
(4) Reed & Maiser, L. A.	157,600	157,600	(9) R. E. Campbell, L. A.	178,714	178,714
(5) Person & Thiele, L. A.	159,224	156,964	(10) Engineers estimate	185,223	185,223

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
5,029 cu. yd. Class 'F' concrete	$17.70	$16.50	$17.00	$17.50	$17.80	$18.10	$19.05	$18.00	$20.30	$21.00
100 cu. yd. Class 'G' concrete	7.00	7.41	8.00	8.00	6.00	18.50	14.00	7.50	9.90	10.00
L. S. reinf. steel	29,500	30,703	31,124	31,000	32,370	31,100	30,300	35,000	31,710	37,762.50
L. S. creo. timber piles	275.00	290.00	300.00	300.00	216.00	350.00	375.00	400.00	296.00	331.25
L. S. reinf. conc. piles	12,000	12,873	15,000	13,500	14,260	13,000	13,700	15,000	15,111	13,320
L. S. same, ALT. cast in place	14,000	12,873	15,000	13,500	12,000	12,500	13,700	15,000	15,111	13,320
L. S. orn. conc. railings and pylons	4,000	4,390	5,587	5,500	4,000	6,500	5,900	7,300	7,255	6,000
L. S. ornamental iron railings	300.00	333.00	330.00	300.00	269.00	350.00	316.00	....	375.00	336.00
L. S. elec. conduit system	1,000	1118.88	850.00	1,000	1,100	1,400	1,060	1,000	961.00	1,000
L. S. lighting system	3,500	4078.14	3,626	3,500	3,800	3,400	3,750	4,300	3,684	4,000
L. S. grading	3,500	4,889½	4,205	5,500	5,000	4,500	5,200	5,700	8,605	8,282.40
820 tons asph. concrete base	2.50	3.50	3.25	4.00	3.75	3.70	3.50	3.60	3.40	3.50
543 tons asph. concr. wear. surf.	2.50	3.50	3.40	4.00	3.75	3.80	3.60	3.60	3.50	3.50
7,877 sq. ft. sidewalk, 3" thick	.11	.11	.11	.11	.13	.13	.11	.12	.13	.12
50 sq. ft. sidewalk, 4" thick	.16	.16	.12	.20	.18	.16	.16	.15	.16	.16
213 lin. ft. special curb	.60	.60	.60	.60	.60	.80	.55	1.00	.20	.60
423 ft. integral curb and gutter, 6"	.85	.90	.90	.90	.90	.80	.75	1.00	.90	.75
609 ft. integral curb and gutter, 8"	1.00	1.00	1.00	1.00	1.00	1.00	.85	1.10	1.00	.80
23 sq. ft. conc. gutter, 8" thick	.30	.30	.25	.30	.33	.28	.35	.60	.25	.24

TUNNEL AND MINE CARS

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The Madsen 70 cu.ft. Side Dumping Tunnel Car is one of an order for 110 placed by the Los Angeles Department of Water & Power for use on the Mono Basin Project. It was especially developed by the manufacturers for the particular work under consideration.

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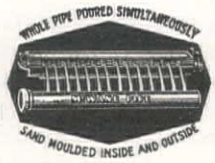

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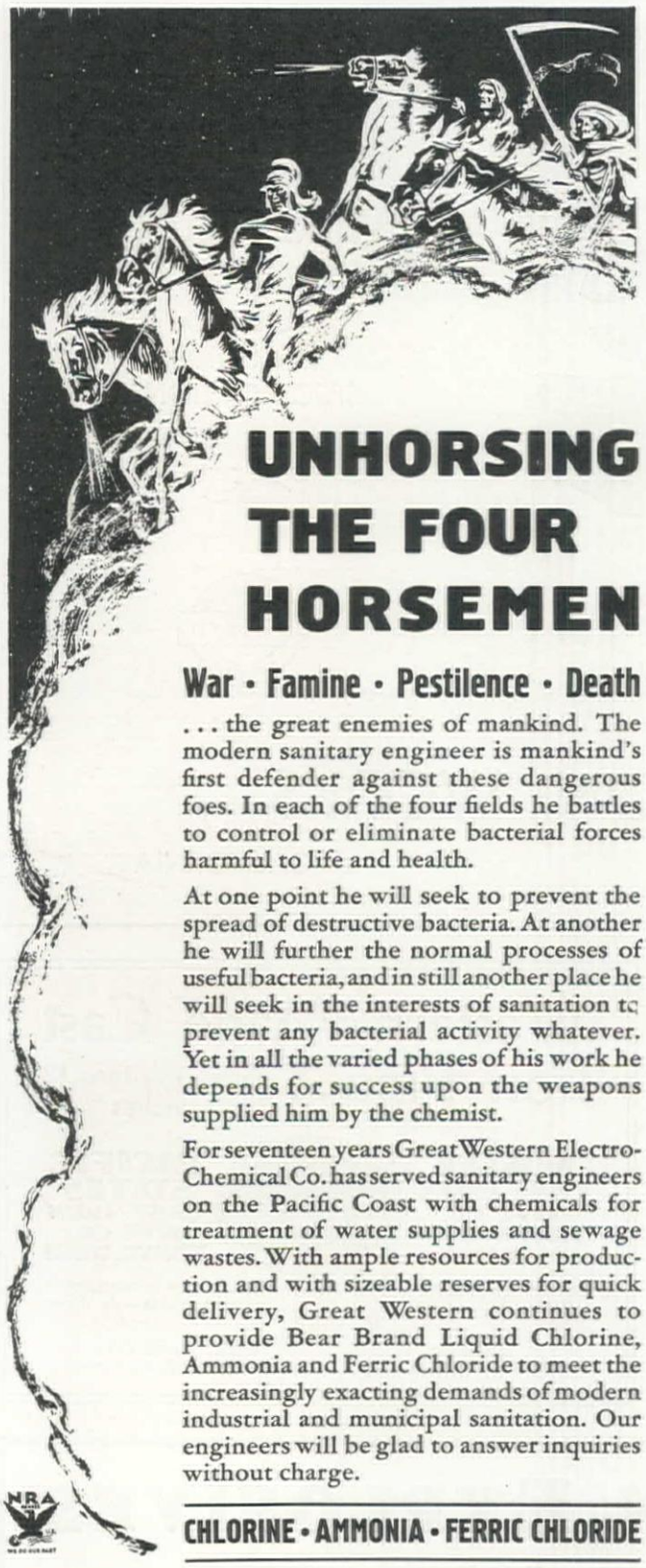

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CONSTRUCTION

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

Large Western Projects

WORK CONTEMPLATED

YUMA, ARIZ.—Additional contracts in connection with const. of the All-American canal: Bids about May, 1935, for canal section betw. diversion dam and Laguna Dam; bids about July, 1935, for model testing and designs for Imperial Diversion Dam; and bids about June, 1935, for 3 large concrete siphons.

BURBANK, CALIF.—Outdoor type sub-station for Los Angeles Dept. of Water & Power. Est. cost, $1,250,000.

IGNACIO, COLO.—Dam, etc., for Ignacio Water Users Assn. Est. cost, $2,200,000. Bonds voted.

EUREKA, CALIF.—Concrete dam, tunnel, steel and wood pipeline and reservoir for city, bids to April. 23. Est. cost, $1,168,000.

YUMA, ARIZ.—11,261,400 cu. yd. canal excav. for Bureau of Reclamation, bids to Apr. 25.

BIDS RECEIVED

GLASGOW, MONT.—Spillway gate structure, cutoff struct., etc., at the Fort Peck Dam, for the U. S. Engr. Office, Kansas City, Mo. Addison Miller, Inc., St. Paul, Minn., $3,985,000, low.

LOS ANGELES, CALIF.—Vehicular tunnel and street work on Figueroa St., for Board of Public Works, L. A., L. E. Dixon Co., Bent Bros. & Johnson, Inc., L. A., $366,607, low.

CONTRACTS AWARDED

LOS ANGELES, CALIF.—To Southern Pacific Co., L. A., $966,508 by Metropolitan Water Dist., for hauling 2,638,000 bbl. cement.

SAN FRANCISCO, CALIF.—To Pacific Bridge Co., Balfour Bldg., S. F., $698,226, by Public Utilities Com., S. F., for 2800 ft. double 54" submarine pipeline.

SAN JOSE, CALIF.—To A. Teichert & Son, Inc., Sacramento, $216,175 (subject to P.W.A. approval), by Santa Clara Valley Water Conservation Dist., for const. the Guadalupe Dam.

LOS ANGELES, CALIF.—To Sharp & Fellows Contr. Co., L. A., $190,723, by Calif. Div. of Highways, for reinf. conc. tunnel arch and 0.2 mi. grading and asph. conc. paving, at Ocean Ave. in Santa Monica.

SEATTLE, WN.—To Queen City Const. Co., Seattle, $232,026, by Bd. of Public Works for const. Laurelhurst Trunk and Intercepting Sewers.

LOS ANGELES, CALIF.—By Purch. Agt., Dept. of Water & Power, Los Angeles, to: (1) Allis Chalmers Mfg. Co., L. A., $793,240 for 7 oil immersed transformers; (2) General Electric Co., L. A., $731,600 for 3 outdoor type condensers.

ENGLEWOOD, COLO.—To Monroe Electric Co., Chicago, $350,000 by City for water plant.

STREET and ROAD WORK

CALLS FOR BIDS

PHOENIX, ARIZ.—Bids to 10 a.m., April 16, by Bureau of Public Roads, Phoenix, Ariz., for 4.718 mi. grading Sec. E, Federal Lands Highway Proj. No. 2, Kingman-Boulder Dam, MOHAVE COUNTY, Ariz. Inv.: 63,200 cu. yd. excav., 917 cu. yd. 'A' concrete. 3-29

LOS ANGELES, CALIF.—Bids to 2 P.M., April 25, by Calif. Div. of Highways, State Bldg., Los Angeles, for: (1) ORANGE COUNTY—1.1 mi. grade and concrete OR asph. concr. pavement betw. 17th St., in Santa Ana, and Fairhaven Ave., involving: 7,600 cu. yd. excav., 210 ton liq. asph. SC 2, 35 ton liq. asph. 90-95 (seal coat), 350 ton stone screenings (seal coat), 75 cu. yd. 'A' concr. structure, 6,415 lb. steel railroad rails. ALT. A—5,050 ton asph. concrete. ALT. B—2,580 cu. yd. 'A' conc. pavement. (2) SAN DIEGO COUNTY—2.8 mi. grads and tr. with liq. asph., betw. 1 mi. east of Barrett and Tecate Road, involving: 86,000 cu. yd. roadway excav., 144,000 sta. yd. overhaul, 182 ton liq. asph. SC 2. 4-2

SACRAMENTO, CALIF.—Bids to 2 P.M., April 17, by Calif. Div. of Highways, Sacramento, for 3.8 mi. grad. and asph. conc. paving, betw. French Camp and Stockton, SAN JOAQUIN COUNTY, Cal., inv.: 17,500 cu. yd. imported borrow, 5,920 tons cr. grav. or stone surf, 282 tons liq. asph. SC-2 rd. mix tr., 15,260 tons asph. conc. pavement. 3-26

SACRAMENTO, CALIF.—Bids to 2 P.M., April 17, by Calif. Div. of Highways, Sacramento, for: (1) SAN MATEO COUNTY—0.2 mi. grad. and asph. conc. paving betw. Crystal Springs Rd. and 3rd Ave., in San Mateo. Involving: 1,130 tons cr. run base, 1,650 tons asph. concr. pavement 342 cu. yd. 'A' conc. arch barrel, 400 cu. yd. 'A' conc. walls. (2) KERN COUNTY—4.5 mi. grading and bitum. tr. surf. betw. ½ mi. south and 4 mi. east of Western Waterworks Pumping Station (Kern 140 A & B), involving: 69,000 cu. yd. excav, 2,546,000 sta. yd. overhaul, 9,350 cu. yd. selected surf. material. 3-26

SACRAMENTO, CALIF.—Bids to 2 P.M., April 24, by Calif. Div. of Highways, Sacramento, for 1.3 mi. retread surf. betw. Mill St. and northerly city limits in Ukiah and betw. Broaddus Creek and northerly line of Northwestern Pacific right-of-way in Willitts, in MENDOCINO COUNTY, Calif. Work involves: 20 M gal. water, 165 tons untr. cr. grav. or stone surf., 5,900 sq. yd. plane pavement, 465 tons plant mix surf. (med. curing type), 2,635 tons screenings, 182 tons emuls. asphalt. 4-2

SAN FRANCISCO, CALIF.—Bids to 2 P.M., Apr. 18, by Bureau of Public Roads, 461 Market St., San Francisco, for 6.886 mi. grading and placing sub-grade reinforcement on Sec. C, Rt. 73, Laguna Natl. Forest Highway, Cleveland Natl. Forest, SAN DIEGO COUNTY, Calif., involving: 231,000 cu. yd. excav., 1,073,000 sta. yd. overhaul, 202 cu. yd. conc. 3-29

SAN FRANCISCO, CALIF.—Bids to 2 P.M., June 25, by Bureau of Public Roads, 461 Market St., S. F., for 4.911 mi. bitum. treatment (light surface application) on Sec. B, the southwest approach to Lassen Volcanic Natl. Park, Lassen Natl. Forest, TEHAMA COUNTY, Calif. Work involves: 210 tons liq. asph. road matl. SC-2. 3-19

SAN LUIS OBISPO, CALIF.—Bids to 2 P.M., Apr. 16, by Dept. of Public Works, Div. of Highways, Office of District Engr., 50 Higuera St., San Luis Obispo, Calif., for 0.4 mi. roadway cut to be widened and roadside to be planted betw. 2 mi. north of Solomon Summit and Santa Maria (V-S, B-2-L) SANTA BARBARA COUNTY, Calif. 4-1

NEWS SUMMARY

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

BIDS RECEIVED

PHOENIX, ARIZ.—All bids submitted to Arizona State Highway Comm., Phoenix, for 5.6 mi. grading, draining and aggregate base course and oil processing (road mix) on Ajo-Tucson Highway, in PIMA COUNTY, NRS 110-A, have been rejected and new call for bids will be issued shortly to be opened later. 3-30

LOS ANGELES, CALIF.—Southern California Roads Co., 2145 E. 25th St., Los Angeles, low $51,482 to Board of Public Works, 153 City Hall, Los Angeles, for improving El Modena St. betw. Figueroa St. and Colorado Blvd., under Cash Contract. 3-28

LOS ANGELES, CALIF.—Dimmitt & Taylor, 815 E. 59th St., Los Angeles, $34,892 low to Calif. Div. of Highways, State Bldg., Los Angeles, for 1.7 miles grading and applying roadmix surface treatment through the Narrows (S.D. 198 F & G) in SAN DIEGO COUNTY, Calif. 3-28

SACRAMENTO, CALIF.—Jones & King, Jackson St., Hayward, $24,389 low to Calif. Div. of Highways, Sacramento, for 0.6 mi. grade and conc. and asph conc. paving betw. southerly boundary and B St., Hayward, in ALAMEDA COUNTY, Calif. 4-3

PORTLAND, ORE.—Bids received as follows by Oregon State Highway Comm., Pub. Service Bldg., Portland, Oregon, for: (1) HOOD RIVER COUNTY (NRH 174-B)—F. J. Kernan, River Rd., Portland, $34,414 for 0.91 mi. grad. and penetr. type bitum. macad. wr. surf. on Cascade Locks Sec. of Columbia River Highway. Next low: Joplin & Eldon, Portland, $40,875. (2) MULTNOMAH COUNTY (NRM 203-C) Parker Schram Couch Bldg., Portland, $46,985 low for 0.59 mi. pav. resurf. on Ash-Jefferson St. Unit, 4th Ave. on West Side Pacific Highway. 3-30

CONTRACTS AWARDED

PHOENIX, ARIZ.—To Hodgman & MacVicar, 714 Plymouth Road, San Marino, $35,004 by Ariz. State Highway Comm., Phoenix, Ariz., for 5 mi. grad., drain and placing select matl. and aggreg. base course approx. 38⅔ mi. north of Flagstaff and extending northerly on Flagstaff-Fredonia Highway, COCONINO COUNTY, Ariz. (NRH 95-J). 3-4

PHOENIX, ARIZ.—To Phoenix, Tempe Stone Co., Phoenix, $68,785 to the Arizona State Highway Comm., Phoenix, Ariz., for 6 mi. widening of roadway and lengthening of drainage struc. at Six Points in Phoenix on Phoenix-Prescott Highway, in MARICOPA CO., Proj. NRH 33. 3-4

PHOENIX, ARIZ.—To Lee Moor Contr. Co., El Paso, $185,075 by Arizona State Highway Comm., Phoenix, Ariz., for grading 4½ mi. and draining, beginning about 56½ mi. northeast of Globe and extending northeasterly on the Globe-Sholow Highway, GILA CO. (NRH 99-I). 3-4

PHOENIX, ARIZ.—To Hodgman & MacVicar, Box 337, Flagstaff, Ariz., $37,698 to Bureau of Public Roads, Phoenix, Ariz., for 2.989 mi. grading Sec. B of Rt. 11, the Payson-Colcord Mt. Natl. Forest Highway, Tonto Natl. Forest, GILA COUNTY, Arizona. 3-19

PHOENIX, ARIZ.—To Lee Moor Contr. Co., 807 Bassett Tower, El Paso, Texas, $95,050 by Bur. of Pub. Roads, Phoenix, for 14.437 mi. plac. bitum. tr. cr. rock surf. on Secs. E & D of Cameron-Desert View approach to Grand Canyon Natl. Park, COCONINO COUNTY. 3-22

PHOENIX, ARIZ.—Award recommended to K. DeWitt, Mesa, Ariz., $162,684 low to Bureau of Public Roads, Phoenix, Ariz., for 3.776 mi. grading Sec. A of Federal Lands Highway Project No. 6, the Globe-Sholow Highway, NAVAJO COUNTY, Ariz. 3-25

PHOENIX, ARIZ.—To K. De Witt, Mesa, Ariz., $26,895 by Bureau of Public Roads, Phoenix, Ariz., for 6.585 mi. placing sub-grade reinforcement on Sec. 'D' of Rt. 10, the Pine-Winslow Natl. Forest Hwy, Coconino and Tonto Natl. Forest, COCONINO and GILA COUNTIES, Arizona. 3-27

PHOENIX, ARIZ.—Award recommended to Rogers Bros., Snowflake, Ariz., $46,081 low to Bureau of Public Roads, Phoenix, Ariz., for 4.527 mi. grading on Section A of Route 30, the Globe-Sholow Natl. Forest Highway, Sitgreaves Natl. Forest, NAVAJO COUNTY, Arizona. 3-29

PHOENIX, ARIZ.—To Heafey-Moore & J. A. Casson, P. O. Box 2293, Phoenix, $56,386, to State Highway Comm., Phoenix, Ariz., for 7½ mi. grading, draining and aggregate base course and oil processing by the road mix method, on the Bisbee-Douglas Highway, junction, about 1 mi. west of Douglas, on the Douglas-Safford Highway, Proj. NRS 114-B (1935) in COCHISE COUNTY. 3-29

PHOENIX, ARIZ.—To Pleasant Hasler Constr. Co., 324 Luhrs Bldg., Phoenix, $152,428 to Arizona State Highway Comm., Phoenix, for 12⅔ mi. grading, draining and place aggregate base course and road oil plant mix at Ft. Huachuca on the Fort Huachuca-Bisbee Highway, NRS 108-A (1935), in COCHISE COUNTY. 3-29

LOS ANGELES, CALIF.—To Southern California Roads Co., 2145 E. 25th St., Los Angeles, $271,664 by Board of Public Works, City Hall, Los Angeles, for improv. Sepulveda Blvd., betw. Ventura Blvd. and Beverly Blvd. 4-1

LOS ANGELES, CALIF.—To Southern California Roads Co., 2145 E. 25th St., Los Angeles, $82,054 by Board of Public Works, 153 City Hall, Los Angeles, for improving Sepulveda Blvd., betw. National Blvd. and Venice Blvd., under Cash Contract. 4-1

LOS ANGELES, CALIF.—To United Concrete Pipe Corp., Box 1, Sta. H, Los Angeles, $23,515 (asph. conc.) low to Calif. Div. of Highways, Los Angeles, for 0.5 mi. asph. conc. paving and shoulders surf. with plant mix surf. (medium curing type) betw. Prairie Ave. and Commercial St., in Inglewood (L. A. 174), in LOS ANGELES COUNTY, Calif. 4-3

LOS ANGELES, CALIF.—To Oswald Bros., 366 E. 58th St., L. A., $45,547 by Calif. Div. of Highways, L. A., for 21 mi. shoulders to be graded and bitum. tr. screen gravel or stone borders betw. E. Highline Canal and Sand Hill in IMPERIAL COUNTY, Calif. 3-5

LOS ANGELES, CALIF.—To L. A. Paving Co., 3200 E. Vernon Ave., L. A., $111,222 by Calif. Div. of Highways, L. A., for 3.4 mi. grad. and concr. pav. betw. Winter Canyon and Las Flores Canyon in LOS ANGELES COUNTY, Calif. 3-6

LOS ANGELES, CALIF.—To B. G. Carroll, 4396 Maryland St., San Diego, $64,148 by Calif. Div. of Highways, L. A., for 2 mi. grad. and concr. paving betw. Riverside Ave. and Colton in SAN BERNARDINO COUNTY, Calif. 3-6

LOS ANGELES, CALIF.—To Sully Miller Contr. Co., 1500 W. 7th St., Long Beach, $56,149 by Calif. Div. of Highways, L. A., for 0.7 mi. grad. and asph. conc. and conc. pav. betw. Long Beach and Signal Hill betw. Stanley Ave. and Loma Ave., LOS ANGELES CO. 3-12

LOS ANGELES, CALIF.—To Sharp & Fellows Contracting Co., 533 Central Bldg., Los Angeles, $190,723 to Calif. Div. of Highways, Los Angeles, for const. a reinf. concr. tunnel arch and 0.2 mi. grading and asph. concr. paving at Ocean Ave. and Colorado Ave. in Santa Monica, LOS ANGELES COUNTY, Calif. 3-20

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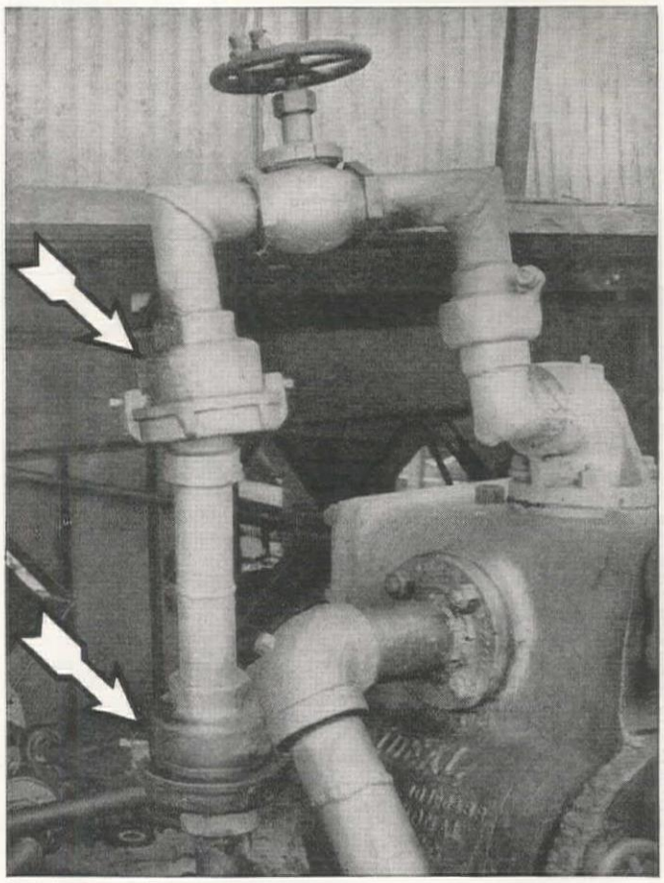

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Flexible Ball
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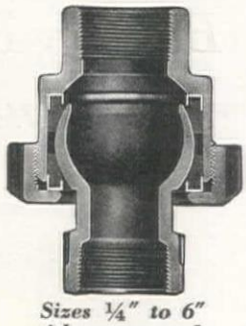

Sizes ¼" to 6" with screw ends. 4" to 48" with flange ends.

are indispensable on any assembly of steam, air, or fluid-carrying pipe which must contend with movement or vibration. They prevent pipe breakage or leaks, caused by engine or pump motion or the expansion and contraction due to temperature changes.

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HELENA, MONT.—Awards as follow by the State Highway Dept., Helena, Montana, for: (1) GLACIER COUNTY (NRS 316B)—To Kirkpatrick Bros., Kalispell, $29,322 for 5.056 mi. grad., surf. with cr. grav. sub-base matl. and top course of cr. grav. and const. small drain. struc. on Sec. B of Cut Bank N. Road. (2) PONDERA COUNTY (NRS 321B)—To Tomlinson-Arkwright Const. Co., Great Falls, Mont., $33,699 for 6.239 mi. grading, surf. with grav. sub-base matl. and a top course of cr. grav. and const. small drain. struc. on Sec. B of the Valier West Road. 3-18

CARSON CITY, NEV.—To Fredrickson & Watson Const. Co. and Fredrickson Bros., 873 81st Ave., Oakland, and Jones & King, Hayward, $167,846 by Nevada State Highway Comm., Carson City, Nev., for 28.05 mi. grading, surf. and oiling betw. Schurz and 9.6 mi. south of Fallon, Rt. 1A, Secs. A, A, C1 and C2, in MINERAL, LYON and CHURCHILL COUNTIES, Nevada. 3-13

CARSON CITY, NEV.—Awards as follow by the Nevada State Highway Comm., Carson City, Nev., for: (1) LINCOLN COUNTY (Proj. 1163)—To George French, Jr., P. O. Box 107, Stockton, $133,924 for 16.21 mi. grad. and grav. surf. from Alamo to 4 mi. E. of Crystal Springs, Rt. 7, Sec. B1. (2) CLARK COUNTY (Proj. 113)—To Union Paving Co., Call Bldg., S. F., $79,324 for 10.18 mi. grad. and grav. surf. from Las Vegas to a point approx. 10 mi. southeast Rt. 5, Sec. D1. 3-22

CARSON CITY, NEV.—To Fredrickson & Watson, 873 81st Ave., Oakland, and Jones & King, Hayward, $160,129 by Nevada State Highway Comm., Carson City, Nev., for 9.45 mi. grad. and grav. surf. from Washoe-Lyon County Line to 5 mi. N.E. of Fernley and from Fernley overpass to a point approx. 1.5 mi. south, Secs. A1, A2, A3, A4 and B, Rts. 1 and 2, Proj. NRH 84A, 66B and 79A and B (1935) in LYON COUNTY, Nevada. 3-23

CARSON CITY, NEV.—To U. B. Lee, 1059 Carpentier St., San Leandro, Calif., $26,097 to Nevada State Highway Comm., Carson City, Nev., for 16.61 mi. asph. road mix surf. from California-Nevada state line to the junction with Rt. 5 (Death Valley Rd.), Rt. 29, Sec A, NYE COUNTY, Nevada. 3-27

CARSON CITY, NEV.—To Dodge Const., Inc., Fallon, Nev., $97,930 by Nevada State Highway Comm., Carson City, Nev., for 20.86 mi. grading and gravel surfacing from Coaldale to Rhodes, Sec. F and A1, Rt. 3, in ESMERALDA and MINERAL COUNTIES, Nevada. 3-27

SANTA FE, NEW MEXICO—Awards as follow by State Highway Engr., Santa Fe, N. M.: (1) McKINLEY COUNTY (NRS 209B)—To Ernest Everly, Albuquerque, N. M., $69,611 for 5.710 mi. grad., surf., etc., betw. Gallup and Ft. Defiance, St. Rd. No. 68. (2) EDDY COUNTY (NRFLH 4 and 830A)—To A. O. Peabody, Las Cruces, N. M., $34,079 for 19.498 mi. double bitum. surf. tr. on U. S. Route 62, east of Carlsbad. 3-9

SANTA FE, NEW MEXICO—Awards as follow by the Nevada State Highway Engineer, Santa Fe, N. M., for: (1) DONA ANA COUNTY (NRS 215B)—To A. O. Peabody, Las Cruces, $53,833 for 5.314 mi. grad. and shaping roadway and cr. select matl. surf. on St. Rd. No. 28, betw. Las Cruces and San Miguel. (2) LEA COUNTY (NRS 238) —To Leone Bros., Trinidad, Colo., $29,484 for 11.141 mi. grad. and shaping roadway and cr. selec. matl. surf. on St. Rd. No. 18, betw. Portales and Lovington. 3-9

PORTLAND, ORE.—Awards as follow by Oregon State Highway Comm., Public Service Bldg., Portland: (1) MARION CO. (NRS 243)—To J. C. Compton, McMinnville, Ore., $33,609 for 0.27 mi. oil mat surf. tr. and 1.64 mi. surf. and penetr. type bitum. macad. wr. surf., also furn. cr. rock or cr. grav. in stockpiles on Salem-Pringle Creek Sec. of Morningside Secondary Highway. (2) WASCO COUNTY (NRH 36A and 36C)—To Edlefsen-Wygandt Co., Peninsular Ave. and Columbia Blvd., Portland, $61,458 for 1.23 mi. grad., surf. and penetr. type bitum. macad. wr. surf. and 432 lin. ft. pavement widening and resurf. on West Entrance of The Dalles Section of Columbia River Highw. 3-8

PORTLAND, ORE.—Award recommended to Brant-Sturgill Co., Inc., College Place, Wn., $33,543 to the Bureau of Public Roads, Portland, Oregon, for const. or improv. the Mt. Adams Highway reconst. grading and subgrade reinf. proj. FHEC 17-A1, Natl. For. Road Proj., located in Columbia Natl. Forest, KLICKITAT COUNTY, Wn. 3-18

PORTLAND, ORE.—Award recommended to Tomlinson-Arkwright Const. Co., Great Falls, Mont., $43,545 by Bureau of Public Roads, Portland, Ore., for 25.919 mi. constr. or improving the Glacier Natl. Park, Transmountain Highway, East Side, and Babb-Many Glaciers Oiling projects PEC-1-D1, D2, E1, E2, and PEC-3A (per.), A1, B1, Natl. Park Road Projects located within the Glacier Natl. Park, GLACIER COUNTY, Montana. 3-30

PORTLAND, ORE.—Contracts awarded as follows by the Oregon State Highway Comm., Public Service Bldg., Portland, Oregon, for: (1) DESCHUTES COUNTY (NRM 123-F)—To Kearn & Kibbee, 42 S.E. Salmon St., Portland, $35,875 for 0.48 mi. pavement constr. on the Redmond Section of The Dalles-California Highway. (2) DOUGLAS COUNTY (NRM 78C and NRM 78D)—To Jacobson-Jensen, 517 N.E. Stanton St., Portland, $26,705 for 0.61 mi. pavement widening and resurf. on the Roseburg Sec. of Pacific Highway. (3) MALHEUR COUNTY (NRS 231)—To Morrison Knudsen Co., 319 Broadway, Boise, Idaho, $26,484 for 2.36 mi. grading on the Malloy Ranch-Idaho State Line Sec. of I-O-N Highway. (4) COOS COUNTY (NRS 207-B)—To J. W. & J. R. Hillstrom, Marshfield, Ore., $27,031 for 1.81 mi. grad., surf. and oil mat. surf. tr., also furn. cr. matl. in stockpiles on Empire-Pigeon Point Sec. of Cape Arago Second. Highway. 3-30

SALT LAKE CITY, UTAH—Award to W. W. Clyde & Co., Springville, Utah, $43,402 by State Road Comm. of Utah, S. L. City, for 3.877 mi. grav. surf. road betw. Harrison Ave. and Uintah, NRS 162 (1935), in WEBER COUNTY, Utah. 3-25

BRIDGES and CULVERTS

WORK CONTEMPLATED

NEWPORT BEACH, CALIF.—State Highway Commission of California has completed final negotiations for railroad right-of-way over the Coast Highway at Newport Beach, and call for bids will be issued within three months for construction of an overhead crossing at the Arches Intersection. Est. cost, $180,000. 4-1

CALLS FOR BIDS

LOS ANGELES, CALIF.—Bids to 2 P.M., April 17, by District Engr., Calif. Div. of Highways, 808 State Bldg., Los Angeles, for const. a structural steel and conc. pedestrian overhead structure across the state highway in Santa Monica about 0.5 mi. northwest of Colorado Ave., in LOS ANGELES COUNTY, Calif., involving: 162 cu. yd. 'A' concrete, 9000 lb. reinf. steel, 39,000 lb. struct. steel. 4-2

LOS ANGELES, CALIF.—To A. S. Vinnell, 969 Amalia Ave., Los Angeles, $27,729 to Calif. Div. of Highways, Los Angeles, for 1.7 mi. grading and roadbed tr. with fuel oil and applying seal coat betw. Camarillo State Hospital buildings and Lewis Road, in VENTURA COUNTY, Calif. 3-21

LOS ANGELES, CALIF.—To V. R. Dennis Const. Co., 3911 5th Ave., San Diego, $38,999 to Calif. Div. of Highways, Los Angeles, for 0.8 mi. grad. and asph. conc. pav. betw. Emerald Ave. and east city limits of El Cajon, SAN DIEGO COUNTY, Calif. 3-23

LOS ANGELES, CALIF.—To R. E. Hazard Contr. Co., P. O. Box 1438, San Diego, $16,568, by Calif. Div. of Highways, Los Angeles, for 2 bridges and 0.2 mi. grad. and surf., near Calexico, IMPERIAL COUNTY, Calif. 3-25

SACRAMENTO, CALIF.—To Tiffany Const. Co., 535 N. 7th St., San Jose, $53,084 by Calif. Div. of Highways, Sacramento, for 10 mi. of which 0.6 mi. is to be grad. and surf. with cr, run base and bitum. tr. cr. grav. or stone and remainder widened and borders of cr. run base const., betw. 3 mi. N. of Willow and Orland,, GLENN CO. 3-5

SACRAMENTO, CALIF.—To L. A. Brisco, Arroyo Grande, Calif., $19,263, by Calif. Div. of Highways, Sacramento, for const. borders of cr. run base and apply bitum. tr. surf. on 6.1 mi. betw. 1 mi. and 7 mi. east of Tulare, TULARE COUNTY, Calif. 3-11

SACRAMENTO, CALIF.—To Peninsula Paving Co., 9 Main St., San Francisco, $114,834 to Calif. Div. of Highways, Sacramento, for 1.7 mi. grad. and bitum. tr. cr. gravel or stone surf. on crusher run base betw. Thornton and Daly City in SAN MATEO COUNTY, Calif. 3-19

SACRAMENTO, CALIF.—To E. B. Bishop, Orland, Calif., $63,822 by Calif. Div. of Highways, Sacramento, for 8.7 mi. surf. with cr. run base and bitum. seal coat applied betw. foot of Oregon Mt. and Oregon State Line, DEL NORTE COUNTY, Calif. 3-21

SACRAMENTO, CALIF.—To Healy Tibbitts Const. Co., 64 Pine St., S. F., $17,361 by Calif. Div. of Highways, Sacramento, for 0.3 mi. riprap slope protection betw. Rio Vista Bridge and Sweetwood, SACRAMENTO COUNTY. 3-25

SACRAMENTO, CALIF.—To Pacific States Constr. Co., Call Bldg., S. F., by Calif. Div. of Highways, Sacramento, $19,745, for 0.7 mi. grad. and bitum. tr. cr. grav. or stone surf. (plant mix) in SOLANA CO. 3-25

SACRAMENTO, CALIF.—To Hemstreet & Bell, 501 11th St., Marysville, $16,730, by Calif. Div. of Highways, Sacramento, for 1 mi. grad. and bitum. tr. cr. grav. or stone surf. (rdmix) on creek run gravel base at south entrance to Red Bluff, TEHAMA COUNTY, Calif. 3-26

SAN FRANCISCO, CALIF.—To H. V. Hagen, Globe, Ariz., $110,506 by Bureau of Public Roads, S. F., for 2.357 mi. grad. and placing selected matl. subgrade reinforcement on Sec. D of Federal Lands Highway Proj. 2, the Kingman-Boulder Dam Highway, MOHAVE COUNTY, Arizona. 3-18

SAN FRANCISCO, CALIF.—Award recommended to Morrison Knudsen Company, 1121 Title Guarantee Bldg., Los Angeles, $159,413 by Bureau of Public Roads, San Francisco, for 2.155 mi. grading Sec. A2 of Rt. 3, the Big Oak Flat Road, Yosemite National Park, MARIPOSA COUNTY, Calif. 3-26

DENVER, COLO.—Award recommended to A. H. Read Co., Cheyenne, Wyoming, $187,530 to the Bureau of Public Roads, Denver, Colo., for 19.444 mi. bitum. surf. on the Grand Loop Highway, located in Yellowstone Natl. Park, Proj. NR 1-G1, G2, part G3, Wyoming. 3-4

DENVER, COLO.—To Charles B. Owen, 1375 Monoca Blvd., Denver, $112,541 by State Highway Dept., Denver, Colo., for 2.083 mi. gravel surf. betw. Gunnison and Montrose on State Highway No. 6 in GUNNISON COUNTY, Colo., Proj. NRH 260C. 3-7

DENVER, COLO.—To J. L. McLaughlin, 3003 3rd Ave, N., Great Falls, Mont., $46,977 by Bureau of Public Roads, Denver, Colo., for 3.701 mi. fine grad. and surf. (cr. run) on Grand Loop Highway, Yellowstone Natl. Park, NR 1-J-2, H-4, Wyoming. 3-11

DENVER, COLO.—To Driscoll Const. Co., P. O. Box 733, Pueblo, Colo., $106,849 by State Highway Engineer, Denver, Colo., for 3,659 mi. grading west of Lyons in the north St. Vrain Canon on State Highway No. 66, Proj. NRS 401 (1935), in BOULDER and LARIMER COUNTIES, Colorado. 3-25

DENVER, COLO.—Contracts awarded as follows by the State Highway Engr., Denver, Colo.: (1) DENVER COUNTY (NRM 285-B) To Western Pavement Const. Co., 5230 Washington St., Denver, Colo., $58,038 for 1.217 mi. asph. pav. on Colorado Blvd. in City of Denver, S. H. No. 81. Other bids: J. B. Bertrand, Denver, $62,132; Hamilton, Gleason, Denver, $77,459. (2) EL PASO COUNTY (NRM 79-I) To M. E. Carlson, 4483 Newton St., Denver, Colo., $27,523 for 0.866 mi. grav. surf. in City of Calham on State Highway No. 4. 4-1

BOISE, IDAHO—To J. F. Konen, Lewiston, Idaho, $24,922 by Commissioner of Public Works, Boise, Idaho, for 1.828 mi. const. roadbed, drain. struc. and cr. rock surf. on the Moscow-Pullman Road and on Lime St. in Moscow, LATAH COUNTY, Idaho, NRS 184. 3-25

BOISE, IDAHO—Awards as follow by the Commissioner of Public Works, Boise, Idaho, for: (1) VALLEY COUNTY (NRH 130-G)—To J. F. Konen, Lewiston, Idaho, $27,752. TYPE 'G', for const. a 151.2 ft. concr. overhead struc. over McCall Branch of the Oregon Short Line R.R. and grading and surf. approx. 0.450 mi. of the Payette Highway north of Cascade. (2) LEMHI CO. (NRH 5-A) (1935)—To Nick Burggraf and J. W. Brennan, Pocatello, $49,673. (TYPE 'G') for 5.180 mi. const. roadbed, drain. struc. and cr. rock surf. on Sawtooth Park Highway south from Salmon City. (3) PAYETTE COUNTY (NRH 54-A, NRM-54 and C and NRS 191A)—To Quinn-Robbins Co., Inc., Boise, $34,877 for 0.838 mi. const. roadbed, dr. struc., etc., on Old Oregon Trail; and on 3.177 mi. of Payette-Emmett Highway. (4) SHOSHONE COUNTY (NRH 73-A)—To Triangle Const. Co., Spokane, Wn., $31,397 for const. a 125.3 ft. concr. bridge across the Coeur d'Alene River Channel Change and grading and surf. 0.474 mi. of the Coeur d'Alene-Yellowstone Trail betw. Kellogg and Wallace. 3-20

HELENA, MONTANA—Awards as follow by the State Highway Comm., Capitol Bldg., Helena, Mont.: (1) SWEET GRASS COUNTY (NRS 283B)—To C. & F. Teaming & Trucking Co., Butte, Mont., $34,441 for 2.897 mi. grad. surf. with grav. sub-base matl. and top course of cr. grav. and const. small dr. struc. on Sec. B of the Big Timber N. Road. (2) STILLWATER COUNTY (NRS 288B)—To Tomlinson-Arkwright Const. Co., Great Falls, Mont., $49,265 for 7.480 mi. grad., surf. with gray. subbase matl., etc., on Sec. B of the Columbus-Absarokee Road. (3) HILL COUNTY (NRS 301B)—To Tomlinson-Arkwright Const. Co., Great Falls, Mont., $45,944 for 4.505 mi. grad. surf. with grav. subbase matl. and top course or cr. grav., etc., on Sec. B of the Wild Horse Trail. (4) MADISON COUNTY (NRH 171B)—To J. L. McLaughlin, Great Falls, Mont., $75,644 for 5.191 mi. grad., surf. with cr. grav. and const. small dr. struc. on Sec. B of Ennis-Sappington Road. 3-18

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ABOVE you will see one of the many Marmon-Herrington all-wheel-drive models that are giving outstanding service in the West.

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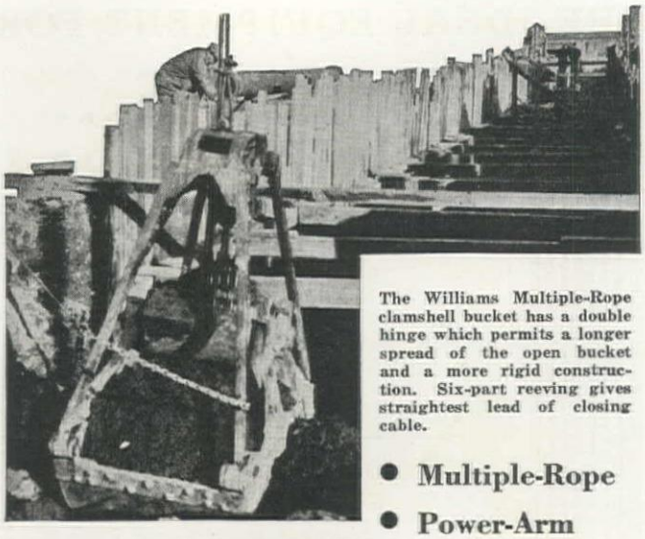

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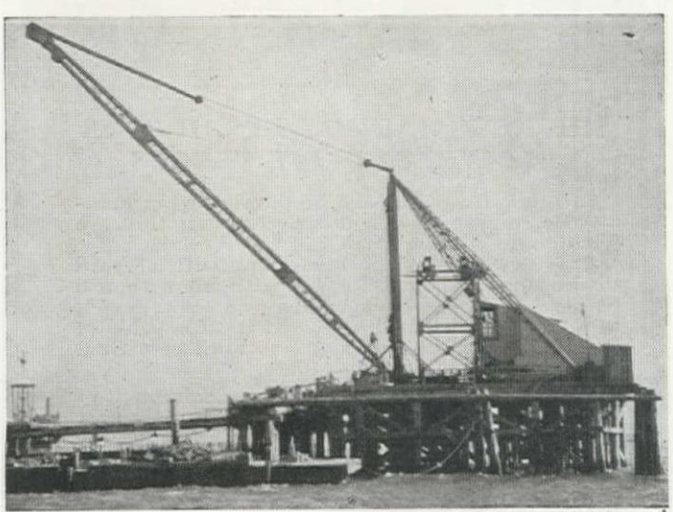

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LOS ANGELES, CALIF.—Bids to 2 P.M., April 22, by County Board of Supervisors, 501 Hall of Records, Los Angeles, for constr. of culvert on Cameron St. south of Covina. Structure will be 9x12 ft., of reinf. concr. with wood wing walls. 4-3

LOS ANGELES, CALIF.—Bids to 2 P.M., April 25, by Calif. Div. of Highways, State Bldg., Los Angeles, for const. a reinf. conc. girder bridge across Trabuco Creek about 2 mi. north of San Juan Capistrano, consisting of 3 48-ft. spans and 2 15-ft. cantilever spans on concr. piers and grad. and concr. pav. of approaches, in ORANGE COUNTY, Calif. Work involves: 11,000 cu. yd. imp. borrow, 630 cu. yd. 'A' conc. (pavement), 161,000 lb. reinf. steel, 832 cu. yd. 'A' conc. (struct.). 4-2

SACRAMENTO, CALIF.—Bids to 2 P.M., April 17, by Calif. Div. of Highways, Sacramento, for const. an overhead crossing over the tracks of the A. T. & S. F. R.R., S. P. Company and Key System, Ltd., in City of Oakland, ALAMEDA COUNTY, Calif. Work involves: 9,000 cu. yd. 'B' conc. footings, 22,000 cu. yd. 'B' conc. superstruct., 2,000 cu. yd. 'B' conc. st. str. slab, 3,500,000 lb. reinf steel, 4,500,000 lb. struct. steel, 1 lot electric lighting system, 59,000 lin. ft. 4¼" reinf. trusses, 95,000 lin. ft. 5¼" reinf. trusses. 3-26

BIDS RECEIVED

LOS ANGELES, CALIF.—Lynch Cannon Engineering Co., 5658 Wilshire Blvd., Los Angeles, $39,993, low to Board of Public Works, 153 City Hall, Los Angeles, for widening existing reinf. concr. girder bridge over San Fernando Road at Southern Pacific Co.'s new tunnel station, under Cash Contract. 3-21

SACRAMENTO, CALIF.—John Carcano, 122 Clarinda Ave., San Rafael, $32,961, low to Calif. Div. of Highways, Sacramento, for reinf. concr. bridge across North Fork of North Fork of Yuba River, at Downieville, consisting of two 40-ft., two 31-ft. and two 9-ft. spans on concr. piers and grading road approaches, in SIERRA COUNTY, Calif. 4-3

CONTRACTS AWARDED

LOS ANGELES, CALIF.—Award recommended (subject to Calif. Div. of Highways approval) to Lynch-Cannon Engr. Co., 5658 Wilshire Blvd., L. A., $149,962 (cast in place), by Board of Public Works, L. A., for const. of the Gaffey St. Bridges, one over Summerland Ave., and the other over Gaffey St. 3-28

SACRAMENTO, CALIF.—To M. A. Jenkins, 3560 'Y' St., Sacramento, $42,143 by Calif. Div. of Highways, Sacramento, for widening 7 reinf. concr. bridges betw. Wheatland and Marysville in YUBA COUNTY, Calif. 3-11

WATER SUPPLY SYSTEMS

WORK CONTEMPLATED

ROSEVILLE, CALIF.—Plans and specifications have been completed by City Engr. John A. Shields for const. of the second unit of the city water works improvements, involving: 4,700 lin. ft. steel pipe, 9,775 lin. ft. cast iron pipe. 3-28

CARBONDALE, COLO.—Bids will be called for in about one month by City Clerk, City Hall, Carbondale, Colo., for replacement of woodstave conduit with steel and cast iron pipe in present water distribution system. P. W. A. loan and grant of $40,000 has already been made. 3-28

IGNACIO, COLO.—Bonds in amount of $2,200,000 have been voted by the Ignacio Water Users Assn., Ignacio, La Plata Co., Colo., for const. dam to impound 100,000 acre feet of water. 3-28

ALMIRA, WN.—Plans and specifications have been completed by Engineer O. Weile, 1818 9th Ave., Spokane, Wn., and call for bids will be issued shortly by City Clerk, for construction of an 80 ft. steel tower, pumphouse and pump, and for drilling an 8" well to 130 ft. depth. Est. cost, $25,000. 3-9

MARYSVILLE, WN.—Plans and specifications are being completed and call for bids will be issued shortly by City Clerk, Marysville, Wn., for a water pipeline between the headwaters near Lakewood Springs to Marysville. Est. cost, $57,000. 3-4

TACOMA, WN.—Plans and specifications are being completed and call for bids will be issued during April to be opened later by Board of Contracts and Awards, for construction of the 3d Unit of the Green River Gravity pipeline. Work involves: 13,490 lin. ft. 52" steel or concr. pipe, 550 lin. ft. 58" steel or concr. pipe, 1,136 lin. ft. 42" steel pipe, 5,698 lin. ft. 48" steel pipe. Gravity control system at the 'J' St. standpipe.

CALLS FOR BIDS

EUREKA, CALIF.—Bids to 8 p.m., April 23rd, by City Clerk, Eureka, for const. of waterworks improvements consisting of a dam on the Mad River, about 25 mi. by road northeast of Eureka, to be variable radius arch 130 ft. high, 550 ft. crest length; one 9 ft. I. D. tunnel, 2400 ft. long; 12 miles 24" and 21" lined steel pipe, concrete coated, and 8 mi. 24" woodstave pipe; and a 5,000,000 gal. Hewitt type reservoir, with redwood roof. Alternate bids will be received on (1) centrif. conc. lined and gunite coated steel pipe; (2) cement wrapped steel duroline pipe, and (3) cement wrapped bitum. lined steel pipe. Est. cost, $1,168,000. 3-30

SUNNYVALE, CALIF.—Bids to 7:30 p.m., April 22nd, by City Clerk, City Hall, Sunnyvale, Calif., for furn. and installing one new pump, 600 G. P. M. 8" column, and repairs to existing pump at City Water Plant. 4-3

TORRANCE, CALIF.—Bids to 7:30 p.m., April 23, by City Council, City Hall, Torrance, for const. of a 250,000-gal. elevated steel water tank and tower. 3-30

DAYTON, WN.—Bids to 2 p.m., Apr. 17th, by City Recorder, Dayton, Ore., for improvements to City Water System. Est. cost, $22,500. 3-28

WALLA WALLA, WN.—Bids to 2:30 p.m., April 23rd, by Veterans Administration, Arlington Bldg., Washington, D. C., for const. and finishing complete deep well pump and pump house at Veterans Administration Facility, Walla Walla, Wash. 3-20

BIDS RECEIVED

SAN FRANCISCO, CALIF.—E. J. Treacy, 309 Call Bldg., San Francisco, $52,836, low to Dept. of Public Work, City Hall, San Francisco, for const. Sec. D of Potrero District Extension to Auxiliary Water Supply System for fire protection. 4-3

OGDEN, UTAH—Identical bids of $39,581.50 were submitted to City Clerk, City Hall, Ogden, Utah, for furnishing 5,285 water meters, by the following concerns: Klenke Hardware Co. and Phoenix Meter Co., Ogden; Hersey Mfg. Co., Boston, Mass.; Salt Lake Hdwe. Co. (Phoenix), Salt Lake City; Geo. A. Lowe Co. (Badger), Ogden; Mt. States Implement Co. (L. H. Nash) Ogden; Crane Co. (Badger), Ogden; Geo. H. Goddard Co. (Arctic), Ogden; Mine & Smelter Co. (American), Salt Lake City; R. B. Raat Co. (Lambert and $43,947 on Trident), Ogden; Worthington Gamon Meter Co. (Model R), Harrison, N. J., and A. P. Smith Mfg. Co. (Federal heavy duty), East Orange, N. J. Award will probably be made to several manufacturers by splitting the order. 3-16

CONTRACTS AWARDED

BEVERLY HILLS, CALIF.—To Franklin B. Gridley, 256 S. Lake St., Pasadena, $18,650, by City Council, City Hall, Beverly Hills, for furnishing and installing cast iron pipe. 3-14

BEVERLY HILLS, CALIF.—To John Grancich, 1117 N. Gage St., L. A., $14,999, by City Council, Beverly Hills, for furn. and inst. cast iron pipe water main, involving 1,140 ft. 12"; 1190 ft. 14" and 1370 ft. 16". 3-28

SAN DIEGO, CALIF.—To M. H. Golden, 404 Calif. Bank Bldg., San Diego, $6,200, by 11th Naval District, foot of Broadway, San Diego, for replacement of salt water flushing system at the Naval Operating Base (Destroyer Base) San Diego, under Spec. No. 7878. 3-6

SAN FRANCISCO, CALIF.—Robert B. McNair and H. Gould, 3745 Rhoda Ave., Oakland, $69,815, low to Department of Public Works, S. F., for const. section 'C' of Potrero District Extension to Auxiliary Water Supply System for fire protection. 3-27

SAN FRANCISCO, CALIF.—To Pacific Bridge Co., Room 1110 Balfour Bldg., S. F., who bid $698,226. ALT. 'A' (STEEL PIPE) to Public Utilities Comm., City Hall, S. F., for constructing a 2800 lin ft. double 54" submarine pipeline across the southerly arm of San Francisco Bay at Dumbarton Strait, 3½ mi. westerly from Newark, to existing caisson at easterly end of S. F. Water Dept's. Bridge, 7 mi. easterly from Redwood City; and for a 435-ft. single 54" line across Newark Slough about 2 mi. westerly from Newark, under S.F.W.D. Contract No. 53. 3-12

SAN FRANCISCO, CALIF.—Contracts awarded as follows by Public Utilities Comm., City Hall, San Francisco: (1) To The Lowrie Paving Co., Inc., 1540 16th St., S. F., $30,690 for laying 6" and 8" cast iron mains from 26th to 48th Avenues and from Fulton to El Camino, under S. F. W. D. Contract No. 76. (2) To W. J. Tobin, 3701 Balfour Ave., Oakland, $49,530, for laying 12" and 16" feeder mains in southwest section of San Francisco, under S. F. W. D. Contract No. 56. (3) To Robert B. McNair and H. Gould, 3745 Rhoda Ave., Oakland, $38,584, for laying 12" and 16" feeder mains in the easterly section of San Francisco, under S. F. W. D. Contract No. 57. (4) To Pacific States Const. Co., Call Bldg., San Francisco, $26,701, for constr. 6" and 8" cast iron mains in area from Funston Ave. to 35th Ave. and from Quintara to Wawona, under S. F. W. D. Contract No. 77. 3-26

SAN FRANCISCO, CALIF.—To Herman Lawson Co., 465 Tehama St., San Francisco, $77,049, by the Dept. of Public Works, San Francisco, for construction of Sec. B. of Potrero Dist. extension to auxiliary water supply system for fire protection. 3-28

ENGLEWOOD, COLO.—To Monroe Electric Co., Chicago, Ill., $350,000 by City Council, City Hall, Englewood, for const. of a complete new municipal water plant for city. 3-28

OGDEN, UTAH.—Contracts awarded as follows (subject to P. W. A. approval) by City Clerk, City Hall, Ogden, Utah: (1) To W. W. Clyde & Co., Springville, Utah, $112,800, for constructing reservoir No. 3. (2) To Chas. A. Halverson & Son, Ogden, Utah, $16,867, for installing water meters. (3) W. Rulan White, Ogden, Utah, $10,971, for furn. and installing water meter boxes. 3-16

OKANOGAN, WN.—To Dominic Coluccio, 8257 Latona Ave., Seattle, $13,175, by Town Clerk, Okanogan, Wn., for laying 1,930 ft. 8" and 3,730 ft. 6" cast iron water main, including hydrants, valves, fittings, service changes and hauling of earth and stone, under PWA Docket No. 1555. 3-9

SEWER CONSTRUCTION

WORK CONTEMPLATED

EL CENTRO, CALIF.—Koebig and Koebig, Consulting Engineers, Rowan Bldg., L. A., have been appointed by P. W. Knigh, City Engineer, El Centro, as consulting engineers for the outfall sewer project for the City of El Centro. 3-14

LOS ANGELES, CALIF.—County Board of Supervisors, Hall of Records, L. A., has authorized County Surveyor to prepare plans and specifications and apply to S. E. R. A. for labor to construct the East Pasadena Storm Drain between Blanche St. and Rubie Wash conduit. Est. cost, $66,000. 3-13

COLORADO SPRINGS, COLO.—Bond election will be held early in April by Colorado Springs, Colo., to vote on $225,000 in bonds to finance const. of a new sewage disposal plant. 3-28

CALLS FOR BIDS

LOS ANGELES, CALIF.—Bids to 2 p.m., April 25th, by Calif. Div. of Highways, State Bldg., L. A., for const. 618 lin. ft. reinf. conc. box storm drain at 3rd and at 8th Sts., in Redlands, SAN BERNARDINO CO., Calif., involving: 3,029 cu. yd. struct. excavation, 490 cu. yd. remove rub. mas. and conc., 112,000 lb. reinf. steel, 785 cu. yd. 'A' concrete. 4-2

BIDS RECEIVED

LOS ANGELES, CALIF.—Mike Radich, 410 N. Formosa, Los Angeles, $18,016, low, to Board of Public Works, L. A., for const. storm drain in right-of-way, south of Buchanan St., between Ave. 54 and Ave. 53. 3-14

CONTRACTS AWARDED

SEATTLE, WN.—To Queen City Const. Co., 603 18th Ave., So., Seattle, $232,026, by Board of Public Works, City-County Bldg., Seattle, Wash., for const. the Laurelhurst trunk and intercepting sewers. 4-1

RIVER and HARBOR WORK

ALAMEDA, CALIF.—City Council, City Hall, Alameda, has authorized City Manager W. P. Koetitz to prepare plans and specifications for a Yacht Harbor to be constructed on site at western end of the S. P. mole in Alameda. Harbor is to be 700 ft. by 1000 ft. with bathing beach and parking area at one end. 3-23

LOS ANGELES, CALIF.—Harbor Dept., City Hall, Los Angeles, has appropriated $40,000 for preparing detail plans and specifications for making field tests, studies, investigation of bearing power and formation of subsoil for new terminal facility at Berths 154 and 155. 3-28

CALLS FOR BIDS

PORTLAND, ORE.—Bids to 3 p.m., April 23rd, by U. S. Engineer Office, 306 Custom House, Portland, Ore., for excavating, hauling and placing materials, shaping and dressing disposal areas and berms, placing and compacting fishway lining and all incidental work for the const. of the lower lock approach canal and fishway at Bonneville, Oregon, located on the Columbia River, 42 miles east of Portland, Oregon.

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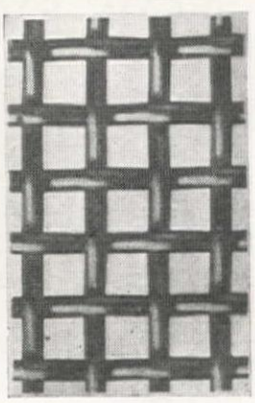

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CONTRACTS AWARDED

SANTA MONICA, CALIF.—To Merritt, Chapman & Scott, Wilmington, $11,103, to City Clerk, Santa Monica, for construction of an extension to the Santa Monica Municipal Pier. 3-16

PORTLAND, ORE.—To Pacific Car & Foundry Company, White Bldg., Seattle, Wn., $108,164, to Engineer Office, Portland, for furn. and installing one derrick and a ship lock emergency dam, and for furn. one derrick, 3 valve chamber unwatering gates and 50 stop logs for the ship lock of the Bonneville Power and Navigation Project, on the Columbia River. 3-23

PORTLAND, ORE.—To A. Walter Norblad, Jr., 515 Commercial St., Astoria, Ore., $15,800, by U. S. Engineer Office, Portland, Ore., for dredging and rock removal in Multnomah Channel, Portland, Ore., under Spec. No. 35-495. 3-22

PORTLAND, ORE.—To Saxton & Looney, 508 Broadway Bldg., Portland, Ore., $24,808, to Engineer Office, Portland, Ore., for dredging in Willamette River, Oregon, at Jackson Bend Bar about 64 mi. above the mouth of the river, under Spec. No. 35-500. 3-22

SEATTLE, WN.—To Puget Sound Bridge & Dredging Co., 2929 16th Ave., S.W., Seattle, $21,750, by Engineer Office, Seattle, Wn., for dredging 145,000 cu. yd. in the Duwamish Waterway for a distance of 600 ft. in the upper waterway. 3-22

Irrigation and Reclamation

WORK CONTEMPLATED

EL NIDO, CALIF.—The El Nido Irrigation District, El Nido, Merced County, Calif., has filed application No. 8238 with State Dept. of Water Resources, Sacramento, for 100 cu. ft. per sec. direct diversion and 10,000 ac. ft per annum underground storage from Duck Slough tributary to Bear Creek, for irrigation and domestic purposes on 9500 acres. 3-7

SUISUN, CALIF.—Ole Nelson, Suisun, Calif. (Trustee for District to be formed), has filed application No. 8244 with the State Dept. of Water Resources, Sacramento, for 25 cu. ft. per sec. and 16,000 ac. ft. per annum from Wooden Valley Creek and Suisun Creek tributary to Suisun Bay, for irrigation and domestic purposes on 15,000 acres. Est. cost, $750,000. 3-7

DENVER, COLO.—Plans and specifications are being completed by the Bureau of Reclamation, Customhouse, Denver, and call for bids will be issued, as follows, for additional construction contracts in connection with the All-American Canal: Canal section between the diversion dam and the Laguna Dam, about May, 1935. 3 large concrete siphons about June, 1935. Model testing and designs for Imperial Diversion Dam and desilting works, about July, 1935. 3-4

CALLS FOR BIDS

YUMA, ARIZ.—Bids to 10 a.m., M.S.T., April 25th, by U. S. Bureau of Reclamation, Yuma, Ariz., for const. of earthwork, All-American Canal, Sta. 1860 to Sta. 3090-75. Boulder Canyon Project, Arizona-California-Nevada, under Spec. No. 621. Work is located from 18 mi. west to 43 mi. southwest of Yuma, Ariz., and from 10 mi. east to 35 mi. northeast of Calexico, Calif., and involves. 11,261,400 cu. yd. common excavation.

ONTARIO, ORE.—Bids to 10 a.m., May 1st, by Bureau of Reclamation, Ontario, Oregon, for construction of earthwork and structures, South Canal, Sta. 736 to Sta. 1340, and South Canal Lateral 17.7, Succor Creek Division, Owyhee Project, Oregon-Idaho, under Spec. No. 619. Work is located near Homedale, Idaho. Work involves: 578,800 cu. yd. canal excavation, 11,000 cu. yd. structure excavation, 25,000 sta. cu. yd. overhaul, 30,000 cu. yd. back fill, 2,220 cu. yd. concrete in structures, 1,500 sq. yd. dry-rock paving, 205,000 lb. place reinforcement bars, 760 lin. ft. lay 18" to 30" conc. pipe, 12M ft. BM erect timber (structures), 20,500 lb. install gates and miscl. metal. 4-1

BIDS RECEIVED

MODESTO, CALIF.—California Gunite Co., 1006 N. Sycamore St., Los Angeles, $16,000, only bid submitted to the Secretary of the Modesto Irrigation District, C. S. Abbott, 823 11th St., Modesto, for repair of old lining by guniting on main canal. 3-5

ONTARIO, ORE.—Morrison Knudsen Co., 319 Broadway, Boise, Ida., $92,388, low to Bureau of Reclamation, Ontario, Ore., for const. struc., South Canal, Sta. 0 to 736, Succor Creek Div. Owyhee Proj., Oregon-Idaho, under Spec. No. 614. 3-29

CONTRACTS AWARDED

FAIRFIELD, MONTANA—To T. G. Rowland & Co., 1558 Yale Ave., Salt Lake City, Utah, $50,420, by Bureau of Reclamation, Fairfield, Mont., for constructing earthwork and structures for open drains, Greenfields Division, Sun River Project, Montana, under Spec. No. 611. 3-22

DAM CONSTRUCTION

BIDS RECEIVED

GLASGOW, MONTANA—Addison Miller, Inc., 1201 Builders Exchange, St. Paul, Minn., $3,985,000 low to U. S. Engineer Office, Postal Telegraph Bldg., Kansas City, Mo., for const. the spillway gate structure, cutoff struct. and appurtenant works for the Fort Peck Dam, 25 mi. southeast of Glasgow, Mont., on the Missouri River. 4-3

CONTRACTS AWARDED

SAN FRANCISCO, CALIF.—Award to Transbay Const. Co., Pier 24, San Francisco, $3,219,965, by Public Utilities Commission, City Hall, San Francisco, for enlargement of the O'Shaughnessy Dam. Secretary of the Interior, Harold L. Ickes, has wired approval of the permit and also approval of the outright grant instead of the original loan and grant.

SAN JOSE, CALIF.—To A. Teichert & Son, Inc., P. O. Box 1113, Sacramento, $216,175 (subject to P.W.A. approval) by Santa Clara Valley Water Conservation District for const. the Guadalupe Dam and Spillway on the Guadalupe Creek about 12 miles from San Jose, under Contract No. 6. (PWA Project 6051) (See Unit Bid Summary) 3-13

FLOOD CONTROL WORK

WORK CONTEMPLATED

SALINAS, CALIF.—A bill has been passed by the State Legislature, asking for $50,000 P.W.A. funds, to conduct a survey of the Salinas River Valley Conservation Project for harnessing water and power of the Salinas River. The project would include a number of check dams and power plants, estimated to cost $10,000,000. 4-1

TUNNEL CONSTRUCTION

CALLS FOR BIDS

OGDEN, UTAH—Bids to 10 A.M., April 18th by Bureau of Reclamation, Ogden, for const. of the Ogden-Brigham Tunnel & the Ogden Canyon Tunnel, Ogden River Project, Utah, under Specs. No. 618. Work involves: 26,480 cu.yd. excav.-tunnels & adits; 5,750 cu.yd. tunnel concrete; 700 cu.ft. gunite coating tunnels; 254 cu.yd. concrete structures; 50,000 lb. steel liner plates; furn. & install. 3-25

BIDS RECEIVED

SAN FRANCISCO, CALIF.—E. T. Lesure, 87 Ross Circle, Oakland, $171,170 low to Public Utilities Commission, San Francisco, for const. the Crystal Springs pipeline tunnel under S.F.W.D. Spec. 74 4-3

LOS ANGELES, CALIF.—L. E. Dixon Co., Bent Bros., & Johnson, Inc. 609 So. Grand Ave., Los Angeles, $366,607 low to Board of Public Works, City Hall, L. A., for const. of a vehicular tunnel and other street work in Figueroa St., betw. Solano Ave. & Bishop Road. 4-3

POWER DEVELOPMENT

WORK CONTEMPLATED

BURBANK, CALIF.—Dept. of Water & Power, L. A., has purchased a 10-acre tract betw. Clybourne and Cahuenga Aves., and Hatteras and Burbank Blvd., in Burbank, as site of an outdoor-type substation. Estimated cost $1,250,000. 3-14

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PIPELINE CONSTRUCTION

CONTRACTS AWARDED

LOS ANGELES, CALIF.—To Macco Const. Co., Clearwater, and Lang Transportation Corp., 5501 Santa Fe Ave., Los Angeles (no totals given) by General Pipeline Co., 2525 E. 37th St., Vernon, for const. 90 mi. pipeline from Refining & Pumping Sta. at Lebec to Co.'s Torrance Plant. Award to Harold Price, Bartlesville, Oklahoma, for welding on the above pipeline. 3-20

MISCELLANEOUS

WORK CONTEMPLATED

SEAL BEACH, CALIF.—City of Seal Beach, Calif., has voted favorably for bonds in amount of $132,000 to finance the following projects: Sewage disposal plant $40,000; Breakwater at West Entrance to Anaheim Bay $62,000; Municipal Water System, $30,000. 4-1

CONTRACTS AWARDED

LOS ANGELES, CALIF.—The Board of Directors of the Metropolitan Water District of Southern California, 306 W. 3rd Street, Los Angeles, has approved a four-year contract with the Southern Pacific Company for hauling 2,638,000 bbls. of cement at an estimated cost of $966,508, between Coxcomb and San Jacinto tunnels. 3-11

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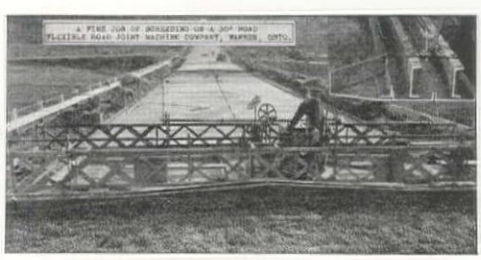

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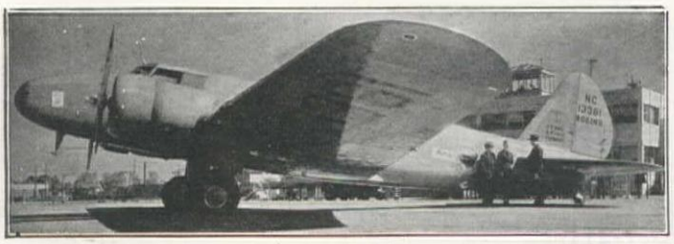

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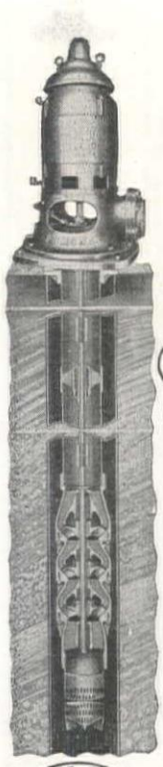

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Bituminous Treatment of Section B, Southwest Approach, Lassen Volcanic National Park

San Francisco, Calif., March 19, 1935.

Sealed bids will be received at the office of the Bureau of Public Roads, 807 Sheldon Building, 461 Market Street, San Francisco, California, until 2 o'clock p.m., on June 25, 1935, for bituminous treatment (light surface application) of Section B, the Southwest Approach to Lassen Volcanic National Park, Lassen National Forest, Tehama County, California. The length of the project is 4.911 miles and it involves major item of work as follows: 210 tons Liquid Asphaltic Road Material, Type S.C.-2. The minimum wage paid labor employed on this project shall be in accordance with the classified labor rates attached to the specifications of which the minimum is $1.00 per hour for skilled labor, 68 cents per hour for intermediate labor and 60 cents per hour for unskilled labor. The attention of bidders is especially directed to the provisions covering the **compliance with codes of fair competition; the subletting** and **assignment** of the contract; and to the **alternate bids** which must be submitted in case the bidder desires to offer any **foreign articles,** materials or supplies. 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 Regional Fiscal Agent, U. S. Forest Service. Plans, specifications and proposals may be obtained at the office of the Bureau of Public Roads, 807 Sheldon Building, 461 Market Street, San Francisco, California. C. H. SWEETSER, District Engineer.

UNITED STATES DEPARTMENT OF THE INTERIOR

Bureau of Reclamation

(Federal Emergency Administration of Public Works)

Construction of Earthwork and Structures, South Canal, Owyhee Project

Washington, D. C., March 30, 1935.

Sealed bids (Specifications No. 619) will be received at the office of the U. S. Bureau of Reclamation, Ontario, Oregon, until 10 o'clock a.m., May 1, 1935, and will at that hour be opened for furnishing labor and materials and performing all work for the construction of **earthwork and structures, South Canal,** station 736 to station 1340, and South Canal Lateral 17.7, Succor Creek division, Owyhee project, Oregon-Idaho. The work is located near Homedale, Idaho. The principal items of work and the estimated quantities involved are as follows: 578,800 cubic yards of all classes of excavation for canal; 11,000 cubic yards of all classes of excavation for structures; 25,000 station cubic yards of overhaul; 30,000 cubic yards of back fill; 2,220 cubic yards of concrete in structures; 1,500 square yards of dry-rock paving; placing 205,000 pounds of reinforcement bars; laying 760 linear feet of 18-inch to 30-inch diameter concrete pipe; erecting 12 M. ft. b.m. of timber in structures; and installing 20,500 pounds of gates and miscellaneous metalwork. This invitation for bids does not cover the purchase of materials which are to be furnished by the Government. Materials to be furnished by the contractor and those furnished by the Government are described in the specifications which will be a part of the contract. The work must be completed within 300 days. Bid security 10 per cent and performance bond 50 per cent will be required. No charge to prospective bidders for copies of the specifications and drawings; to others $3.00, not returnable. For particulars, address the Bureau of Reclamation, Ontario, Oregon; Denver, Colorado; or Washington, D. C.

ELWOOD MEAD,
Commissioner.

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UNITED STATES DEPARTMENT OF THE INTERIOR

Bureau of Reclamation

(Federal Emergency Administration of Public Works Project)

Construction of Earthwork, All-American Canal, Boulder Canyon Project

Washington, D. C., March 25, 1935.

Sealed bids (Specifications No. 621) will be received at the office of the U. S. Bureau of Reclamation, Federal Building, Yuma, Arizona, until 10 o'clock a. m., Mountain Standard Time, April 25, 1935, and will at that hour be opened for furnishing labor and materials and performing all work for the **construction of earthwork, All-American Canal, station 1860 to station 3090-75,** Boulder Canyon Project, Arizona-California-Nevada. The work is located from 18 miles west to 43 miles southwest of Yuma, Arizona, and from 10 miles east to 35 miles northeast of Calexico, California. The estimated quantity of work involved is 11,261,400 cubic yards of common excavation. The work shall be commenced within thirty (30) calendar days after date of receipt of notice to proceed and shall be completed within nine hundred and fifty (950) calendar days from the date of receipt of such notice. Bid security in an amount not less than 10 per cent and performance bond not less than 50 per cent will be required. No charge to prospective bidders for copies of the specifications and drawings; to others $1.00, not returnable. For particulars, address the Bureau of Reclamation, Yuma, Arizona; Denver, Colorado; or Washington, D. C.

ELWOOD MEAD, Commissioner.

NOTICE TO CONTRACTORS

Oakland, California
April 4, 1935

Sealed proposals will be received at the office of the East Bay Municipal Utility District, Oakland, California, until 5:30 p.m., Thursday, April 18, 1935, and will at that hour be opened, for constructing and furnishing 7,700 linear feet of electric welded steel pipe of 24" and 30" diameters for the distribution system of the East Bay Municipal Utility District.

Plans and specifications (No. LS 143) for this work may be obtained by application at Room 1204 of the Latham Square Building, 508 16th Street, Oakland, California.

JOHN H. KIMBALL,
Secretary.

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UNITED STATES DEPARTMENT OF THE INTERIOR

Bureau of Reclamation

(Federal Emergency Administration of Public Works Project)

Ogden-Brigham Tunnel and Ogden Canyon Tunnel

Washington, D. C., March 23, 1935.

Sealed bids (Specifications No. 618) will be received at the office of the U. S. Bureau of Reclamation, Ogden, Utah, until 10 a.m., April 18, 1935, and will at that hour be opened for furnishing labor and materials and performing all work for the construction of **Ogden-Brigham Tunnel** and **Ogden Canyon Tunnel,** Ogden River project, Utah. The work is located near Ogden, Utah. The principal items of work and the advance estimated quantities involved are as follows: 3,670 cubic yards of all classes of open-cut excavation; 26,480 cubic yards of excavation in tunnels and adits; 300 cubic yards of back fill; 5,750 cubic yards of concrete in tunnels; 700 cubic feet of gunite coating in tunnels; 150 cubic feet of pressure grouting; 254 cubic yards of concrete in structures; placing 25,350 pounds of reinforcement bars; furnishing and installing 23 M feet board measure of permanent timbering in tunnels; furnishing and installing 50,000 pounds of steel liner plates in tunnels; and installing 6,700 pounds of gates, gate hoists, and miscellaneous metalwork. This invitation for bids does not cover the purchase of materials which are to be furnished by the Government. Materials to be furnished by the contractor and those furnished by the Government are described in the specifications which will be a part of the contract. Bid security 10 per cent and performance bond 50 per cent will be required. No charge to prospective bidders for copies of the specifications and drawings; to others $1.50, not returnable. For particulars, address the Bureau of Reclamation, Ogden, Utah; Denver, Colorado; or Washington, D. C.

ELWOOD MEAD, Commissioner.

UNITED STATES DEPARTMENT OF AGRICULTURE

(Bureau of Public Roads)

Road Material, Subgrades Reinforcement, Watering, Culvert Markers

San Francisco, California, April 10, 1935.

Sealed Bids will be received at the office of the Bureau of Public Roads, 807 Sheldon Building, 461 Market Street, San Francisco, California, until 2:00 o'clock p.m. on May 7, 1935, for placing subgrade reinforcement and bituminous treatment (light surface application) on Section F of Route 77, the Mt. Shasta-Mt. Lassen National Forest Highway, Lassen National Forest, Shasta County, California. The length of the project is 13.157 miles and it involves major items of work as follows: 15,000 cubic yards **subgrade reinforcement;** 480 tons **asphaltic road material, Type S.C.-2;** 600 M Gallons **watering;** and 170 each **culvert markers.** The minimum wage paid labor employed on this project shall be in accordance with the classified labor rates attached to the specifications of which the minimum is $1.00 per hour for skilled labor, 68 cents per hour for intermediate labor and 60 cents per hour for unskilled labor. The attention of bidders is especially directed to the provisions covering the **compliance with codes of fair competition; the subletting** and **assignment** of the contract; and to the **alternate** bids which must be submitted in case the bidder desires to offer any **foreign** articles, materials or supplies. 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 Regional Fiscal Agent, U. S. Forest Service. Plans, specifications and proposals may be obtained at the office of the Bureau of Public Roads, 807 Sheldon Building, 461 Market Street, San Francisco, California.

C. W. SWEETSER,
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