WESTERN CONSTRUCTION

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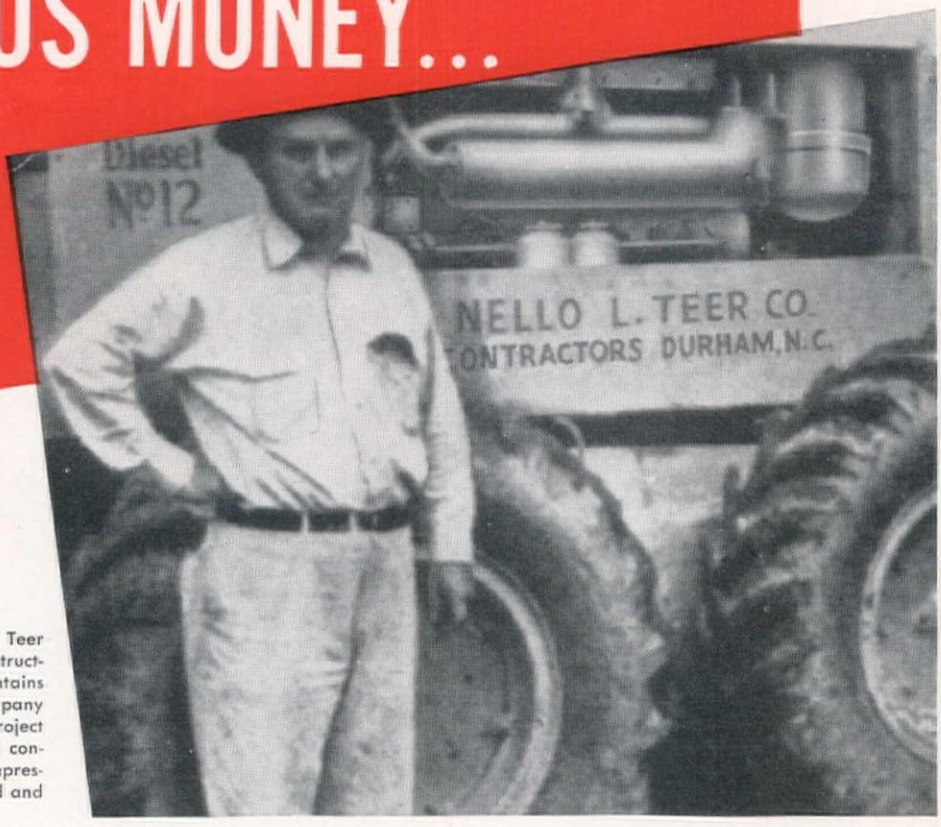
FEBRUARY 1952

O KEEPS ALL OUR MENT ON THE JOB, US MONEY"...



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rication, use *Texaco Marfak.* It stays *in* the bearings, protects against wear and rust. *More than 400 million pounds of Marfak have been sold!*

For wheel bearing protection that requires no seasonal change, use *Texaco Marfak Heavy Duty.* It seals itself in, seals out dirt and moisture.

For crawler track lubrication, use *Texaco Track Roll Lubricant.* It gives effective protection even under severe conditions.

Let a Texaco Lubrication Engineer tell you about the Texaco Simplified Lubrication Plan – how *with only six lubricants* you can handle every major lubrication requirement. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, New York.

CO Lubricants and Fuels

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Faithfully yours
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REPEAT ORDERS and OUTPUT Go Together!

P & J Artukovich
Los Angeles, California

THEIR EIGHTH

Repeat orders are an endorsement of output when you are talking about cranes and shovels. Outfits like P & J Artukovich of Los Angeles, California, aren't buying equipment on looks — they want output. In 1947 P & J Artukovich bought their first Northwest. They found the machine they could depend on and recently the eighth Northwest has gone to work on an Artukovich job.

You too can depend on Northwests for yardage. Plan to join the Northwest Crowd.

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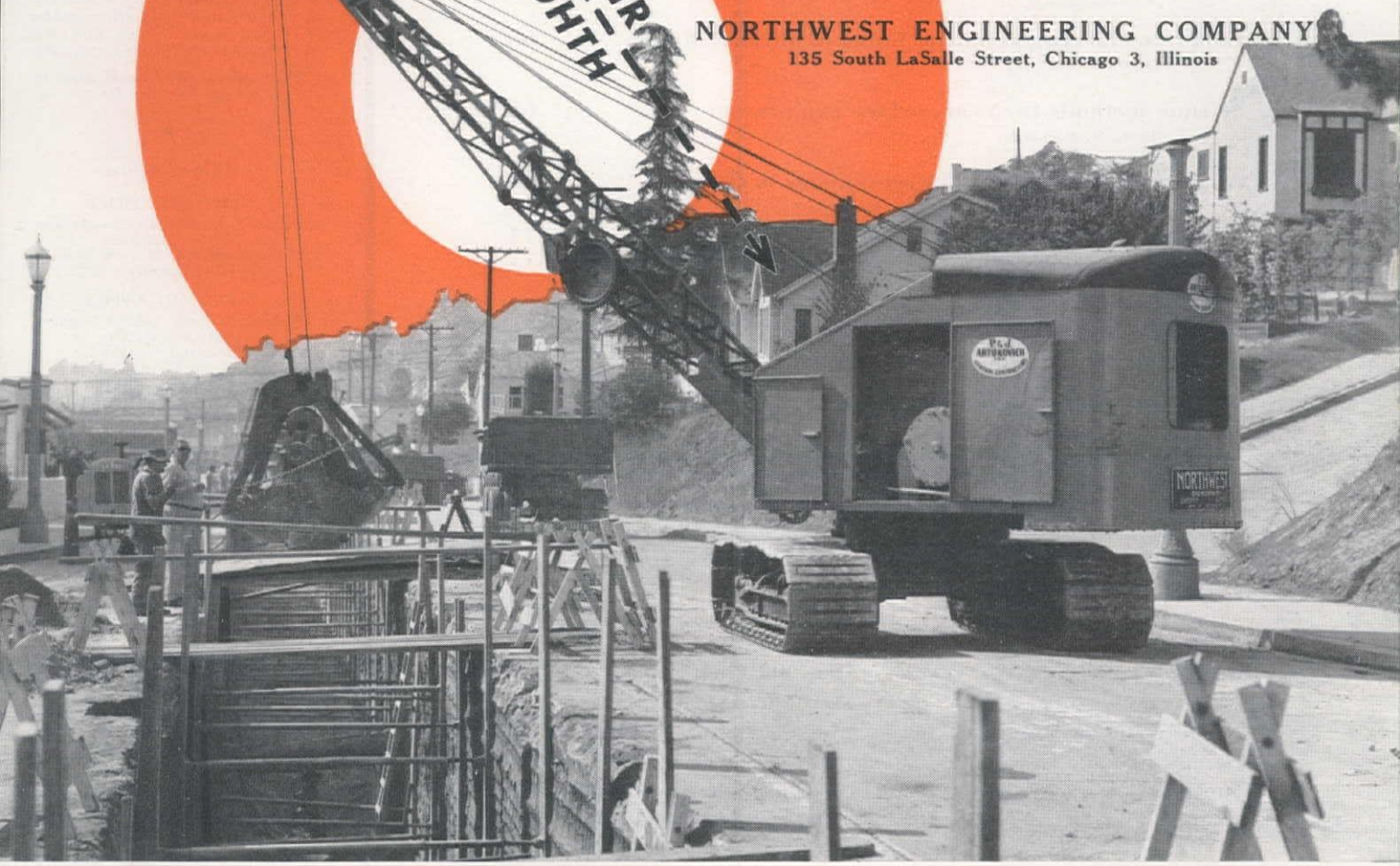
135 South LaSalle Street, Chicago 3, Illinois



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Successful Contractors Stay Successful with Proved Equipment

WESTERN CONSTRUCTION

Volume 27 **FEBRUARY 1952** Number 2

ARTICLES

DEPARTMENTS

FRONT COVER

SMITH RICE COMPANY put sea swells to work to pull a 1,040-ft. outfall to sea for the sewage plant at Monterey, Calif. Actual pulling was done by a barge anchored offshore with tractors onshore assisting. In the cover view, the tractors are being unhitched after the pipe started to move. For complete description of the unusual project, see page 59.

The Construction and Civil Engineering Publication of the West

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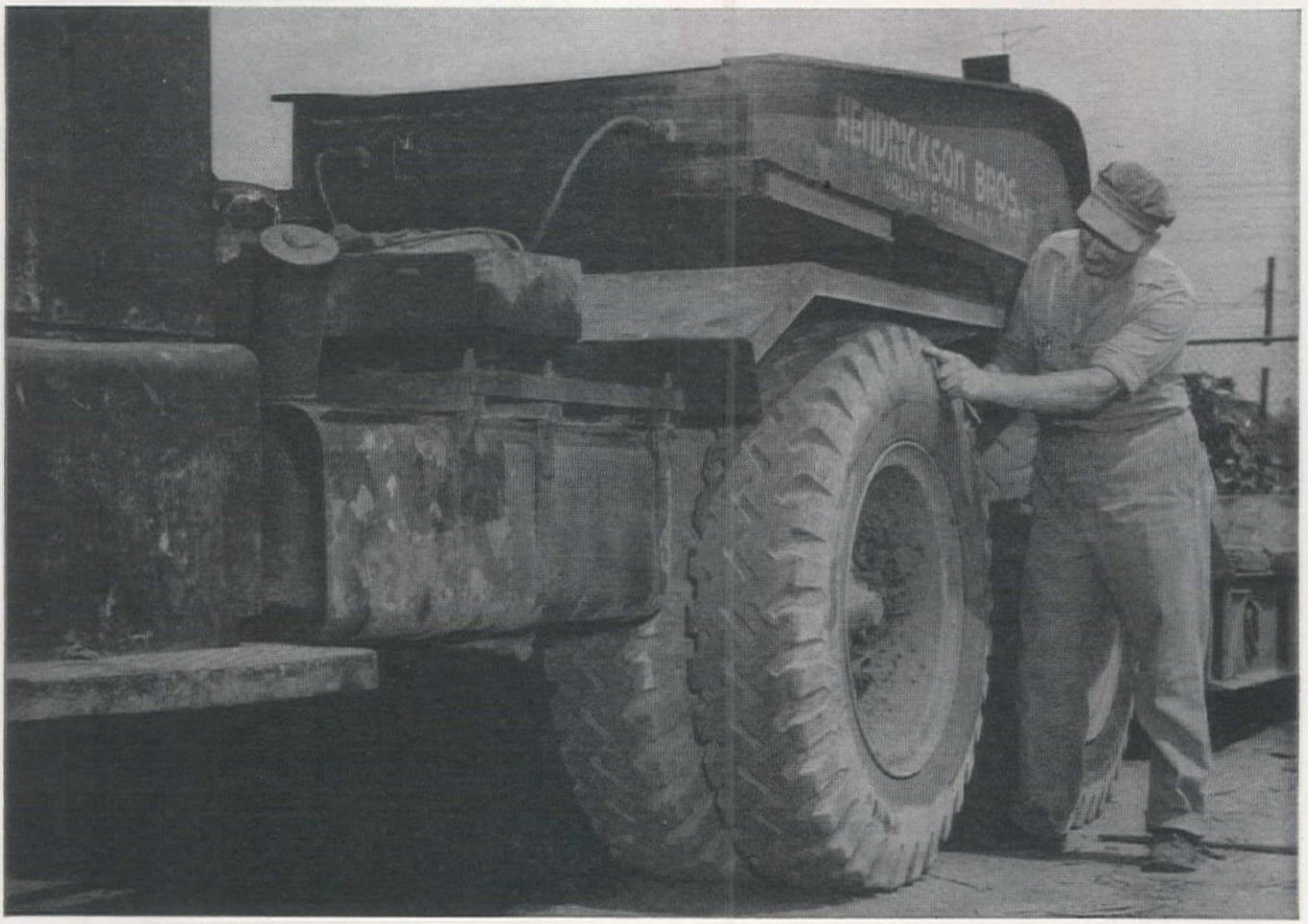
B.F.Goodrich



Off-the-road tires give general contractor better over-all service, more recaps

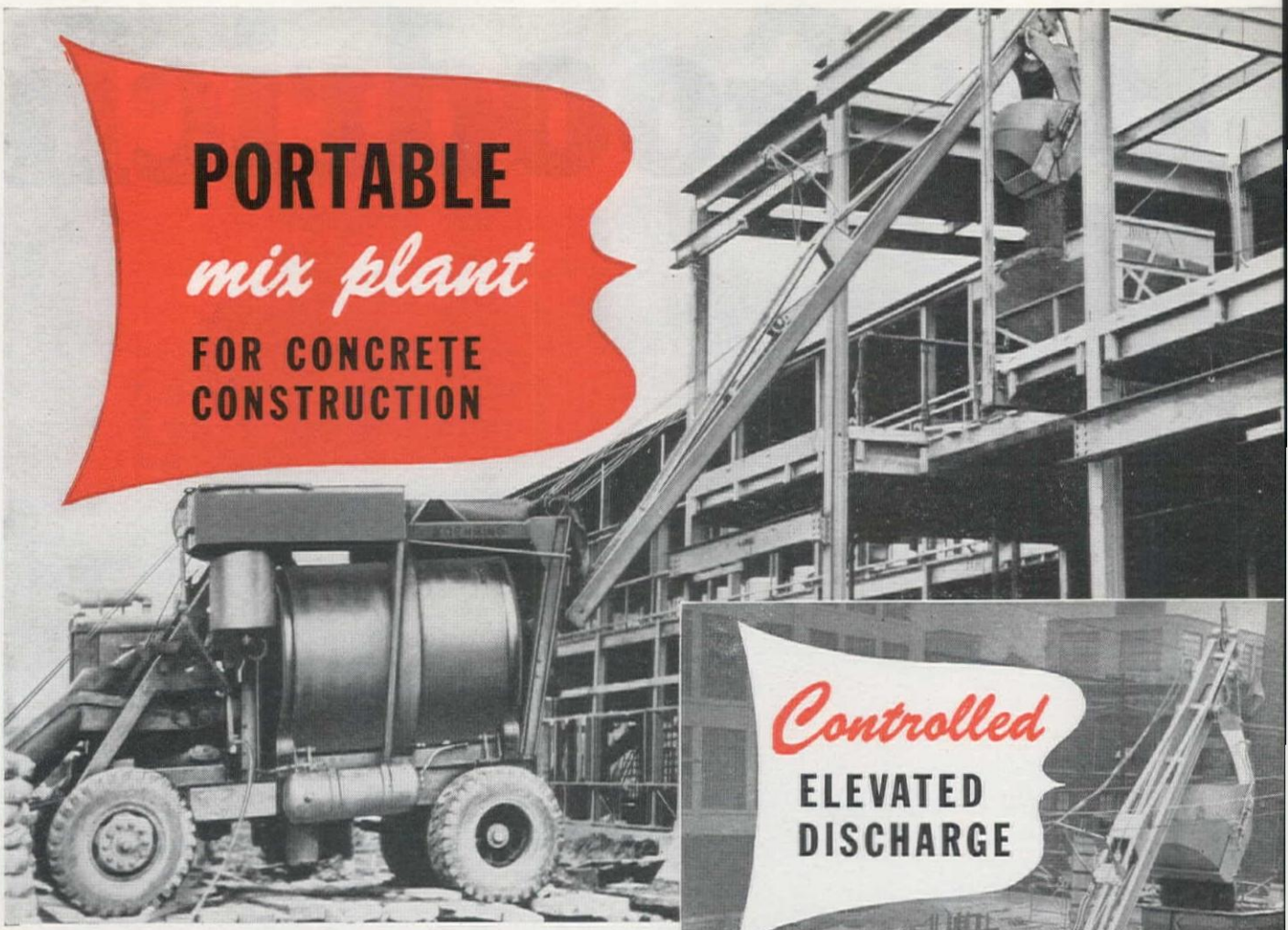
MAURICE HENDRICKSON (above) examines the tires on a low-bed trailer used for carrying 50 to 60 tons of heavy-duty equipment. As Motor Vehicle Supervisor for Hendrickson Bros., Inc., general contractors of Valley Stream, N. Y., it's his job to see that the tires on this company's excavating, grading and heavy construction equipment give good service and can take the rough treatment of off-the-road service.

"We have been using B.F.Goodrich tires for years," Mr. Hendrickson says, "and have found they give us better over-all service than other similar types of tires, better traction and a minimum of service trouble." And he adds: "We particularly like the greater number of B. F. Goodrich tires suitable for recapping."

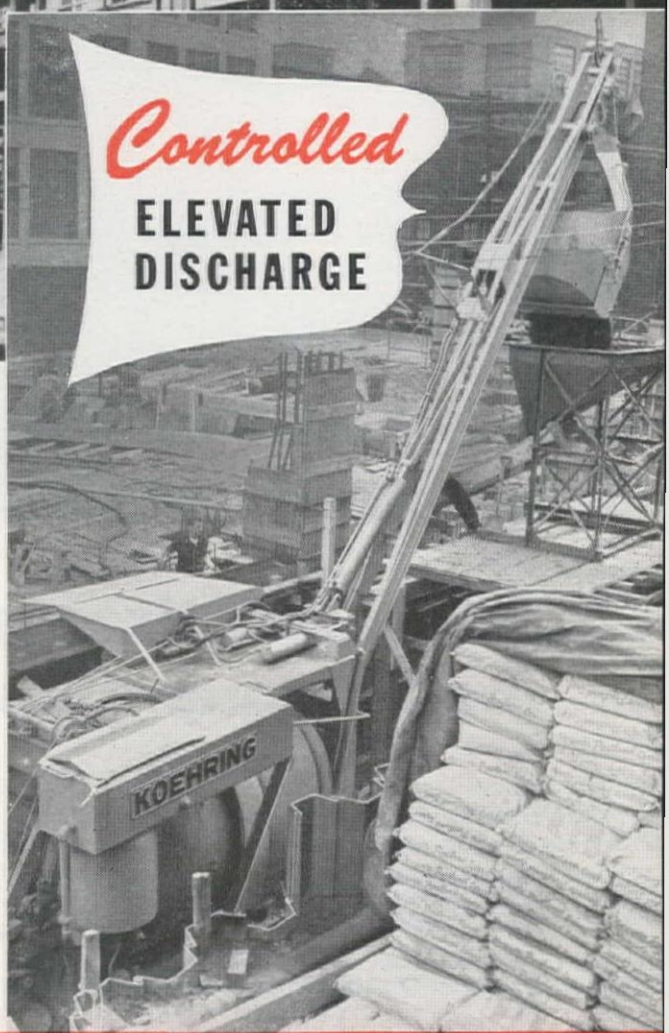
Mr. Hendrickson's experience is typical of that of off-the-road operators throughout the country. They report B. F. Goodrich tires, built with the exclusive nylon shock shield, give excellent service and more recaps under the toughest operating conditions. The strong, elastic nylon cords under the tread rubber stretch together under impact, actually protect the tire body from smashing road shock. This means BFG tires wear longer, give you a 4-way saving:

(1) increased tire mileage (2) greater resistance to bruising (3) less danger of tread separation (4) more recappable tires.

Whatever your off-the-road job, there's a BFG tire designed to do it better and save you money. Hendrickson Bros., Inc., for example, uses B. F. Goodrich Rock Logger, Universal and Highway Express tires, depending on the job to be done. See your local dealer for the full story or write *The B. F. Goodrich Co., Akron, Ohio.*



PORTABLE *mix plant* FOR CONCRETE CONSTRUCTION



Controlled ELEVATED DISCHARGE

MOBILE, VERSATILE, 16-E *twinbatch*®

offers a new low-cost method of producing concrete for floors, foundations, pilings on building construction . . . bridges, aqueducts, tunnels, retaining walls, culverts, streets, highway widening, special batching, etc. Boom elevates 60°, swings in a 160° arc, reaches up and out, bucket discharges controlled batch into overhead forms, hoppers or chutes at a height of 21 feet (higher with special boom). The 16-E mixes and distributes up to 50 cu. yds. per hour, exceeding capacity of larger 27-E single-drum paver. 7-second skip hoist, split-second Autocycle mixing, vertical syphon-type water tank all reduce cycle time and assure maximum-strength concrete. This rubber-tired 16-E *twinbatch* also works over pavement, drives job to job at 6 m.p.h. Ask, too, about Koehring 34-E *twinbatch* for your major paving jobs.

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KWIK-MIX plaster-mortar MIXERS

6-P tilting and non-tilting... to fit your exact needs, Kwik-Mix provides a choice of tilting or non-tilting 6-P plaster-mortar mixers. **6-P tilter** has effortless semi-power tilt. As loaded drum is released, action of paddle shaft drive starts tilting motion. Drum tilts in either direction for quick cleaning. **6-P non-tilter** has low 44" charging height, narrow 33" width, drip-proof discharge door is easily opened and held in place by back-lock lever. Both types have bag cutter grill, saw-tooth non-clogging blades, multiple V-belt drive. Also: 10-P non-tilter; concrete, bituminous mixers; Moto-Bug® (power wheelbarrow).

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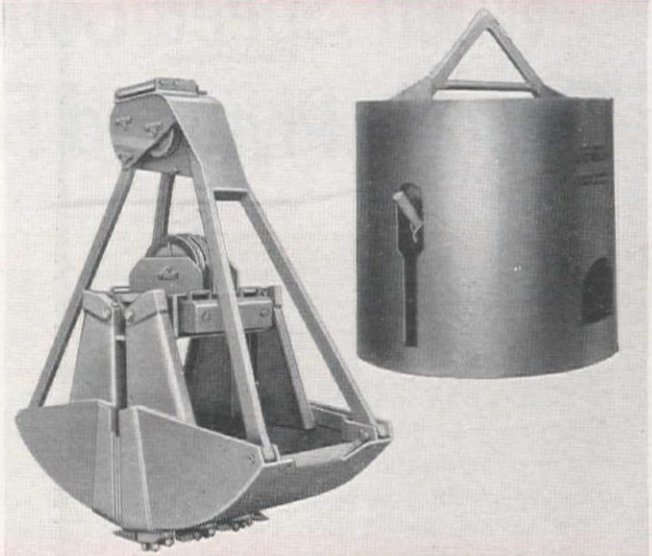
JOHNSON BUCKETS

10 sizes Clamshells, ⅜ to 3 yards... smooth inside and out, Johnson all-welded clamshells dig and dump with less resistance, are fast-filling, easy closing. Big needle-bearing-mounted sheaves reduce friction power loss, deliver full power to cutting lips and teeth. Manganese cutting edge, welded to heavy lips, gets tougher with use.

CONCRETE BUCKETS... Johnson Finger-Tip Control (illustrated) is available in ½, 1, 1½, 2-cu. yd. sizes, single lever operated. Also: 1 to 4-yd. Johnson-Dravo, and 2 to 8-yd. Lo-Slump concrete buckets. Other Johnson products: concrete plants, bins, batchers, elevating chargers, silos.



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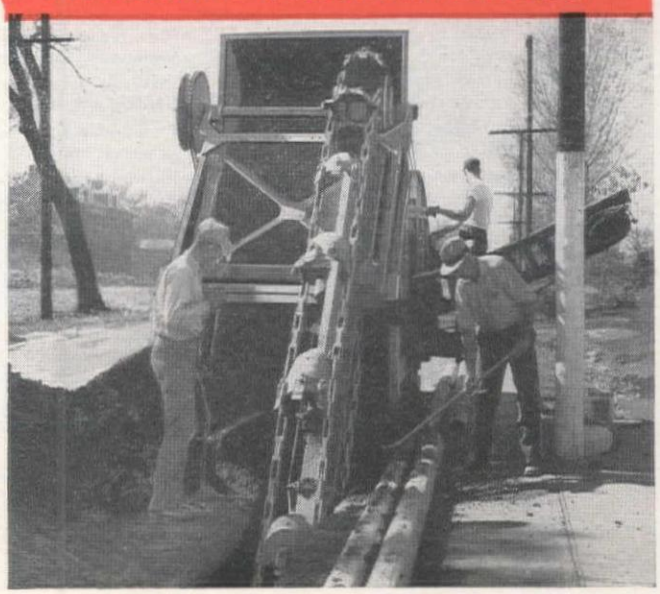
PARSONS TRENCHLINERS®

1-minute, power-shift conveyor . . . and off-set digging boom let this 221 Trenchliner dodge side obstructions without swerving from grade line. Conveyor shifts completely through machine by power in less than 1 minute. Belt direction is instantly reversible, and its speed is synchronized with bucket line speeds . . . no interruption to Trenchliner production. Off-set digging boom is shiftable across full machine width . . . cuts within 10" of either side . . . digs 16" to 36" wide, 8'-6" deep. All operations are reversible for undercutting sidewalks, sewers, or making vertical set-ins. Check into this 221, or the 4 other Parsons sizes.



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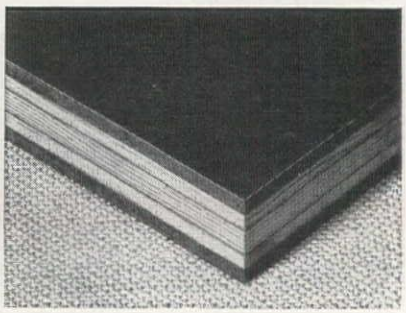
PANEL DISCUSSION

New Form Panel

A NEW PANEL material which combines smooth, wear-resistant hardboard surfaces with the strength and workability of Douglas fir plywood is now being produced by West Coast plywood makers.

Called Plyron, the new panel has been use-tested for concrete form work on several projects. One of the initial users, Contractor F. A. Canuso who is using the material in forming overpass road slabs on the New Jersey Turnpike, reports the new material "is giving us some of the smoothest concrete we have ever seen. We are getting plenty of re-uses, too."



Faced with hard, dense, long-wearing hardboard surfaces, Plyron relies on Douglas fir plywood inner construction to furnish the "muscle," making it puncture-proof, dimensionally stable and relatively light weight. The material has excellent nail holding properties and retains the easy workability of plywood. Rigid industry quality standards have been established for Plyron, similar to those for Douglas fir plywood. Details on the new product may be obtained from Douglas Fir Plywood Association, Tacoma 2, Washington.

Plywood Cuts Formwork Costs

Douglas fir plywood concrete form panels cut formwork application time and costs by over 20% in building the Kanawha Airport Terminal Building, Charleston,

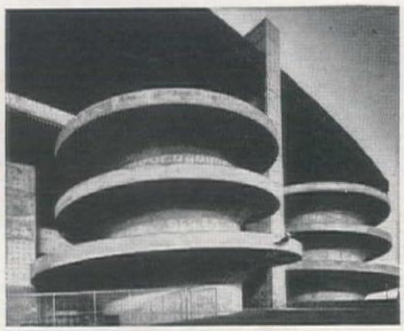
West Va., according to Charles J. Kuhn, president, Kuhn Construction Co.

"The panels speeded formwork all along the line," says Kuhn. "Panel re-use also helped lower costs." On the job, form sections were built by placing ¾"-thick Exterior Concrete Form panels across studding. Forms were held in line with double 2x4 wales, backed by double 2x6 liners, placed vertically.

Architects Tucker and Silling, Charleston, West Va., who specified plywood on the job because the panels "permit a smooth monolithic surface to be cast simultaneously with structure," report that concrete surfaces on the Terminal are uniformly smooth and even textured.

Plywood Solves Form Problems

Plywood was called on to help solve an unusually intricate concrete form job in building the spectacular twin-spiral ramps at the University of Washington Stadium addition. All concrete surfaces were curved; ramp floor slab thickness varied to provide drainage; minimum form costs were required; exposed surfaces had to be smooth, fin-free.



To create the smooth, sharply curved concrete surfaces, Strand & Son, Seattle, contractors on the job, used ¼" plywood form liner, sheathed with lumber and backed by 2x4 studs and double 2x4 wales. The 4' wide form sections were bent to the required curvature by inserting shims between studs and walers. In this way, sections were stripped, re-erected and bent to the next required radius without re-constructing the basic form structure. Architects: Geo. W. Stoddard & Associates, Seattle, Washington.

Plyform Calculator Available

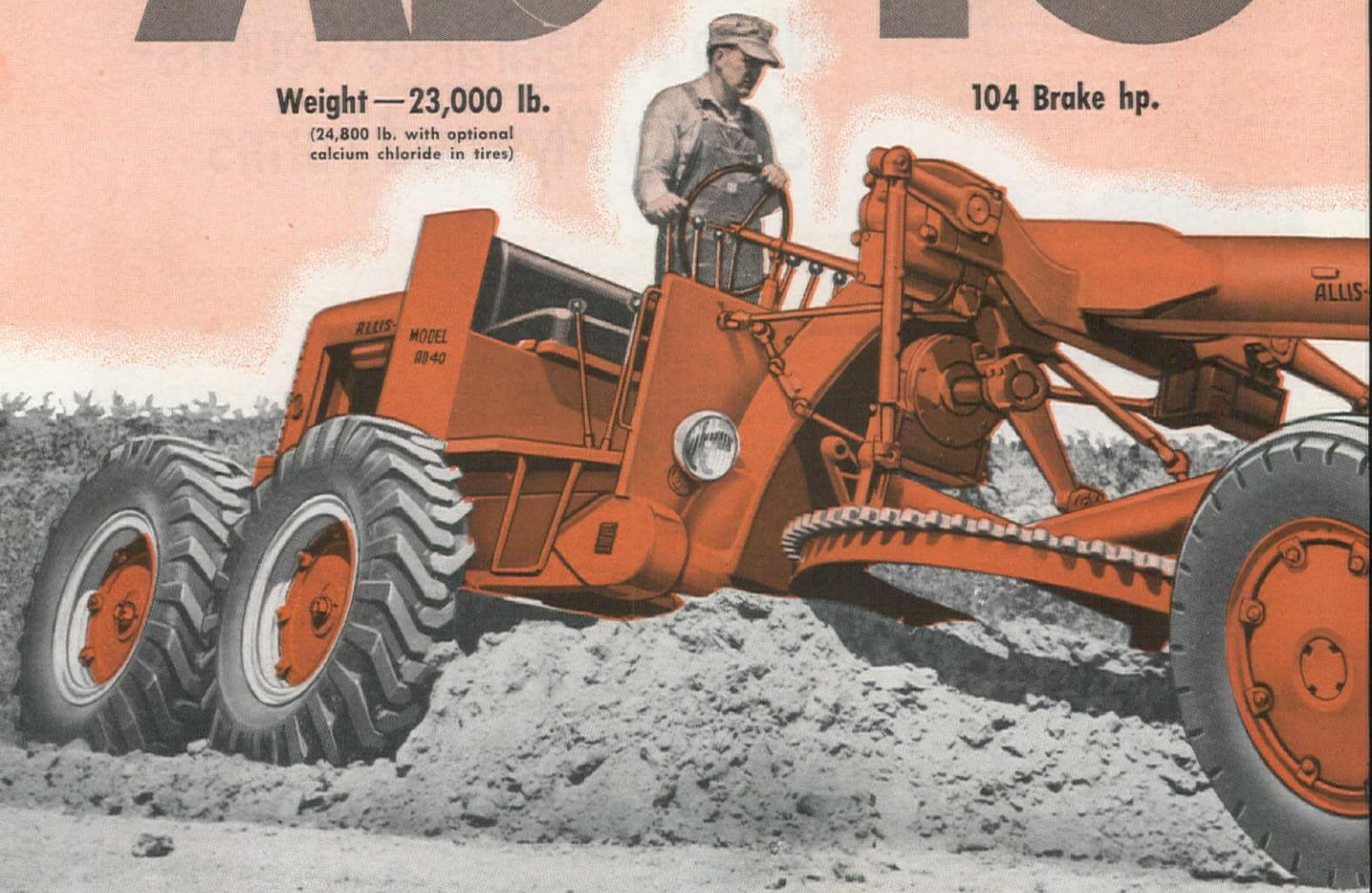
A handy new slide rule calculator which gives construction data for plywood forms is available for $1.00 from Douglas Fir Plywood Association, Tacoma 2, Washington. Included with calculator is leaflet "Design Assumptions for New Keely Calculator."

NOW! a Great New HEAVY-DUTY GRADER

Allis-Chalmers AD-40

Weight — 23,000 lb.
(24,800 lb. with optional calcium chloride in tires)

104 Brake hp.



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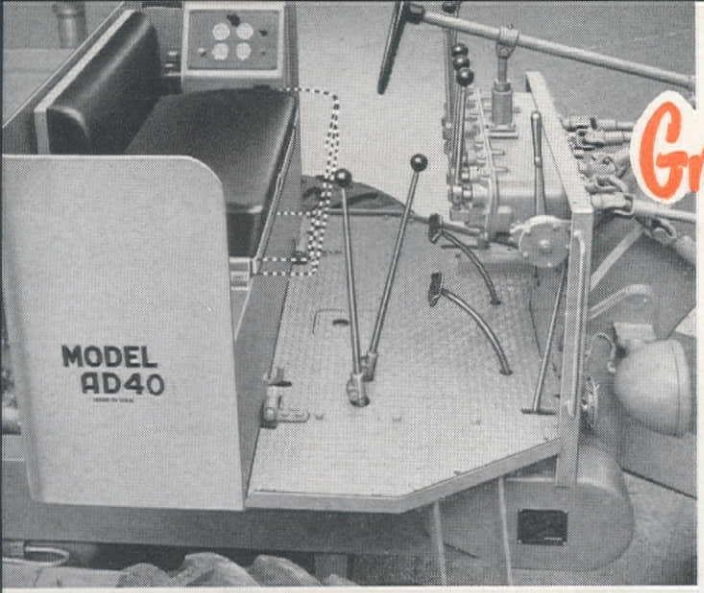
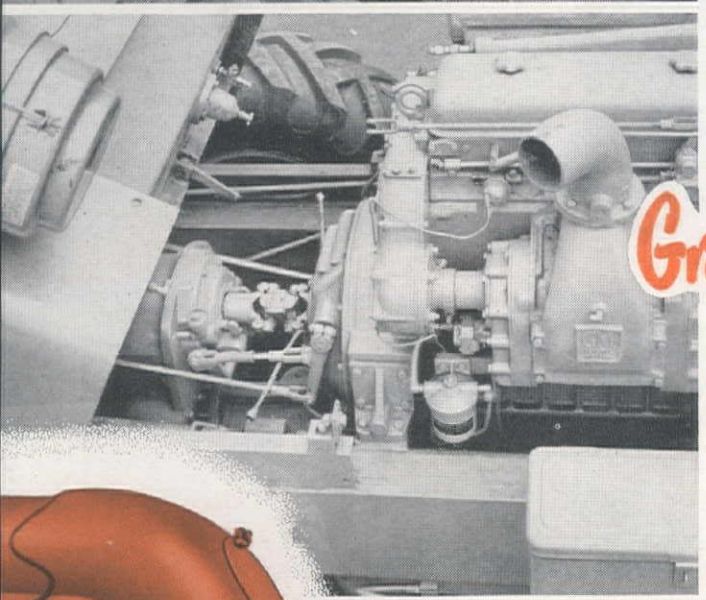
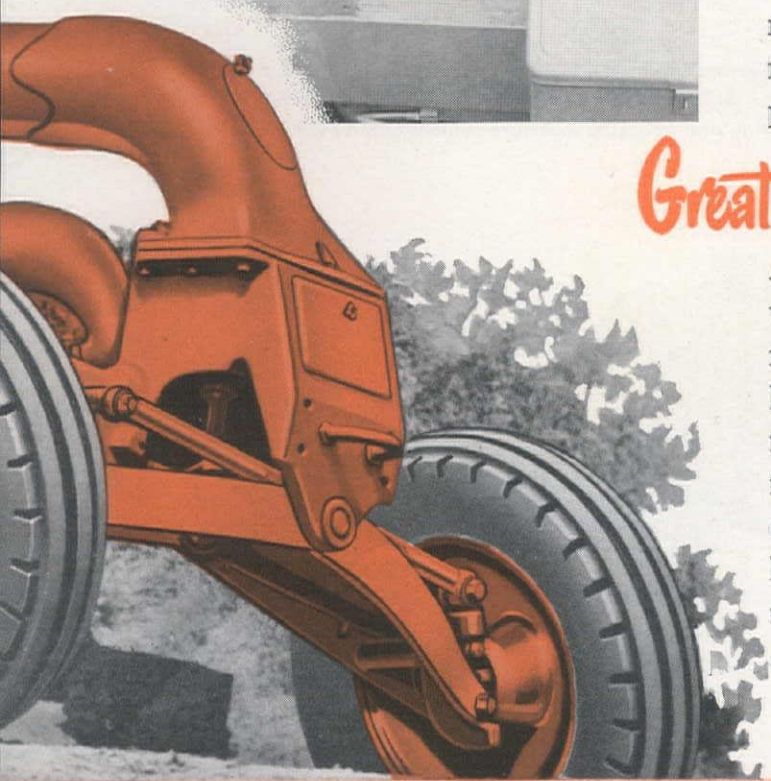






Great New operating ease

No other grader has been designed with the operator more in mind. **Unmatched Visibility**—Single tubular frame from front to platform, new lift cases, low control box and tapered platform give operator a full view of what he is doing. **Feather-Touch Steering** — New hydraulic booster system, fully enclosed in the frame, provides effortless steering with positive control even under toughest conditions. **All-Around Comfort**—Roomy platform, adjustable seat (as shown) and simple controls offer any size operator true comfort—sitting or standing.

Great New service simplicity

Here's maintenance and repair accessibility second to none. Combined fuel tank and seat unit tilts forward for easy access to clutch, transmission and drive shaft. Transmission can be removed without disturbing floor plates. Power take-off and hydraulic pump are mounted outside the dash.

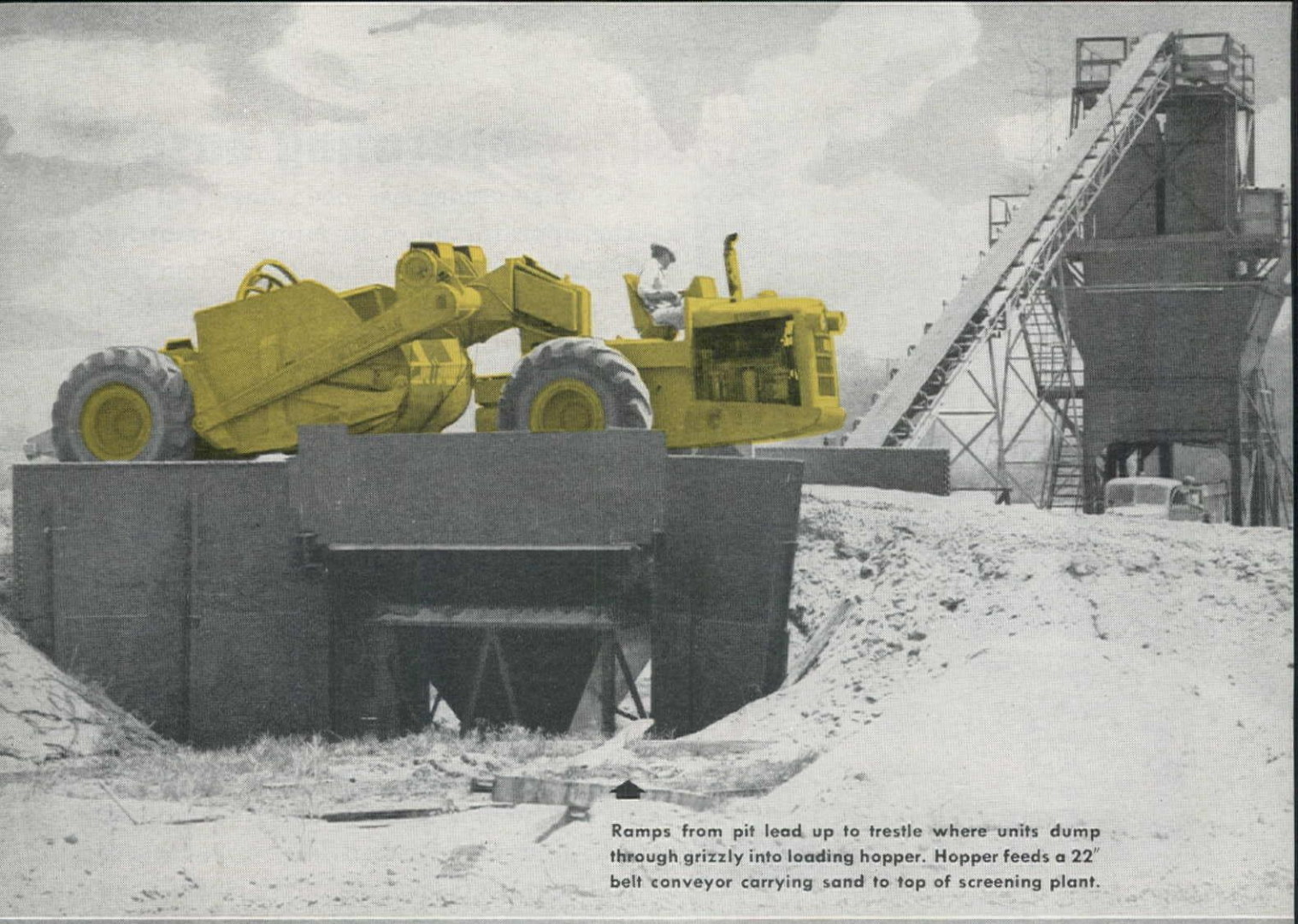
Great New performance

Add these outstanding operator and service advantages to the exclusive Allis-Chalmers features that include ROLL-AWAY* Moldboard — extra high clearances from front to rear — shock-absorbing tubular frame—dependable General Motors 2-Cycle diesel power . . . and you have the finest heavy-duty grader on the market. Get the full story on this new AD-40 from your Allis-Chalmers dealer now.

ROLL-AWAY is an Allis-Chalmers Trade-mark.

see your ALLIS-CHALMERS dealer

ARIZONA: Phoenix — Neil B. McGinnis Equipment Company. NORTHERN CALIFORNIA: Oakland—Buran Equipment Company; Eureka and Willits—Aikins and Williams Tractor Co.; Modesto—J. M. Equipment Co.; Fresno—Food Machinery and Chemical Corp.; Salinas and King City—Livingston Bros. Tractor Company; No. Sacramento, Stockton, Redding—Moore Equipment Company, Inc.; Mountain View—Redwine Tractor Company; Visalia—Tulare County Tractor Company. SOUTHERN CALIFORNIA: Bakersfield—San Joaquin Tractor Company; Los Angeles, San Diego and Riverside—Shaw Sales & Service Company. IDAHO: Idaho Falls and Boise—Southern Idaho Equipment Company. MONTANA: Missoula—Mountain Tractor Company; Sidney—Northland Machinery Company; Billings — Seitz Machinery Company, Inc. NEVADA: Elko—C. W. Paul Hardware and Machinery; Reno—Moore Equipment Company, Inc. OREGON: Eugene, Roseburg and North Bend—Farm and Industrial Equipment Co.; The Dalles—Dielschneider Equip. Oreg. Ltd.; Medford—Tractor Sales and Service, Inc.; Klamath Falls—West Hitchcock Corp.; Portland—Wood Tractor Company. UTAH: Salt Lake City—Cate Equipment Co., Inc. WASHINGTON: Seattle, Tacoma and Wenatchee—A. H. Cox Company; Spokane—American Machine Company. WYOMING: Casper—Studer Tractor & Equipment Co.



Ramps from pit lead up to trestle where units dump through grizzly into loading hopper. Hopper feeds a 22" belt conveyor carrying sand to top of screening plant.

Tournapull dumps 4 to 5-ton load from trestle into hopper. Before loading, material is harrowed to permit drying and to assure moisture content of not over 1½%.

LETOURNEAU LET® EQUIPMENT

Arizona — Phoenix
ARIZONA EQUIPMENT SALES, INC.

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"D" doubles output of clamshell, truck at Whittier Narrows Dam sand plant

Consolidated Products gets 75 tons of fine, dry sand hourly with self-loading Tournapull, 35 tons with old method

At Whittier Narrows Dam, on the San Gabriel River near El Monte, California, Consolidated Rock Products Co. of Los Angeles took the contract to produce very fine, dry, prepacked sand for gunite filler between rip-rap to prevent washing. "It was a difficult job," reports R. C. Griffin, Production Manager. "The finished product had to meet U. S. Engineers' specification of 95 to 100% passing #16 mesh screen, 60 to 85% passing #30 mesh, 30 to 50% passing #50, and 15 to 25% passing #100. Material could not carry over 1½% moisture content.

"We started the operation with a clamshell and truck. This combination was not satisfactory. The clamshell dug too deep, continually getting sand that was too moist. The trucks needed to have roads built and maintained in order to haul over the sand pile to the screening plant (it cost $800 just to build one short roadway). Production averaged only 35 tons an hour."

Consolidated Rock then rented a high-speed D Tournapull from Sterling R. Macbeth & Co., Inc. of Montebello, California. The rubber-tired 7-yd. "D" proved to be "just the right tool for the job," according to Mr. Griffin.

"It got sand of proper moisture by making a very thin cut," Griffin reports of the self-loading rig. "It doubled our production, delivering 75 tons of sand an hour at an operating cost about 10% lower than the other method. It needed no road-building or sprinkling of the haul route to travel any place over the entire sand area."

If you have similar jobs to do . . . feeding sand or gravel, stockpiling, or stripping, for example . . . get in touch with your LeTourneau Distributor. He'll be glad to show you how Tournapulls and other high-speed, rubber-tired LeTourneau equipment can boost *your* output and lower *your* costs, too. Or, if you wish, he can put you in touch with contractors who have Tournapulls for subcontract or rental.

Before renting his Tournapull to Consolidated, Macbeth used the "D" on a series of highway, land leveling, and housing jobs. "It works well in confined places," says Macbeth, "can carry loads over concrete curbing without damage, self-loads well, drives anywhere." On this housing project, it delivered 10 to 11 loads of hard, dry, silty loam hourly over a typical 4400′ cycle. Performance was so good on all these jobs that Macbeth recently bought his 2nd D Tournapull!

Tournapull—Trademark Reg. U. S. Pat. Off. DP-68-BC

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COLORADO BUILDERS' SUPPLY CO.

Nevada — Reno
SIERRA MACHINERY COMPANY

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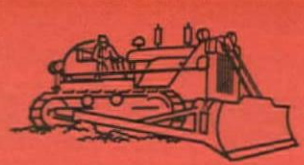
LOGGERS & CONTRACTORS

Wyoming — Casper
COLORADO BUILDERS' SUPPLY CO.

Puts a River in its Place

THE BIG RED CHAMP BUILDS UP THE WALL. The International TD-24 is the work champ of the levee and of the world. It's the most powerful crawler tractor made, and the fastest. Also a champ for "handle-ability," with fingertip control for pivot turns, feathered turns, and turns with power on both tracks. All this means it moves more paydirt per day.



Four International crawlers help build wall to save town and mines from Ohio floods

Three times in five years the Ohio River rampaged through Rosiclare, Illinois. Each time it flooded the great fluorspar mines there, the biggest in the world, America's most important source of this vital fluxing agent used in making steel.

J. D. Barter Construction Co. was given the job of taming the river with a $360,000 flood wall. Four out of the five crawler tractors he put on the project are Internationals, and Sam Barter tells why:

"They really do a job, that's why! And they can take it as well as dish it out. We have one TD-18 with 3,000 hours that's never been touched. A TD-24 with 1,500 hours and not one minute's downtime."

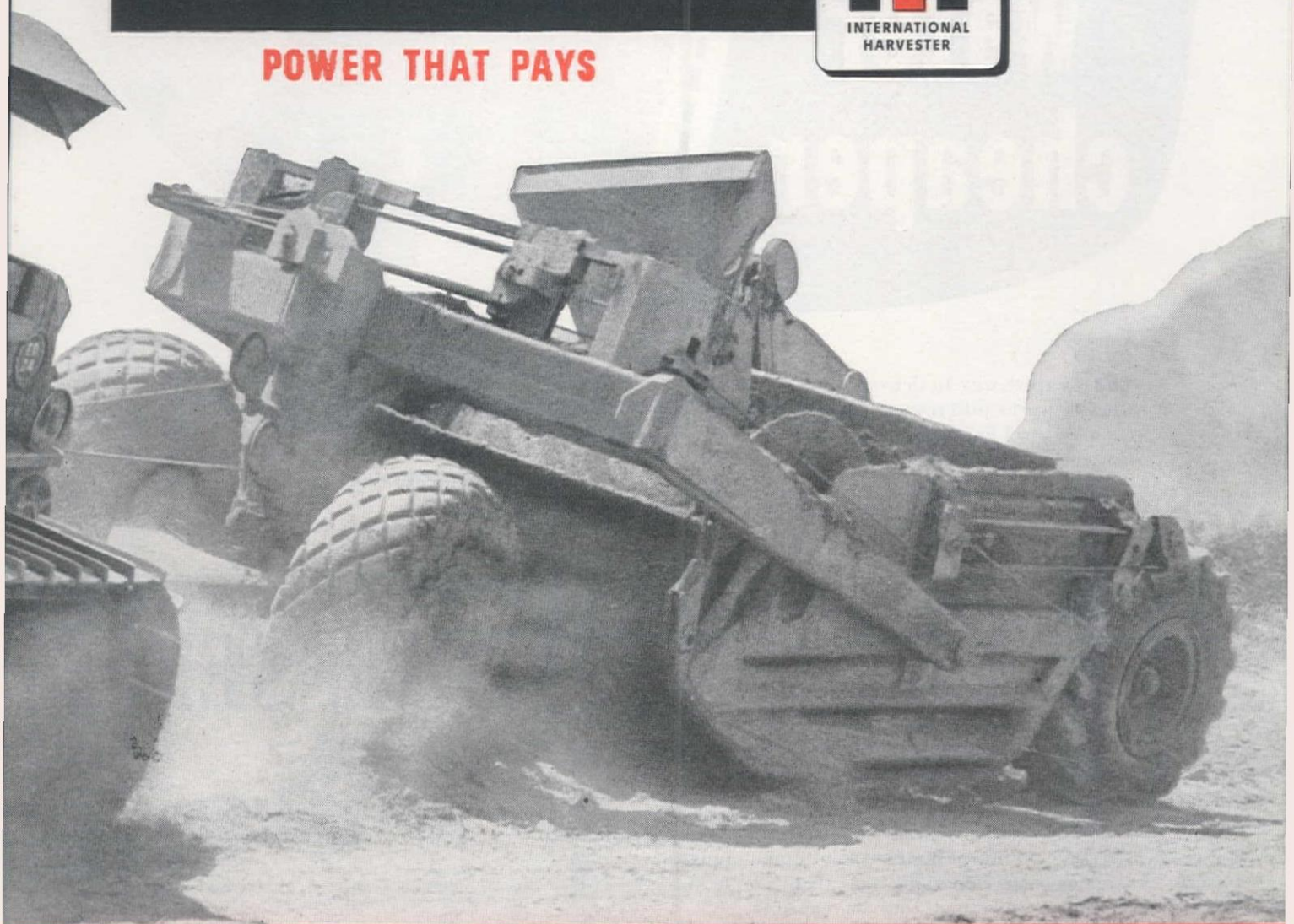
Check with your own friends who own International crawlers. And ask your nearest International Industrial Distributor for details on the whole International line. He's always at your call with expert service both in his shop and at your job site. Get the low-down. You'll go International from then on in!

INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILL.

INTERNATIONAL

INTERNATIONAL HARVESTER

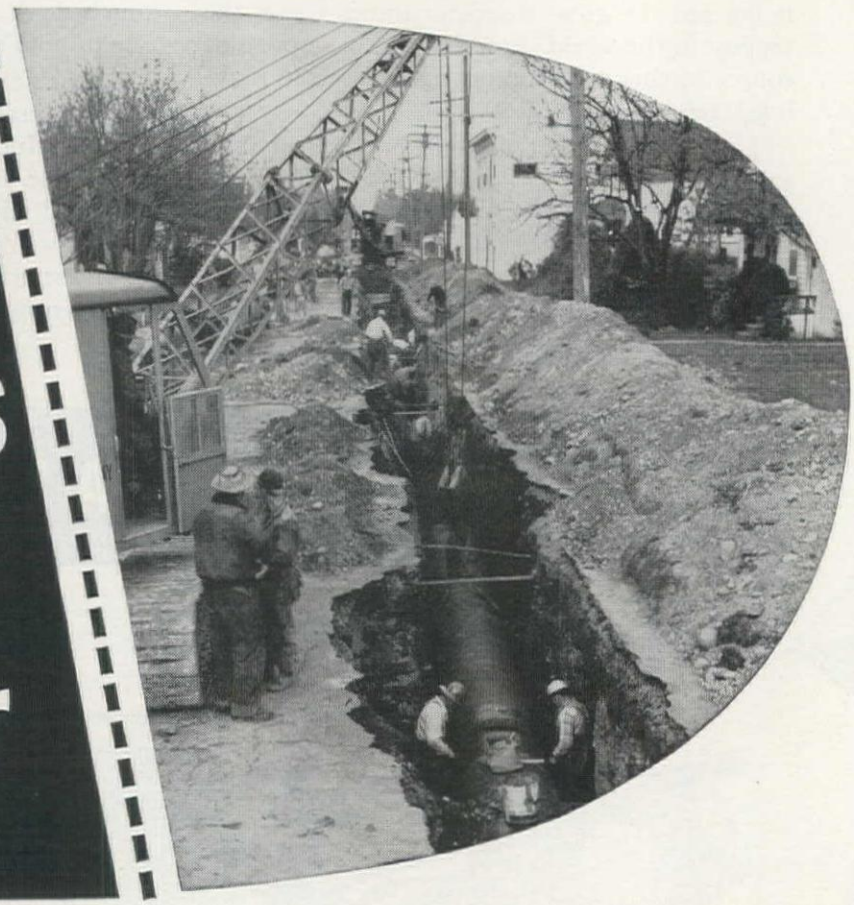
POWER THAT PAYS



Portland, Ore., contractor reports:

Chas. T. Parker, of Parker-Schram Co., says: "On this 36" pipe line using Dresser Couplings, a foreman, crane operator, oiler and six-man crew were able to average 15 lengths per day, complete except for coating. This in spite of almost incessant heavy rains. Where ditch was available without obstruction, we were able to complete about five lengths per hour. We know of no better method of connecting lengths of pipe in a water line."

A Dresser-Coupled steel line delivers water cheaper



The cheapest way to deliver water to the place where it turns into revenue is with a Dresser-Coupled steel line—the line that cuts *installation* costs, *leakage* losses and *maintenance* costs.

As in the case of this Portland water main, construction of a Dresser-Coupled line keeps going despite adverse weather conditions. Because a wrench is the only tool needed to make joints, costly weather delays are minimized or eliminated. And, in good weather, this type of construction sets a pace no other method can equal. The line starts paying its way sooner.

Leakage losses are cut because Dresser Couplings stay "flexible-tight" for the life of the line. Controlled gasket pressure is provided by controlled bolt tightness around the joint.

Maintenance costs are reduced also. Dresser Couplings harmlessly absorb underground stresses; and modern glass-smooth pipe linings, undamaged in joining because there's no heat, assure sustained high carrying capacity.

From all standpoints, a Dresser-Coupled steel line gives you the ultimate in performance and economy. See your Dresser Sales Engineer or write our Bradford Office for literature.

BE SURE you get the best line at the best price. Put steel pipe and Dresser Couplings in your specifications.

DRESSER

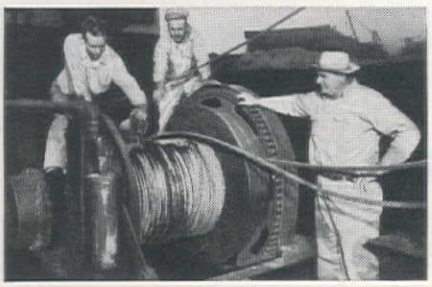
"FLEXIBLE-TIGHT"

COUPLINGS

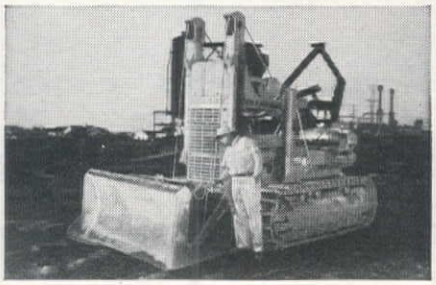
Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). Warehouses: 1121 Rothwell St., Houston, Texas; 101 S. Bayshore Highway, South San Francisco, California. Sales Offices: New York, Philadelphia, Chicago, Houston, South San Francisco. In Canada: 629 Adelaide Street, W., Toronto, Ontario.

"This boom-hoist line is one of the jobs Tiger Brand does for us," says Dominick Billi, above, master mechanic of the Guy F. Atkinson Company's Long Beach district. "Despite loads up to 20 tons, it's still going strong after 8 months of steady service."

Construction firm gets long life from Tiger Brand Rope!



For longer rope life, Mr. Billi's advice is regular lubrication with a good grade of wire rope dressing. He says: "Pile-driving operations in the salt air here are plenty hard on lines, so that even rope as tough as Tiger Brand needs this extra care. We find that it definitely prolongs rope life."



"Skiploaders, power shovels, and heavy-duty tractors are some of the other places where we use Tiger Brand Wire Rope," says Mr. Billi. "And no matter how tough the work, it always gives us trouble-free service. We know we can count on Tiger Brand Rope for long life on any job it does."

For any construction job you handle, rely on tough American Tiger Brand, the wire rope that's rigidly controlled by United States Steel from raw ore to finished product. To get all the stamina engineered into it, you're welcome to the services of a Field Specialist. Contact your local distributor or write Columbia-Geneva Steel, Room 1422, Russ Building, San Francisco 6.

USS

U·S·S TIGER BRAND Wire Rope

Columbia-Geneva Steel Division, United States Steel Company, San Francisco

UNITED STATES STEEL

Users from Coast to Coast Praise the Adams No. 610

King of all Motor Graders for Rugged, Heavy-Duty Work

Wherever you go, you'll find the husky, 100 hp. Adams No. 610 hard at work on the roughest, toughest grading operations.

Pictured above are just a few of the many jobs that the No. 610 handles easily, economically . . . high bank sloping—material spreading and maintenance of haul roads on dam projects—precision subgrading for new highways—blending and spreading heavy road mix.

For users who do not need such brute strength and power, Adams builds a complete line of medium- and standard-duty motor graders—a machine with the right power and right capacity for every grading requirement.

Ask your local dealer to show you how and why Adams Motor Graders are always your best buy.

J. D. ADAMS MANUFACTURING CO. • INDIANAPOLIS, INDIANA

Only Adams has this exclusive combination of advantages

- **8 Overlapping Forward Speeds**...Flexible working range speeds work—increases output—provides high transport speeds.
- **Wide Range of Blade Positions**—Without Mechanical Adjustments . . . Saves Time in Adapting Machine to Needed Cuts.
- **Positive-Action Mechanical Controls** . . . Dependable, accurate adjustments—because they're geared . . . Easy, natural steering.
- **Ample Operating Clearances**...Quick, easy adaptation to work . . . Operator comfort, convenience, efficiency.
- **Fast, Easy, Servicing Plus World-Wide Dealer Service** . . . Saves time and money.

See your local Adams dealer

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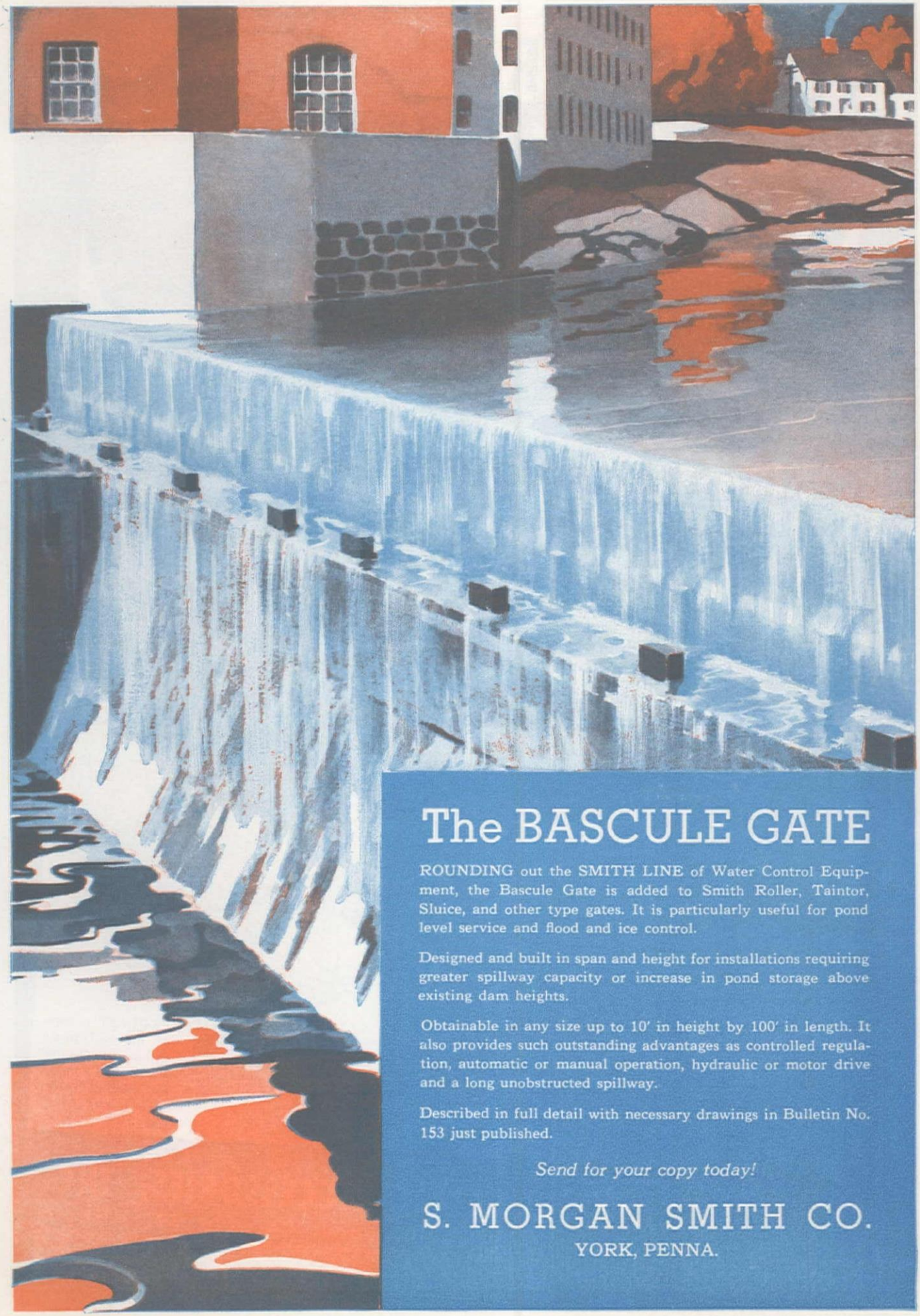


The BASCULE GATE

ROUNDING out the SMITH LINE of Water Control Equipment, the Bascule Gate is added to Smith Roller, Taintor, Sluice, and other type gates. It is particularly useful for pond level service and flood and ice control.

Designed and built in span and height for installations requiring greater spillway capacity or increase in pond storage above existing dam heights.

Obtainable in any size up to 10′ in height by 100′ in length. It also provides such outstanding advantages as controlled regulation, automatic or manual operation, hydraulic or motor drive and a long unobstructed spillway.

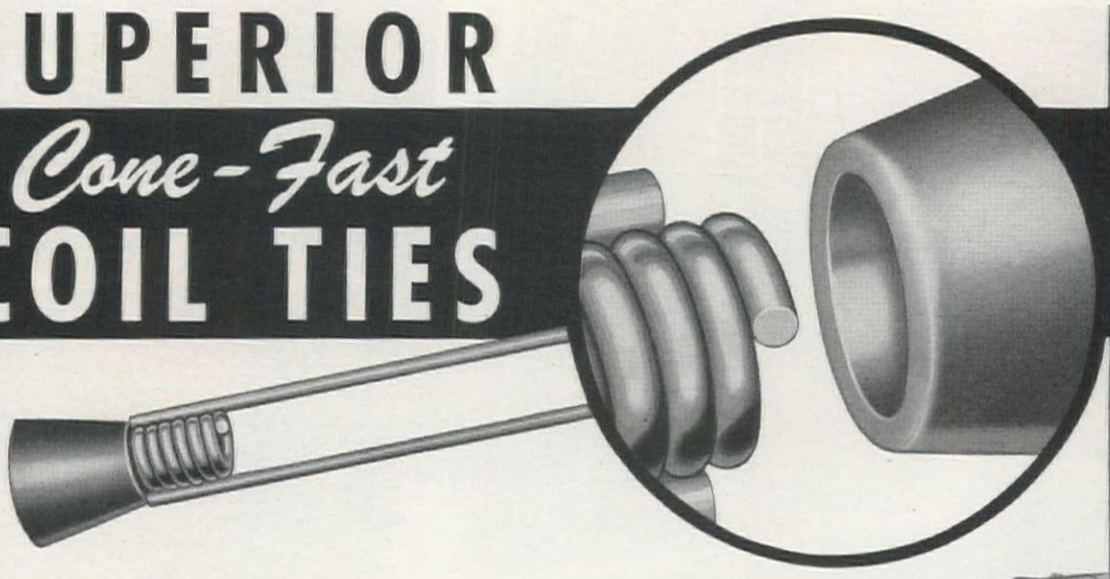
Described in full detail with necessary drawings in Bulletin No. 153 just published.

Send for your copy today!

S. MORGAN SMITH CO.

YORK, PENNA.

SUPERIOR *Cone-Fast* COIL TIES



YOU CAN CUT YOUR FORM COSTS!

Because the cost of form work is a prime factor in the total cost of bridge piers and abutments, retaining walls, filtration and sewage disposal plants, and other engineering projects, it is obvious that the forming phase offers the greatest opportunity to save material and reduce labor costs.

The use of Superior Cone-Fast Coil Ties is one direct means of cutting costs and here's why: The *exclusive* feature of this tie is the extension of the coil beyond the ends of the wire struts (enlarged detail above) which allows a reamed Coil Cone to be fitted snugly in place before the opposing panel is erected. No separate gadgets are required. Cone-Fast ties are practically a "must" when large panels are used on walls where the workman cannot get inside the forms. Cone pointed Coil Bolts are easy to engage because of the large square openings in the cones. Bolt Holders (shown on panel form) keep bolts and washer on panel when stripping and moving for reuse.

Cone-Fast Coil Ties are available for Coil Bolts ½" to 1¼" in diameter and can be used with all types of forms. All working parts are returnable. For maximum efficiency plan your form work with SUPERIOR Cone-Fast Coil Ties.

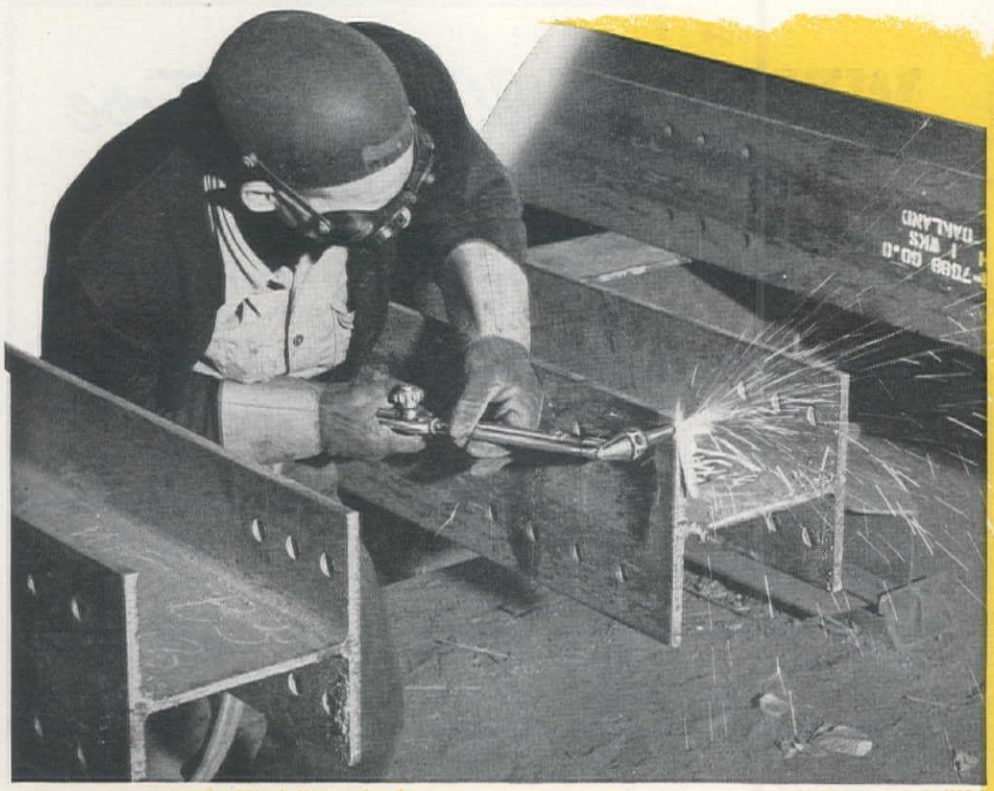
REQUEST a copy of our 56-page catalog. It contains a valuable table for spacing studs, wales, and form ties.

SUPERIOR CONCRETE ACCESSORIES, INC.

4110 Wrightwood Avenue, Chicago 39, Illinois

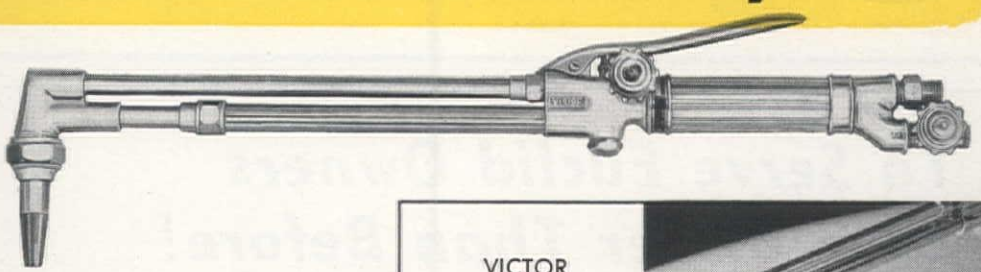
New York Office: 1775 Broadway, New York 19, N. Y.

Pacific Coast Plant: 2100 Williams St., San Leandro, Calif.



the man on the job...

...Wants VICTOR Reliability



He gets reliability and efficiency in VICTOR welding and cutting torches, and regulators because they're built right.

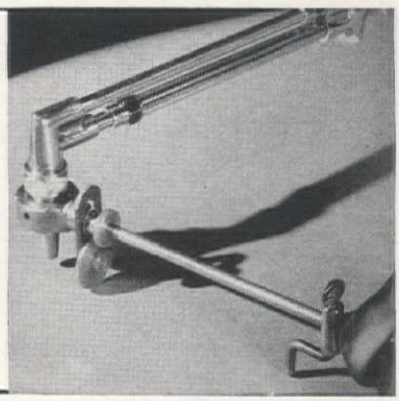
Precision machining assures leak-proof joints and ease of maintenance. Four head angles—90°, 75°, 45° or straight—and 4 lever positions—top or bottom and forward or rear of handle—enable you to choose the torch that exactly fits the job in hand.

VICTOR's complete range of tips, in sizes 000 through 16, are designed to give maximum cutting speed and gas savings on any job from light sheet to heavy plate cutting.

See for yourself why it costs less to own and operate VICTOR. Ask your VICTOR dealer for an on-the-job demonstration *TODAY*.

VICTOR
CIRCLE CUTTING
ATTACHMENT

adjusts to
various heights
and diameters
from 1¼" to 28".



VICTOR

Welding and Cutting Equipment Since 1910

VICTOR EQUIPMENT COMPANY

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Proved Performance

on the toughest jobs

On a wide range of jobs and under the toughest conditions, "Eucs" move more loads or tons per hour at the lowest cost. Large capacity, long life in heavy duty service, and speed on the haul and dump—these are features that assure low cost hauling and dependable performance.

Bottom-Dump Euclids have proved their rugged staying power and ability to do the toughest jobs in off-the-highway construction and industrial work. Powered by diesel engines of 190 to 300 h.p., they range in capacity from 13 to 25 cu. yds., and have top speeds loaded up to 34.4 m.p.h.

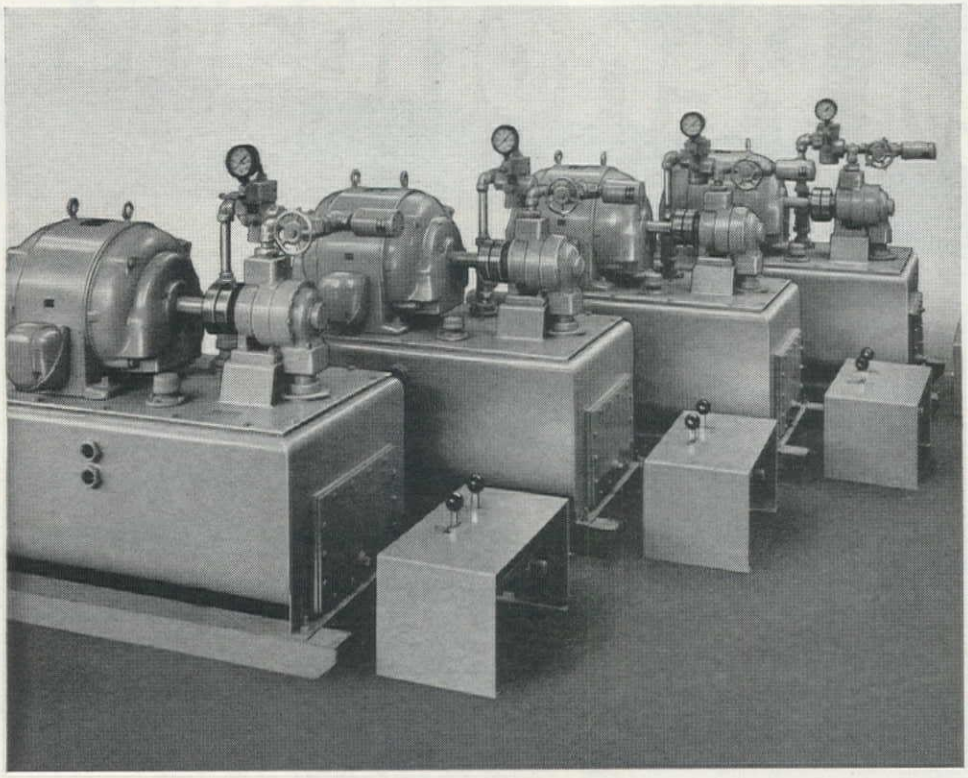
Rear-Dump "Eucs" are designed and built to move rock, coal, ore, overburden and other heavy excavation. They range in capacity from 10 to 34 tons, have top speeds up to 36.3 m.p.h. with full payload, and diesel engines of 125 to 400 h.p.

For help with your off-the-highway hauling prob lems, call your Euclid Distributor today or write for information on the complete line of Euclid equipment for moving earth, rock, coal and ore.

"EUCS" are job proved for more loads per hour and more profit per load.

The EUCLID ROAD MACHINERY Co., CLEVELAND 17, OHIO
CABLE ADDRESS: YUKLID **CODE: BENTLEY**

EUCLIDS *Move the Earth*



▶ **Hydraulic power units and controls for Lookout Point Dam, designed and built by RUCKER to rotate, raise, return and lock gates of four Walker free discharge valves operating under 200 feet head of water. These units have 20 hp. motors, 25 g.p.m. pumps and deliver 1600 p.s.i. Each operates an 8" diameter, 162" stroke lifting ram, and an 8" diameter, 51" stroke locking and rotating ram. Corps of Engineers job; contractor, Willamette Iron & Steel Company.**

How to Bid Safely on Jobs Requiring Hydraulic Power & Controls

Let RUCKER Design and Estimate For You

If you're bidding on specifications that call for hydraulic power units and controls to operate dam gates, discharge valves, mixing plants, etc., call RUCKER for quotations.

Hydraulic and Pneumatic Problems are Our Business

RUCKER is the largest firm in the West specializing in fluid power problems. We have worked with and know the requirements of the U. S. Engineers, Bureau of Reclamation and public utility engineers. You get a firm quotation from us and can bid with full assurance that the hydraulic system will be designed and built to meet the specifications.

It's Easy to Work With Us

- Our field men are all experienced mechanical or chemical engineers.
- Large in-stock inventory of nationally accepted components—valves, motors, pumps, filters, regulators, etc.—eliminates delays and guesswork.
- Manufacturing facilities enable us to assemble and shop test before delivery.
- You save grief, because we handle the entire job, including written operation and maintenance manual.

Why "guesstimate?" Call us if your bid includes hydraulic or pneumatic systems. Phone, write or wire NOW. No obligation.

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Concrete pipe equipment
Batching plants
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Quick service—field engineers in 3 Western contracting centers. Call office nearest you.

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Here's why you need these 26 features of BLAW-KNOX *Hi-Boy* TRUKMIXERS!

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BIGGER PAYLOAD EVERY TRIP

1. The lightest weight*, complete, standard heavy-duty truck mixer.
   * 3-cu. yd. Hi-Boy—5485 lbs.
   *4½-cu. yd. Hi-Boy—6715 lbs.

HIGHER PRODUCTION

2. Split-second charging through 32″ unrestricted opening.
3. Fast discharge without segregation, even with zero slump concrete.
4. Blade system that discharges entire batch without residue.
5. Fastest and easiest control of discharge.
6. Higher discharge—no confining chutes.

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7. Maintenance-free revolving hopper.
8. Hopper seal guaranteed for one year.
9. Easily replaceable mixing blades.
10. Extreme accessibility for maintenance or repair.
11. New silent, automotive transmission—the standard of comparison.
12. Double roller chain drum drive.

BETTER, EASIER OPERATION

13. Single lever drum control operated from ground or walkway.
14. Single discharge control operated from ground or walkway.
15. Convenient quick visual inspection of batch before discharge.
16. Quick-opening inspection hatch.
17. Finger-tip control for reversing drum rotation.
18. Back-mixing if desired, with hopper in charging position.
19. 3-position, quick-acting, stainless steel water valve.

GREATER EFFICIENCY

20. Complete end-to-end mixing, even of zero slump concrete.
21. Grout-proof automatic water nozzle, properly located.
22. All metal clutches running in oil.
23. Clutch controlled V-belt driven water pump.
24. 2-compartment, splash-proof, tilt-proof automatic water measuring tank.
25. 2-compartment flush tank.
26. Washout hose included.

Ask your BLAW-KNOX distributor about the advantages of the "COMPLETE READY-MIX PACKAGE"

You'll like the advantages of getting all your equipment . . . clamshell buckets, batching, mixing and charging plants, and Hi-Boy Trukmixers . . . all in one shipment, backed by one responsibility, with one source for expert service, and covered by one financial arrangement. Ask your Blaw-Knox distributor to explain every benefit of the "Complete Ready-Mix Package".

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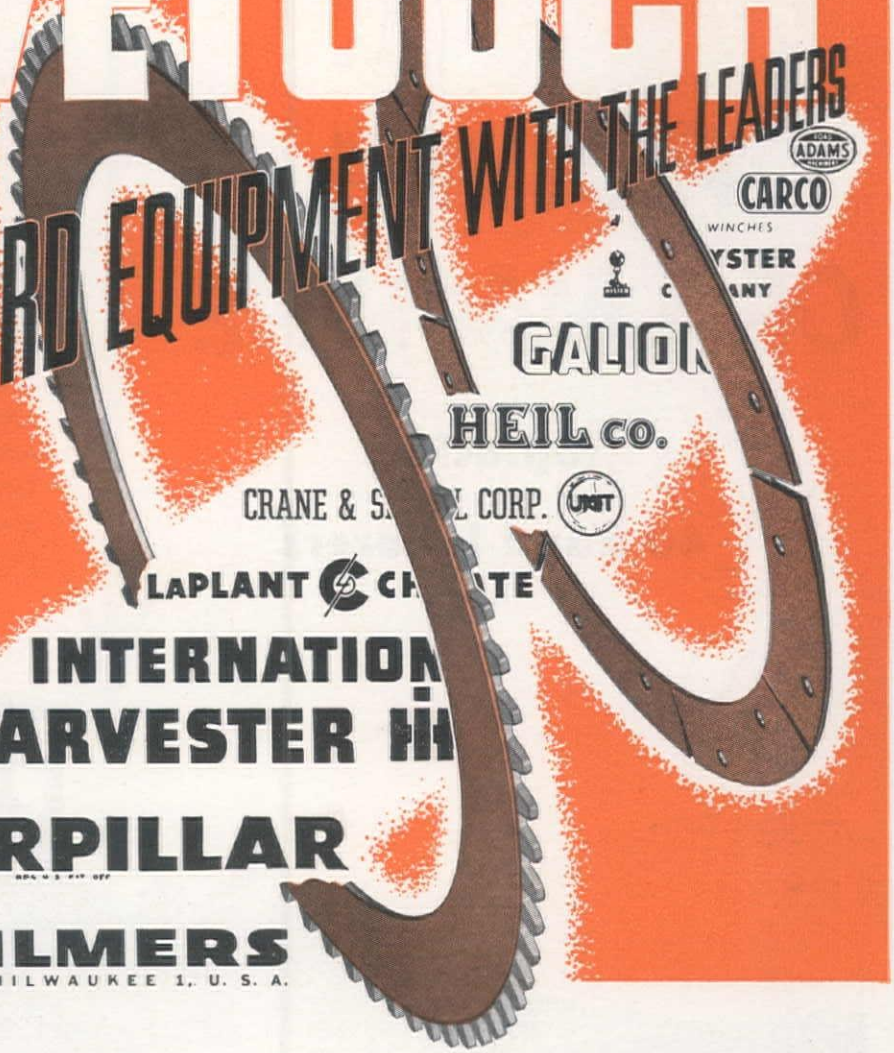
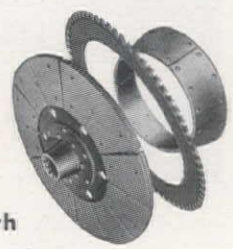
STANDARD EQUIPMENT WITH THE LEADERS



ALLIS-CHALMERS
TRACTOR DIVISION — MILWAUKEE 1, U. S. A.

. . . BECAUSE IT LASTS LONGER



Leading manufacturers everywhere specify Velvetouch . . . because Velvetouch clutch plates, facings and brake linings insure *extra* hours of dependable, trouble-free service. This means *extra* savings for the user. And *extra* savings for you when you replace with Velvetouch—made by the world's largest manufacturer of all-metal friction products. For details contact your jobber, our nearest branch . . . or The S. K. Wellman Co., 1374 E. 51st St., Cleveland 3, Ohio.

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PICTURE OF A MACHINE

replacing 40 hand laborers

● Despite many modern technological developments, a certain amount of clean-up hand labor has remained a necessity in practically all construction work.

But now the Gradall, with its extreme versatility and exacting hydraulic tool control, eliminates much of this clean-up hand labor. Contracts are completed faster, costs are cut, and manpower conserved.

Reports from the field often show one Gradall replacing 40 men . . . *and doing the job better, faster, for less.*

Why not investigate all of the applications of this one versatile machine in your work? Your nearest Gradall Distributor will be glad to demonstrate its many profit possibilities with a field demonstration.

Gradall®

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BROWN-BEVIS EQUIPMENT CO., *Los Angeles 58 California*
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GRADALL—THE MULTI-PURPOSE CONSTRUCTION MACHINE *with Controlled Down Pressure*

MINNEAPOLIS-MOLINE
MM
MODERN MACHINERY

Heavy Duty WHEELERS

DESIGNED TO DO MORE JOBS... LAST LONGER...COST LESS TO OWN

UTIL 51 h.p. High-turbulence, slow-speed, 51 h.p. engine is the power and economy leader . . . 6 shuttle speeds cut job time . . . 18 roller bearings in steering and front axle assembly for easy handling of capacity front-end loads.

Right Job Equipment

Profit-wise operators find that the wide *choice of heavy-duty attachments* designed for MM Industrial Wheelers handle a great number of jobs in less time. For many jobs RTI or UTIL Wheelers may be equipped with both front and rear mounted attachments that make both ends pay.

Matched Equipment

The right attachments designed to match the power and weight of MM Industrial Wheelers are rigidly mounted to make the unit *last longer* and provide larger capacity. Front axle and tire capacity are rated at 5,000 and 12,000 pounds. MM Wheelers may be equipped with ½ up to 3½ yard buckets depending on material to be handled.

Low-Cost Equipment

MM Wheelers are high-production machines that provide heavy-duty power for many low-cost, interchangeable industrial attachments. They are precision built for long-life, and are engineered for the job. High speed on the job and between jobs cuts machine time and operator's time.

RTI 27 h.p. From radiator to drawbar its toughest built for this power . . . has years-ahead engine design with 140 fewer parts and outstanding service features . . . tire sizes and wheel treads to fit all requirements.

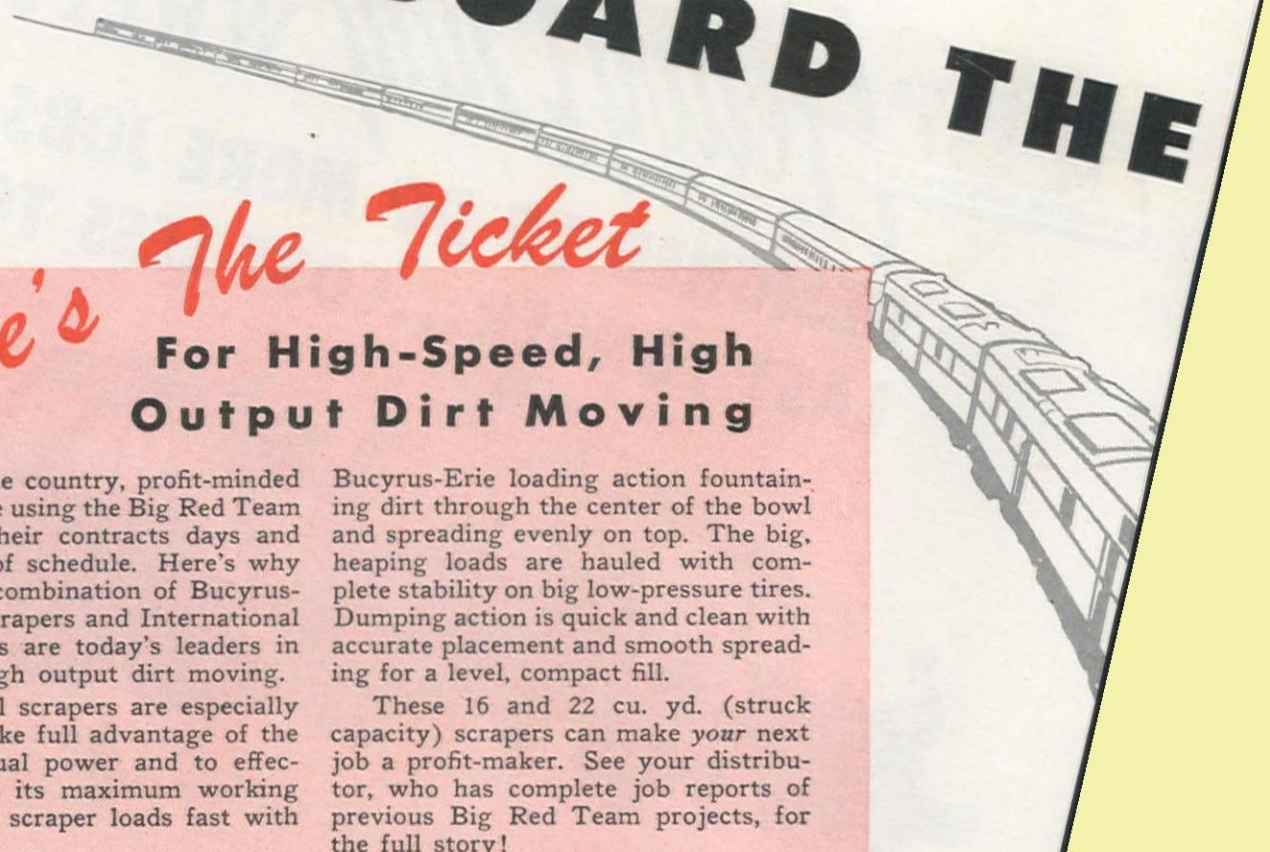
HERE'S TOP PERFORMANCE

Accurately controlled cooling maintains uniform engine temperature to deliver more power. More even distribution of power is accomplished by the progressive burning in MM's high-turbulence combustion chambers. The high-compression, valve-in-head engine of an MM delivers *dependable* power.

MINNEAPOLIS-MOLINE

MINNEAPOLIS 1, MINNESOTA

GET ABOARD THE



Here's The Ticket

For High-Speed, High Output Dirt Moving

All over the country, profit-minded contractors are using the Big Red Team to complete their contracts days and weeks ahead of schedule. Here's why this matched combination of Bucyrus-Erie B-type scrapers and International TD-24 tractors are today's leaders in high-speed, high output dirt moving.

Both model scrapers are especially designed to take full advantage of the TD-24's unusual power and to effectively develop its maximum working capacity. The scraper loads fast with Bucyrus-Erie loading action fountaining dirt through the center of the bowl and spreading evenly on top. The big, heaping loads are hauled with complete stability on big low-pressure tires. Dumping action is quick and clean with accurate placement and smooth spreading for a level, compact fill.

These 16 and 22 cu. yd. (struck capacity) scrapers can make *your* next job a profit-maker. See your distributor, who has complete job reports of previous Big Red Team projects, for the full story!

BUCYRUS ERIE

SOUTH MILWAUKEE, WISCONSIN

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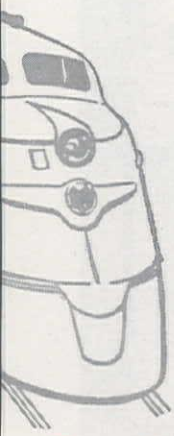
BIG RED TEAM

PROFIT TRAIN!



B-250

22-YD. CAPACITY

Three TD-24 and B-250 combinations owned by J. S. Moorhan, Muskogee, Oklahoma, work on a flood control project in Ft. Worth, Texas.

B-170A

16-YD. CAPACITY

New size and strength, greater flotation, and new loading visibility are now available in the B-170A 16 yd. scraper.

See Your

International Industrial Tractor Distributor

"Million Dollar Gate" and then some!

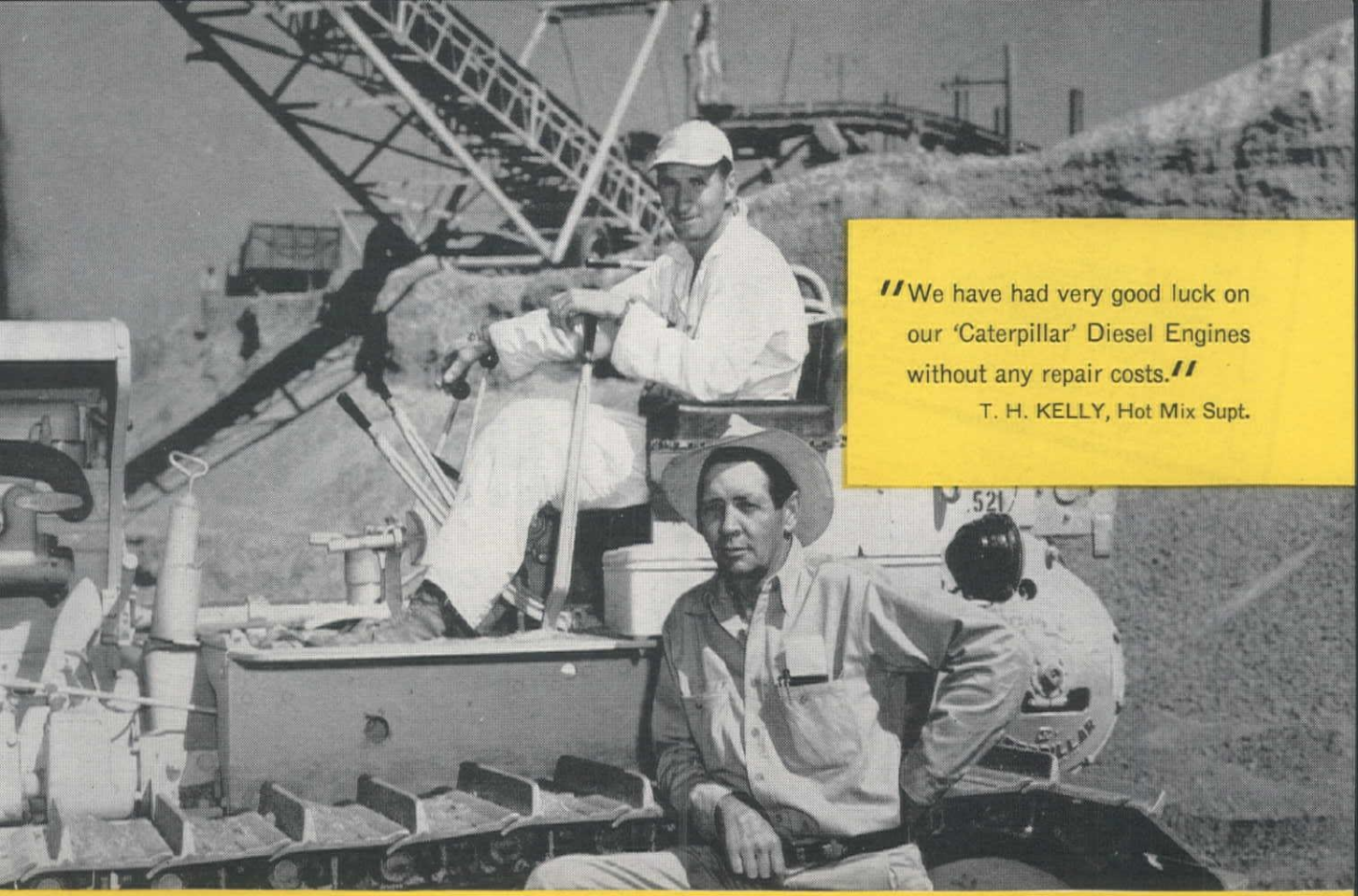
WELL-MANAGED operations all over the country have invested millions of dollars in Chapman Standard Sluice Gates . . . and have received a substantial return in the savings effected by easy installation, low maintenance and dependable service.

Installation is expedited because interchangeable couplings don't have to be match-marked. In fact, the entire mechanism is made so that repair and replacement parts fit into place precisely, with no "file-and-fit" needed on the job.

And Chapman Standard Sluice Gates can be specified with the type of operating control best suited to the job . . . manual, hydraulic cylinder, or motor-operated floorstands. Get the full facts from Chapman's Standard Sluice Gate Bulletin 25 . . . send for your copy now.

The Chapman Valve Mfg. Co., Indian Orchard, Mass.

Chapman *Standard* Sluice Gates



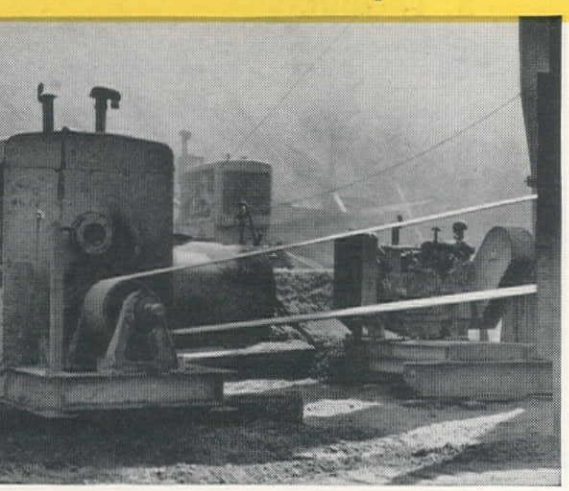
"We have had very good luck on our 'Caterpillar' Diesel Engines without any repair costs."

T. H. KELLY, Hot Mix Supt.

A "Cat" D17000 runs the mixer, a D8800 the dryer, and a D315 the dust collector in the asphalt plant. A D17000 drives the portable crusher that supplies the aggregate. A "Cat" D8 Tractor with No. 8S Bulldozer stockpiles and feeds material at the plant.

He called it luck

but quality manufacture started it



LONG PERIODS of good performance in any power-producing machine depend on these major factors: *Good design, good construction, good care and good dealer service.*

The four "Caterpillar" Diesel Engines powering the Peter Kiewit Sons' Co. crusher and hot mix plant near Agoura, Calif., are proving they have *all* it takes to do a good job — while thousands of their mates are doing likewise all over the world. Many have run up records of 50, 60, 70 and over 100 thousand hours of operation — and they are still on the job. By proved field performance, the "Cat" Engines mentioned here are still young.

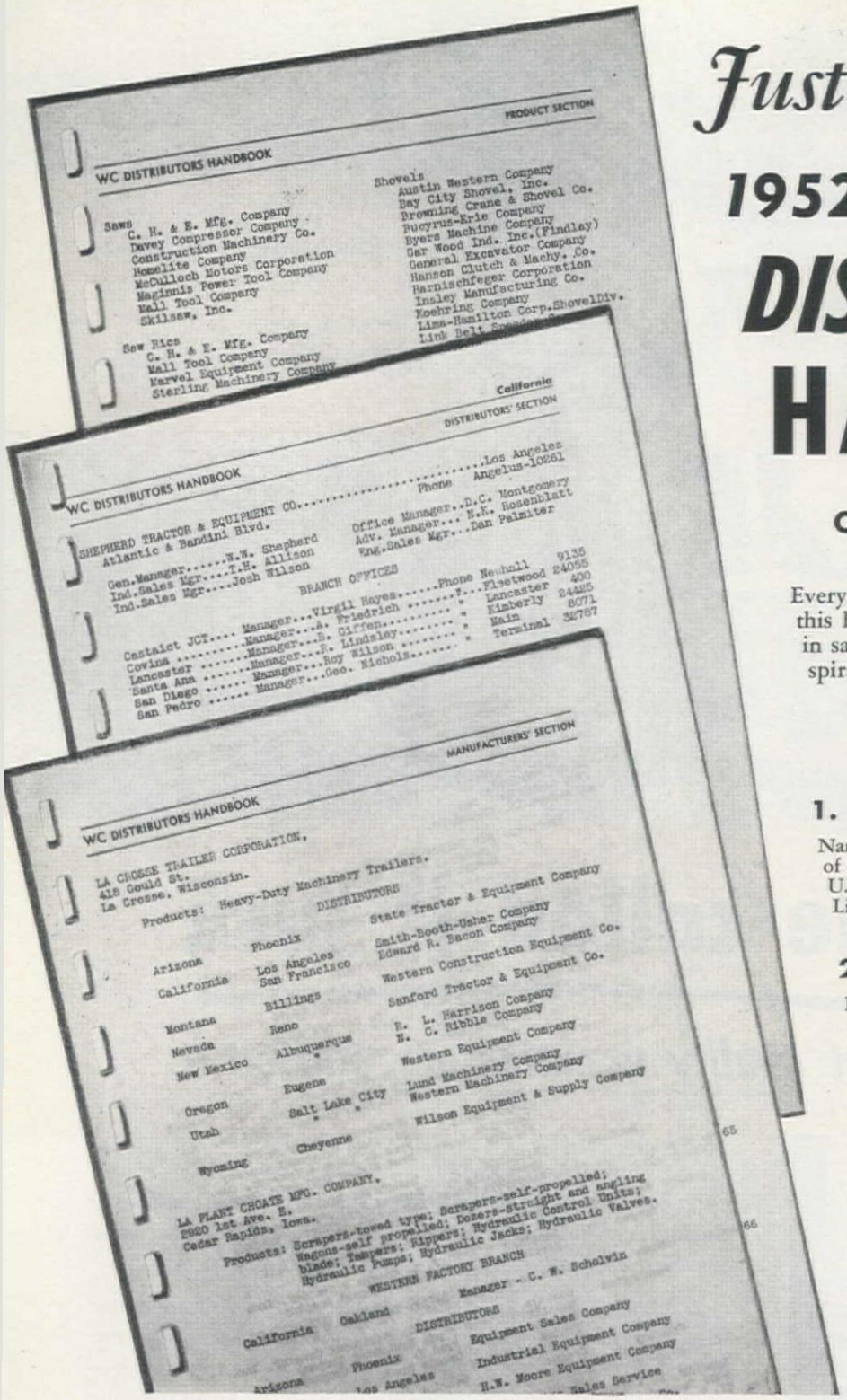
NOTE — Are *you* a "Caterpillar" owner? Remember: *Good care is good preventive medicine.* It takes only a few minutes to check starting, fuel, lubrication and cooling systems. It's no trouble having your "Caterpillar" Dealer inspect your equipment regularly. And when necessary, he can readily rebuild working parts before they become worn beyond repair. Good forethought is good business.

CATERPILLAR TRACTOR CO. • San Leandro, Calif.; Peoria, Ill.

CATERPILLAR

REG. U. S. PAT. OFF.

DIESEL ENGINES
TRACTORS • MOTOR GRADERS
EARTHMOVING EQUIPMENT



Typical pages, actual size, to show type of content.

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Every Western contractor and manufacturer can use this handy, time-saving reference—pays for itself in savings on wires and phone calls. Pocket size; spiral bound.

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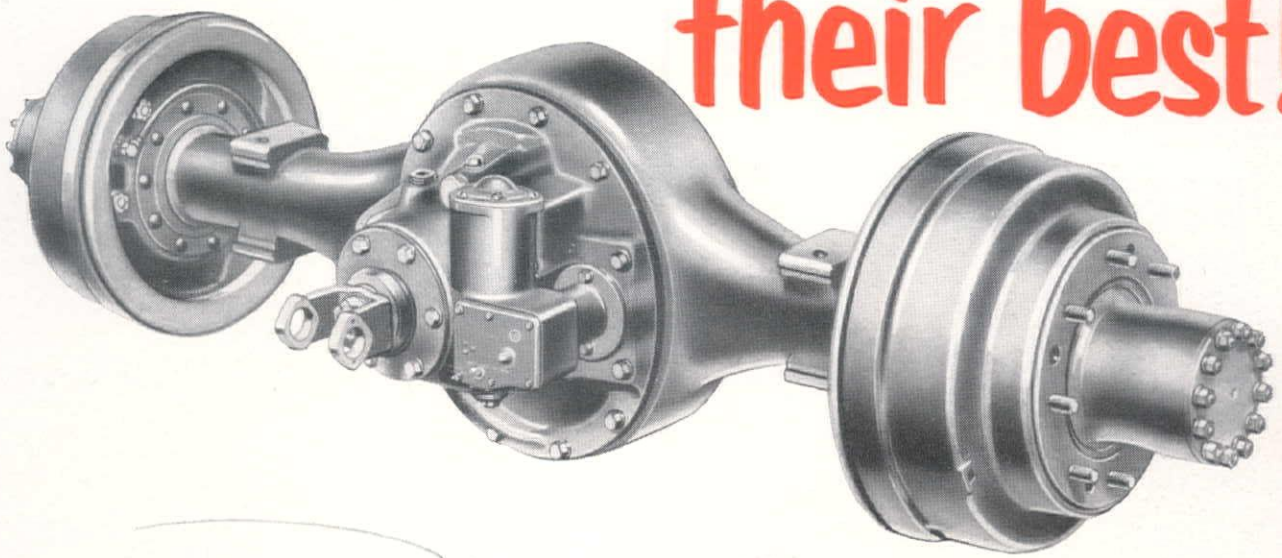
give your truck engines a chance to perform at their best!



These Exclusive Eaton Features Keep Trucks on the Job, Reduce Upkeep, Add Thousands of Miles to Axle Life—

- **PLANETARY GEARING**
- **FORCED-FLOW LUBRICATION**

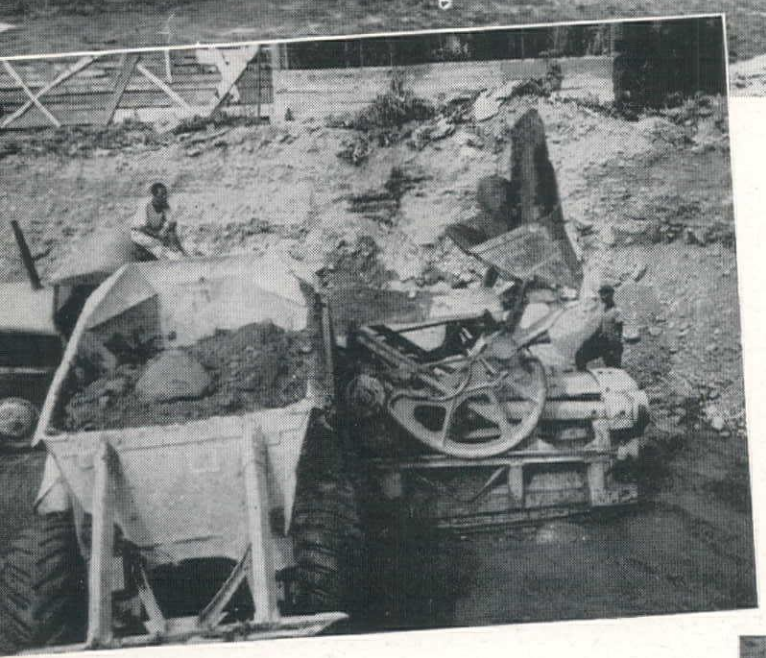
SPECIFY Eaton 2-Speed Axles; they double the conventional number of gear ratios, enabling drivers to select a ratio for pulling power or speed, a ratio best suited to road and load conditions. This permits engines to operate in their most efficient and economical speed range, cuts gas and oil consumption. It reduces stress and wear on engine and power transmitting parts, holds maintenance time and cost to a minimum, adds thousands of miles to engine and over-all vehicle life. Your dealer will explain how Eaton 2-Speed Axles will help your trucks haul more, faster, at lower cost. They pay for themselves over and over, and give trucks materially higher trade-in value.

Axle Division
EATON MANUFACTURING COMPANY
CLEVELAND, OHIO

EATON
2-Speed Truck
AXLES

PRODUCTS: Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater-Defroster Units • Snap Rings Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers

LOADS BIG TRUCKS



The EIMCO 104 loads big trucks easily with rock, sand or gravel. When used in pits, quarries, mines, construction jobs or clearing highways, this flexible fast machine has no equal for low-cost loading.

Repeat orders, from users who have kept accurate performance records, prove the high efficiency of the EIMCO 104.

Price-wise there is no equal — the EIMCO 104 costs only a fraction of the price of heavier, slower moving equipment of equal loading capacity.

The 104 loads at the rate of 4 to 6 buckets per minute with an average load of 1¼ yards per bucketful.

Write for more information on the EIMCO 104.

EIMCO A566

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

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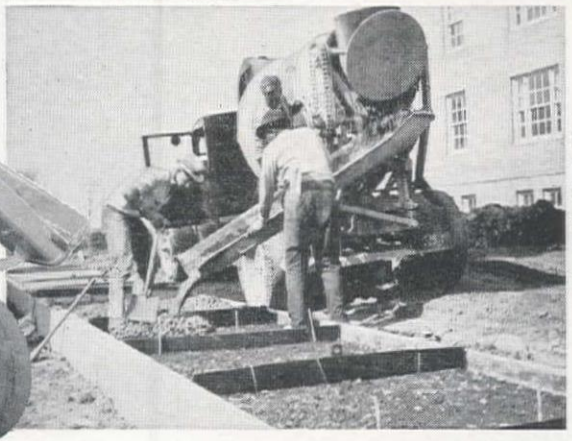
AGENTS IN ALL PRINCIPAL CITIES THROUGHOUT THE WORLD

15 Years of PROGRESS

SMITH LEADERSHIP REVOLUTIONIZED THE TRUCK MIXER INDUSTRY



An early model Smith-Mobile working on Greendale Housing Project near the city of Milwaukee, in 1937.

SMITH-MOBILE
Early Model Built in 1937

1st in the Field

FIRST high discharge truck mixer.

FIRST to eliminate the need for hoist or ramp.

FIRST with a controlled discharge.

FIRST to provide visible mixing.

FIRST with feed chute charging.

FIRST to provide for shrinking and mixing of batch as materials enter drum.

FIRST to introduce water through the feed opening.

FIRST to provide water injection through both ends of drum.

FIRST steep distributing spout, especially ideal for dry concrete.

FIRST to announce fluid drive as standard equipment.

FIRST with LOADLIMIT models.

1952 Model
SMITH-MOBILE

You want the very finest truck mixer that money can buy. You get it in the Smith-Mobile.

Rome wasn't built in a day. Nor was the modern Smith-Mobile evolved overnight. It was designed around basic Smith inventions and patents long before anybody else built high discharge truck mixers. Important refinements were added from year to year, all based on intensive research and practical experience gained in the field.

Today, Smith-Mobile continues, as always, to be the acknowledged leader in the industry. Buy Smith-Mobile and be sure you are getting the best. Five sizes available. Standard or LOADLIMIT models.

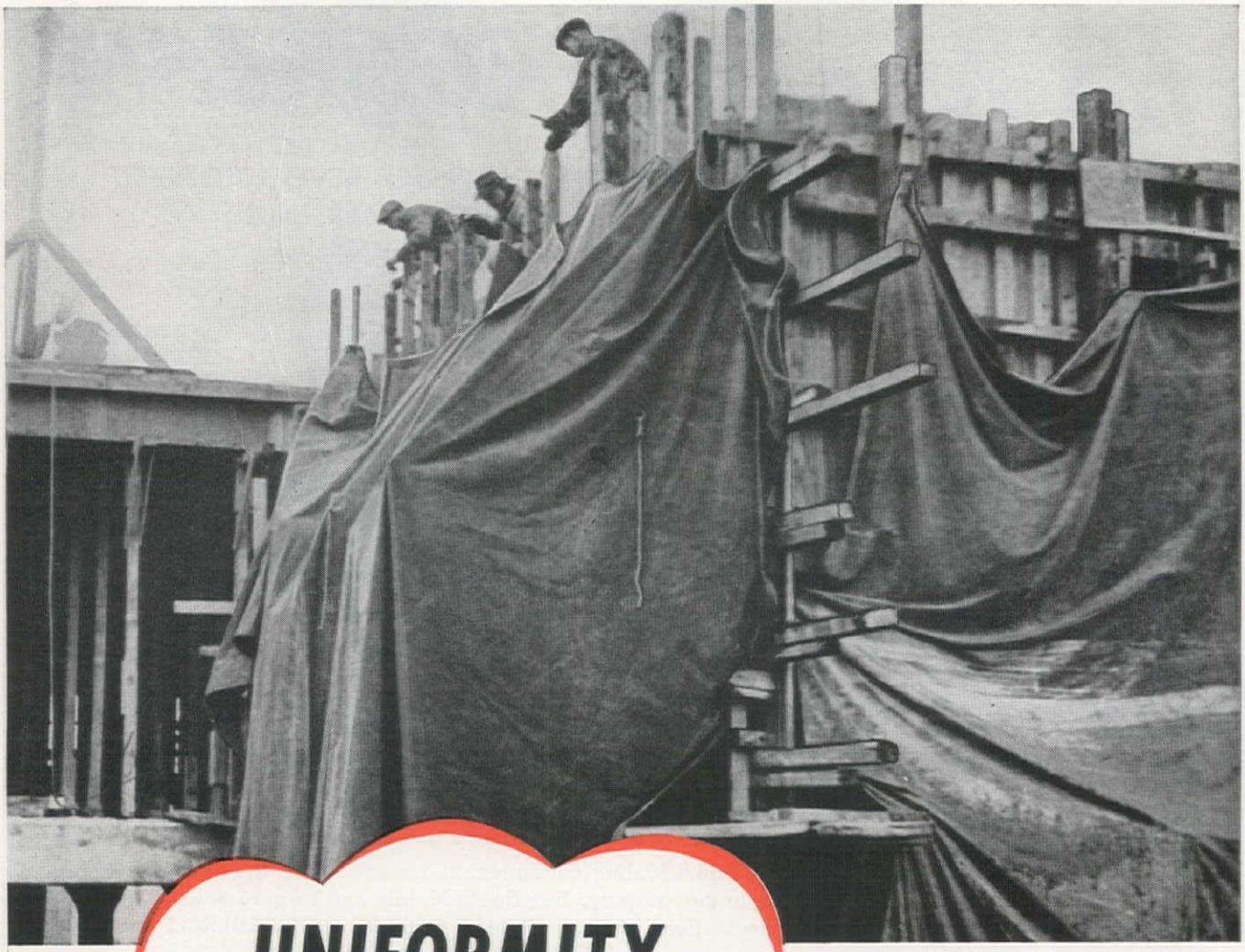
Write for descriptive literature.

THE T. L. SMITH COMPANY, 2871 N. 32nd Street, Milwaukee 45, Wis.

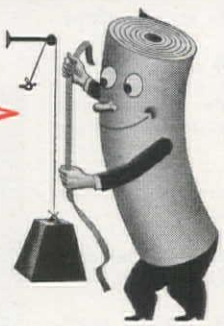
SMITH MOBILE

The Original High Discharge Truck Mixer and Agitator

A 6019-1P

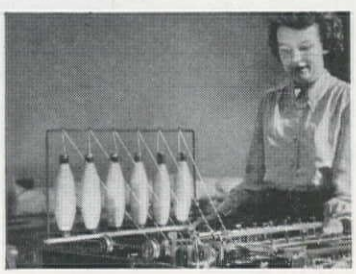


UNIFORMITY
Makes the Big Difference
In TARPAULINS



Mt. Vernon — Extra

Gives You Greater Fabric Uniformity



One of a series of comprehensive laboratory controls throughout production to assure uniformity in all Mt. Vernon-Woodberry products. The unit shown automatically tests 6 strands of yarn at one time.

Mt. Vernon - Woodberry Mills

Branch Offices: Chicago • Atlanta
Baltimore • Boston • Los Angeles

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40 WORTH ST. · NEW YORK

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT Calol O.H.T. Grease

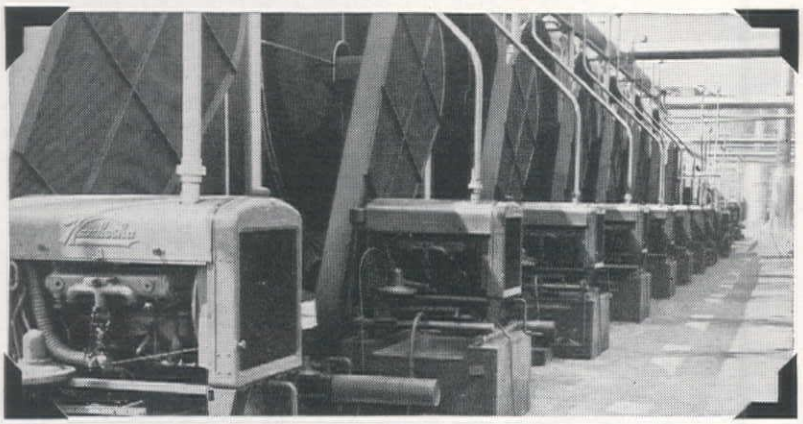
UNIT High-speed ball bearings

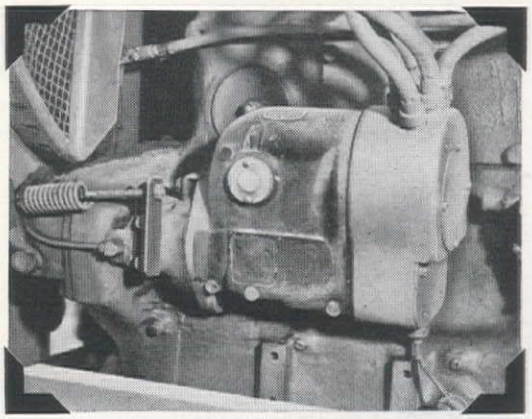
OPERATION Magnetos

CONDITIONS 160° F. ambient temp.— high-speed, constant load

FIRM Sunray Oil Corp., Newhall, Calif.

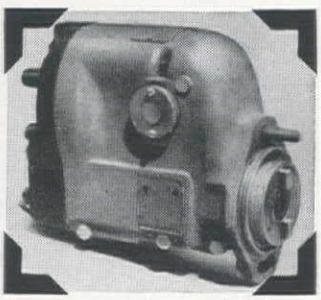
Anti-friction-bearing-maintenance work cut in half!



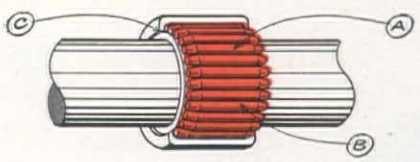


144 HIGH-SPEED BEARINGS in 72 magnetos on various types of engines required servicing at 1- to 3-month intervals until Calol O.H.T. Grease was used on them. Now they are serviced only at intervals of 3 to 6 months, although heat from the continuously operating engines keeps "drive-end" bearings at an average temperature of 160°F. Three other brands of comparable type grease tried by Sunray Oil Corp., owners of the engines, would not stay put on the magneto bearings under these tough conditions. Calol O.H.T. Grease has lubricated bearings satisfactorily in temperatures up to 400°F.

IN SERVICE TWO YEARS in the "hot end" of the magneto at right, this bearing is still in good condition. It was lubricated twice yearly with Calol O.H.T. Grease. This special grease for bearings is recommended for all types including sealed bearings in electric motors and generators. Use it anyplace where extended service is required or oxidation and high temperatures may be a problem.



How Calol O.H.T. Grease protects bearings in severest operating conditions



Used in any type of bearing under any operating condition, high temperature-low speed, high speeds to 10,000 rpm, temperatures from minus 10° F. to 400° F., CALOL O.H.T. Grease will last indefinitely.

A. Contains special oxidation inhibitor—helps prevent rusting, corrosion, hardening of grease at any time.

B. Resists high temperatures—eliminates coking and formation of deposits.

C. Provides excellent seal against water... lubricates efficiently in slight moisture.

FREE CATALOG: "How to Save Money on Equipment Operation," a new booklet full of valuable information, is ready for you. Write or ask for your free copy today.

TRADEMARK "CALOL" REG. U.S. PAT. OFF.

CALOL

STANDARD TECHNICAL SERVICE checked this product performance. For expert help on lubrication or fuel problems, call your Standard Fuel and Lubricant Engineer or Representative; or write Standard Oil Company of California, 225 Bush St., San Francisco.

STANDARD OIL COMPANY OF CALIFORNIA

It'll soon be 21!

For 20 straight years Internationals have been first in heavy-duty truck sales.

It will soon be 21. Another year will be added to International Trucks' heavy-duty leadership because truck operators who know hauling costs will *continue* to prefer the trucks that give them lower operating and maintenance costs, longer truck life.

If you are interested in these money-saving advantages, why not see your International Truck Dealer or Branch about the truck engineered for your job?

INTERNATIONAL HARVESTER COMPANY · CHICAGO

Check these exclusive advantages of Internationals:

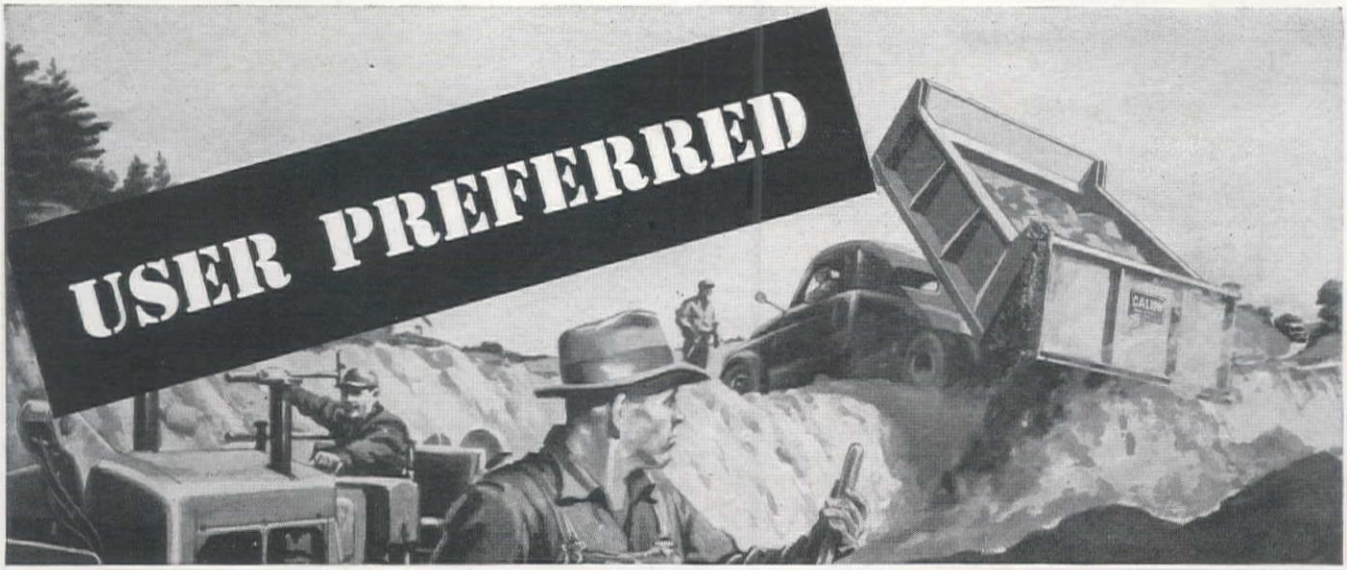
- All-truck engines—exclusively for truck work—built in the world's largest truck engine plant.
- The "roomiest, most comfortable cab on the road"—the Comfo-Vision Cab designed by drivers for drivers.
- Super-steering system—more positive control, easier handling and 37° turning angle.
- Traditional truck toughness that has kept International first in heavy-duty truck sales for 20 straight years.
- 115 basic models . . . everything from ½-ton pickups to 90,000 lb. GVW off-highway models.
- America's largest exclusive truck service organization.

International Harvester Builds McCormick Farm Equipment and Farmall Tractors . . . Motor Trucks . . . Industrial Power. . . Refrigerators and Freezers

INTERNATIONAL TRUCKS

More than One Million Now on the Road

Model LF-210, 175 inch wheelbase, with 5 cu. yd. concrete mixer, 37,000 lbs. GVW

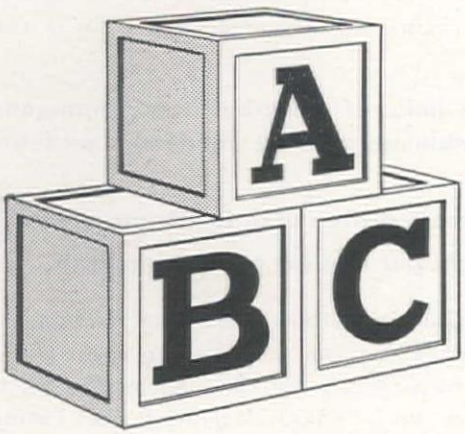


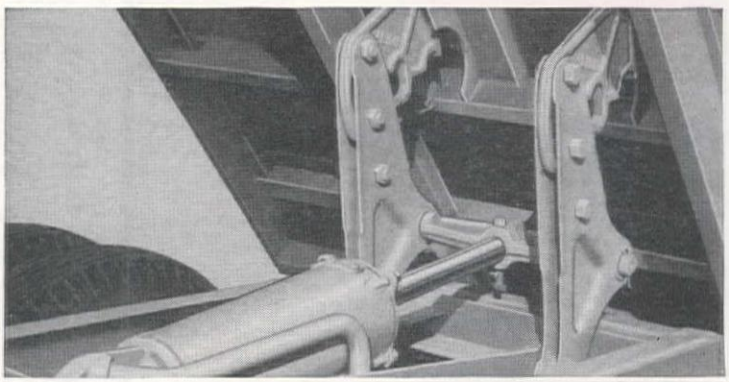
. . . MEANS *BEST THERE IS!*

You see so many dump trucks (all makes) equipped with Galion hydraulic hoists and allsteel dump bodies because "Users Prefer" Galion equipment.

Through experience countless dump truck operators have found that Galion equipment performs better . . . lasts longer and has chassis saving qualities as well.

And that's easy to understand . . . for Galion successfully unites an exclusive Fulcrumatic lift ACTION with perfect operating BALANCE and top quality CONSTRUCTION resulting in dump truck performance so smooth . . . so reliable . . . so efficient as to earn for it the stamp of leadership . . . "User Preferred".





Scientifically positioned fulcrums and transfer linkages automatically "shift" the load at different points, eliminating lift-shock and smoothing out lifting action throughout the dumping cycle. The result is longer hoist, body and chassis life . . . better dumping performance!

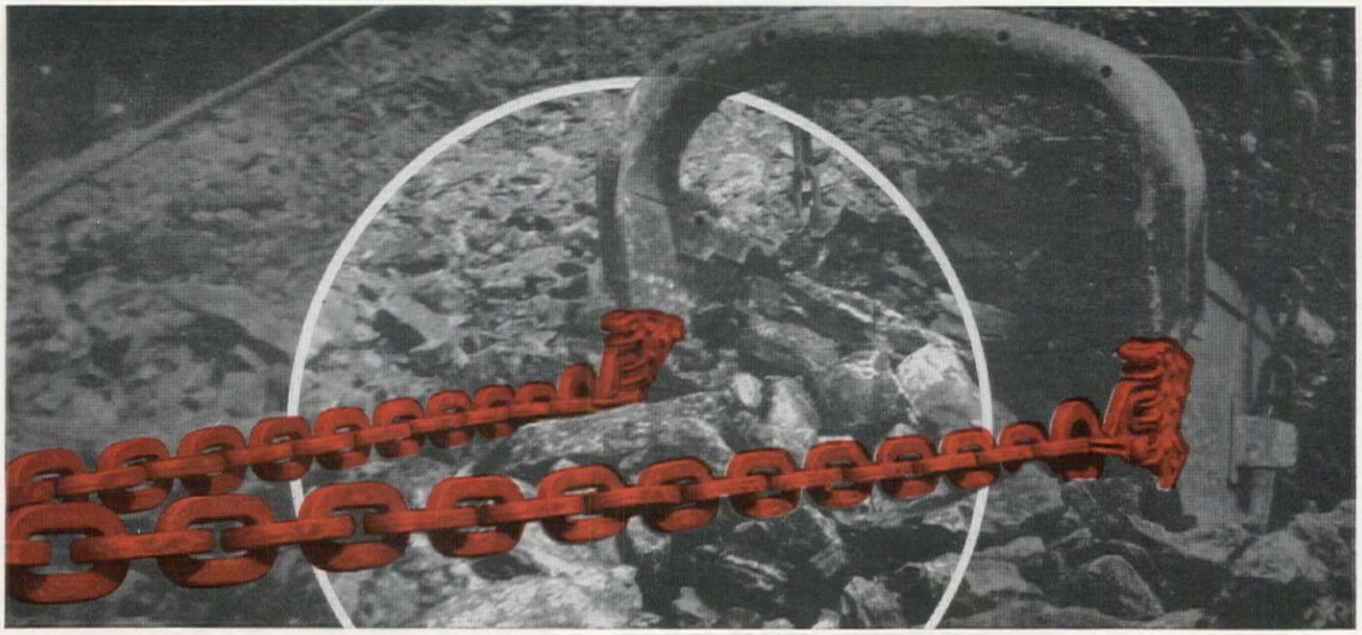
MAKES A WHALE OF A DIFFERENCE THE "WEIGH" IT LIFTS

Sales and Service FROM Coast to Coast

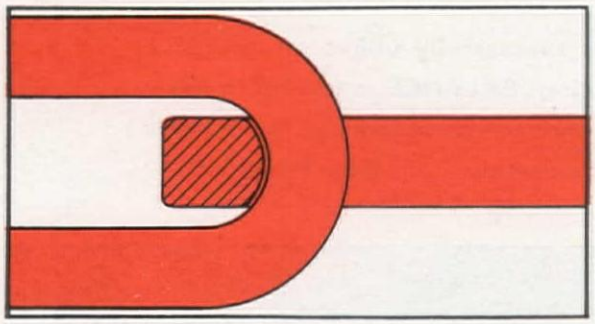
GALION

ALLSTEEL BODY COMPANY
GALION, OHIO

A exclusive hoist *Action*
B perfect operating *Balance*
C proved quality *Construction*



ESCO DRAG CHAINS



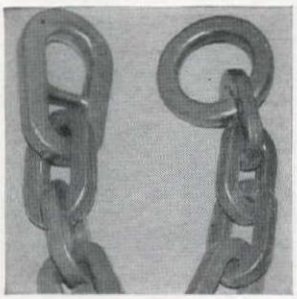
lick wear and shock of toughest digging

If you want more hours of service and lower costs per yard from your drag chains, here's your answer — *ESCO* chains which give you

Solid cast links of work-hardening manganese steel, combining greatest toughness and shock resistance.

Oversize cross section area for longer wear.

More weight per foot for greater strength.



Shape of links distributes wear over large area, makes chains last longer.

Either end rings or pear links may be provided, depending upon owner's preference.

Dealers in all major cities stock *ESCO* drag chains in sizes from ¾" to 2¾". (They can provide drag chains for any make bucket.) For particulars on sizes and lengths ask your dealer for bulletin 108-J, "*ESCO* Dragline Bucket Fittings"; or fill in and mail the coupon.

ESCO Dippers, Hoe Dippers, Dragline and Coal Loading Buckets

ELECTRIC STEEL FOUNDRY

2163 N. W. 25th Avenue, Portland 10, Oregon

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ELECTRIC STEEL FOUNDRY
2163 N. W. 25th Avenue, Portland 10, Oregon
Please send me your Bulletin 108-J, "ESCO Dragline Bucket Fittings".

Name_____

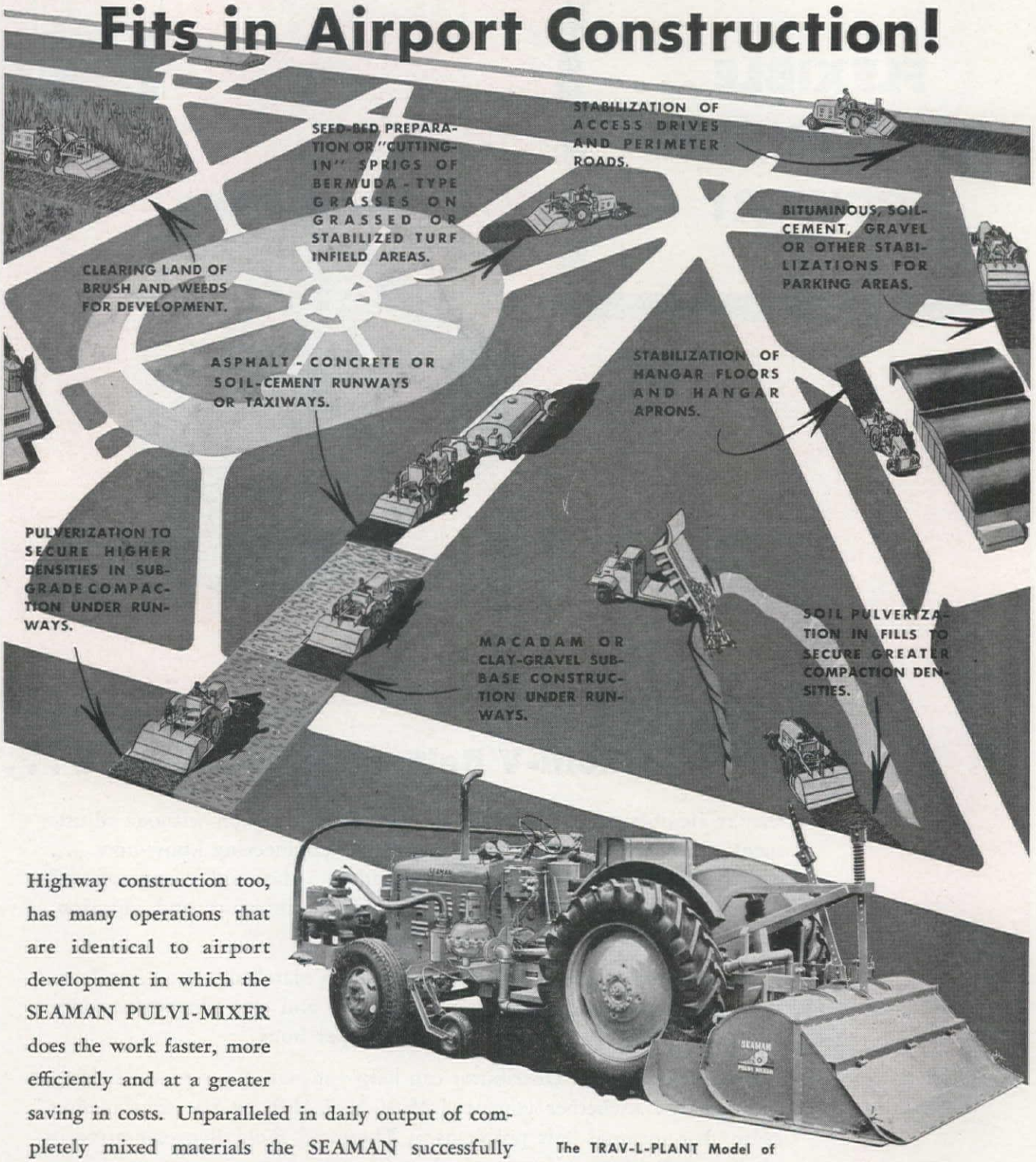
Company_____

Address_____ Zone_____

City_____ State_____

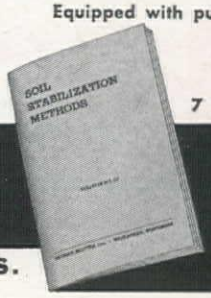
Make and model of machines used_____

Where the SEAMAN PULVI-MIXER Fits in Airport Construction!



Highway construction too, has many operations that are identical to airport development in which the SEAMAN PULVI-MIXER does the work faster, more efficiently and at a greater saving in costs. Unparalleled in daily output of completely mixed materials the SEAMAN successfully challenges the most extensive projects; low in investment, it is profitable on the smallest jobs. Plan on a SEAMAN in your 1952 operations.

The TRAV-L-PLANT Model of the SEAMAN PULVI-MIXER.
Equipped with pump, spray bar and full tachometer assemblies for application of bitumen or water.
Volumetric meter optional.
7 ft. mixing width. Gasoline or diesel powered.



Send for this FREE book on up-to-the-minute practices in mixing for all types of stabilized construction. Write for Bulletin 25.

SEAMAN MOTORS, Inc.

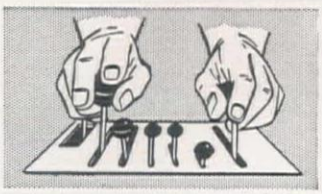
285 N. 25TH ST., MILWAUKEE 3, WIS.

up to 25% more production

LINK-BELT SPEEDER with *Speed-o-Matic* controls

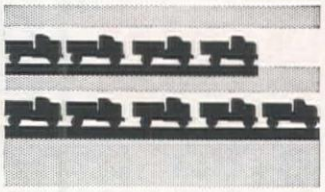
DELICATE SEWER DIGGING between water and gas mains is accurately handled here by an LS-51 owned by City of Greenville, Michigan. Many municipalities and other governmental bodies choose the LS-51 because faster job action creates striking budget savings.

Speed-o-Matic full hydraulic controls mean stepped-up production

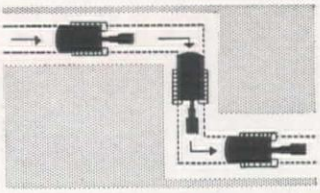


Speed-o-Matic Controls — fully hydraulic! You "feel" the load all the way. Simple, easy—fingers instead of muscles do work.

Eliminates up to 150 parts — cuts friction, no worn bushings, pins, links or clutch toggles to put you "down."



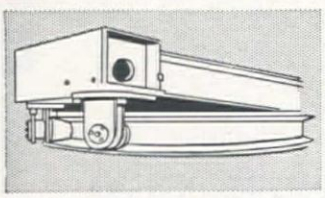
Up to 25% more production — fast operating cycle steps up output and profits. Effortless control keeps operator fatigue down.



Turns on a Dime. Either track can drive or be locked independently. Hydraulic control gives instant response.

Here are other Link-Belt Speeder PLUS FEATURES that work for you

Convertibility — designed for peak production as shovel, crane, dragline or trench hoe. Convert in field—quickly, easily.



Hook Rollers — Cone-shaped for *true* rolling. Reduce roller and roller path loads—eliminate center pin pull.

All-Welded Stress-Relieved Construction — extra strength without extra weight. Resists impact, twist. Field service simple.

Service—fast, efficient. Link-Belt Speeder Service is nationwide—near you with replacement parts, factory-trained mechanics.

LINK-BELT SPEEDER
CORPORATION 12,710

Builders of the most complete line of shovels, cranes and draglines

CEDAR RAPIDS, IOWA

CUMMINS® DIESEL PARTS
give more service!

When your Cummins Diesel requires scheduled overhaul or non-scheduled emergency service, install Genuine Cummins Parts. Because we take *twice* the care in manufacture, every Genuine Cummins Part *fits* exactly, has *longer* life, gives you *trouble-free* service. You'll get added years of dependable performance from your Cummins Diesels when you *insist* on Genuine Cummins Parts.

Only Cummins Dealers, located from coast to coast, sell Genuine Cummins Parts. Contact the dealer nearest you from the list below.

CUMMINS ENGINE COMPANY, INC. · COLUMBUS, INDIANA

Diesel power by CUMMINS

CUMMINS Dependable DIESEL

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That's why a Dodge "*Job-Rated*" truck is your best bet. It provides the kind of power that takes its job in stride!

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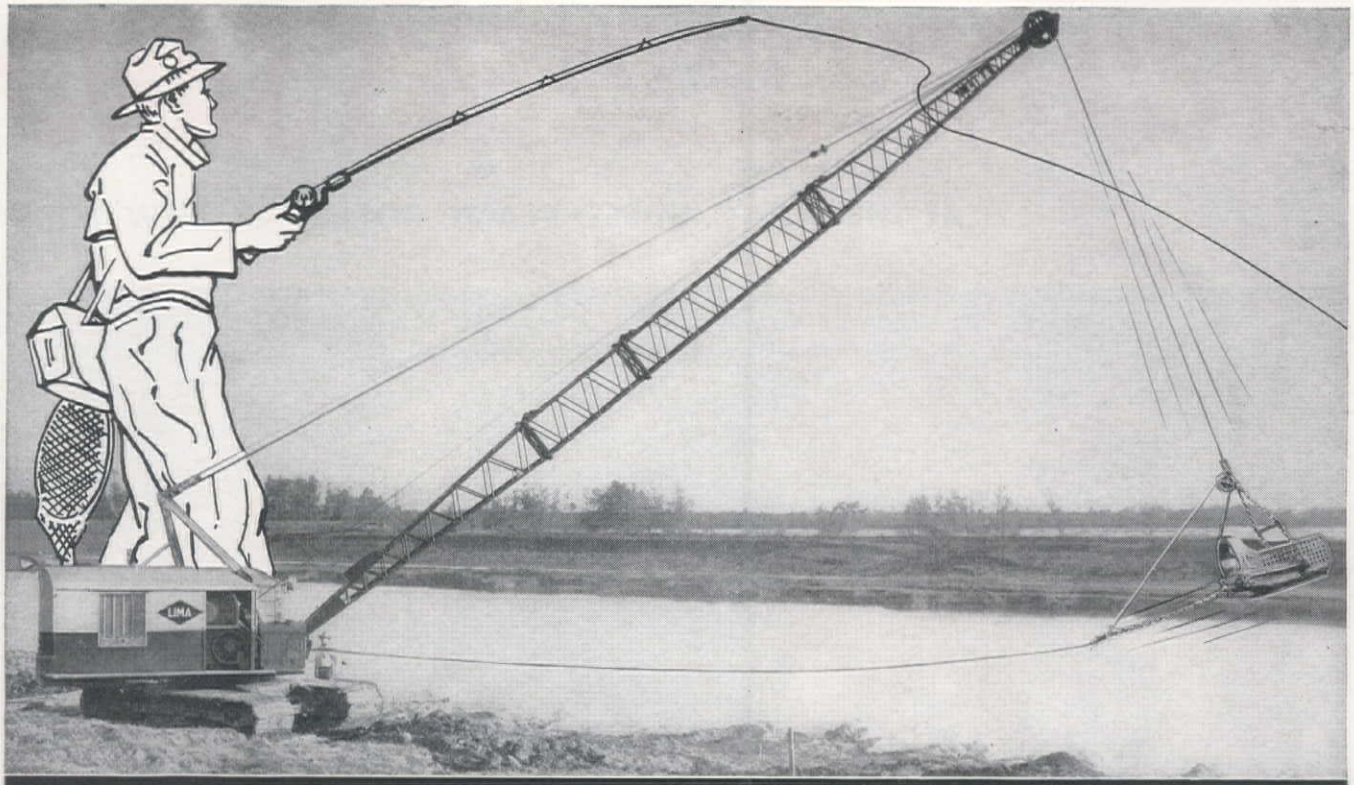

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When you're after record yardage, a smooth flowing line is just as vital . . . so we took a tip from the fisherman, and made our reels friction-free. You can 'cast' the dragline bucket further, increase your radius of efficient operation from each location. You can bring in bigger catches, because more power is going into the work lines and less into *friction drag on the machinery*. And there's further big benefits from reduced maintenance . . . less frequent lubrication, and smoother operation, because misalignment from bearing wear, that affects clutch alignment and functioning, is eliminated.

Lima pioneered the use of anti-friction bearings at all important bearing points on draglines, shovels, and cranes. They've kept on pioneering with other improvements that put Lima equipment in the top rank of profitable performers. If you want proof of this—just ask the Lima user. If you want details on how to put Lima equipment on your *pay-off* roll . . . just get in touch with us.

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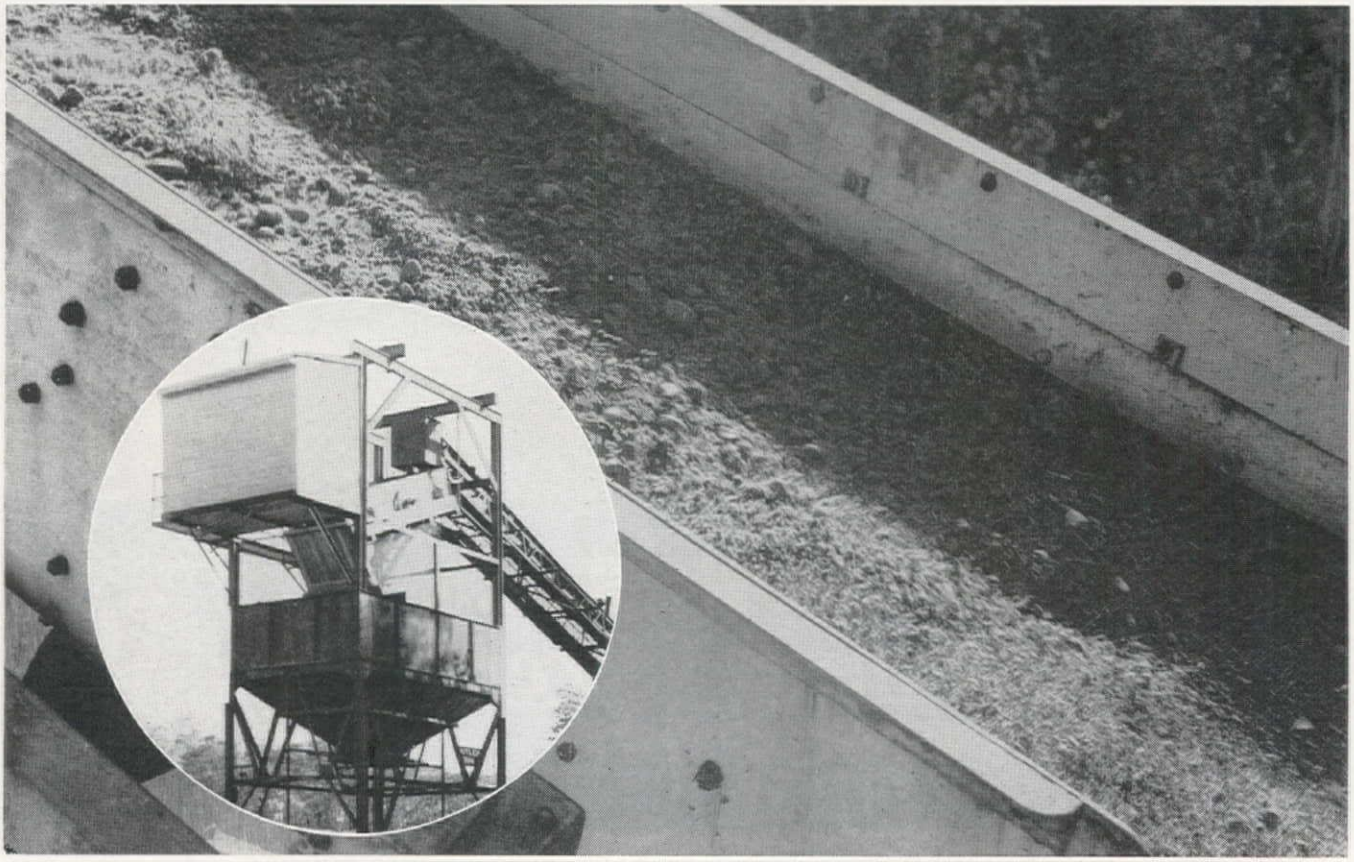

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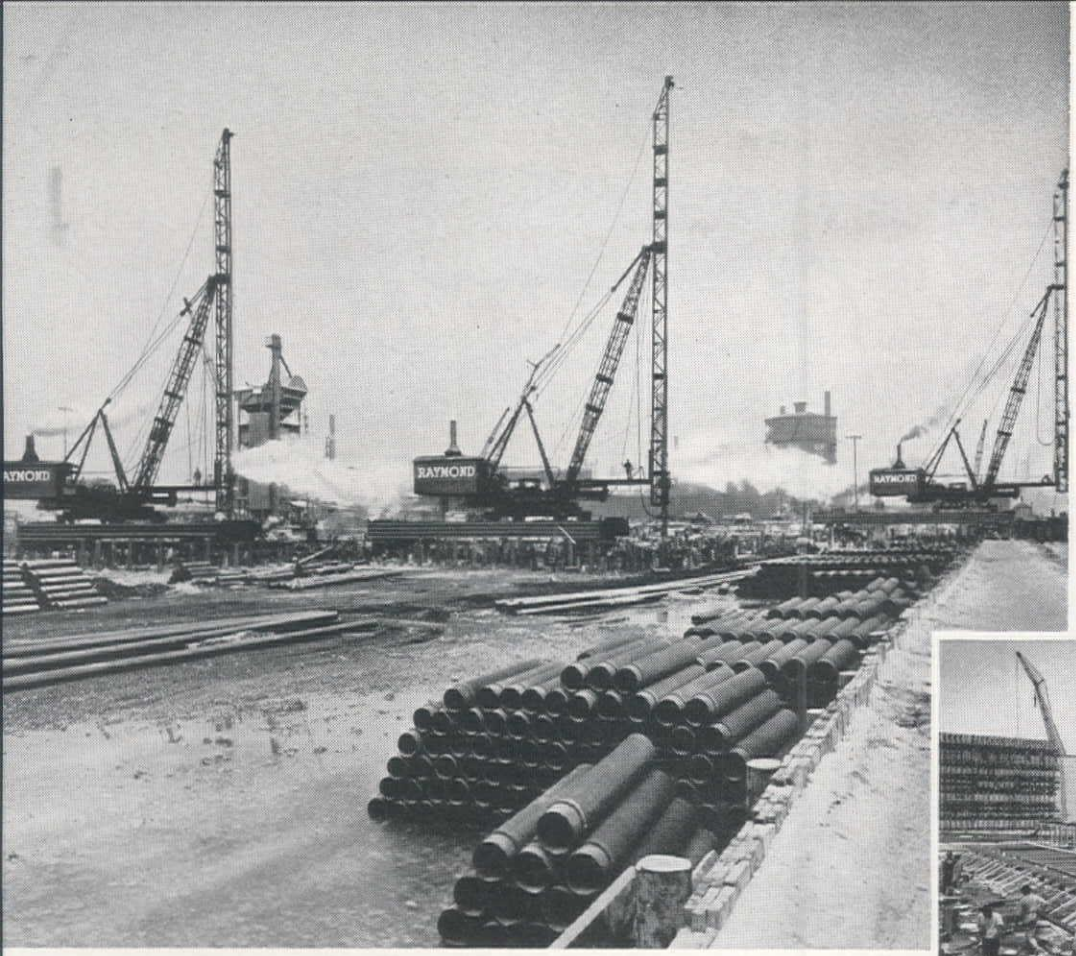
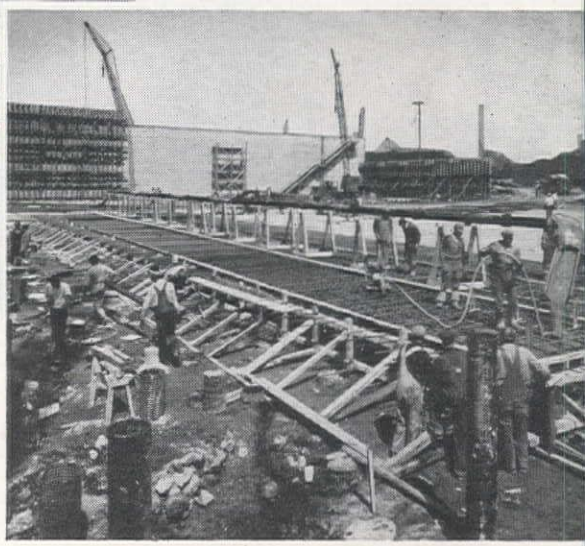


ORE DOCK

GREAT LAKES STEEL CORPORATION

ZUG ISLAND MICHIGAN



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FOR GREAT LAKES STEEL CORPORATION

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The construction of the Ore Dock was the 50th contract between Great Lakes Steel Corporation and Raymond Concrete Pile Company. The work involved the placing of approximately 36,000 cu. yds. of concrete on 7100 long pipe step-taper piles.

WE ARE EXTREMELY PROUD OF THIS RECORD OF SERVICE TO THE GREAT LAKES STEEL CORPORATION

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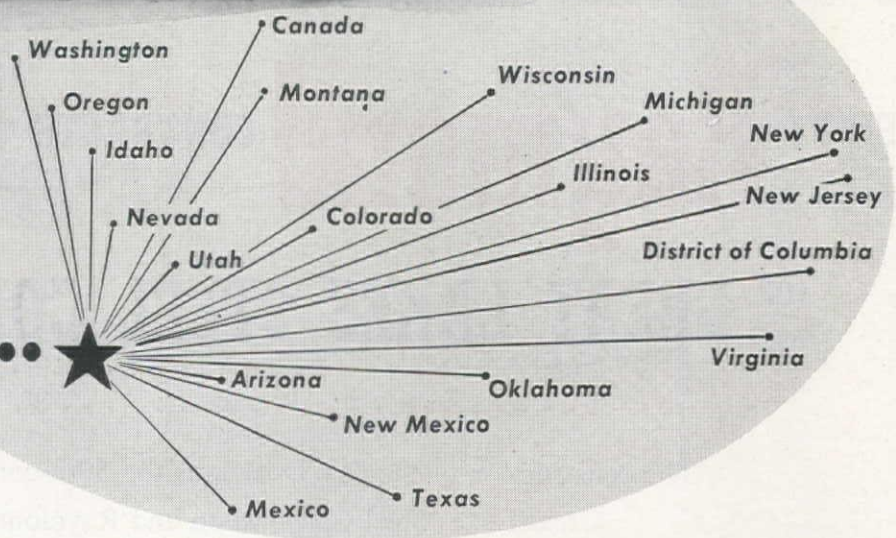

An asphalt plant so good it's making money for contractors throughout the continent—that's the new STANDARD SM! Actual field experience—North, South, East, and West—has proved the SM to be *outstanding* for economy and dependability. It's the contractors' "work-without-worry" sweetheart.

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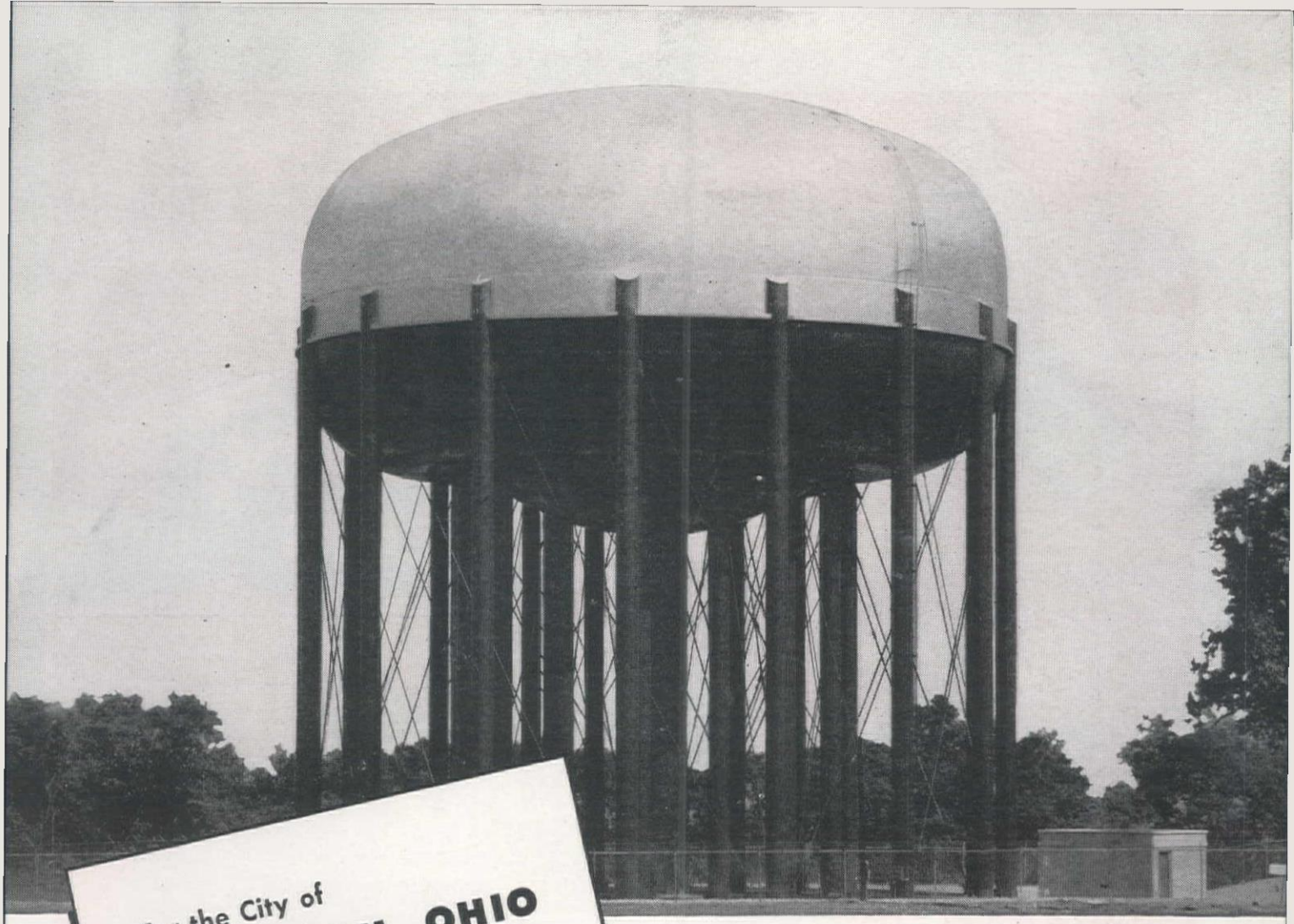

For the City of
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The *Toro-segmental Bottom* Tank by PITTSBURGH • DES MOINES

This Pittsburgh-Des Moines elevated steel tank, recently erected for the City of Dayton, is of new *Toro-segmental Bottom* design, with a water storage capacity of 2,000,000 gallons. The design carries the load by suspension of the tank bottom, rather than by beams—using less steel, and achieving lower cost. • The pleasing appearance of the tank is matched by its efficient performance: head range is but 34½ ft. The tank diameter is 102 ft.; high water line is 95 ft. above foundation tops. • Write for a consultation on your water storage requirements.

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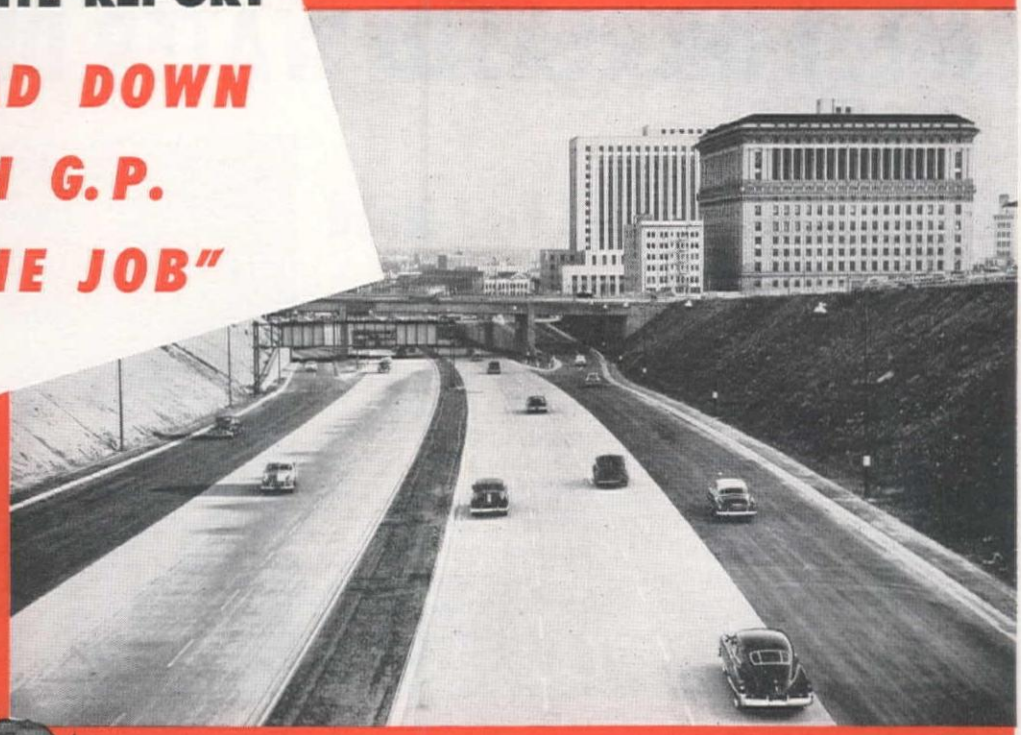
WEBB & WHITE REPORT

"OVERHEAD DOWN WITH G.P. ON THE JOB"



The newest link in the Hollywood-Santa Ana Freeway as seen from the Grand Avenue Bridge facing the Los Angeles Civic Center

BEFORE

AFTER

Webb & White, pioneer Southern California contractors, recently completed construction of the Grand Ave. to Los Angeles St. section of the multi-million dollar Hollywood-Santa-Ana Freeway.

Operating on rigid work schedules which frequently called for double shifts, they found that with General Petroleum's Lubrication Engineers on the job, none of their equipment was kept waiting for lack of lubricants or fuel.

According to partner Jim White, "G.P.'s service has helped keep our schedules moving...by having our petroleum products on the job when we needed them, we were able to keep our overhead to a minimum and finish the job ahead of schedule."

You can put General Petroleum's know-how on your job, too. The G. P. Representative in your area can show you how you can lengthen machinery life, reduce lubricant inventories and simplify maintenance methods. Call him in today!

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11-6

HOW HORTON ELEVATED TANKS HELP MEET INCREASED WATER DEMANDS

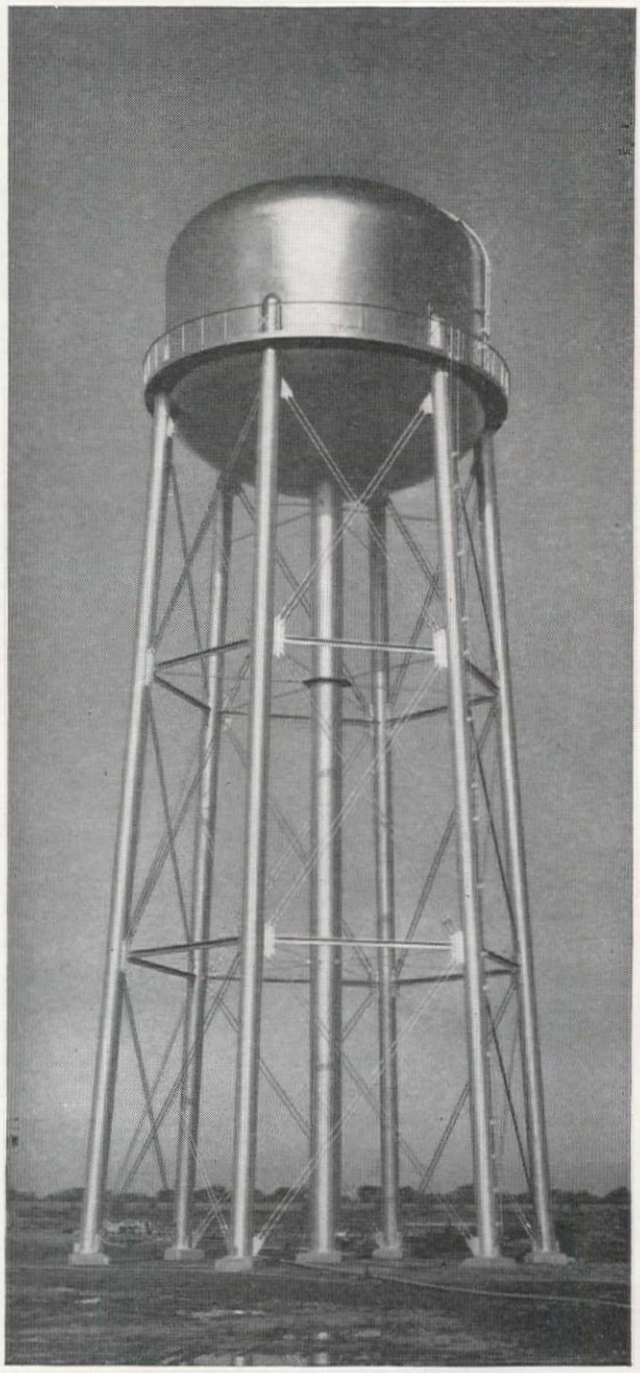
Growing Communities Find Need For Added Water Service

Many western towns are rapidly expanding in population and industry. Oftentimes existing water systems have become overtaxed and inadequate to meet new, increased water requirements.

Designed with safety and economy in mind, Horton elevated tanks can efficiently fulfill these multiplied water demands. As modern, good looking structures, Horton tanks provide dependable gravity pressure and offer constant water service to keep distribution pressures uniform at all times—even during peak load periods. They also provide a dependable water reserve that helps maintain adequate distribution pressures in case of emergencies. Should a fire break out and the main distribution service become overtaxed, Horton elevated water tanks are positive assurance of that extra needed pressure to combat fires effectively.

There is economy, too, with Horton elevated storage. Water needed to fill the tank can be pumped at off-peak periods when power rates are low. The water reserve in elevated tanks frequently improves insurance classifications which results in lower insurance premiums. These and many other savings help to make Horton elevated water tanks pay for themselves many times over.

Countless numbers of municipalities, large and small, are enjoying the extra benefits offered by Horton elevated tanks . . . Chico, California; Oxnard, California; Eureka, California; Stockton, California; Nyssa, Oregon, and many more towns like these. See how your city can benefit with elevated storage. Write our nearest office for full information on Horton elevated water tanks.



A typical 250,000-gal. Horton ellipsoidal bottom elevated tank in western United States. Horton elevated storage tanks of this type are built in standard sizes from 15,000 to 500,000 gals. and other designs in sizes up to 3,000,000 gals.

HORTON

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Cleveland 15.....Guildhall Building	Seattle 1.....1355 Henry Building
Detroit 26.....Lafayette Building	Tulsa 3.....Hunt Building
Houston 2.....C & I Life Building	Washington 6, D. C.....1103 Cafritz Building

WESTERN CONSTRUCTION

February 1952 Vol. 27, No. 2

Engineers—Planners and doers

Engineers divide into two general classes—those who like to plan, and those who like to get things done in the field. Although this statement is obviously over-simplified, these two basic qualities can be observed with differing ratios in every technical man. The planner is loathe to reach final conclusions, while the doer is inclined to snap-judgment in the interest of expediting the work to be done. In a frontier civilization the doer takes precedence because of the pressing need for his accomplishments, but in a stabilized economy the planner gradually takes over.

The first group—the planners—are not happy unless striving for the complete answer to the assigned problem. Starting with a set of physical conditions they will develop solutions using all possible combinations. Then, they will select other criteria and repeat the study to check the new answer against the first. This step will bring to mind other variations of the original premise and a really earnest planner is pleased to carry forward this process and refine his previous refinement until his boss, or some higher authority demands a decision.

On the other hand, the doers are driven by a corresponding urge to get the job under way, and are only happy when the dirt starts to fly, even though they know it may be necessary to improvise or even revise as work progresses. They have the firm conviction that a project completed, even though only 95% perfect, is more useful than one still in the study stage. If charged with an occasional failure, this group should also be credited with tremendous accomplishments.

The West owes much of its progress to the engineers who can be classed as doers. Early railroad builders were more concerned with starting any feasible bridge or tunnel than spending weeks hunting for a slight improvement in location. In the field of water development, also, where would the largest metropolitan area of the West be today if planners were still calculating whether Hoover Dam was the best site for the initial storage on the river or whether the Owens Valley Aqueduct could be built? Where would the progress of the Northwest be if studies were still under way on the proper location of Grand Coulee Dam? Bonneville Dam had to be partly relocated after it was under construction because the doers were over-anxious, but it is done and producing precious power.

Today, the doers are giving way to the planners. Studies pile on studies while the perfect solution is sought as the basis for setting policies for governing all future accomplishments. The West is still in an expanding economy and the spirit of getting things done should not be lost.

West's economy is rubber mounted

With the further threat to availability of materials for highway construction, the Western state highway departments should unite in pointing out that this region is built on a rubber-tired economy. It is probably impossible to expect special relief for Western roads in the present period of national scarcity. But it might be possible to prepare figures indicating the mounting traffic pressures to accelerate favorable consideration of Western needs.

Using California as an example of a Western state where roads are essential arteries for the movement of people and freight, figures are available to show that the load is approaching the break-down of existing facilities. Basic fact of the utter dependence on highway transportation is the automobile registration figure, which is about one for every two people, as compared to the national average of one in four. If highway traffic in Eastern states were suddenly to double, the volume and load impact would provide a rough measure of the Western problem.

Further, figures can demonstrate ever increasing pressure. The state's annual survey of traffic showed that in a one-year period the average increase in highway traffic was 6.3%. On some key routes for long freight hauls the figures are more startling; on U. S. 40 the main line from Reno to San Francisco Bay traffic increased 23.6% in one year, and the interstate route from southern California to Arizona showed an increase of 21.4%. Finally, this mounting load is being imposed on a system of highways which has deficiencies on 81% of its mileage.

The picture of essential need for this form of transportation brings the Western highway picture into sharp focus. Restrictions being placed on the nation's highway program should be modified as applied to the West, because facts can demonstrate conclusively that these highways are the accepted arteries of defense circulation for both the people in the industries and the goods they produce.

No foundation!

Foundation problems reach the ultimate when there is no first story for a two-story building. In the fullness of its bureaucratic wisdom the federal agency which now regulates the use of materials for construction authorized the building of a second floor for a municipal building, but denied the permit for the lower one. The small Western city had planned a civil defense headquarters, and the request for this construction was approved. City officials had also asked permission to build a firehouse, and this was refused. In this case half-approval was the same as no approval at all, since the defense headquarters was to be located in the second story over the firehouse. Thus does the strict interpretation of regulations bring confusion to construction.

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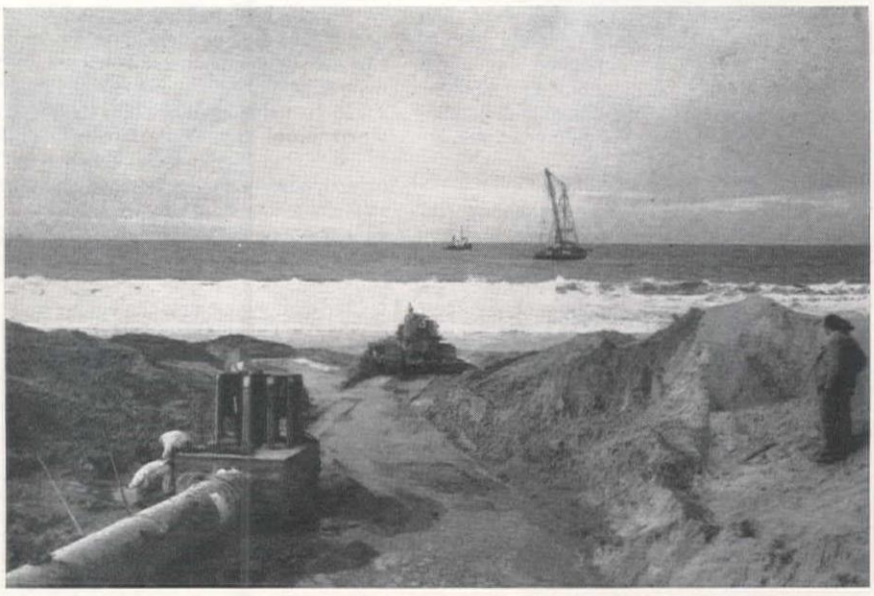


JUST PRIOR TO THE PULL, cables from barge anchored offshore were attached to the discharge structure (lower left), and tractors began to extend the trench to breaker line in the surf.

Pulling a 1,040-ft. outfall into the ocean in two hours

Barge offshore, assisted by tractors onshore and sea swells, pulls 93 tons of pipe and discharge structure into position—Pipe assembled on skids in trench—Tractors take a bath

UTILIZING the rise and fall of the ocean, the Smith Rice Company recently made just a good evening's work out of pulling to sea the 1,040-ft., 93-ton outfall sewer pipe which will discharge the effluent from the new Monterey treatment plant into the Pacific, 800 ft. from the beach. Using a barge anchored about 2,000 ft. offshore that had a 305-ton line pull the work was directed by radio from the beach.

While preparations consumed several working days, the actual pull was accomplished well within two hours. The preparations can be divided roughly into two phases: (1) Assembling and laying the pipe in a trench leading from the sewage treatment plant to within 100 ft. of the water's edge, which was done by the prime contractor, and (2) rigging the tow lines and continuing the trench from the end of the pipe to the breaker line in the surf. The rigging was done by the Smith Rice Company and the prime contractor provided tractors for excavating the trench.

Outfall design

The welded steel pipe used for the Monterey outfall is concrete lined and Somastic coated. Of 24-in. diameter, the pipe is No. 3 gauge and weighs 180 lb. per lin. ft. The outlet structure, which was attached to the end of the pipe on the beach, consists of a pipe elbow encased in a concrete block 7 ft. long, 5 ft. wide, and 3 ft. high. This block was chamfered at the leading end to permit it to act as a sled and lead the pipe when it was being pulled out to sea. Reinforcing bars of 1¼-in. size bent into hooks and set in the concrete block provided means for attaching the towing lines. During the pulling operation the discharge opening was protected with a wood and wire guard.

Preparation

The Monterey sewage treatment plant is located north of the City of Monterey and is situated in a sand dune area about 1,100 ft. from the beach. A trench was excavated in a straight line from the plant to a point about 100 ft. from the water's edge. In the bottom of the trench 2 x 12-in. timbers, at 4-ft. centers were laid crosswise to act as pads. On the pads, extending the full length of the trench, 6 x 6-in. runners or stringers were laid. Skids, constructed from four 2 x 12-in. planks about 4 ft. in length, were laid across the runners at 16-ft. centers. The pipe was laid on these skids and short pieces of 2 x 6-in. material were nailed up under the pipe on the skids to keep it from rolling. The runners were greased with tallow. Each skid was attached to the pipe by short pieces of rope to make sure it would move with it during the pull. The piece of rope was tied around the pipe a short distance ahead of the skid and fastened to the skid's outer edges. To remove the skids during the pulling operation a depression was excavated at the end of the runners and three men were stationed there to cut the ropes and remove the skids as they reached this point (see illustration).

During these preparations clips were welded to the sides of the pipe for connecting concrete block anchors to be placed after the outfall had been pulled into the water.

Discharge structure attached

When the pipe had been laid, the discharge structure, which had been cast at the plant, was slid to the leading end of the pipe and attached. As prepared for the pull, this structure was about 100 ft. from the water's edge with the pipe strung out behind it towards the plant. The end of the trench at this point was about 15 ft. below the top of the sand dunes and some 40 ft. of sand extended out between it and the waterline.

Extending trench

While Smith Rice forces began rigging their tow lines, two track tractors went to work to cut a trench in the sand (see illustration) between the outfall structure and the water's edge. The trench was extended on rough grade to the breaker line in the surf. During this operation the tractors were required to enter the surf and incoming waves would wash over the tops of the tracks and drench the operators. This trench was opened to keep the pipe as low in the sand as possible, thus permitting it to become covered. When the tractors had cleared the majority of the trench, and the tow or pulling lines were attached to the outfall structure, a 2½-yd.

Sauerman bucket was pulled out into the breakers to provide finished grade. However, due to unexpected delays in anchoring the barge, the waves had time to wash sand back into the trench, making it necessary to reuse the tractors.

Rigging

While the tractors were removing the sand barrier and cutting the trench, lines were being rigged for the pull. Three lines leading from winches on the barge were used for the pull. The outer two lines were in a bight, that is passed through a sheave forming them into one continuous cable. The two lines rigged in this manner enabled the barge to make use of them in moving from side to side, if necessary, to change its alignment with the pipe. These outer lines were of 1¼-in. size and the center line was a 1⅝-in. cable. The sheave, through which the outer lines passed, and the center line, were attached to the end of a triangular-shaped "toe plate." From the base of the toe plate four lines of 1¼-in. cable, two from each corner, extended back to the outlet structure. At the outlet structure they were connected to the reinforcing bar hooks and to two auxiliary 1-in. cables that passed around the concrete block by U-bolts.

Pulling barge

Designed and constructed by Smith Rice Company, the barge used in the pulling operation is 50 ft. wide and 150 ft. long. The equipment used in the pull included three winches on the front for the three towing lines. The two outboard or side winches are 2-drum Skagits with a 110-ton line pull each. The center forward winch is an Allen Johnson with an 85-ton line pull. The dual-drum outboard winches also handle the lines for the breast anchors.

In spotting the barge for the pull it was towed toward shore in line with the pipe by the towship, a converted Navy YMS, and when it was just under a mile offshore the 6-ton stern anchor was dropped. This anchor was attached to 2,200 ft. of 1⅝-in. cable. As the barge continued towards the beach this line was paid out until the barge was about 1,000 ft. from shore. At this point two 3-ton breast anchors were dropped, one out from each side of the barge. With these anchors set the barge could control itself and move about by pulling on either of the three anchors. Just prior to the pull the barge pulled itself back to about 1,500 ft. from the shore and dropped four 5-ton anchors attached to 2½-in. anchor chain.

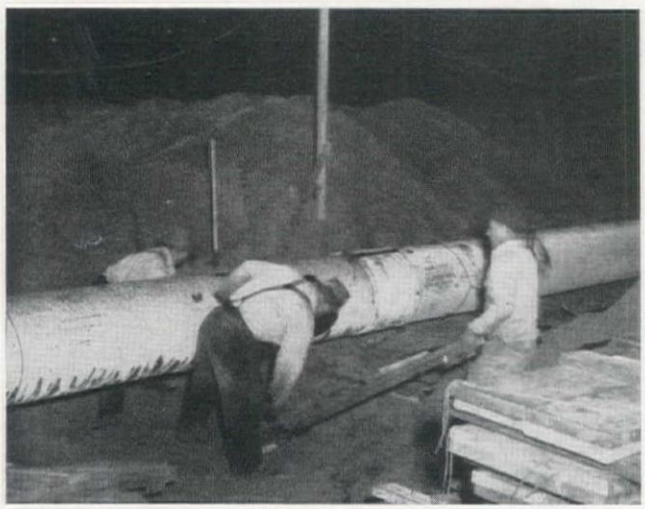
Pulling the pipe

To get the 1,040-ft. pipe started, two tractors aided the barge by pulling on the lines. As soon as the pipe started into the water, fast action was required to detach the tractors. Throughout the entire pulling operation contact was maintained between the barge and the beach by two-way radio. Supplementing this was a loud horn on the beach that could be used to signal the barge. The radio equipment was of the walkie-talkie type and the supervisor of the operations kept it with him at all times.

Actual pulling was done on the surge or rise of the sea. The winches revolved constantly, always reeling in line, but as the barge fell in the trough between swells they would be taking in slack. When the barge rose on a swell a pull would be exerted against both the pipe and the anchors to its stern. The pipe would move from 12 to 16 ft. with each surge and the anchors would hop or skip along the ocean bottom. As the most efficient pull is obtained when the angle between the ocean floor and the cable is small, operations had to halt for about an hour when the anchors were dragged in too close to the barge. It was necessary to move the barge out further and reset the 5-ton anchors. When the pull was complete the end of the pipe was about 150 ft. from the beach.

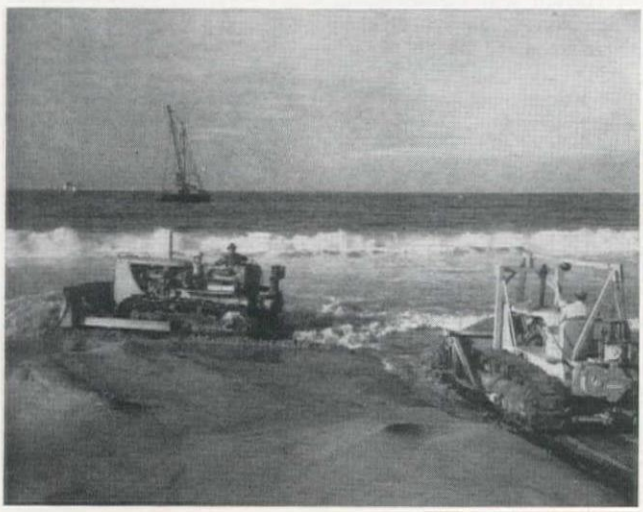
Anchoring the pipe

The following day, while the prime contractor began preparations for connecting the pipe with the plant outlet, a diver descended to remove the protective covering on the outfall's discharge end and fasten the concrete anchors that would hold it in place. Ten 5-ton concrete anchors were connected to the outfall structure. Two 2-ton blocks, one on each side, were attached to the clips welded on the pipe at 50-ft. centers.



SKIDS were removed during the pulling operation when they reached a depression previously excavated at the end of runners.

STANDING on the outfall structure (before it was pulled to sea), from left: Joe Grigsby, superintendent for Barrett & Hilp and DeLuca & Sons; Harry N. Jenks, consulting engineer; H. D. Severance, Monterey city engineer, and Walter Hahn, Jr., Monterey city manager.



TRACTORS bathed in the surf to extend the trench on rough grade to breaker line in the surf.

Personnel

George Mitchell was general superintendent for Smith Rice Company and in charge of the pipe pulling operation. Walter Hahn, Jr. is city manager for the City of Monterey. Design and planning of the sewer plant was carried out under the direction of J. D. Severence, Monterey City Engineer. Harry N. Jenks was consulting engineer. Joe Grigsby is general superintendent for Barrett & Hilp and DeLuca & Sons who are constructing the Monterey sewage disposal plant under a $823,382 contract. Art Dure is assistant superintendent.

For P. G. and E.'s Bear River Dam, the contractor is—

Quarrying and placing 10-ton rocks

Coyote holes and secondary shooting used by Utah Construction Company to obtain 1,500,000 cu. yd. of broken granite for 230-ft. high rock-fill dam — Handling is hard on equipment

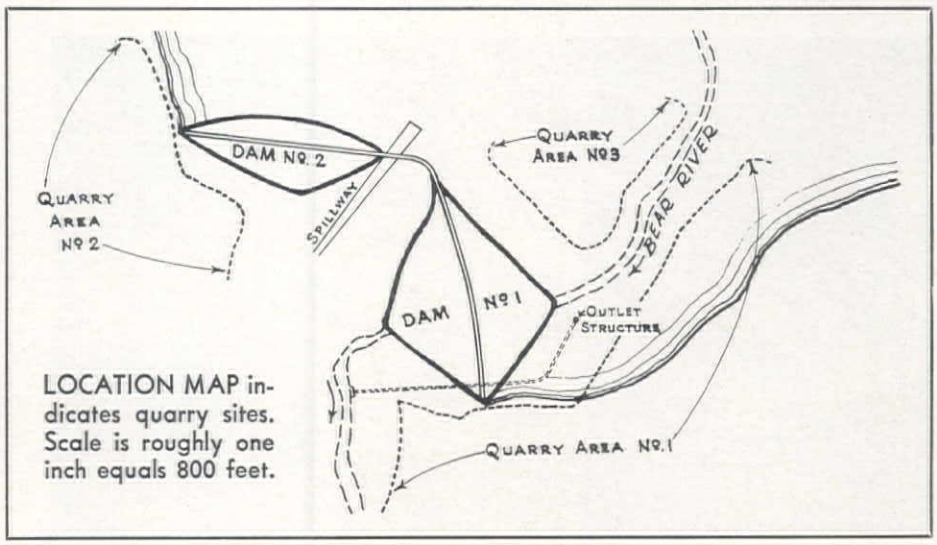
QUARRYING and dumping have been concluded for the first season on the Bear River rock-fill dam being built by Pacific Gas & Electric Co. on a branch of the Mokelumne River at a site 40 mi. east of Jackson in central California. The structure will ultimately contain about 1,500,000 cu. yd. of fill in the two dams required at the site. Work is being carried out by Utah Construction Co. Operations in the quarry and on the placed-rock section last year can be described at this time. Pouring of the concrete water-seal facing will be active during this season.

A unit in P. G. & E.'s power program on the Mokelumne River, of which the Bear River is a tributary, the project includes: (1) a main rock-fill dam 230 ft. high and a 140-ft. high wing dam that have a combined crest length of 2,080 ft.; (2) a combination surge tank and creek diversion; (3) a 13,281-ft. diversion tunnel and (4) a penstock for a 2,100-ft. head. When completed the Bear River project will provide an additional 40,000 hp. to existing power facilities. Design features of the dams and details of the Mokelumne River development were reviewed in *Western Construction*, March 1951, pages 63-66. Driving the 1,095-ft. length of unlined diversion tunnel was completed in November 1950. Present plans call for completion of the entire project by the end of the 1952 construction season.

Site description

The fifteenth rock-fill dam construction by P. G. & E., the Bear River project is being built at a site where two massive granite domes oppose each other at the downstream end of a mountain valley. The bottom of the valley is at elev. 5,500 ft. Clean bedrock appeared between the domes, which have provided adequate quarries. A low saddle beyond the right abutment of the main dam required construction of the smaller wing dam. The ridge between the two dams is being utilized for the spillway.

Basically the dams consist of (1) 1,340,000 cu. yd. of loose rock quarried and dumped as fill in 100-ft. lifts; (2) a 152,000-cu. yd. layer of placed rock on the upstream face 22 ft. thick at the base and 10 ft. thick at the dam crest, laid on the dumped rock to provide a suitable method of transmitting the load from the concrete face to the loose fill; (3) the reinforced concrete slab itself, with hori-



LOCATION MAP indicates quarry sites. Scale is roughly one inch equals 800 feet.

zontal and vertical watertight joints, over the placed-rock layer.

Operations began in April 1951 at the dam site. In the fall and winter of 1950, preliminary work in opening up the quarries, driving the diversion tunnel, and stripping the site, was accomplished.

Diversion through the tunnel was accomplished by the construction of a small earth and rock fill at the upstream toe of the main dam.

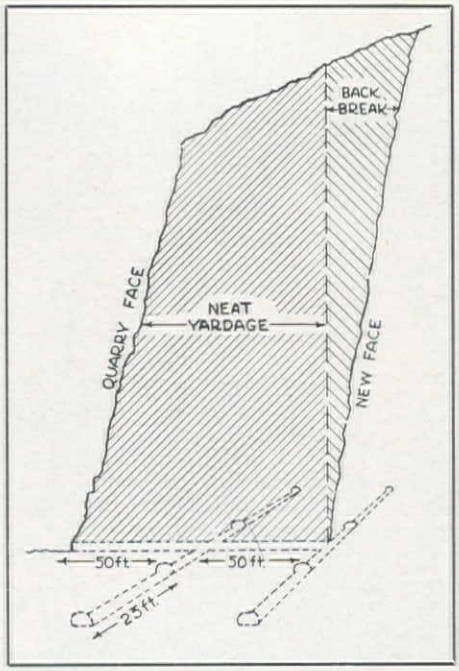
Stripping of the main dam site consisted of the removal of a comparatively small amount of overburden and disintegrated rock, which was done by dozers and sluicing. The site of Dam No. 2 required excavation of 135,000 cu. yd. of overburden and rock by shovel and scrapers. The steeper portions of the abutments on this dam were scaled by a long-boom dragline carrying a standard ripper with the wheels removed. After all stripping was completed, the foundation of both dams was thoroughly sluiced to sound rock.

Rock quarrying

Quarry sites for the rock included the three indicated on the accompanying sketch map. Quarry 3, located about 800 ft. upstream from the main dam, was planned to provide rock for the first 100-ft. lift on the main dam. Quarry 2 was strategically located to provide rock to bring the wing dam up to a height of 110 ft., at which elevation it could be used as a haul road (¼ mi.) to convey the rock from Quarry 2 for the second 100-ft. lift on the main dam. Quarry 1, located near the left abutment of the main dam, is being held in reserve.

Working two 8-hr. shifts, the loose rock fill was placed at an average of 5,500 to 6,000 cu. yd. per day. About 900,000 cu. yd. of the loose rock had been placed in the fill when operations closed down for the winter.

Rock quarrying and hauling could have been continued after the advent of heavy snows and cold weather. However, specifications call for the rock to be sluiced with water as it is dumped in the fill to keep fines from accumulating near the top. When temperatures dropped below the freezing point, the water, applied at a ratio of at least three times as much water as rock, turned to ice shortly after being applied. This caused the water to remain "static" instead of carrying fines down through the fill.



TYPICAL SECTION of quarry face shows general arrangement for a major blast. Maximum height of quarry face last season was 215 ft.

Drilling and shooting in the quarries represent major construction operation and to date approximately 650,000 lb. of powder has been used, indicating the magnitude of this work. The rock is a fine grained Sierra granite which, unlike a material such as limestone, does not break easily. A total of 860,000 lb. of powder has been used to date in the diversion tunnel, foundation excavation, cut-off trenches, spillway excavation, and quarry excavation.

Quarry 3 was the smaller of the two, and its topography and maximum face height of 70 ft. made the use of down-holes and horizontal holes along the floor the most economical plan for shooting. Occasionally breast holes were used as a supplement. About 185,000 cu. yd. of material were obtained from this quarry.

In Quarry 2, where operations were being carried on just prior to shutting down, the size and height of face to be developed (maximum of 215 ft. to date) resulted in the decision to use the coyote-hole method—small tunnels driven into the face at floor level, with enlarged pockets for the explosives. These pockets were usually spaced at 20-25 ft. intervals, and after loading the tunnel was stemmed, or packed.

In planning the system of coyote holes for each shot, cross sections were taken through each pocket and the yardage of rock to be handled by the explosive pocket was computed. Each pocket was given a calculated charge to break this amount of rock. Any existing rock cleavage and the bedding planes were taken into consideration in planning the loads. The load in some pockets has been as much as 14,000 lb.

The loading factor, commonly called powder factor, depended on the neat yardage plus overbreak to be obtained from the blast, and ranged from 0.44 to 0.80 lb. of explosive per yard of rock in place.

By the end of the season 24 coyote holes with a total length of about 3,000 ft. of tunnel had been driven, pocketed and loaded with 500,000 lb. of powder, to produce about 725,000 cu. yd. of rock (measured in place).

Coyote holes

Following the preparatory work of benching off Quarry 2, 15 coyote holes, spaced about 65 ft. apart and 3½ x 5 ft. in section, were driven 50 ft. into the face at the level of the floor. Crosscuts in these holes averaged about 40 ft. in length with a pocket at each end of the hole. About 77,800 lb. of powder was used in these holes and resulted in bringing down 174,000 cu. yd. of rock.

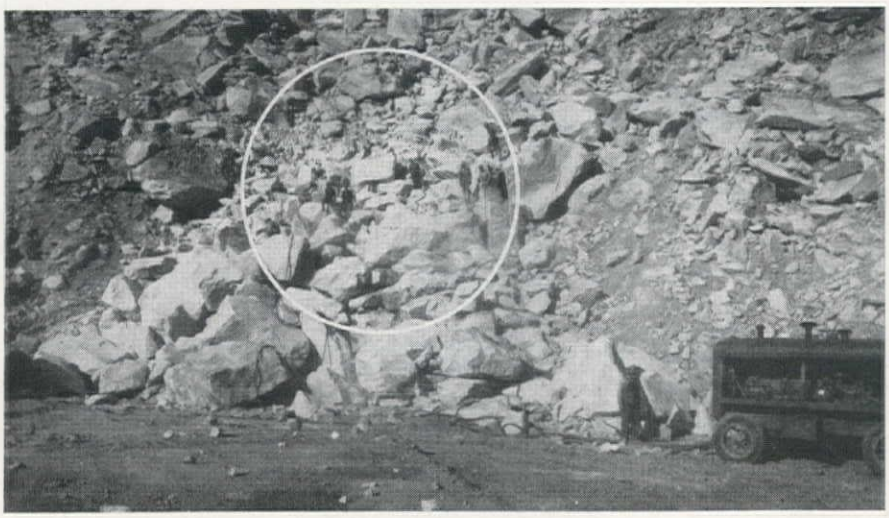
The next series of 4 coyote holes, shot about 2½ months later, had cross tunnels extending parallel to the face of the quarry to form a "T." These holes had a total length of 538 ft. in which 70,000 lb. of powder was loaded, and resulted in breaking out 148,000 cu. yd.

The next two holes were what are termed "straight gut" and consisted of two tunnels, each about 200 ft. long, driven directly parallel to the face of the quarry. Pockets in these holes, nine in one and eight in the other, were loaded with 106,840 lb. of powder and resulted in 155,000 cu. yd. of material moved. A further variation was provided in the next coyote holes driven to form a double "T" with two extensions at right angles. These two holes, totaling 488 ft. in length, were loaded with 156,450 lb. of powder and moved 200,000 cu. yd. of rock.

The last hole of the season, number 24, entered the left side of the quarry and then made a "dog leg" almost parallel to the face. Shot on November 6, it was 175 ft. in length, was loaded with 32,900 lb., moved 46,000 cu. yd.

In driving the coyote holes, one man worked in each hole doing his own drilling, shooting and mucking. Drilling was done either from a small jumbo or with

DWARFED by quarried material, secondary drilling and shooting crews work the quarry face. There are eight men in this picture, seven within the circle.



a "Swede" drill. A 16-hole total was generally used in driving the holes, and an average break of 4 ft. was obtained. An air-tugger hoist and slusher consisting of a scoop pulled by cable was used for mucking the holes. To provide an anchor to attach the sheave for the mucking cable, the top hole was drilled deeper and a wooden plug inserted before the charge was placed in this hole. When the round was fired this extra depth of hole and the plug provided a hole for the anchor pin. Generally one man could complete two 4-ft. rounds per shift.

Pockets were loaded with Atlas bag powder, and 100 lb. of 40% gelatin explosive was placed in each pocket as a primer. For firing, the pockets were connected in series, and parallel lead wires were brought out to the face. A 440-volt AC power source was used to detonate the blast. In some instances Atlas Rockmasters (fractional second delays) were used to control the force of a pocket. For instance, on the straight gut holes the outside pocket was equipped so that its blast would be delayed .004 sec., and thus act against any force from the inner pockets coming out the stem.

Stemming was done by backfilling the tunnel with alternate sections of sand and loose rock.

The coyote holes have yielded from 1.6 to 2.0 times as much back break as neat yardage (see sketch).

Secondary shooting

Due to the nature of the granite rock in Quarry 2, large pieces were frequent in the break obtained by the coyote hole shots. A considerable amount of secondary drilling and shooting was required to reduce them to sizes that could be handled by the shovels. In some instances these large pieces or "boulders" ran as large as 30 cu. yd. in size. The secondary drilling and shooting was carried out on a three-shift basis with crews averaging about eight men each. Jackhammers were used for the drilling. Air for this work was supplied by two 1,350-cfm. stationary compressors and three 500-cfm. portable compressors.

Generally the powder ration used in this phase of the work was one stick per cubic yard of rock. In some instances the capping method of placing the powder directly on top of the rock in a bed of sand was used. Shots were electrically detonated using power from an electric shovel. The large shots were usually fired between shifts at 3:30 p. m. and before the day shift started at 6:30 a. m.

However, when necessary this secondary shooting was carried out during the shifts. Some days a shovel could work at one location at the quarry face the entire day without moving, and on other days it had to move three or four times to permit such shooting. When preparations for a shot were completed, the powder foreman would notify the quarry boss who immediately started clearing personnel and equipment from the blast area.

The contractor developed an interesting procedure to save time in moving the electric shovel from the blast area to the edge of the quarry. When the shovel was working at the quarry face, the electric cable extended straight behind the machine for a distance of about 50 ft., then turned to run more or less parallel with the quarry face to the power source outside the quarry. Two sled-mounted towers supported a 100-ft. portion of the cable above the ground to permit trucks to reach both sides of the shovel. One of these towers was spotted almost directly behind the shovel and the other towards the power source. From the second tower to the edge of the quarry the cable was supported over several horses to keep it clear of the ground and in plain sight to lessen the possibilities of its being run over.

When necessary to move the shovel for a blast, a rope tied to the cable about 20 ft. from the machine was hooked over a bucket tooth and the bucket raised to hold the cable clear of the shovel tracks. Two hauling trucks were pressed into service, one for each tower. At a signal all three units moved toward the quarry edge in parade fashion and workmen flaked the slack cable being taken up on the lead tower sled. After the blast the procedure was reversed. Under normal conditions it was possible to clear the blast area, fire the shot, and have the equipment back at work well within 10 min.

TOO LARGE for a 5½-yd. shovel, some rocks are balanced on bucket mouth and "juggled" to waiting truck. Special cradles were improvised to protect truck beds.

As large size rock is desirable for this type of dam, the specifications call for 1- to 10-ton stone. Rubble, including the fines and small rock, is wasted. This waste in Quarry 2, which represents about 10% of the quarry material, is loaded and hauled 200 ft. to the quarry edge and dumped into the ravine below the wing dam.

Even after the secondary shooting, many rocks average 5 to 6 cu. yd. in size, too large to fit into a 6½-yd. shovel bucket. In loading rocks of this size, a lot of "juggling" is required on the part of the shovel operators to get them balanced across the mouth of the bucket so they can be lifted into the trucks.

The loose rock fill is placed by end-dumping from the abutment out toward stream channel to provide a maximum lift 100 ft. deep. As the truck loads of rock reach the fill, a spotter directs the dumping. A dozer works the top of the fill to keep the edges cleared and the top of the lift at the desired level. Rock receives no compaction other than that given by following loads and by sluicing. As soon as a load has been dumped, water from two monitors is played on the rock to sluice down the fines, keeping them from accumulating at the top and between the large rocks. These monitors, supplied by three 350-hp. pumps, each supplying 4,200 gpm. at 150-psi. pressure, are similar to the nozzles used in placer mining. The pumps are located about 1,500 ft. from the dam and lift the water 250 ft. to dam crest.

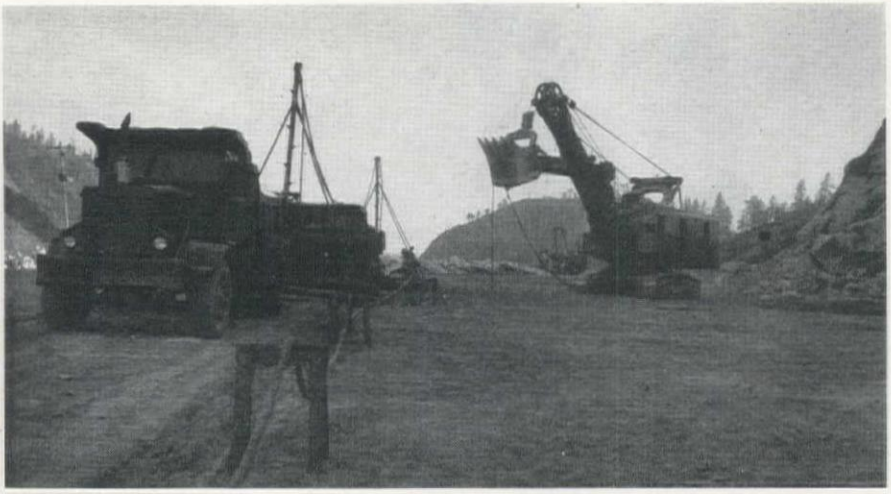
Equipment wear

The highly abrasive character of the fine-grain granite, combined with the pounding the equipment receives from the large rocks, requires considerable maintenance of truck beds. Even the sturdiest of trucks undergoes a severe "beating" by the hammering of 5- and 6-cu. yd. chunks of rock. Two specially designed rock cradle type beds were job constructed and have proved very serviceable.

Wear on shovel buckets has also been heavy, requiring the use of a very large amount of hard facing material and teeth. One shovel wore out two 6½-cu.

BEAR RIVER DAM FACTS

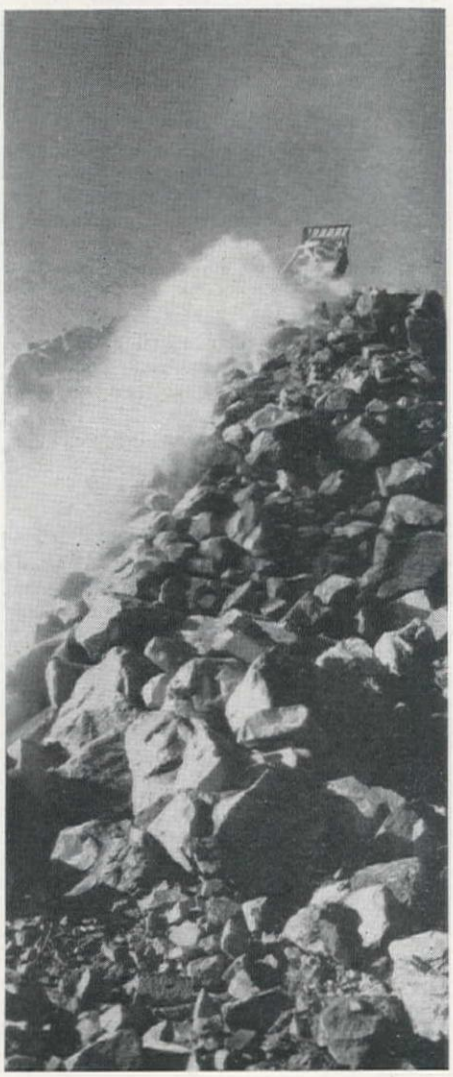
	MAIN	WING
Dam type	rockfill	rockfill
Crest length (ft.)	960	1,120
Crest width (ft.)	20	20
Base thickness (ft.)	650	360
Height (ft.)	245	140
Volume		
Loose rock (cu. yd.)	990,000	350,000
Placed rock (cu. yd.)	96,000	56,000
Reinforced concrete (cu. yd.)	25,000	14,000
Reservoir capacity (acre-feet)	48,500	
Crest elevation (ft.)	5,820	
Spillway elevation (ft.)	5,816	



PARADE OF EQUIPMENT leaves quarry prior to blast. Trucks are hauling tower sleds used to keep electric power cable in clear, while shovel "picks up its skirts" and follows.

yd. buckets during the season. To combat the constant wear on tracks, tractors are now being equipped with manganese steel pads. Difficulties in obtaining replacement parts for all types of equipment further aggravated the situation. Due to the maintenance of haul roads, however, truck tires stood up very well.

A LOAD OF ROCK is dumped from top of 100-ft. lift as hydraulic monitor plays on loose rockfill to sluice down fines.



The characteristic feature of this type of dam is the section of "placed rock" on the upstream face which forms a stabilized support between the rock fill and the concrete slab that provides the watertight membrane. The laying up of this section on the 1.3 to 1 slope, starting with a thickness of 22 ft. at the base, is one of the most time-consuming and skilled operations on this type of project. Long experience with this design on the part of P. G. & E. has resulted in specifications and controls to secure adequate results. Details of this design feature were covered in the previous article.

Basically the placed-rock layer is about the same as a dry masonry wall. Specifications require rock-to-rock contact (point-to-point bearing), with each rock contacting at least three adjoining rocks. Voids are filled by hand chinking with smaller rocks, but not more than 5% chinking of the area of the face is permitted.

These placing operations were under the direction of a superintendent with an assistant at each of the two dams. Each assistant had two or three crews, averaging about 6 to 8 men operating with its own crane. Large rocks used in this placed section were literally put into position by hand, and heavy work with sledge and crowbar was required as edges and protuberances were knocked off to bring the irregular sections into proper bearing.

Suitable rock from the quarry was dumped within easy reach of the cranes. Foremen kept watch for the best rocks available for placing and arranged other rocks to receive them. The placing work involved considerable movement of the crew on the slope to attach and remove slings. Also, skips had to be loaded with chinking material. When placing a large rock, it was sometimes necessary to shift it five or six times before it was finally set in place. When finally in place, the voids between it and previously placed rocks were hand filled with the smaller rock chinking.

Aggregate and concrete

To supply aggregate for the necessary concrete work, a plant was set up at a pit about a mile upstream from the dam. The pit runs heavy on sand, making it necessary to supplement pit-run material with rock from the quarries. Rock for this purpose was obtained at Quarry 3. Due to the availability of logs, a crib was built to support the screening machinery and the bins for the four sizes of aggregates.

Rock was crushed by primary and secondary units and carried by conveyor belts to the top of the crib-supported plant to a triple-deck screen. Sand was routed through a classifier, also located on the crib. Trucks were loaded at the side of the plant from chutes leading from each bin.

Batching was carried out by a Noble plant and mixing was done in a Ransome dual-drum paver set on blocks beneath the batching plant. Concrete is delivered to point of pour and placed with cranes.

Personnel

Construction of this project for Pacific Gas & Electric Co. is under the direction of H. W. Haberkorn, engineer of hydroelectric construction, and John W. Woodward. On the job for P. G. & E. is J. E. Cooney, superintendent of construction, and George B. Thacher, project engineer. Other members of the P. G. & E. construction department staff on the project are C. E. Joslin, dam inspector; H. K. Moulton, office engineer, and Stan Olds, chief of party.

Robert K. Ames is project manager for Utah Construction Co., with Ben Arp as assistant. Bert Sandberg is project engineer.

General superintendent is Emmet H. Steeples. Jim Wise is concrete superintendent; J. W. (Bill) Adams is electrical superintendent; Herb Alexander is master mechanic of construction equipment, and Mack Moorehead is master mechanic of hauling equipment.

EQUIPMENT AT BEAR RIVER

CRANES AND SHOVELS

- 1 6½-cu. yd. Marion electric shovel (151-M)
- 1 5½-cu. yd. Manitowoc diesel shovel (4500)
- 2 3½-cu. yd. P&H combinations (1055)
- 1 2½-cu. yd. Bucyrus-Erie combination (54-B)
- 4 2½-cu. yd. Northwest combinations (80-D)
- 1 1¼-cu. yd. Northwest crane (5)
- 2 ¾-cu. yd. Northwest cranes (25)
- 1 20-ton Lorain truck crane (41)

TRUCKS AND VEHICLES

- 4 20-cu. yd. Euclid end-dump trucks (34-ton)
- 11 13-cu. yd. Euclid end-dump trucks (22-ton)
- 6 9-cu. yd. Euclid end-dump trucks (15-ton)
- 12 Trucks, various models
- 14 Pickup trucks

OTHER AND INCIDENTAL EQUIPMENT

- 2 1,350-cfm. Sullivan compressors
- 3 Portable compressors
- 7 Tractors
- 1 Caterpillar grader (12)
- Various welding rigs, lubrication equipment, concrete equipment, etc.

The men who are wrestling rocks at Bear River

Utah Construction Company and Pacific Gas and Electric Co. personnel pictures on this page were snapped by Robin Dager, field editor of Western Construction, during a visit to the Bear River hydroelectric project described on preceding pages.

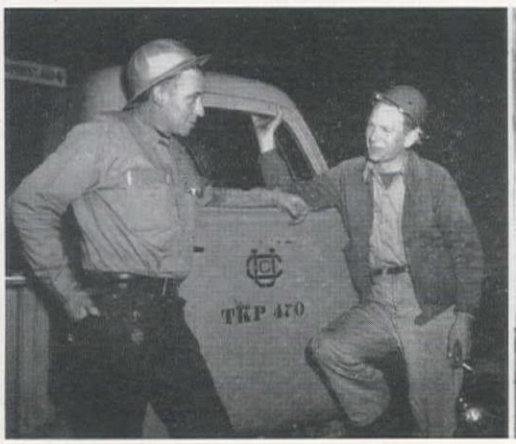
(Note: Identification in each case is left to right)

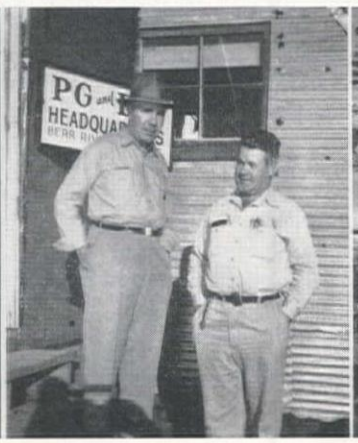
TOP: *E. H. Steeples*, general superintendent for Utah Construction Co., talks things over with *R. K. Ames*, project manager and *Bert Sandberg*, project engineer. BOTTOM: In the P. G. and E. office, *H. K. Moulton*, office engineer, looks at drawings with *G. B. Thacher*, project engineer and *C. E. Joslin*, dam inspector.

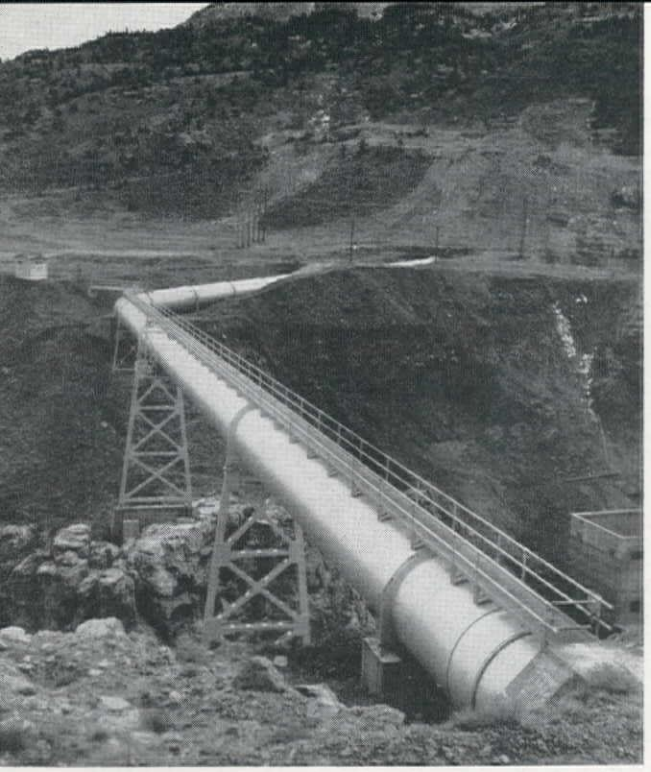
LEFT: *Mack Moorehead* is master mechanic for Utah on hauling equipment. *Herb Alexander* (not shown) is master mechanic for construction equipment.

RIGHT: Utah Construction Co. personnel: *J. W. "Bill" Adams*, electrical superintendent; *Jim Wise*, construction superintendent; *Ben Arp*, assistant project manager, and *Pete Hansen*, swing superintendent.

BELOW, LEFT: *George Kates*, night truck foreman, and *Ernie Goldshag*, day truck foreman for Utah Construction Co. talk for a minute as their shifts meet. BELOW, CENTER: In front of P. G. and E. headquarters, *J. E. Cooney*, superintendent of construction, chats with *Stan Olds*, chief-of-party. BELOW, RIGHT: *Harry Frederick*, night plant foreman for Utah Construction Co., and *E. Paul Jennings*, the firm's aggregate plant superintendent.







Experimental lining placed in old siphon

Tentative conclusions reached on the field testing of a cement-mortar lining placed to control corrosion—Climatic conditions severe during Wyoming experiment carried out by the Bureau of Reclamation

By

G. E. BURNETT

Engineer
Bureau of Reclamation
Denver, Colorado

HERE, BRIEFLY, is a summary of the significant construction details, service results, and tentative conclusions reached on the experimental cement-mortar lining placement in the Shoshone River Siphon on the Bureau of Reclamation's Shoshone Project in Wyoming. The siphon, constructed in 1939 about 4 mi. west of Cody, Wyoming, conveys irrigation water across the Shoshone River canyon to the inlet portal of the upstream tunnel of Heart Mountain Canal.

The segment of the siphon line in which cement mortar was applied is a welded plate-steel pipe 850 ft. long and 10 ft., 3 in. in diameter. By 1949, considerable rusting had developed through the coal-tar paint originally applied to the interior, and as an experiment it was decided to reline the pipe with cement mortar. Although this type of lining had established a record of good service in buried water pipe, it had not previously been used in exposed pipe that would be empty in cold winter weather. A contract for cleaning and lining was awarded to American Pipe & Construction Co. of Los Angeles, Calif. The work was started March 29, 1950, and was completed April 17 of the same year.

Lining construction

Hand methods were used for cleaning the pipe. Loose scale, rust, and paint were removed by scrapers and wire brushes. Tight rust and paint were allowed to remain. Immediately ahead of lining, a final clean-up was made with push brooms and damp mops.

Mortar was placed with an electrically operated centrifugal lining machine originally designed for 30-in. pipe but adapted for operation in the 123-in. diameter siphon. Centrifugal force for casting mortar against the surface was developed by a dispensing head rotating at 1,400 rpm. The machine traveled through the pipe at a rate of 1½ ft. per minute. The mortar was given a smooth dense finish directly after placing by steel trowels rotating on arms affixed as a component part of the lining machine. Thickness of lining was ¼ in. at the top, 3/16 in. on the sides, and 5/16 in. on the bottom.

Mortar was mixed in a paddle-type mixer installed in a mobile van located at one end of the siphon. It was transported to the lining machine by an electrically operated buggy and shoveled by hand into the hopper of the machine. Mortar was prepared in equal parts by volume of sand and a mixture of Type II portland cement and pozzolan. Ratio of pozzolan to portland cement varied from 1:5 to 1:9, by volume. Water was not measured but was added in sufficient amount to make the mortar plastic and workable. The slump was about 2 in. Estimated water-cement ratio was 0.32.

An 11-ft. test section of lining was placed on April 3. A spiral corrugation in this lining resulted because of inadequate adjustment of the single trowel in use at the time. Difficulty was also experienced in maintaining the allowable

The basis for progress . . .

SEARCH for new solutions to engineering problems provides the basis for construction progress. The more severe the conditions of any problem, the more the need for thorough study and possible experimenting with unusual adaptations. Methods successful in other fields may be tried under entirely different conditions. By such investigations and the objective analysis of results is engineering science advanced.

An example of such a search for the answer to a problem of extreme severity was the field experiment of the Bureau of Reclamation to stop corrosion in an old steel siphon, seasonally wet-and-dry, in rigorous Wyoming climate. Running full during the irrigation season, the pipe remains dry during the below-zero winter months.

As a possible solution, the Bureau engineers decided to borrow a time-tested process from the field of water supply—the use of cement-mortar lining applied to old steel pipe. This method, developed by the Centriline Corp., has been used extensively in the West to stop corrosion and improve hydraulic characteristics on existing water mains and supply lines, where conditions usually provide relatively constant temperatures and complete saturation.

After a full year of service the Bureau brings to engineers of the West this authoritative report on the experiment. Release of this type of engineering data adds to the fundamental knowledge and subsequent advances in the field of hydraulic development, which are so essential to the progress of the West.—Editor.

thickness range of 3/16 to 5/16 in. As heavy frost during the night caused the lining to freeze, this lining was removed the next day.

Full-scale lining operations commenced on April 11 following a forecast for 5 days of favorable weather. The spiral corrugation effect obtained in the test run was completely eliminated by the use of two opposed trowels. At times, chattering in the trowel arms produced a slight longitudinal ripple, but this was not considered to be a serious defect. The lining sloughed twice in the section passing under the highway because of excessive condensation in this area. The third attempt was made successfully by placing the lining at 3:30 a. m. This sloughing was the only real difficulty encountered in the operation, and the job was completed on April 14.

Some checking in the lining began to appear the day following first placement. The checks were in a diagonal pattern, spaced about 1 to 4 in. apart, and appeared on the side of the pipe which was exposed to the sun's rays during placement; that is, on the east side for lining placed in the morning and on the west for lining placed in the afternoon. Practically no checking occurred in the crown and invert areas. Maximum outside shade temperatures were 64 deg. F. on April 11, and 66 deg. F. on April 12. Subsequently, checking was virtually eliminated by confining lining operations to periods when the pipe would not be exposed to direct sunlight.

A map crazing pattern also developed in parts of the lining, due to drying shrinkage. After April 12, hand-operated spray guns were used to wet the lining, limiting cracking to a minimum.

Lining in service

By April 17, the lining was observed to be holding firmly against the steel and the siphon was filled with water. On April 22, the siphon was drained for final observation before placing it in service for the irrigation season. All cracks had closed with the wetting expansion of the mortar, and the lining appeared to be satisfactory.

The siphon was drained in October 1950, at the close of the first irrigation season, and inspection the day after showed the lining still in good condition. All cracks were firmly closed, except where one piece of mortar, 1½ sq. ft., had fallen in an upper quarter area. By November, even though the siphon had been bulkheaded to minimize air movement, drying had reopened the cracks to widths ranging generally from hairline to 1/16 in., and in some cases as much as ⅛ in. The lining had become drummy in much of its area, and some sagging had developed in isolated areas in the crown. Also, a few more small pieces of lining had spalled.

CLEANED steel surface shows the pitting which had developed during ten years of service as a result of corrosion.

Deterioration did not progress significantly during the ensuing winter, although sagging in the crown became somewhat more pronounced. Apparently, the extreme cold, minus 31 deg. F., experienced that winter contributed very little, if at all, to the distressed condition.

The second season

On April 24, 1951 the spalled areas were patched with cement mortar and on April 25 the siphon was refilled for the 1951 irrigation season. Filling was accomplished at a slow rate to avoid disruption of the lining.

As expected, the lining during service again expanded to close cracks and generally fit the pipe. When observed in October 1951, 24 hr. after draining, the condition once more appeared satisfactory. However, the following day the cracks had started to reopen and drumminess again was evident.

In all, three small pieces, less than 1 sq. ft. each, had spalled. Two of these fell after the siphon was drained, and rust found on the underlying metal must have formed while the mortar was still in place. Rust was also found under a loose area adjacent to a spall and under a small spot that had lifted from the invert. Intimate contact of mortar with steel is necessary to prevent rusting. Therefore, it appears that wetting following the first winter's drying did not completely restore contact between mortar and steel in all areas.

Conclusions

Several tentative conclusions may be reached in the light of experience gained with cement-mortar lining in the Shoshone River Siphon.

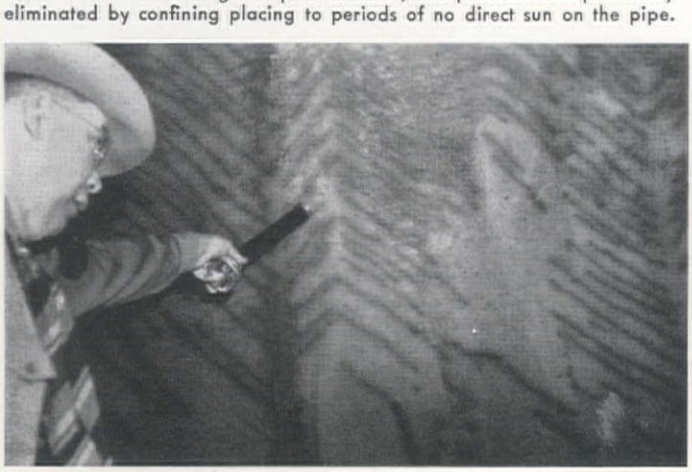
Where steel pipe, at least large-diameter pipe, will be empty for extended periods, the utility of cement-mortar lining is questionable because of the danger that drying may cause excessive loosening and spalling.

It is probable that the mortar used for such linings could be improved by employing air-entraining agent rather than pozzolan to obtain the desired workability. Also, preshrinking the mortar before placement might be beneficial. Such a mortar has been applied experimentally in the Bureau's engineering laboratories as a lining in pipe of 30-in. diameter. Subsequent drying has resulted in only a very few minute, hairline cracks.

Applying the mortar in exposed pipe at night, or sprinkling the exterior during the day even though outside temperatures are moderate, should help to reduce checking. Possible advantages of applying a membrane sealing compound following steel troweling should also be considered.

Specifications for this work were prepared in the office of the chief engineer of the Bureau of Reclamation, L. N. McClellan. The work was performed under the supervision of W. F. Kemp, district engineer; William Kilmore, chief, construction section, and M. S. Hoyt, civil engineer, all of the Bureau's Big Horn District, Cody, Wyo.

DIAGONAL CHECKING appeared in some areas exposed to sun's rays about 24 hr. after lining was placed. Later, this problem was practically eliminated by confining placing to periods of no direct sun on the pipe.



DRAINED at the close of the first irrigation season, this efflorescence appeared at the location of the diagonal checks. No rusting was evident. Intimate contact of mortar with steel is necessary to prevent rusting.

The refraction seismograph bids to replace core drilling for—

Near-surface exploration

By
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SETTLEMENT of one corner of a building was of particular concern to a metropolitan property owner because he was contemplating construction of a large warehouse elsewhere on the land and wished to avoid further foundation problems. Cores extracted from a pattern of test holes drilled in the vicinity failed to reveal poor bearing material; still, the one building had settled. By what economical means might he determine conclusively and thoroughly the nature of material underlying his property?

Such a situation as this hypothetical one represents a practical field for application of refraction seismic methods. The refraction seismic technique has been used successfully for many years by the petroleum industry as an aid to its explorations. However, development in the last few years of portable, lightweight equipment has made a variety of near-surface seismic applications practical and profitable to the construction and mining industries. A primary use is in measuring depths to bedrock where this information is needed for planning construction.

Fewer restrictions

In the example given, refraction seismic techniques could well have revealed, for instance, the existence of an ancient stream course meandering through the property and directly underlying the known area of subsidence. Core samples perhaps would not have shown significant differences between stable original and unstable fill materials. The refraction seismograph, providing means of measuring sound velocities in the two soils, could have differentiated between them, showing their boundaries and determining their depths.

Other applications are to be found in determinations of the nature of material to be excavated from deep highway cuts or dam abutment sites, location of the water table in unconsolidated alluvial material, or location of buried remains of old construction projects (structures or filled canals and other excavations). In addition, near-surface geological contacts and faults can often be accurately delineated. Although the practical depth for problems of these types is 200 ft. or less, the equipment can be used for certain problems of considerably greater depth.

The general practice to date has been to obtain the above information through core-hole exploration. However, whereas valid drilling information is restricted to the point location of the core, seismic data are produced as a continuous record along a profile line. Thus, where the refraction seismic method can be employed, it is usually possible to eliminate much of the core drilling and thereby effect a large saving in both time and expense. Nevertheless, a certain amount of core-hole work is generally necessary in order to check seismic interpretation as well as to obtain samples of sub-surface strata for engineering tests.

Effective techniques

The most effective use of this engineering technique is in the reconnaissance program. At this time maximum savings can be obtained, through efficient and economic planning for the needed core-hole work. This drilling is then performed to tie down weak points in the geophysical work and provide the samples mentioned. In general practice, a few exploratory holes are put down at the outset of all work so that subsequent seismic interpretation will be on a firm basis, or be tied to defined "end points." The amount of information desired and the degree of complexity of the problem will then determine just how the exploration program should be handled.

A typical instrument spread for a common near-surface problem is composed of twelve detectors, or geophones, spaced along the desired profile line at intervals of from 10 to 50 ft. A small charge (¼ to 2 lb.) of 40% dynamite is then tamped into a hole about 30 in. deep at each end of the instrument spread so that successive records can be obtained in both directions along the profile. When a charge is detonated, shock waves are generated in every direction. Of the many possible wave paths, only two are considered for near-surface measurement problems. These, and the physical conditions governing their reception by the geophones, are more fully described in connection with an accompanying schematic diagram on page 69. Roughly, one path may be thought of as lying just below the surface and in line with the instrument spread. The other is a downward one through the overburden until it encounters bedrock (high velocity material), where it is refracted obliquely along the surface of the bedrock, thence back through the overburden to the surface for reception.

Obtaining the record

In this type of refraction work only the first, the earliest, energy at each geophone is recorded. Hence, those geophones nearest the shot point will record energy traveling through the surface (low velocity) material. However, at some point along the spread, refracted energy will begin arriving ahead of surface impulses since it will have gained a time advantage through traveling a part of its path in higher velocity bedrock material. From this point to the end of the profile, refracted energy will continue to arrive first.

Energy received by the successive geophones along the spread is transmitted from them by wire to amplifiers as a series of electrical impulses. After amplification, the impulses are fed into a twelve-trace recording galvanometer; here the chain of energy events is retained on photographic film. This film is immediately developed so that the operator may ascertain that a satisfactory record, or seismogram, has been obtained.

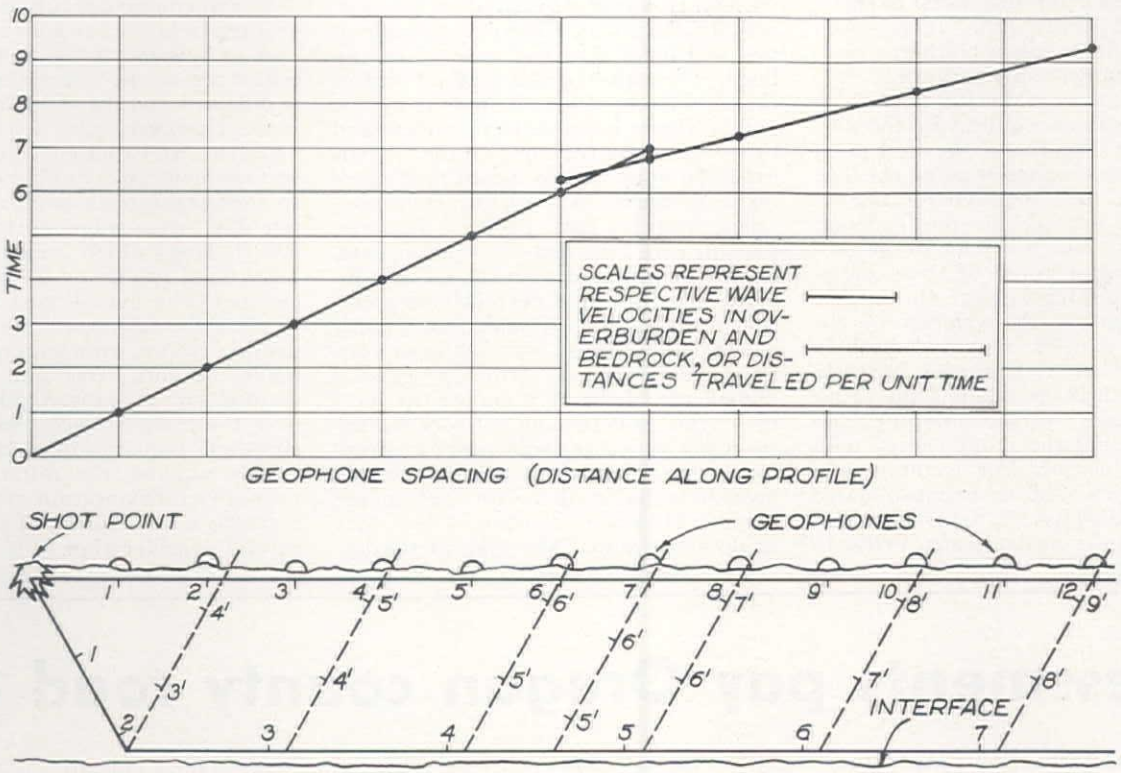
Portability important

After shooting from both ends of the spread, plus any offset shots that may be necessary, the cable and geophones may be moved to a new profile and the process repeated. The length of spread, amount of charge, depth of shot, and amount of offset, if any, are determined for each area or project depending on

Concluded on page 70

REFRACTION seismic equipment, compact and portable, is shown here, left to right: amplifier case (open), recording galvanometer (on tripod), geophones and connecting cables.

The theory of refraction seismography



REFRACTION seismic exploration is based on the detailed measurement of travel times of an artificially created shock wave through various near-surface strata. Earth shock waves generated by detonation of a small dynamite charge are picked up by sensitive detectors, or geophones, set out at measured distances from the origin point of the blast. By carefully measuring the time taken for shock energy to travel from the shot point to the various geophones, it is possible to compute the velocity of the energy through both the overburden and any higher velocity material. The velocities so obtained in turn permit detection of the locations of subsurface boundaries as well as of their respective material natures.

Of the infinite number of shock-wave paths existing in all directions from the source of detonation, only two are considered for problems of near-surface measurement. One is a surface path, directly along the line of geophones. It may be thought of as traveling in the overburden (low velocity material).

The other path is one of many directed generally downward until they are reflected and refracted at the bedrock, or velocity, interface. The particular wave path which "makes this method work" is the single one which hits the interface at such an angle as to be refracted along the interface, according to established optical theory. These two significant wave paths are shown schematically in the profile drawing. Arbitrary time increments are marked on each path. Note that the reflected wave from the interface does not arrive in the vicinity of the second geophone until well after the surface wave has passed. This geophone, recording only the first impulse it receives, is "triggered" by the surface wave.

In the usual case, where the interface material transmits sound faster than the overburden (in the drawing, twice as fast), the refracted wave, traveling much faster than the surface wave, might be said gradually to "get ahead of the surface wave." For instance, the drawing shows the surface wave after 11 time units to be almost directly above the point reached by the refracted wave in only 7 time units.

In traveling along the interface, this refracted wave creates progressive disturbances that move toward the surface again—much in the manner of generation of bow waves by a ship in its passage across the sea. Several of these are shown by dashed lines, arriving at geophones 4, 6, 7, 8, 10, and 12. Eventually, one of these "bow waves," despite its slow velocity upward through the overburden, reaches a geophone ahead of the direct surface wave. In the profile drawing, this occurs at geophone seven, which receives a refracted wave at Time 6.85. This "bow wave" left the interface at Time 4.64, just under geophone 6, while the surface wave was between geophones 4 and 5. Beyond geophone 7, all remaining geophones receive the refracted wave first.

From the diagram it may be seen that the time intervals between geophone receptions of the surface wave are equal. Therefore, a graphical plot of these points, distance of geophone from shot point against time of reception, would be a straight line. The same is true of points representing distance and reception time of geophones receiving the refracted wave first. The slopes of the lines bear definite mathematical relationships to the velocities in the materials transmitting the shock energy. Trigonometric computation involving these velocities gives the depth to bedrock.

The graph includes two points not ordinarily recorded; they are shown for purposes of illustration. The upper point at geophone 6, representing a later time, would not be recorded. Correspondingly, neither would the upper point at geophone 7. Thus is established the break in the curve.

The "continuous" nature of information gained by seismic methods is well illustrated in this, the simplest case, a horizontal interface, continuous under the entire length of profile, producing the two sloping lines developed above. A more complex situation, involving angular repose or irregularities of the interface, or introducing a third material with its own velocity, would produce correspondingly more complex graphic records, subject to more rigorous interpretation.

Near-surface exploration

. . . Continued from page 68

the nature of the problem involved. The equipment used for this work is small, rugged, and lightweight. It is easily portable so that projects hitherto inaccessible are now readily surveyed.

From the seismograms it is possible to measure the time required by the surface wave to travel from the shot point to the various geophones along the line, and also the time required for the refracted wave to travel down to bedrock, along the interface, and back to the geophones. Using a graph of these measured times plotted against the known surface distances, the velocity of the shock wave can be computed, both in the overburden and in the bedrock. From this can be determined the depth to their contact. Further, different types of rock transmit the shock energy with different velocities. For example, the velocity in dry sand or unconsolidated fill is about 2,000 fps.; in water-saturated sand, 5,000 fps.; in limestone, 14,000 to 16,000 fps.; and in unweathered granite, 19,000 fps. Thus, the character of subsurface material can often be evaluated.

The theory governing refraction seismic applications is perhaps of text-book variety. However, as is so often the case, actual field practice involves complexities and unknowns not covered in any book. The value of the method and of the equipment, then, is limited by the ability of the interpreter to understand the information recorded on the seismogram. In practice this means that every bit of information available from a detailed study of local geologic features, plus all core information or other data, must be correlated with the seismic information so that a correct interpretation may be made. Usually, an experienced geophysicist or geologist can reasonably predict, from a general knowledge of the area and of the local rock types, whether or not rock velocities exist which are so distinct and uniform that their characteristics would provide reliable data for subsurface studies. However, it often is necessary to do some actual shooting at the site to judge whether or not reliable results can be obtained. This should be handled in the form of an experimental survey.

Costs

It is of course difficult to state in general terms just what a given survey will cost or how much can be accomplished within a given period of time. Every job is different and involves different problems. However, past experience indicates that an experienced crew of three or four men can lay out and shoot three to four separate instrument spreads in one day. An average working spread is 300 ft. long, which means that 900 to 1,200 ft. of profile or traverse could be covered. The overall cost for this type of work should average well under $300 per day. Hence, from an economic standpoint, in both time and money, the method offers substantial advantages over the presently accepted practice of core-hole exploration alone. Where it can be applied, the refraction seismic near-suface exploration method is most certainly a tool worthy of the engineer's careful consideration.

Assessments pay Oregon county road costs

A study of costs shows that Oregon's system for financing county road improvements is sound — The work in Marion County is an example

COST FIGURES provide continuing justification for an assessment method of payment used by Oregon counties for certain county road improvements. In the past three years Marion County has surfaced over 22 streets with either an oil mat or asphaltic concrete 18 and 20 ft. wide.

The Oregon legislature in 1949 passed an enabling act whereby dedicated and public roads lying outside corporate limits might be paved and the costs covered by assessment of abutting property owners. As prerequisites to such work, at least 75% of the frontage property must be improved, and 70% of the owners involved must sign a petition for the work.

Typical procedure and specs

Following qualification of the petition, the county surveyor conducts a survey and prepares plans and estimates. If subsequent public hearings bring no objections, bids are called and a contract executed. The resulting work, in Marion County, has been performed mostly on roads and streets of 60-ft. width, of which the center 40 ft. are covered by the work—20 ft. of surfacing, 5-ft. shoulders and 5-ft. ditch slopes. As much as possible, improvement designs are standardized, beginning with a compacted base course 5 in. thick (minimum) of local river bar material, 3 in. to 0 in size. Keyed to this, depending on the pavement type to follow, is a 1-in. course of crushed rock, ¾-in. to 0.

The O-11 oil mat specified in Marion County is an adaptation from Oregon State Highway Department specifications, and is a bituminous bound wearing surface less than 1½ in. thick constructed by the penetration method. It is constructed in four lifts of aggregates and bituminous cements. Total coverage of the cements is 1.15 to 1.20 gal. per sq. yd., and of the aggregates about 0.053 cu. yd. per sq. yd. The specified thickness of a completed mat is 1½ in. Asphaltic concrete, when used, is typically 2½ in. thick and is placed on a 3½-in. compacted rock base course.

On account of the nature of this work and the circumstances calling for its execution, contracts are generally small and for short lengths of roadway. The partial tabulation of jobs shown here includes only two that are more than a half-mile long. It does indicate the recent design change that provides for 20 ft. of pavement width instead of 18 ft., as was the earlier practice. Unfortunately, 1951 work is not well represented, though the one contract tabulated does bear out the continuing rise in highway costs.

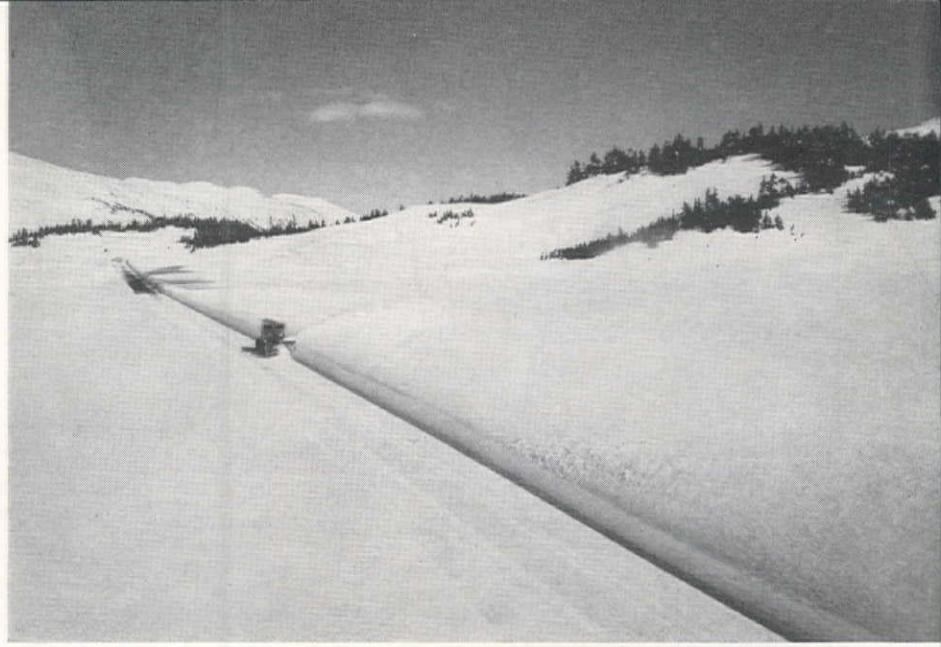
Cost trends

The average cost for oil mat surfacing in 1949 was $1.69 per owner-ft. In 1950 this figure rose 23% to a value of $2.08. During 1950 the asphaltic concrete surfacing was used in 20-ft. widths, averaging about $2.48 per owner-ft. Only one completed street in 1951 is available for comparison. A similar asphaltic concrete surfacing then cost $2.92 per owner-ft., indicating a rise of 17½%. From these cost trends, established over three years, A. D. Graham, Marion County surveyor, anticipates a further cost increase for 1952 of 10% to 20%.

Cost analysis of Marion County road improvement program

Year	Pavement width	Pavement type	Contract cost	Engineering cost (10%)	Total cost	Owner footage	Cost, per owner-foot
1949	18'	O-11	$2,414.41	$241.44	$2,655.85	1,508.86	$1.76
1949	18'	O-11	2,670.04	267.00	2,937.04	1,633.05	1.80
1949	18'	O-11	2,701.69	270.17	2,971.86	1,809.79	1.64
1949	18'	O-11	2,131.95	213.20	2,345.15	1,432.12	1.64
1949	18'	O-11	3,231.50	323.15	3,554.65	2,200.07	1.62
1949	18'	O-11	1,446.31	144.63	1,590.94	930.28	1.71
1950	20'	A. C.	5,209.35	520.94	5,730.29	2,466.44	2.32
1950	18'	O-11	3,744.07	374.41	4,118.48	1,974.25	2.08
1950	20'	O-11	4,129.76	412.98	4,542.74	1,967.73	2.31
1950	20'	A. C.	7,704.58	770.46	8,475.04	3,200.30	2.65
1950	20'	O-11	7,613.25	761.32	8,374.57	3,815.38	2.20
1951	20'	A. C.	7,117.25	711.72	7,828.97	2,677.07	2.92

To connect principal cities of Alaska and major military installations, a network of 1,000 mi. of paved roads is being provided. Conditions and climate make design a problem and construction sometimes a messy, discouraging job



The problems of Alaska road-builders

By H. A. STODDART
Division Engineer, Division 10,
Bureau of Public Roads
Juneau, Alaska

A SYSTEM of more than 1,000 mi. of paved highways that will connect the principal cities of the Territory of Alaska and which reflects the latest thinking in modern road building is now in the process of construction. The underlying reason for this sudden development and expansion of the highway system is the fact that the defense of Alaska has been determined to be strategically important to the United States. The major military installations in the Anchorage and Fairbanks areas must be expanded, supplied and maintained.

Planning, and design problems

In addition to railroad and air facilities these installations will be served by the new highway system as shown by the map on page 79. It can be seen that the highways connect two major ice free sea ports with the interior and with the Alaska Highway which extends through Canada to the United States. Also a third sea port is available in southeastern Alaska at Haines, which is joined by a cutoff to the Alaska Highway. In addition to the military importance of the new highways, they open up the rich Kenai Peninsula, the famed Matanuska Valley, the Tanana Valley and the Fairbanks area to civilian development.

Responsibility for constructing this highway system was assigned to the Alaska Road Commission by the Department of the Interior. The Bureau of Public Roads was requested to give assistance and made the surveys and prepared the plans for more than 600 mi., as well as supervising construction of roughly half the total mileage. The balance of the program has been under the supervision of the Alaska Road Commission.

Since national security is a 24-hr. a day, 12 months out of every year business, it was desirable that these roads should be so designed that: (1) they could be maintained free of snow and (2) be available for maximum utilization (without special wheel load restrictions) even during the period of the annual spring thaw. Although the volume of traffic which will use the highways is expected to be comparatively light, the proportion of heavily loaded trucks will be high. These and other factors have caused the design standards to include: (1) a two-laned paved highway with a 24-ft. finished top; (2) maximum grades usually held to 7%; (3) a grade line raised above the natural ground to prevent excessive icing on the roads, to facilitate snow removal and to protect the pavement against high water; and (4) sufficient granular subbase and base material to prevent damage to the road surface during the period of the spring thaw.

These design requirements are not particularly new or peculiar to Alaska, and construction and maintenance conditions in many respects are the same as found in any of the northern states. However, factors of geography, climate and transportation involved in the construction of roads in far northern areas create additional problems which are often quite difficult to solve. Some of these factors and the problems they create may be of interest to highway engineers and contractors.

Although the popular concept of Alaska as "Seward's Ice Box" may be exaggerated, it is none the less true that it can, and does, get cold during the winter. In the interior the total sum of the degrees of temperature below freezing is more than the sum of the degrees of temperature above freezing over a one-year period. For this reason, except for a few feet at the surafce which alternately freezes and thaws, the ground is permanently frozen in some areas to depths of several hundred feet.

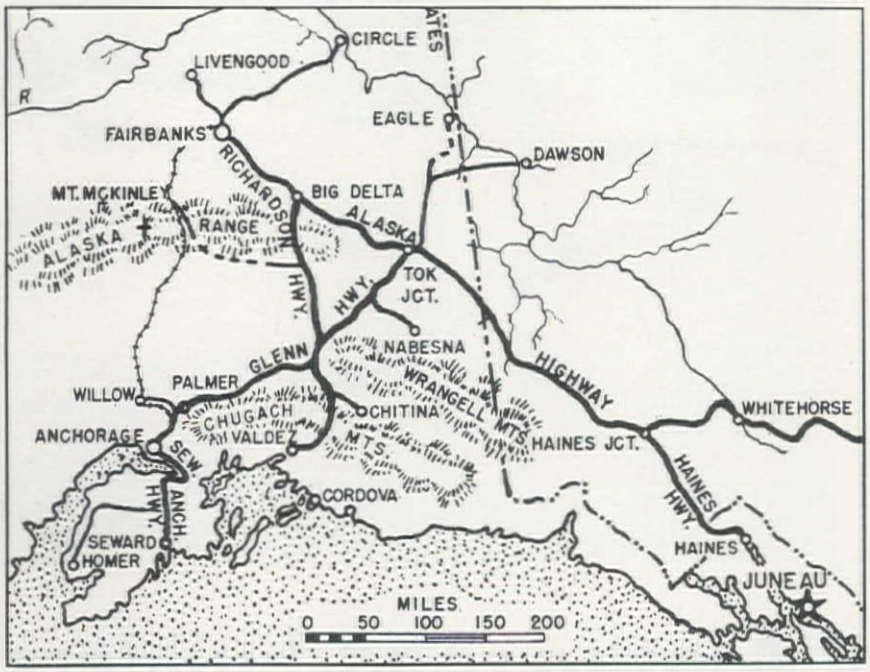
In the broad valleys between the principal mountain ranges the ground is covered with a forest growth of fir, tamarack, birch and poplar, the particular species of tree at any place being an indication of the type of soil and drainage characteristics that prevail in the area. An organic mantle composed of forest litter, mossy plants, small brush and other growth sometimes termed duff or tundra forms a spongy insulating layer on the ground surface. Often this layer is so effective that the level of the permanently frozen ground is within inches of the surface.

In such areas trees are usually stunted and are short lived. Also because they are not deeply rooted they can be overturned readily. When the insulating properties of the duff are destroyed, as when a highway right-of-way is cleared, the level of the permanently frozen ground is depressed. Since the soil beneath the duff may contain very high amounts of water when thawed rapidly the soil can become very soft. Construction equipment can and does quickly transform an area containing such material into deep quagmire.

Location considerations

In the improvement of the new highway system every effort is made to utilize the existing cleared right-of-way since the ground has thawed through the years; has drained and the old road is much more stable than the same soil would be in a recently frozen condition. Where a new location is required the design grade is so placed as to provide for the construction of a fill section wherever possible and is placed directly on the duff with a minimum of disturbance.

These fills are made of sand and/or



IN CASE you're not familiar with places and names in the Territory of Alaska, the map above is offered as a guide. Major highways and terminal cities mentioned in the article are shown.

gravel from glacial deposits which are plentiful in Alaska. Such fills require a leveling course after the soil beneath the fill has thawed to compensate for unequal settlement prior to the placement of the pavement. No side ditches are used unless they are required to improve drainage conditions.

Although the highway location is laid out to follow the gently sloping valleys wherever possible, it is inevitable that some cut and fill through areas of permafrost must be included. The excavation of these cuts is very difficult and no fixed procedure has been developed. Depending on circumstances many methods are used. If time permits the area is cleared, stripped and allowed to thaw and drain for a full summer season prior to further construction. Some soils are sandy to granular and contain low amounts of water. Cuts containing such material can sometimes be moved a few inches at a time as they thaw and the excavation used in fill construction. Other cuts that are mostly silts can be cut a few inches at a time and the soil if very wet wasted, or the cuts are blasted and the entire excavation wasted since the use of such material would cause fills to settle excessively and remain unstable for a long period. In some instances it is possible to use minor amounts of the frozen soil by mixing it with dry select borrow in the larger fill section.

Spanning swamps

Muskeg swamps are often encountered along the coastal areas of southeastern Alaska and on the Kenai peninsula. These organic beds may vary in depth from 2 to 20 ft., and may be from 100 to 3,000 ft. wide. If the depth of muskeg is less than about 3 ft., and the area to be crossed is less than perhaps 1,000 ft., is is usually excavated, the material wasted and replaced with granular select borrow. If the deposit is very deep and the area extensive the grade is held about 4 ft. above the level of the muskeg and borrow is placed directly on the muskeg.

Considerable consolidation of the underlying material occurs, so that often as much as 2 cu. yd. of borrow is required to make 1 cu. yd. of net fill. Continued settlement must be expected for some time and this requires that either the pavement must be delayed for a period of time or that an additional leveling pavement must be subsequently placed. Aside from the settlement, which is an unavoidable annoyance, 4 ft. of gravel fill over muskeg will spread the load sufficiently from a heavily loaded truck so that the completed fill structure and bituminous pavement remains entirely stable.

The adopted standard pavement design provides for a 1½- to 2-in. hot-mixed, hot-laid bituminous concrete. RC-3 cut-back asphalt is used as the binder in the mix and for the seal coat, while MC-1 or MC-2 is used to prime the base. The use of liquid asphalt as the binder in the mix was dictated by the fact that RC-3 was the heaviest grade that could be shipped in tankers or barges in bulk. Penetration grades of asphalt cement must be transported in steel drums or wood barrels, adding materially to the construction costs.

At the beginning of the highway program a study of the comparative costs was made between the use of packaged asphalt cement and the construction of storage facilities for handling liquid asphalts. It appeared that the use of liquid asphalt had merit and a tank farm consisting of fourteen 10,000-bbl. tanks was erected at Valdez, and one erected at Anchorage with five 10,000-bbl. tanks. These tanks are filled every spring and have sufficient capacity to supply all the projects requiring asphalt for the following construction season.

Adaptations of RC-3

Although the use of RC-3 cut-back asphalt in a paving mixture is not new, certain adaptations to meet Alaska conditions may be of some interest. The paving season cannot normally be expected to exceed about four months and during this period considerable cool, cloudy, rainy weather is normal. These conditions ruled out cold-mixed and blade-laid mixes since they could not be properly cured and, if caught in a rain, economically dried. Both stationary batch and continuous mix plants are permitted. The RC-3 is heated to 175-200 deg. F., and the aggregate to 250-275 deg. F., prior to introduction into the pug mill. Specifications provide that a hood must be constructed over the pug mill connected with a strong exhaust fan to collect and remove all naphtha vapors which are formed during the mixing process. As a result of this precaution no serious fires have occurred in the three construction seasons to date using this material.

The mix produced at these high temperatures approaches an asphaltic concrete with a sufficient amount of the volatiles removed to permit immediate placement by use of a laying machine and compaction by steel rollers. The mix is somewhat less stable than an asphaltic concrete for a few days, also the amount of bitumen must be at least 0.5% to 1%

EXISTING ROAD in typical permafrost country shows poor alignment. Improving location and making use of stability provided by thawing under old roads are location problems.

ARC's tank farm at Valdez houses fourteen 10,000-bbl. units, which is a year's supply of liquid asphalt. Use of RC-3 grade avoids shipping and handling asphalt cement in drums.

less than might be used if it were an asphalt cement. Alaska aggregates tend to be somewhat deficient in fine sand and natural filler, and no effort is made to add fine grained material. The result is a mix slightly coarse in texture and with a higher void content than usually constructed in the States. However, the completed pavement is of excellent quality, entirely stable and with proper maintenance will undoubtedly give satisfactory service for a long period of time.

Combatting spring break-up

The factors that produce failure in a pavement during the spring break-up—freezing weather, silty soil and a ready supply of water—are all abundantly present in Alaska so that frost action is particularly severe. It has been the practice to cover silty subgrades with from 24 to 30 in. of clean granular material of a type not affected by frost. In a series of traffic tests performed as a joint enterprise of the Alaska Road Commission and the Bureau of Public Roads in the spring of 1950, trucks with different axle loadings up to 20,000 lb. were driven backward and forward over 100-ft. long test sections at several locations. The purpose of these tests was to determine the thickness of sand and gravel that was needed to protect a silt subgrade during the spring thaw. From these tests it was concluded that about 20 in. of granular base material is sufficient to protect a poor soil during the critical period of the spring break-up when subjected to continuous traffic of trucks loaded to 20,000 lb. Since the thickness of the base is usually 24 in. or more over silty soils it is believed that the new highway system will be able to carry legal traffic on a year around basis without recourse to load restrictions. This belief is supported by the fact that much of the completed mileage has now experienced continuous traffic through two spring break-up periods without any visible distress.

One exception to the last statement in the preceding paragraph should be noted. On intermittent sections aggregating less than 3 mi. of a 65-mi. section of the Alaska Highway from Tok Junction toward Big Delta a 4-in. crushed base course was placed directly on the existing road and then given a bituminous surface treatment. The total thickness of a sand and gravel base and subbase on this section is varied, with as little as 4 in. in places at some locations, and it has been necessary to restrict traffic to passenger cars during the spring break-up period. Observation of the distressed areas has shown that failure usually develops in places where the gravel and sand is less than 12 in. thick. The section has for several years, previously to the surface treatment, been supporting traffic without any indication of trouble. The placement of a surface seal apparently was sufficient to permit the distress which subsequently developed by preventing rapid drying of the soil. It is planned to build this section to the same standard as the balance of the system before completion of the current construction program.

The paving program is being done on a contract basis. To attract competent construction companies and to obtain reasonable unit price bids it was found necessary to set up the work in contracts of sufficient size to warrant the expense of moving heavy equipment to the projects and to provide work for at least one full construction season. Contracts ranging in amount between $1,000,000 and $3,000,000 have been determined to be the most economical. Competition for the work is good with from five to six bidders for each project. It is customary for two or more contractors to combine as joint venturers in submitting bids.

Construction costs

Typical construction costs vary from 70% to 85% above those for similar work in the Western states. The typical major items on a project are select borrow, crushed base and plant-mix material. The cost for select borrow varies between $0.65 to $1.00 per cu. yd., and about $0.30 per cu. yd. mi. for haul (1,000 ft. free haul). The unit price for crushed gravel base has stabilized at about $2.00 per ton and the cost of mix varies between $6.00 to $7.00 per ton. The asphalt is furnished to the contractor by the Government without cost.

While these prices may seem high it should be remembered that common labor receives a minimum of $2.77 an hour, dozer operators $3.22, shovel operators $3.57 with time and a half above 40 hr., and double time for Sundays and holidays. Needless to say Sunday work is rare.

At the present time about 360 mi. are completed through the paving stage, about 335 mi. are under contract and will be completed by the fall of 1952. The remaining 325 mi. will be placed under contract as surveys and plans are made with completion of the entire program scheduled for 1954 or 1955. The cost of the entire program will be roughly 45 to 50 million dollars.

NEW COMPONENTS of the modern Alaska highway system, like the Glenn Highway 40 mi. from Anchorage, show the results of modern alignment and surfacing.

ONE HOUR— TWO BELLED CAISSONS

Special drilling-excavation method used to complete 300 belled caissons for building foundation at a rate of one every 30 minutes — Columns designed for loads to 220,000 lb. are of 2-ft. diameter extending 21 ft. down to 6-ft. bell section

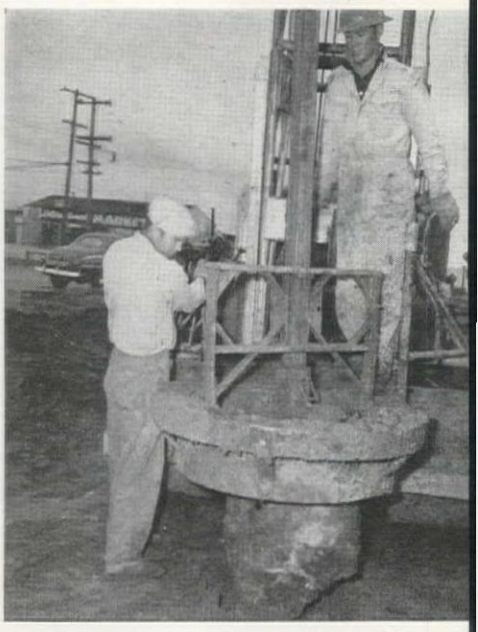
USING AN EFFICIENT drilling-excavation method, the P & Z Co., San Francisco foundations specialists, are installing 300 belled caissons to support column loads up to 220,000 lb. for the Bret Harte School in San Francisco. The work is being carried out as a subcontract for the Cahill Construction Co., general contractors for the construction of the school.

Selected for lower cost

The belled caissons, actually spread footings set underground, are vertical concrete columns with bases that have been widened or "belled." The size of the bells used is governed by the soil conditions and the column loads they must support. At the Bret Harte School site, which is partially made up of old bay fill at elev. plus 2 and about 300 ft. from the present shore line, the soil conditions would not support ordinary column footings under the required load without objectionable settlement. While providing the same support as a cluster of piles the belled caissons were selected as a result of a lower cost estimate.

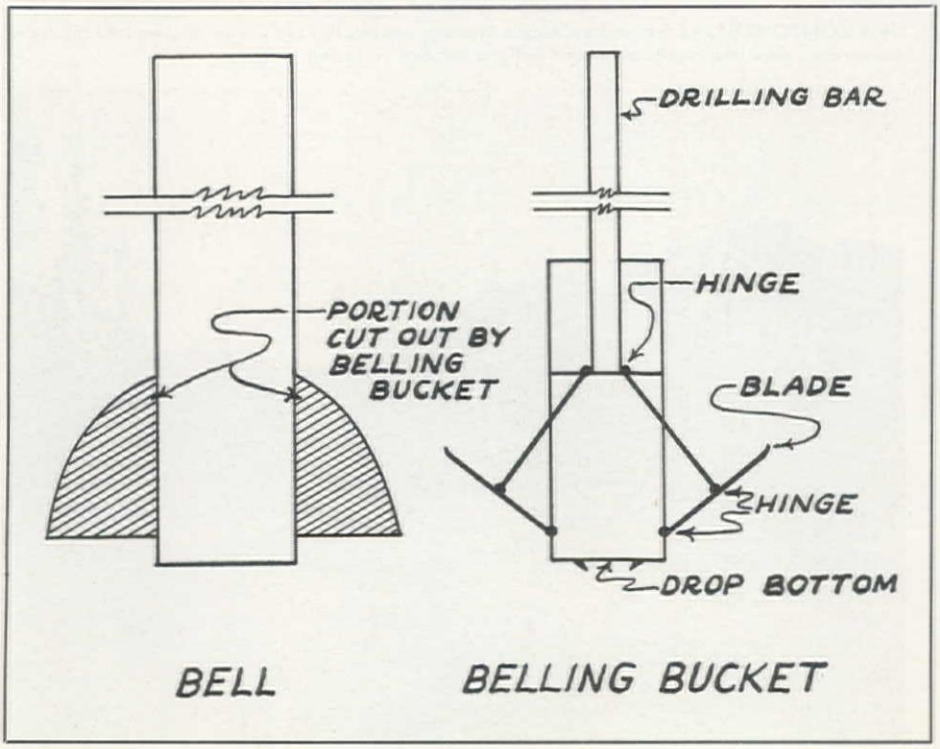
The underground units being used for the Bret Harte School range in length to a maximum of 21 ft., depending on subsurface conditions. They have a column diameter of 24 in., and a bell section at the base that varies in diameter from 3 to 6 ft. This belled-out section rises on a 2 to 1 slope (see illustration).

The flat surface at the base of the bell has been designed to transmit a load of 4 tons per sq. ft. Generally, the soil conditions and the column load are the governing factors of the belled caisson's dimensions. In designing the underground columns, skin friction—the friction between the sides of the column and bell section and the walls of the shaft—was not taken into consideration.



STARTING—
Starting the bucket into the ground, ring gear in drill table turns yoke which in turn caused kelley bar (and bucket) to revolve.

ON BELLING BUCKET, cutting blades progress from vertical toward horizontal position as excavation proceeds. Blade surfaces are angled to feed material into bucket slots.



Installation

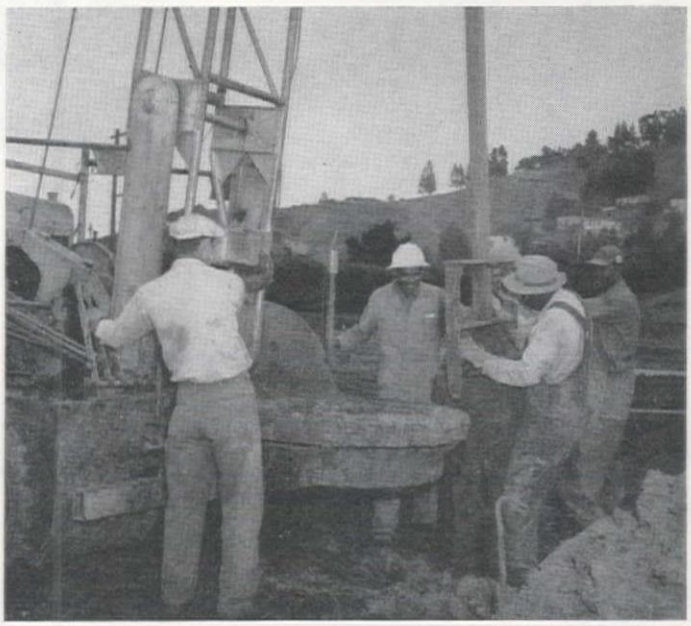
The method used for installing the belled caissons involves: (1) drilling the vertical shaft and widening or belling the base; (2) inserting the cage of steel reinforcing in the excavated shaft; and (3) filling the entire hole with concrete. The reinforcing extends from the base of the bell to about 3 ft. above the ground surface or a sufficient length to connect with the steel of above-ground structural members. The reinforcing extends into the center section of the bell only, not into the outer or flanged section. Due to the method used, no hand finishing or forming is required before the concrete is placed. The earth or shape of the excavated shaft acts as the form. No casing or lining is required for the shafts in the current installation. Use of casing at other sites would depend upon size of the shaft, site depth and soil conditions. All shafts are inspected before concrete is placed. If they are too deep to be inspected from the surface, and it is necessary for the inspector to descend, casing must be installed as a safety measure. Inspection at the current project is relatively easy as the inspector can see to the bottom of their 21-ft. depth by using a flashlight.

Drilling equipment

The equipment used for driving the shafts and widening the belled bases has evolved from a drilling rig used in parts of the West for cesspool excavation. Basically it consists of a truck-mounted drilling mast and power plant, a square "kelley" bar for turning and sinking the digging buckets, and two types of cylinder-shaped drilling buckets. One bucket is used for drilling the shaft and the other for widening the base and forming the bell section. (See diagram.)

In operation the rig is set up at the

EMPTYING—
To empty buckets, they are swung clear of drilling table and bottom is dropped. Note the cutting blade projecting from bucket slot.



CHANGING—
When shaft is completed, the belling bucket is quickly substituted for the shaft bucket. About eight bucket loads complete a shaft.

desired location and the kelley bar is spotted on the stake marking the point where the bell is to be placed. Once in place, the shaft bucket is attached to the end of the kelley bar and lowered through a ring gear in the drilling platform. A yoke is placed around the kelley bar and fitted into the ring gear to turn the drilling assembly. The shaft bucket is used to excavate the full length of the caisson hole. After the shaft has been dug it is replaced by the belling bucket.

Shaft and bell excavation

The buckets, which are the same diameter as the finish shaft, have drop bottoms for emptying excavated material. Each bucket is equipped with two sets of cutting teeth and slots in the bottom for digging and collecting the material. However, the teeth in the bucket used in the shaft are much larger as its prime function is to drive the hole, where the belling bucket has slots in its sides to collect the major portion of the material it excavates. During the shaft excavation, the bucket usually descends from 2 to 3 ft. before becoming full. On the present job about eight trips or loads are required to complete the shaft. When the bucket is full, it is lifted and the crew, using a hook attached to a short piece of rope, swing it clear of the rig to empty.

Belling bucket features

Simple in design, the belling bucket is the same diameter as the shaft and slightly over 3 ft. high. Two slots, one on each side, permit the cutting or digging blades to extend from a vertical position outward from the bucket in an ever-increasing angle until they are fully extended and on a horizontal plane. The blades are connected at a point 4 in. above the bottom of the bucket. During the belling operation the bottom of the shaft is 4 in. below the base of the bell and this permits proper cleaning of the hole. Consequently, when completed, the concrete shaft extends 4 in. below the flat base of the bell section. The surfaces of the blades are set on an angle to feed the excavated material into the slots in the sides of the bucket. Material falling into the bottom of the shaft is collected by the small teeth on the lower surface of the bucket.

Operation of belling bucket

The outward or inward movement of the blades in the belling bucket is controlled by the action, either pushing or pulling, of the kelley bar. This motion is made possible by the use of three hinges for each blade: the first at the square head at the top of the bucket; the second at the base of the blades where they are attached to the bucket; and third at a point about one-half the length of the blades. As the head at the top of the bucket is moved downward on its shaft by the weight of the kelley bar, it pushes a connecting piece that extends to the hinge at the center point of the blade, causing the blade to move in an outward and downward direction. When the bucket is full of material and ready to be withdrawn for emptying, the pull of the kelley bar reverses the procedure, bringing the blades into the slots of the bucket. (See illustration.)

After the shaft and bell are completed and inspected, the reinforcing cage is lowered and the concrete is placed. The 2¾ cu. yd. of transit-mix concrete required for the shaft and bell is vibrated as poured. Generally a transit-mix truck can supply enough concrete for two caissons. Concrete was designed for 3,000 psi. compressive strength at 28 days.

ON THE JOB, from left: Jack Fassio, City of San Francisco building inspector; Fred Pavlow, general manager and chief engineer, P & Z Co.; Bill Short, superintendent, Cahill Construction Co.

Water problems

On the Bret Harte School project, the low elevation caused the base of the belled caissons to be below sea level and presented a water problem. It was necessary to pour concrete immediately after each excavation was completed to prevent the open shaft from becoming filled with water. During the excavation, water was usually contacted at a depth of about 7 ft., but seepage was slow. A standby pump was maintained to keep the water level down in the event delivery of concrete was delayed.

The crew necessary for the work included a driller, machine operator, and labor foreman, with two laborers to empty the buckets, place the reinforcing steel and pour the concrete. Reinforcing cages were fabricated on the site by the steel supplier. Generally it required about 30 min. to complete one of the belled caissons.

Personnel

Fred Pavlow, general manager and chief engineer for P & Z Co., was in charge of the belled caisson installation. Bill Short is superintendent for Cahill Construction Co., Jack Fassio is San Francisco building inspector at the job. The structural design of the school was prepared by Hall and Pregnoff, structural engineers, San Francisco. Architects were Hobart & Kerr, San Francisco.

Holing through of 6-mi. bore for Los Angeles hydro project completes driving on last of three tunnels — Mucking operation (left) removed 357 cu. yd. per day, or a 78.77-ft. advance, for 31 consecutive working days. Best 24-hour advance was 104 ft. It all adds up to . . .

Tunneling at world record speed completed at Owens Gorge

By
W. C. MASON
Project Engineer
Department of
Water and Power
City of
Los Angeles

HOLED THROUGH from two headings last September, and now being lined, the 6-mi. tunnel on the Owens River Gorge Power Project holds many world's records for driving speed. This tunnel, the longest of three on the project, is an integral part of the 112,500-kw. hydroelectric power development being undertaken by the Department of Water and Power of the City of Los Angeles in the Owens River Gorge, which has a potential capability of delivering to the citizens and industries of Los Angeles 600,000,000 kw-hr per year. The power will be generated by three 37,500-kw. plants and will be transmitted to Los Angeles over a 258-mi. 230-kv. single-circuit transmission line. When the present construction program is completed it will bring the total power system of the Department up to a 1,030,000-kw. capacity.

The section of the Owens River being developed is located 300 mi. north of downtown Los Angeles. It extends from Birchim Canyon in Inyo County, 15 mi. northwest of Bishop, in a northwesterly direction to the southern end of Long Valley in Mono County. The area lies between the steep eastern slope of the Sierra Nevada Mountains on the west and the Casa Diablo Mountains on the east.

Geologically this region consists essentially of a volcanic tableland through which the Owens River has cut a narrow V-notch gorge varying in depth from 200 to 700 ft. This volcanic tableland was created by undulating lava flows of several hundred feet in thickness coming from the North over an ancient eroded land surface of granitic rock and glacial till which has been interlaced by basalt flows.

The principal rocks encountered in the tunnel driving were the lavas (rhyolite and basalt) and tuffs, granite and glacial till. Rhyolite accounted for 41% of the total, tuffs for 21%, glacial till for 20%, granite for 16% and basalt for 2%. The entire region is crossed by a definite fault system which has caused a large percentage of the rock structure, through which the tunnels were driven, to be seamed, fissured, and shattered. This condition required the placing of steel supports in about 75% of the footage driven. Generally the steel supports were 5-in. WF 18.5-lb. beam sections.

On April 21, 1949, the Department, by force account, at the South Portal of Tunnel No. 2, shot the first round of powder, in the driving the aggregate 10½ mi. of tunnel. All tunnels excepting for ½ mi. of No. 1, are concrete lined and have a finished diameter of 10.1 ft. Further, all tunnels are designed for internal pressure, circular in section, and have a slope between 0.0015 and 0.0023. Due to the type of rock encountered, the tunnels will be practically 100% fully reinforced.

Syndicate awarded contract

On May 19, 1949, the Department awarded a contract for the tunnels and surge chambers to a syndicate of contractors, known as the Owens Tunnel Contractors, consisting of the firms of Bressi and Bevanda, Guy F. Atkinson, Teichert and Son, and David Gordon of Denver. The syndicate's low bid was $8,947,520. Vincent Bressi is the managing partner and Roscoe P. Downs, project manager.

On June 13, 1949, the syndicate took over the driving of Tunnel No. 2. It is 11,092 ft. long, with a slope of 2.3 ft. per 1,000 and was driven entirely from the south portal. It was holed through Mar. 28, 1950 at the tailbay of Power Plant No. 1. The average footage per three-shift day was 42.26 ft., and the best records made were 1,720 ft. for a 31-day period and 85 ft. in a 24-hr. period.

Tunnel No. 3 is divided into two sections connected by a 10-ft. steel siphon that is 2,683 ft. long. The northerly section of Tunnel No. 3 is 11,805 ft. long with a slope of 1.5 ft. per 1,000. Driving

Continued on page 78

History and general features of the Owens Gorge Project

THE GORGE POWER PROJECT is a further step in utilizing the falling water of the Owens River Aqueduct. In 1905, with a population of 200,000 and a rapidly diminishing water supply, Los Angeles initiated a long-range program with $24,000,000 of bond financing (1905 and 1907) for lands and water rights in Owens Valley and the 240-mi. aqueduct. By gravity flow, this aqueduct was designed to bring 446 cfs. (288 mgd.) of water from Owens River on the eastern slope of the Sierra Nevada to Los Angeles.

Incidental to this aqueduct for water supply, was the development of hydroelectric power by the City of Los Angeles. By 1936, from the falling water of the aqueduct and tributary streams, 118,300 kw. was being developed. This was the total generating capacity of Department-owned plants.

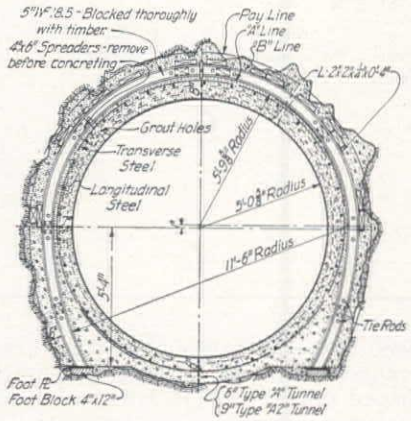
To guarantee continued capacity flow for the Owens River Aqueduct, a further source of water was sought in the Mono Lake area, 340 mi. north of Los Angeles, and actually farther north than San Francisco. In 1940, the Mono Craters Tunnel and Long Valley Dam (known as the Mono Basin Development) were completed and added 140 cfs. (90 mgd.) to the city's water supply. (This amount is included in the 490 cfs. momentary and 446 mean annual capacity of the aqueduct system.)

During the World War II years, due to the phenomenal growth of the city, the need for additional power became acute; and so, in line with the Department's foresighted policy of keeping the supply ahead of the demand, the Board of Water and Power Commissioners authorized the Owens River Gorge Power Project in June 1947.

Crews started at once to make topographic surveys, lay out roads, locate core-drill holes and stake camp sites. The construction of 14 mi. of permanent roads and two modern camps to house 700 men was completed in the spring of 1949.

After considerable preliminary study of topography, tunnel and penstock lengths, surge chamber requirements, available plant sites, standardization of plant equipment and other pertinent factors for the total utilization of available head, it was determined that the most economical scheme from the standpoint of construction, operation and maintenance was the building of three plants, all of equal heads with identical and interchangeable equipment.

Long Valley Dam, at the northern end of the Gorge, creates a reservoir (Lake Crowley) with a present capacity of 183,000 ac.-ft. The dam was designed to allow for a future increase in height of 20 ft. to bring the capacity of the reservoir to 315,000 ac. ft., but no provision has been made to raise the dam at this time. Elevation of the average lake level determined for design purposes is 6775, which is the water level when the proposed high-dam reservoir is one-half full by volume. At the southerly extremity of the present development, at the



Typical tunnel cross-section

conjunction of the Gorge and Birchim Canyon, the lower of the three plants will have a tailbay elevation of 4400 above sea level.

Water from Lake Crowley will be conducted to the northerly plant (No. 1) by means of existing outlet works, Tunnel No. 1 and Penstock No. 1. From the afterbay of Plant No. 1 the water will discharge directly into Tunnel No. 2, thence through Penstock No. 2 to Plant No. 2. Similarly, water will be conducted through the No. 3 tunnel, siphon and penstock system to lower Plant No. 3, where it will be discharged into the Owens River just above Rock Creek.

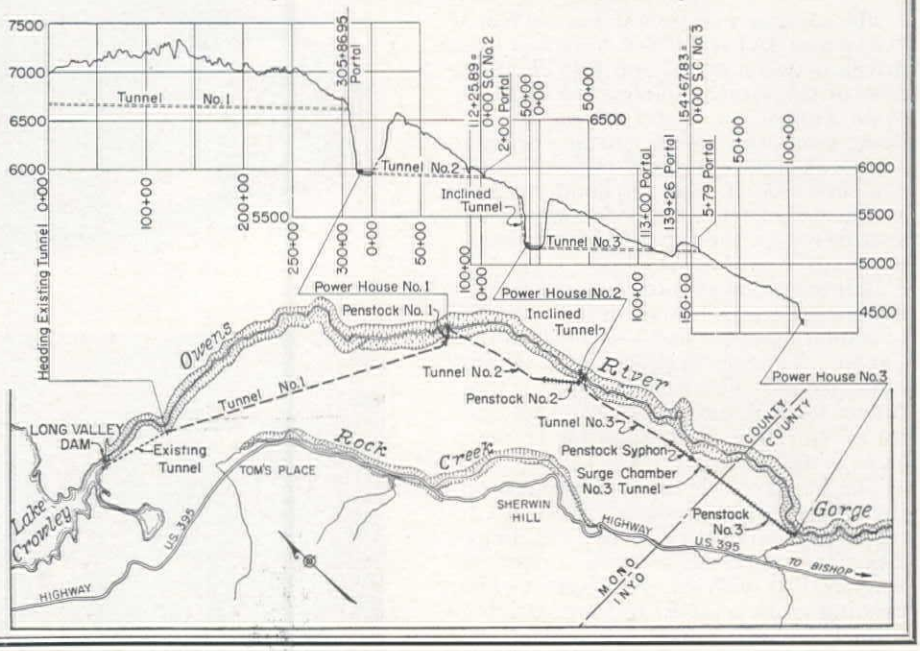
The three plants are located to give a net effective head on all plants of about 750 ft. at full load. Because of fluctuations in the Lake Crowley water level, Plant No. 1 will operate at variable heads. The design of the plants allows any or all of the plants to be by-passed by utilizing the Owens River stream bed as a by-pass channel.

Power Plant No. 3 has been ready for generation of electrical energy for several months and Power Plant No. 2 will be completed in the very near future. Penstocks No. 2 and 3 and the siphon are nearing completion. The power plants have been constructed entirely by force-account by the Department's construction crews; and, although the erection of penstocks and siphon were let to contract, they are being completed by force-account.

The three plants are outdoor type having identical and interchangeable machinery. Each plant has one 37,500-kva. Westinghouse generator and one 51,200-hp. Francis reaction-type Pelton turbine. One of the distinguishing features of the project is the remote-control arrangement tieing all three plants together so that the three machines can be operated as though they were in the same plant. Under normal operating conditions, all plants will be controlled and operated from the control room of Plant No. 3. Since they will also operate automatically, all equipment has been designed for supervisory control.

The total of 112,500 kw. and 600,000,000 kw-hr per year to be ultimately made available from the plants will be transmitted to Los Angeles over a 230-kv. single-circuit steel tower transmission line 258 mi. long.

Plan and profile of the Owens Gorge Project



Department of Water and Power
City of Los Angeles

TUNNEL HEADING INSPECTION REPORT (Typical)
OWENS GORGE PROJECT

Tunnel Heading: No. 3 South Portal — Date: Sept. 13, 1949 — Item No. 111
Shift: Day (7:30 A. M. to 3:30 P. M.) — Contract 6885

ROUND NO.	1. Start	Finish	2. Start	Finish	3. Start	Finish
Setting Up and Drilling			10:00	10:25	2:00	2:20
Loading and Shooting			10:25	10:50	2:20	2:35
Ventilating			10:50	11:30	2:35	2:45
Mucking	7:30	9:25	11:40	1:05	2:45	(3:30)
Supporting	9:25	10:00	1:05	2:00		
Excavation Classification	Main Tunnel		Main Tunnel		Main Tunnel	
Type Section	"A"		"A"		"A"	
Station 87+84 to Station	87+76		87+68			
Feet Advance	8		8			
No. Cars of Muck	22		20		16	
Type of Rock	Rhyolite		Rhyolite		Rhyolite	
How Did Rock Break?	Well. Some overbreak both sides.		Well. Some overbreak in crown.		Regular	
No. Holes Drilled	35		35		35	
Depth	8'		8'		8'	
No. Caps (No. Delays 7)	35		35		35	
Lbs. Powder, 17%	85		85		85	
%						

Other Holes
Other Holes

in this section was started on July 18, 1949 at the south portal and finished on Aug. 26, 1950 at the tailbay of Power Plant No. 2.

In this tunnel the 24-hr. record was broken on several occasions with footages of 86 on September 23, 85 on September 24, 87 on September 28 and 82 on October 4. The best footage for an 8-hr. shift was 31. From August 25 to September 30, 1949 the contractors drove 2,204 ft., an average of 71.1 ft. per day. Over 10,100 cu. yd. of muck was removed and 31,340 lb. of 45% and 17% powder was used in approximately equal amounts. The 250 rounds shot averaged 9.75 ft. per round using an average of 35 holes. This section was mainly through pink and gray rhyolite traversed by numerous jointing planes.

Breaking more records

The southerly section of Tunnel No. 3 (known as 3A) is 2,102 ft. long and was driven between May 5 and July 25, 1950. It is of the same diameter and slope as Main Tunnel No. 3, and driving was all done from the north portal through shattered light grey and pink rhyolite. The first 300 ft. was all hand-mucked and spaded except for an occasional plug shot to loosen the fractured face. Maximum cover over 3A is 70 ft.

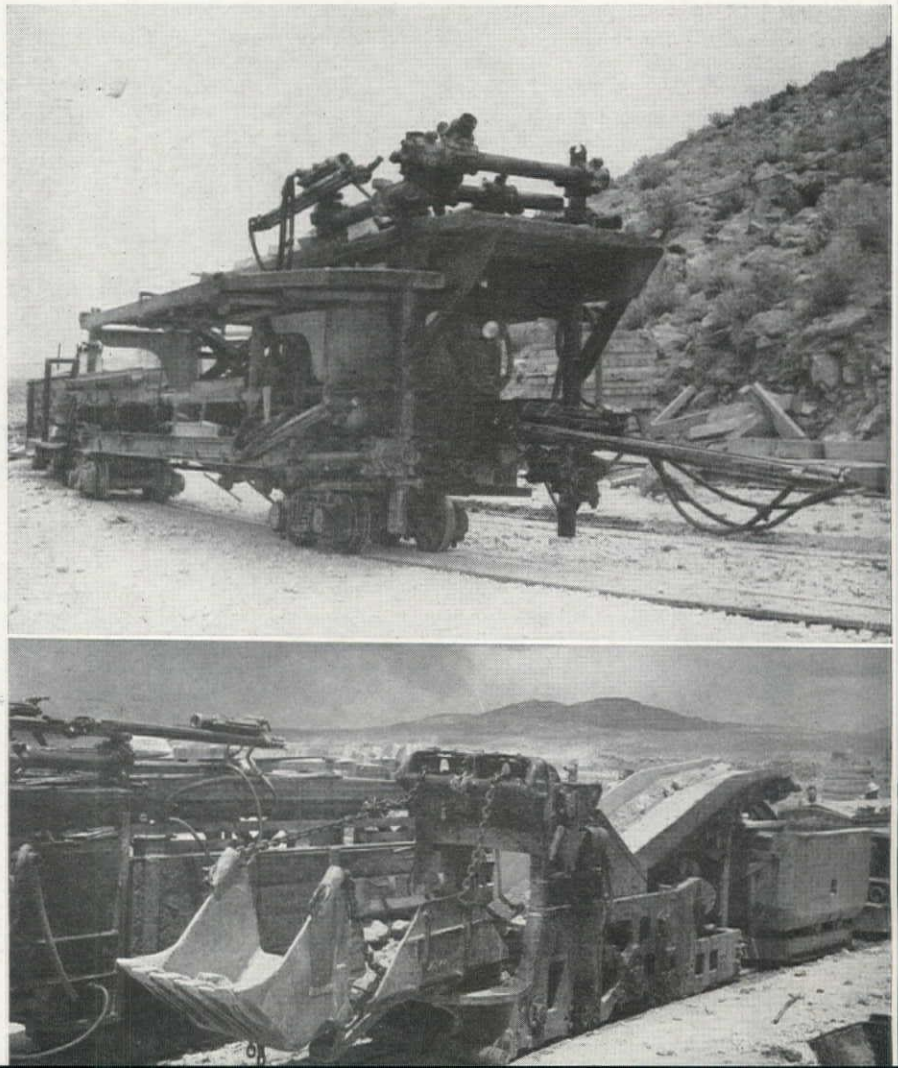
Before work was started on the Gorge Project, the previous records for bores of similar diameter had been made at the Carlton Tunnel, Cripple Creek, Colorado in 1940. The best footage in that tunnel for a 31-day period was 1,879 ft.; for a 24-hr. day, 74 ft.; and for an 8-hr. shift, 27 ft.

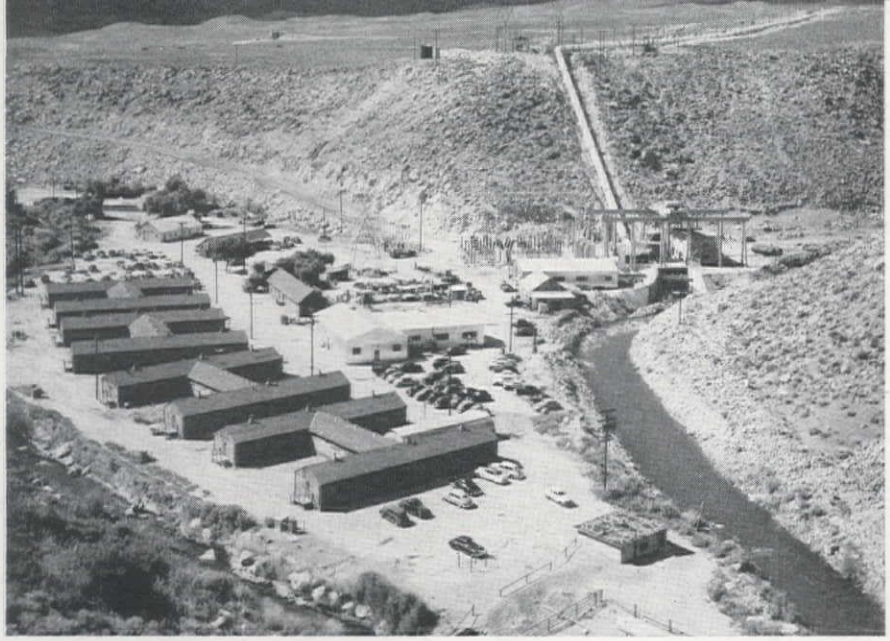
The best records made in tunnels on the Gorge Project were in Tunnel No. 1, which was driven from two headings. The north portal excavation started on Aug. 29, 1949 with the enlargement of an existing work adit 450 ft. long. Driving from the south portal began Sept. 11, 1949. The northerly end of this tunnel connects with an existing horseshoe-shaped tunnel 6,576 ft. long which will be provided with a ¼-in. steel liner. The new tunnel, 10.1 ft. in diameter with a fall of 1.5 ft. per 1,000, will extend the existing tunnel 31,050 ft. in a southeasterly direction to the rim of the gorge above Power Plant No. 1.

The records broken in Tunnel No. 1 were all at the north heading. Within one month of the record breaking progress in Tunnel No. 3, the crews in No. 1 had come within 3 ft. of equalling the 31-day record of the No. 3 crews by driving 2,201 ft. However, within another month they had exceeded the No. 3 record by 238 ft. From Oct. 24 to Dec. 2, 1949, the "tunnel stiffs" in North No. 1 unlimbered themselves and drove 2,442 ft. in 31 consecutive work days through a compacted volcanic ash (tuff) formation for an average footage of 78.77 ft. per day. (Carlton Tunnel's best single day was 74 ft.). In compiling such a record, 29,627 lb. of 17% powder and 4,160 lb. of 45% powder were used, loading an average of 31 holes per round. The length of rounds averaged 10.97 ft. About 11,060 cu. yd. of muck was removed for an average of 356.81 cu. yd. per day. The best footage for any 24-hr. period was 104 ft., and the best advance per shift was 41 ft.

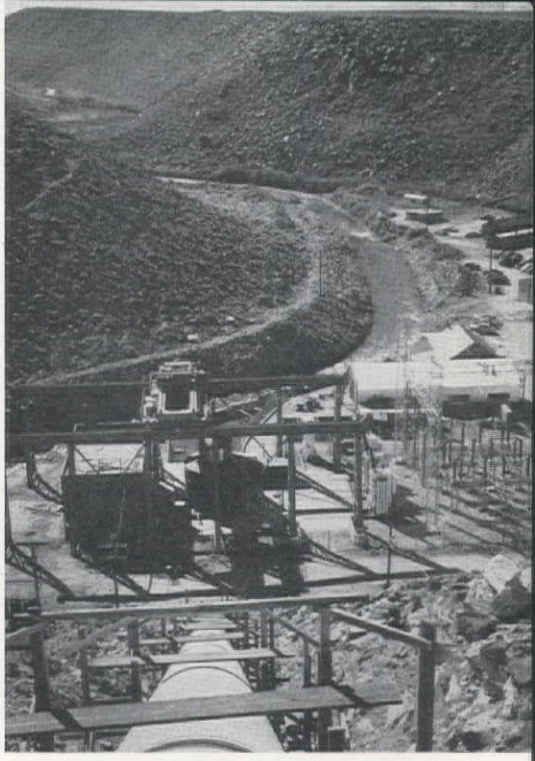
During this record-breaking period George W. Foster was general superintendent for the contractors, and C. C. (Bill) Harris was his assistant. For the past year, Milan (Mike) Roych has been tunnel superintendent.

KEY UNITS in the speed records were the drill jumbo (top) mounting five Ingersoll-Rand drills, and the Conway mucking machine (bottom). The typical round consisted of 35 holes, and during fast progress the advance was almost 11 ft. per round. The Conway operated with a 20- to 25-ft. reach and mounted a ⅜-yd. bucket.





ABOVE—Volcanic tableland created by lava flows several hundred feet thick was pierced by the tunnels. The Owens River, entering the picture from the right has cut a narrow gorge from 200 to 700 ft. deep through the lava flows.



RIGHT—Identical plants designed for interchangeable equipment are built for a 750-ft. head with a 37,500-kva. generator. Plant No. 3 is shown, with the junction of Owens River and Rock Creek in the background and Camp Birchim at the right.

In breaking the tunnel-driving records, the same crews were used as in regular routine progress. There was no special augmented organizational setup for record breaking purposes. No bonus money was paid for additional footage in setting records.

Typical crews

A typical shift-crew, in driving the size bore used at the Gorge, consisted of 1 walker, 1 shifter, 5 miners, 6 chucktenders, 1 tool nipper, 1 mucking machine operator, 2 locomotive operators, 2 trainmen, 2 muck-dump stiffs, 1 compressor operator, 1 electrician, 1 mechanic and 1 change-house attendant. Where water was encountered, 1 pump attendant was added. The day shift was augmented by 1 powder make-up man (a miner) and a bull-gang. The bull-gang consisted of a tracklaying foreman and 6 to 8 laborers. The miners did the drilling and loading; set the tunnel supports, crown bars, lagging, blocking, collar braces and spiling; barred down loose rocks; set short track sections ahead of the mucking machine; and set long rails and pipe as required. The bull-gang laid track (long rails) and air lines, hung ventilating pipe, installed passing-tracks and car-passers, kept the track ballasted and to grade, and did incidental labor work inside and outside the tunnel.

Steel ribs in the typical supported tunnel section were generally spaced on 6-ft. centers; but in the wet section, the contractor chose to space them on either 5-ft. or 4-ft. centers, and at times, double sets were placed.

The southerly 2,631 ft. of Tunnel No. 1, from surge chamber to the rim of the gorge where it connects with Penstock No. 1 will be lined with a steel liner 106 in. in diameter fabricated from 3/8-in. plate. The space between the liner and tunnel wall will be backfilled with concrete.

In Tunnel No. 1 (north heading) progress was slowed down considerably after Dec. 3, 1949 due to encountering a slight amount of water while driving through a saturated tuff. At the south heading "water-make" did not start until Sept. 30, 1950 in a glacial till formation.

Both headings were driven through these wet formations after these dates, but the total water in the tunnel at present does not exceed 1,200 gpm. No water was encountered in Tunnel No. 2; and only in the northerly 600 ft. of Tunnel No. 3 did the contractor slow down because of water trouble. The maximum "make" in No. 3 was approximately 350 gpm. At times, when a sudden surge was encountered in Tunnel No. 1, the standard method of breastboarding was used; and only once was a pilot hole driven, and that less than 30 ft. in length. There was no evidence of gas in any of the tunnels.

Drill jumbos and mucking machines

In driving the tunnels, the drill jumbos at all headings were similar. The typical jumbo was 20 ft. long, had a 4-wheel Timken-bearing double axle on each end and a 24-in. gauge. On the front, there were five Ingersoll-Rand pneumatic drifter drills provided with power feed on 48-in. aluminum shells. The drills were of standard design, equipped with New York head. The power feed was suitable for 4-ft. steel change. Working pressure is 100 psi. Drill rods were of conventional hollow steel, 1⅛ in. round, lugged shank in 4, 6, 8, 10, 12-ft. lengths, and Liddicoat throwaway bits were used almost exclusively.

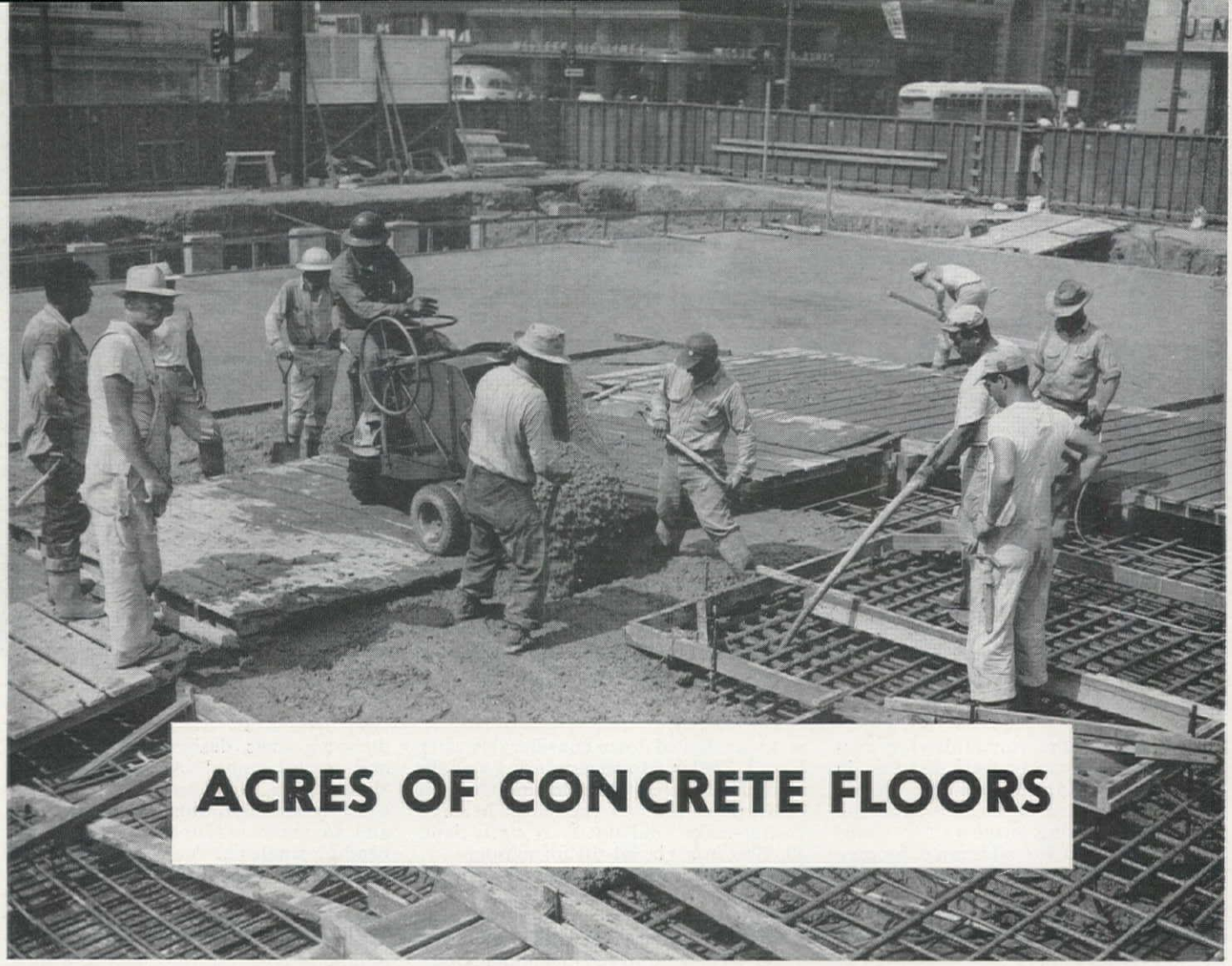
Mucking machines were electrically-operated Conway Type 50-A with conveyors of 20- to 25-ft. reach and ⅜-cu. yd. buckets. The locomotives were Goodman and General Electric storage-battery (56-cell) type. Card Iron Works Granby-type side dump muck cars of 90-cu. ft. capacity were used in all tunnels except North No. 1. There, new type 120-cu. ft. cars with pneumatic dumping jacks, designed by Mr. Bressi and manufactured by Great Western Welding Co., were used. Passing tracks were spaced approximately ½ mi. apart, and for mucking operations near the heading single car "car-passers" instead of cherry-pickers were used.

The lining of the reinforced concrete tunnels is being accomplished by the Pumpcrete method. The tunnels have a minimum concrete thickness of 8 in. at the crown, 7 in. at spring-line and 6 in. in the invert. Dry-batching is done at a Noble CA-104 plant outside the portal and hauled to a Ransome 35-S dual drum tunnel mixer in cars holding two batches of 1⅓ cu. yd. each. From the mixer, the concrete is transported by conveyor belt to a Rex Double Pumpcrete which forces it back of the tunnel-liner forms through an 8-in. pipe. The unit is capable of pumping over 50 cu. yd. of concrete per hour.

To date, Tunnels 2, 3 and 3A are completely lined and the three surge chambers, which are of the differential-type, reinforced concrete lined, are completed. Surge chamber No. 1 shaft has an outer chamber diameter of 30 ft., and is 176 ft. in depth. Surge chamber No. 2 is 40 ft. in diameter and 44 ft. deep, and Surge chamber No. 3 is 40 ft. in diameter, 69 ft. deep.

Personnel

Samuel B. Morris, General Manager and Chief Engineer, has the responsibility of this $42,000,000 development; and Charles P. Garman, until his recent promotion to Assistant General Manager and Chief Engineer of the Department, has been in charge of the project. His successor as Chief Electrical Engineer and Assistant Manager is William S. Peterson. James D. Laughlin, Engineer of Design and Construction, is in direct charge of the design and construction, and their coordination on both contract and force-account work.



ACRES OF CONCRETE FLOORS for the UNDERGROUND GARAGE in Los Angeles

With precast wall units in place and the site excavated, current work on the City Park Garage has been concentrated on framing the columns and slabs for the three floors — Final berm removed and gunite wall shot

BUILDING ACRES of concrete flow slab into the underground City Park Garage in Los Angeles has developed new construction methods and techniques based on the cooperative efforts of contractors, engineers and architects. As a result, the field work on this large and unusual sub-surface, reinforced concrete structure has been economical, and carried out at high speed with due regard for safety. In addition to the unique method of supporting the exterior walls with precast columns, described in detail in *Western Construction*, July 1951, the more recent feature includes the form work for hundreds of haunched columns and placing concrete over acres of slab. This article describes the current features of the work, with special emphasis on the column and slab operations.

By
CHARLES A. McMAHON
Project Superintendent

General background

The City Park Garage project in Pershing Square at Los Angeles is now 70% complete with completion scheduled early in 1952. The rapid rate of progress of this three-story underground garage was made possible by new and unusual construction methods. The basic idea of constructing this 2,000-car garage varies widely from conventional methods. Precast units were set in drill holes 9 ft. on center around the perimeter, then the 350 x 600-ft. area was excavated about 30 ft. deep, leaving only a berm of safe slope against the precast units. Next the center core of the building was constructed and later this portion of the structure was used as a huge anchor block to shore the precast exterior wall units while the berm was excavated. After guniting the panels between these units the various floors of the inner core were connected to the exterior wall units.

Preliminary construction procedures were described in the previous article in

Western Construction. Excavation for the main portion of the structure was completed in July, leaving only a berm with a safe slope to stabilize the precast units around the perimeter of the project. A dirt ramp in the center of the project was used for access during the construction of the north and south sections. This ramp will be excavated after all of the earth is removed from the lower sections as the structure is completed.

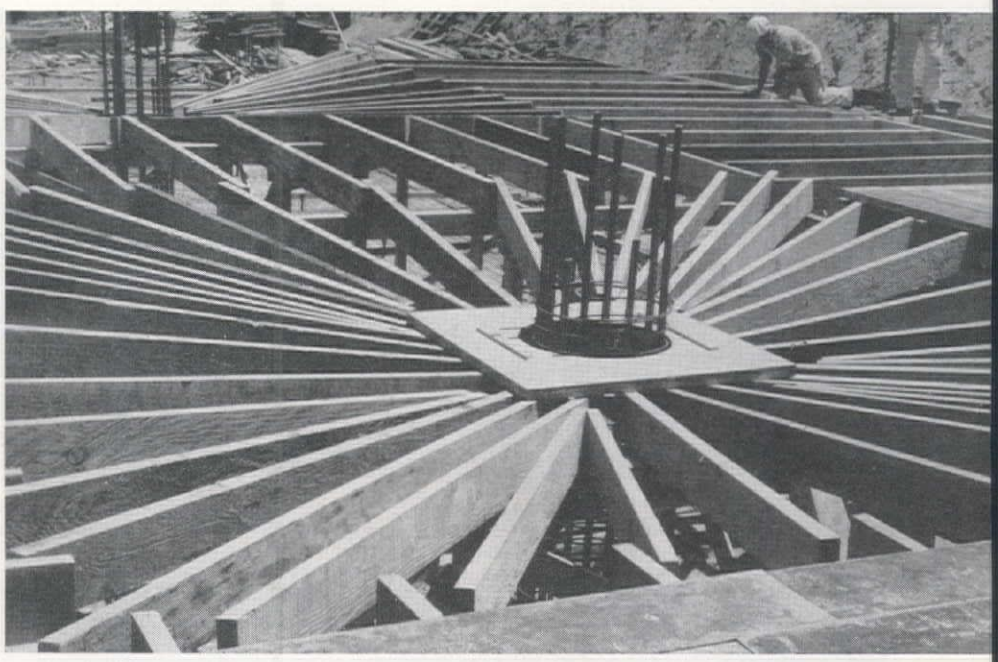
Soil and water conditions

Some ground water was encountered at the 20-ft. level on the west side but this was lowered by pumping out a deep sump for two weeks. All seepage water is now pumped with one 4-in. pump operating two hours per week.

There was a wide variation in the soil found within the project area. The first 4 ft. of depth consisted of spongy black loam built up by the Park Department during its 80 years of caretaking. A dark brown adobe was found to extend down to the 10-ft. level. Below this level the soil consisted of sand and gravel with small amounts of fine particles which were predominant in the south half, while the north half contained a material known as Puente Shale (dark blue siltstone). The bearing value of all of the soils was over 6,000 lb. per sq. ft.

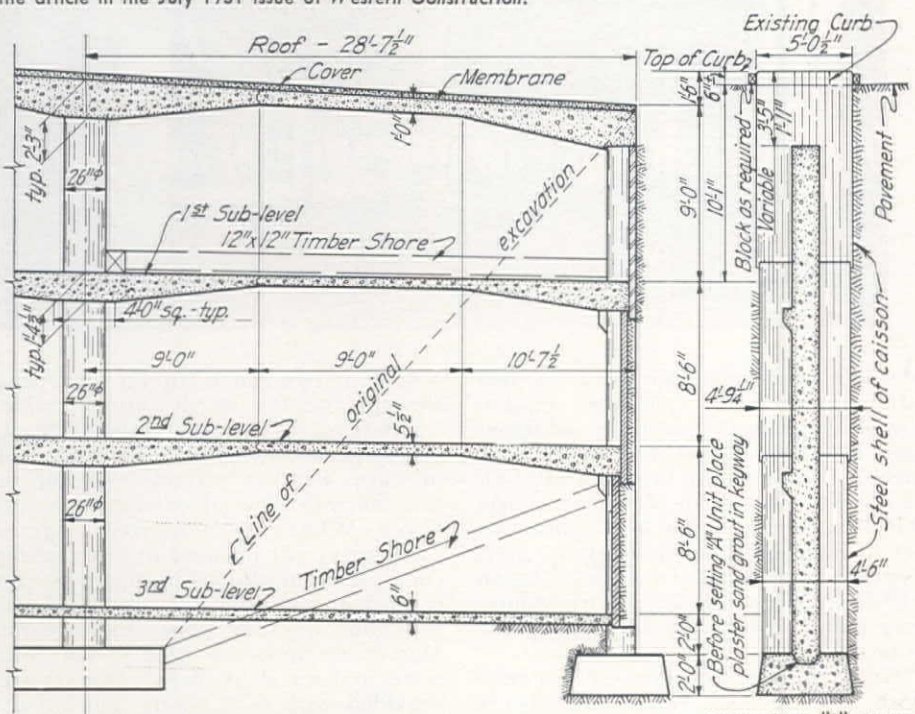
A ½-yd. Bucyrus-Erie back hoe dug all of the footings, which averaged 10 ft. square and 2 ft., 9 in. deep. Sides of the banks were trimmed neat and concrete was poured against the earth. Hooks on the ends of the reinforcing bars for the footings were eliminated by the use of new high bond type bar (A.C.I. 318-51).

An underground air duct and drainage system combined in one unit was installed above the footings and below the third subfloor slab. These concrete ducts varied in size from 2 x 2 ft. at the extremities to 6 x 10 ft. in cross section at each one of four 440,000-cfm. exhaust fan locations. The duct system extends to each floor level by sheet metal risers and will change the air in the 630,000-sq. ft. garage every 6 min. Weep holes were provided in the 6-in. walls of the concrete ducts and the pervious material from the job site was used as backfill.



FRAMING for a haunched column with the 2 x 8 joists in place ready for the metal slab forms. A special sheet-metal valley is used down the four corners. The transition section extends the 26-in. round column to a 4-ft. square.

PRINCIPAL DESIGN features with detail of precast wall unit in drilled hole. The field experiment of guniting wall sections as the berm excavation was carried down proved successful. They were extended down in about 4-ft. lifts to the lowest floor. This drawing was prepared especially for the article in the July 1951 issue of *Western Construction*.



TYPICAL SECTION—WALL UNITS IN PLACE

PRECAST "A" UNIT IN CAISSON

All the ducts are pitched to four locations and pumps with a total capacity of 4,400 gpm. were installed in sumps to lift any seepage water to the Los Angeles storm drain system.

Four 10,000-gal. gasoline storage tanks and one 1,000-gal. waste oil tank were placed in concrete vaults below the third subfloor slab level as part of the service station facilities.

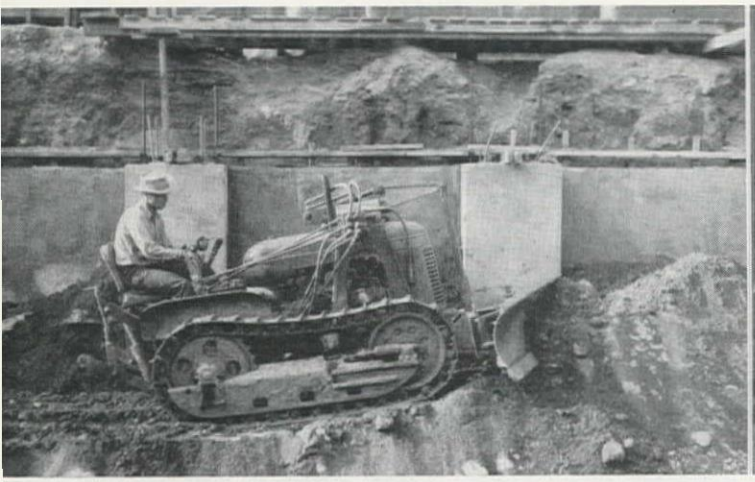
The 5-in. third subfloor slab reinforced with wire mesh was placed on the soil after footings, tanks and ducts were placed and backfilled.

The 26-in. diameter columns spaced 27 ft. apart were formed with steel forms furnished and set by Robert J. Hiller Co. Timber falsework for the floor slabs was designed and a model of a typical floor bay was erected on the jobsite. Every detail including the layout and nailing for economical erection was planned before the job of erecting falsework for the ten acres of floor slab was started.

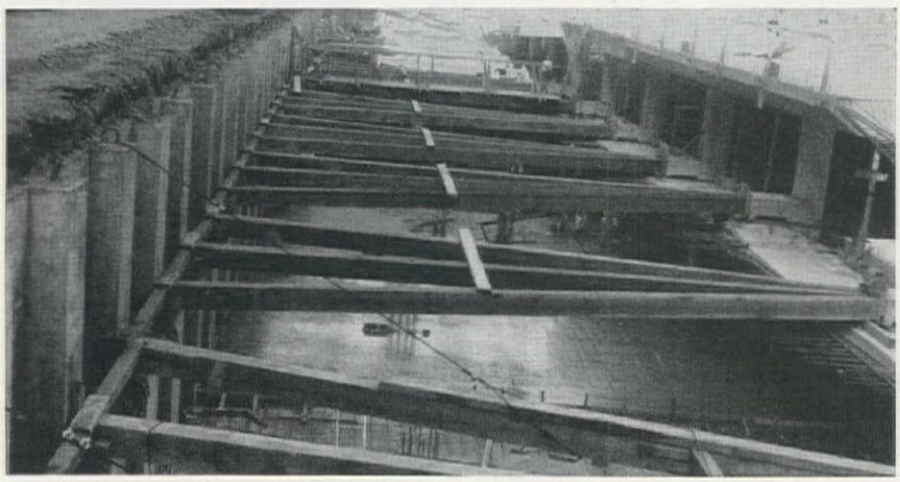
Continuing economies

Close collaboration of the architects, engineers, and the contractors developed an economical design, with further economies introduced by the contractors after the project was under construction. Plans were changed and new building permits were obtained on the modified designs. This active cooperation, plus good job management, resulted in better design, lower costs and faster progress. Some of the best examples of the economies were in the exterior wall construction, already mentioned, the haunched slab design, and the spacing and size of structural members. Since the haunched floor slab used in this garage is streamlined the method of erection is of interest because it is far more economical than the conventional drop panel, capital-head type of concrete floor system.

The construction steps in preparing a typical slab ready for concrete can be



WALLS are extended downward by dozing out the berm in 4-ft. lifts (left) and then shooting a 5-in. gunite wall between the precast columns. This sequence was extended down to the bottom floor.



LEFT—Shoring between the completed central core and the precast wall columns permitted removal of the berm. The second sub-floor slab is being placed to complete the structure to the outer wall.

BELOW—Haunched columns provide a streamlined appearance to the second sub-floor ceiling, with a pleasing pattern produced by the metal pan forms.

outlined as follows: First the surveyors marked column center lines on the floor and a 2 x 4-in. template 30 in. square was nailed to the concrete slab at each column location. This was used as a guide for erecting falsework and to align the bottom of the circular steel column forms. Then the stringers and supporting posts were erected and set to grade. All layout marks were placed on the stringers with lumber crayon at the make-up bench so no measuring was necessary during erection. The 2 x 8-in. joists were set 28 in. apart on the 4 x 6-in. and 4 x 8-in. stringers, and were set radially with varying spacing at the column haunches.

Placing concrete

The next step was to set a transition section (from 26-in. round to a 4-ft. square section) on the joist at the column. This provided a means for aligning the top of the steel column form and a starting point for metal slab forms. The 16-gauge metal slab forms 1 ft. wide, 5 ft. long and 2 in. deep were laid on the joists and a sheet metal valley section (see illustrations) was fastened to the metal pans at the haunch sections by means of sheet metal screws. This was necessary to fill in the openings left by the forming of a trapezoidal section with square metal forms.

After the column's reinforcing steel and forms were placed the grout mix, followed by 3,000-psi. concrete, was placed in the forms. Later the lower mat of reinforcing slab steel was set, followed by conduit installation and upper steel mat. Round steel screed posts with steel spikes were set in small holes already in the metal pans. Later a cast arm which supported a 2 x 4-in. guide was set to establish finish floor grade. Steel inspection, clean-up and the installation of 5-ft. wide runways for motorized buggies prepared the area for placing the concrete.

Graham Bros. delivered all concrete with new 6½-yd. White transit-mix trucks from a plant located about 3 mi. from the project. Average running time is 45 min. for a round trip for the trucks through the daytime downtown traffic. The largest slabs averaged about 450 cu. yd., which was easily placed and finished in warm weather without overtime to the concrete crew or cement finishers. Seven Whiteman motorized buggies carrying ⅓ yd. are used in distributing concrete from the job hoppers to the formed areas and travel up to 16 mi. per hour on long runs. Lightweight Master vibrators are used in the concrete, and for slabs these vibrators are provided with 6-ft. shafts and 2⅛-in. heads. They are operated easily by one man instead of the usual two-man crew

required by heavier vibrators. An additional 6-ft. shaft was placed on the same vibrators for concrete placement in high 8-in. walls.

All of the floor slabs were water cured because Lapidolith, a penetrating floor hardener, will be applied after all of the slabs are complete. Sealtex is used in curing the roof slab, which received a 5-ply membrane mopped with coal tar and covered with 2 in. of asphalt concrete. Later a 30-in. depth of select soil will be placed on the roof slab for the park restoration.

The interior south half of the structure is complete and the process of connecting the slabs to the precast exterior wall units is well advanced. Excavation, timbering and guniting is now in progress on the north half of the structure.

Unique method for exterior walls

The exterior wall construction, which is the outstanding feature of the project effected great savings and resulted in a decrease of the construction period over conventional methods. Interlocking steel sheet piling with steel wales and struts have been common practice to support uncemented soils during the construction of sub-surface structures. A contractor exposes himself to the possibility of costly lawsuits because of the noise and vibration connected with the pile driving operations in an area surrounded by multiple-story buildings and many underground utilities. The drilling of the holes around the lot, and the precasting and placing of exterior wall units was well described in the first article and proved to be very practical and economical.

After the inner core of the structure was completed the removal of the berm supporting the exterior wall units was started. Pneumatic clay spades were used to scale the soil down the first 4 ft. below the top of the precast units. After ⅝-in. round reinforcing steel was placed on 6-in. centers each way, a mix of 1 part cement to 4½ parts sand was gunited in the 5-in. panels between the precast units as the excavation progressed. An Oliver angle dozer was effectively used to cut the berm down the next 4 ft. to the first subfloor level. Then the reinforcing steel was set and the second 4-ft. panels were gunited. Precast concrete blocks were set against the first subfloor columns to receive the shoring timbers. The columns at this level were reinforced with a 10-in. wide flange steel wale set at the floor level to take the additional stress of the three timbers (see illustration). Horizontal brace timbers (12 x 12-in.) averaging 30 ft. in length were then set by means of a hand winch attached to a gin pole.

Excavation of the berm then continued at the lower level. A Caterpillar dozer was used to push the soil to a ½-yd. shovel which loaded 7½-yd. International trucks. Up to 1,000 cu. yd. per night shift were hauled to a dump about 4 mi. from the project, through the downtown streets from 6 p. m. to 2 a. m.

As the next 8 ft. of berm was removed (between the first and second subfloors) the panels were gunited. The berm was then cut to a grade of 3 ft. above the third subfloor and the panels gunited as this further excavation progressed.

Completing floors and roof

A bench 3 ft. high and 12 ft. wide was left undisturbed at the base of the present units, to provide necessary resistance to the bottom of the units while the 12 x 12-in. timbers above supported the upper portion of the units. Then the floor slabs were placed at the second subfloor level and first subfloor level between the inner core of the building and the exterior wall units.

With the exterior wall units held securely by two connecting concrete floors the timbers were removed and the roof section was placed. Later the dirt bench was removed at the base of the exterior wall by means of a Caterpillar skip loader. Finally the underground work was installed and the outer bay of the third subfloor was placed. This work consisted of the concrete air ducts and agricultural drain tile around the exterior wall to carry off any water that may pass under the third subfloor.

The drill holes which were used to place the exterior wall units were backfilled with pervious material found on the job site. Channels of pervious material connected these drill holes to this drain line for the purpose of eliminating the possibility of developing any hydrostatic head behind the exterior wall. Placing of the third subfloor slab on the ground completed the concrete work for this new and unusual method of constructing the three-story underground structure in downtown Los Angeles.

The garage will be operated as six parking lots under one management. Directional lights, arrows and floor markings will guide the flow of cars to the proper floors. The driver will receive a time-stamped parking receipt as he steps from his car and an experienced attendant will then park the car. Eight Otis escalators are now being installed for the convenience of the garage patrons.

Personnel

The joint venture contractors are Ford J. Twaits Co., Morrison-Knudsen Co., Inc., and T-S Construction Engineers, Inc. The architect is Stiles Clements Associated Architects and Engineers, with Murray Erick as consulting engineer.

Among the many sub-contractors are: Lohman Bros., plumbing, heating, ventilating; C. G. Willis & Sons, Inc., excavation; Otis Elevator Corp., escalators; Pacific Electrical and Mechanical Co., Inc., electrical work; Blue Diamond Corp., reinforcing steel; R. J. Hiller Co., Inc., slab forms, steel column forms and cement finishing; Graham Bros., concrete; Case & Casey Foundation Co., drilling; Case Gunite Co., gunite.

Restoration of the Park will begin about February 1952. At that time the original trees and shrubs will be brought back to Pershing Square and replanted.

AN OVERALL VIEW of the City Park Garage site, looking southwest. Both north and south sections of the structure are in an advanced stage of construction. Two of the inner cores of the circular ramps are shown in the foreground.

HOW IT WAS DONE . . .

Submarine oil pipeline pulled 4,450 ft. out into the Pacific

FACED WITH a critical need for new transportation of crude petroleum from oil fields in Newhall, Santa Paula and the Ojai Valley, Union Oil Co. planned a new marine terminal just south of Ventura both as a storage reservoir for crude products from the fields and for a distribution center for refined products which could be brought by tanker from refineries in Los Angeles and San Francisco.

Pacific Pipeline Construction Co. of Montebello, California, put down a 7,500-foot, 20-inch submarine pipeline, said to be the longest on the West Coast and designed to run from the terminal to a spot 4,450 feet out in the Pacific Ocean where tankers can discharge refined products and receive the crude petroleum. The 20-inch pipeline will pump crude from the storage tank to ships at a rate of 14,000 barrels per hour while an 8-inch line will carry refined products from ship to storage tanks. Both pipelines are made of steel with a center lining of spun concrete and an outside shell of gunite.

The 20-inch pipe, weighing 185 pounds per lineal foot, was welded into 250-foot sections and lifted onto trolley way dollies by means of Caterpillar diesel tractors equipped with Trackson sidebooms. Two sections were placed on the dollies at one time and these sections then joined.

The first 500-foot joined section was supported by a steel sled to support the weight of the pipe as it slid along the ocean bottom, pulled by lines from a barge anchored about a mile off-shore. Succeeding 500-ft. sections were moved into position for welding to the preceding section, the entire pulling operation for the 20-in. pipe taking 19 consecutive hours—11 less than originally estimated. The operation was then repeated for the 8-in. pipe which weighs 47 pounds per lineal foot.

TOP—View of Caterpillar side-boom tractor units used for laying part of the submarine pipeline for Union Oil Co. near Ventura, Calif.

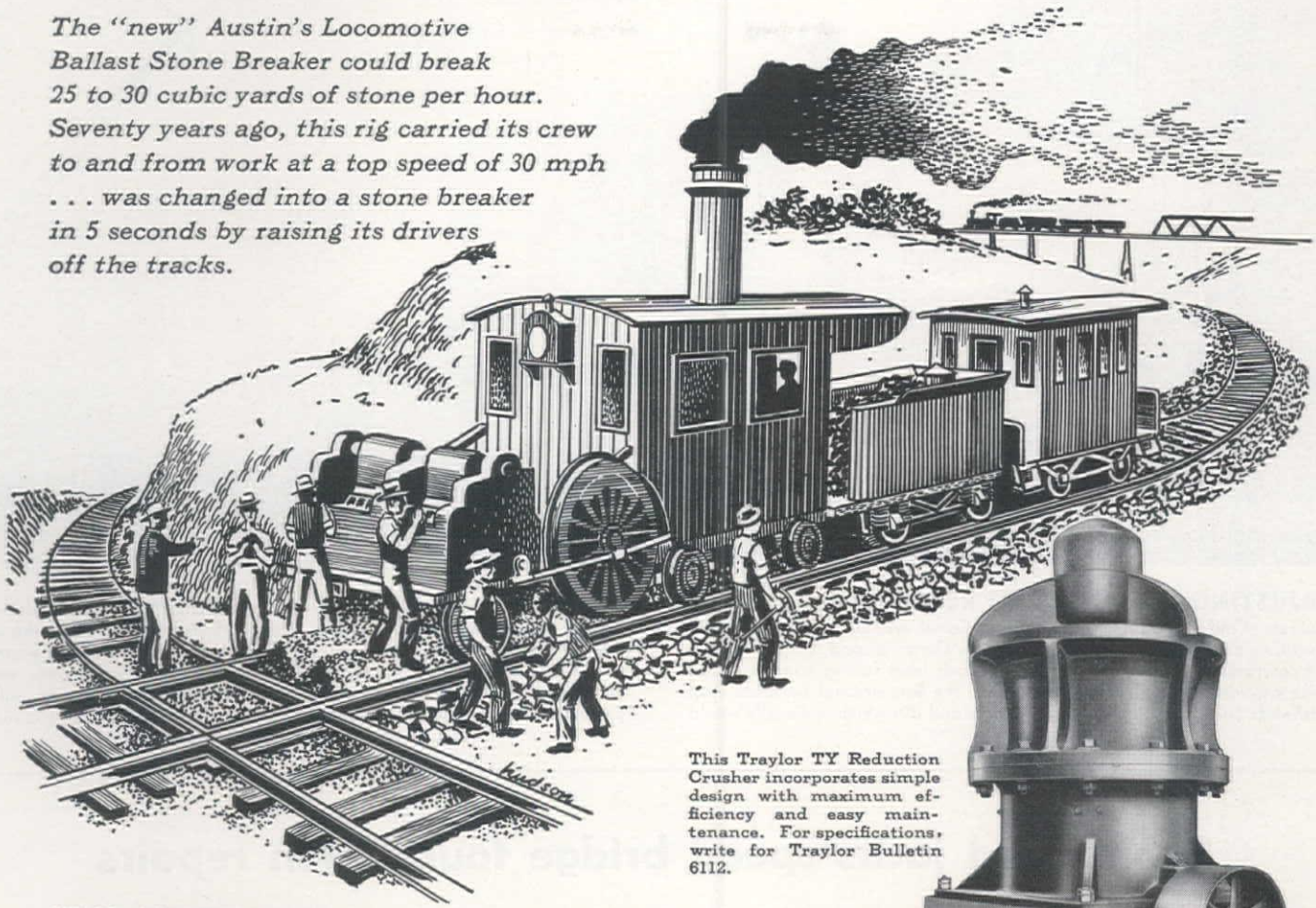
BOTTOM—Point of entrance into the sea for the West Coast's longest pipeline. Pacific Pipeline Construction is building the line to serve as a loading station for oil tankers.

"Copter" becomes "cropter" on Delta-Mendota banks

AIRBORNE OATS AND BARLEY seeds are sprinkled along the spoil banks of the Bureau of Reclamation's Delta-Mendota Canal to strangle the growth of weeds. This government project was undertaken to protect farmers from added weed control costs which might have resulted from the newly constructed canal system. Use of a helicopter from Kern-Copters in Bakersfield speeded completion and assured the accuracy of the seeding operations.

Workin' on the railroad . . .

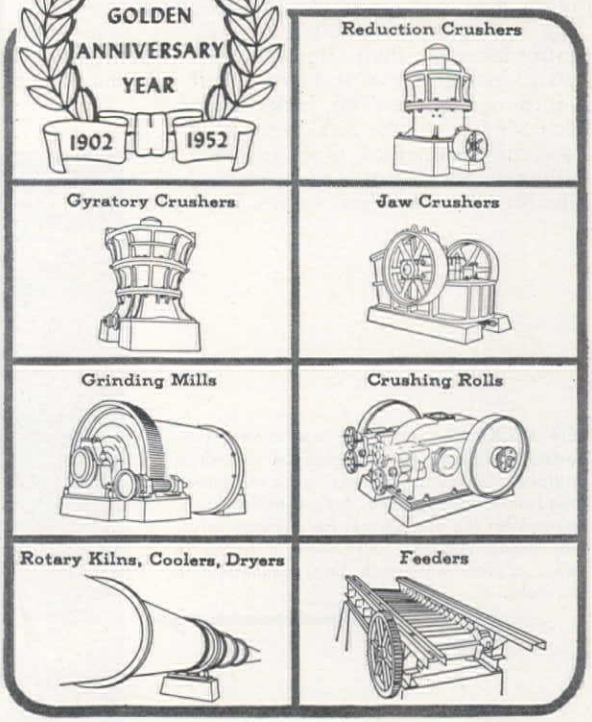
The "new" Austin's Locomotive Ballast Stone Breaker could break 25 to 30 cubic yards of stone per hour. Seventy years ago, this rig carried its crew to and from work at a top speed of 30 mph . . . was changed into a stone breaker in 5 seconds by raising its drivers off the tracks.



This Traylor TY Reduction Crusher incorporates simple design with maximum efficiency and easy maintenance. For specifications, write for Traylor Bulletin 6112.

IT IS AMAZING how fast the construction industry has progressed in just one man's lifetime! Of all the things our country is noted for, perhaps the greatest is its ability to develop machinery to save the labor of men . . . the cause and keystone of its ability to grow so fast. For over 50 years, Traylor has been most active in furthering the development of more efficient machinery for the construction industry. In fact, Traylor equipment is known all over the world for its modern design and rugged dependability. Construction men have come to depend on experience to supply the answers . . . not only in their own work, but in the work of men who supply them with the tools they need. That's why they depend on Traylor. For Traylor has experience . . . half a century of it.

OUR GOLDEN ANNIVERSARY YEAR
1902 1952



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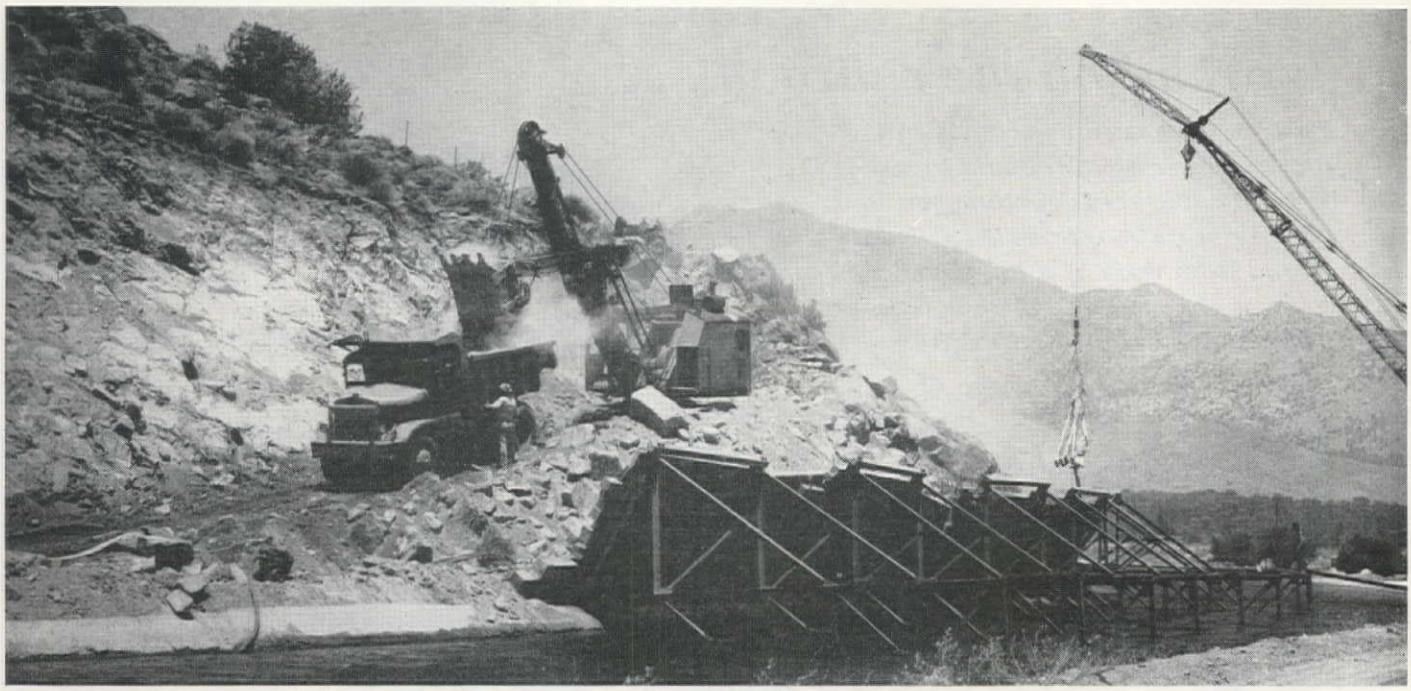
A TRAYLOR LEADS TO GREATER PROFITS



ADJUSTING THE ANGLE OF REPOSE of banks bordering Southern California Edison Co.'s Borel Canal without hindering canal operation presented a problem to Bechtel Corp., second stage construction contractor on the project. To keep debris from falling into the canal, which delivers water to Borel Powerhouse, the firm erected portable steel bulkheads (pictured above) to catch rocks and dirt which ordinarily would have clogged the canal during blasting operations. Cranes were used to lift the bulkheads from location to location. Bechtel is flattening the cut and fill slopes and constructing a 12-ft. bench on the cut side of the canal so the banks will stand up under inundation. Relining operations were completed by Johnson Western Constructors last winter, and the entire project will be finished this month. *—Photo courtesy Bechtel Briefs*

Submerged jacks speed bridge foundation repairs

ON THE PEACE RIVER BRIDGE of the famed Alcan Highway a bridge pier was sinking and tilting. The problem was to provide adequate support until the undermined foundation could be replaced.

The first step was to drive a cofferdam around the pier so that a steel reinforced concrete sub-foundation could be laid. The cofferdam was then allowed to fill with water and divers sent down to put jacks into operation. Ten jacks were placed at the base of the pier on the new concrete sub-foundation. Once in place and adjusted, they sustained a load of 800 tons for more than sixty days. During this period, the jacks were entirely submerged.

Accurate pressure adjustment for each jack was achieved by installing them in banks of five each with a hand pump and reservoir for each bank hose connected in manifold. In this way, all five in each bank were loaded the same.

After the water was pumped from the cofferdam, the jacks were protected by forms in such a way they could be removed after the concrete was poured and hardened. They were ultimately recovered after serving their purpose. Returned to the factory they were restored to practically new condition and sent back to the contractors for further service in other and equally adverse circumstances. Simplex-Jenny hydraulic jacks, manufactured by Templeton, Kenly and Company, Chicago, were used on the Peace River job.

TEN JACKS, five of which are shown, supported the Peace River Bridge on the Alcan Highway for 60 days while an undermined foundation was replaced. Jacks remained submerged for the entire time. For accurate pressure adjustment the jacks were installed in banks of five with each bank connected in manifold.

BUCYRUS ERIE

6-YARD 150-B

Brings NEW SPEED, POWER, CAPACITY

To Heavy Duty Excavating

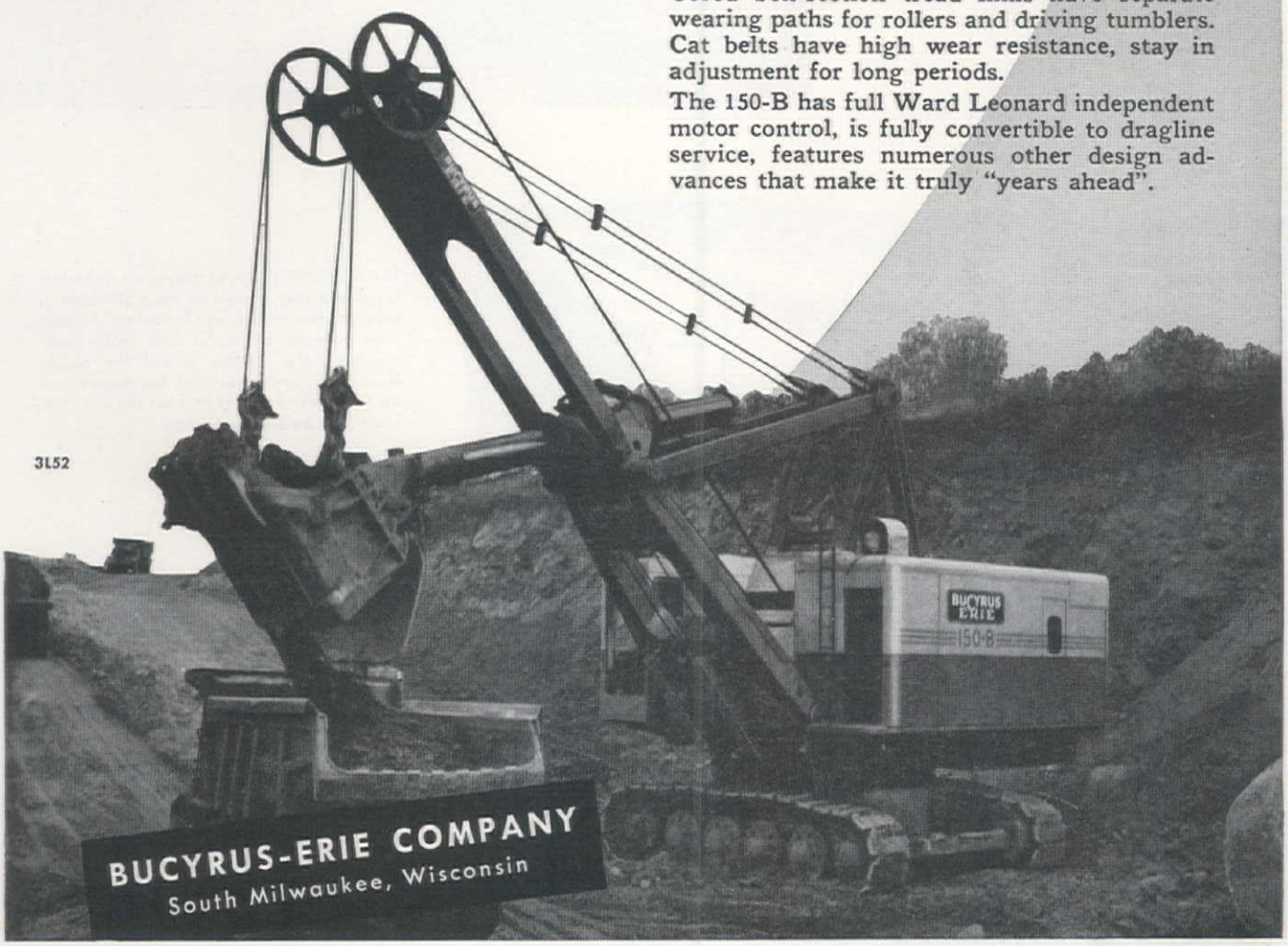
ADDED to the time-proved superiorities of design and construction which have made Bucyrus-Erie quarry and mining shovels traditionally "years ahead" are important features new to an excavator of this size, yet *thoroughly proved in the field*. Among these 150-B features are:

Exclusive Two-Section Boom with tubular dipper handle free to rotate in saddle block. Used with outstanding success on Bucyrus-Erie's large stripping shovels for many years, this design speeds the working cycle and permits increasing the payload because it reduces front end weight materially — yet provides enormous strength. Upper boom section carries only load resulting from pull of ropes, strong trussed lower section transmits directly to the revolving frame the vibrations, torsional and shock loads set up in digging. Rope crowd is quiet, positive, with crowd machinery located on the deck.

Powerful New Main Machinery designed for double twin hoist, smoothly delivers power where you want it, when you want it. Hoist machinery pulls dipper straight through tough banks with steady positive action. Fast smooth swing, with quick acceleration and deceleration, shaves seconds off every cycle.

Larger Stronger Mounting has new propelling machinery arrangement, which provides rapid engagement of the propel for fast move ups. Cored box-section tread links have separate wearing paths for rollers and driving tumblers. Cat belts have high wear resistance, stay in adjustment for long periods.

The 150-B has full Ward Leonard independent motor control, is fully convertible to dragline service, features numerous other design advances that make it truly "years ahead".



Giant quarter-mile long culverts pre-erected and floated into place

IN CONNECTION with a runway extension project at McChord Air Force Base at Tacoma, Wash., installation of a pipe culvert was a problem faced by the contractor, Woodworth & Co., Inc.

Two 144-in. culverts, each 1,530 ft. long, had to be installed in Clover Creek. Water level, which varied from 6½ to 8 ft. above invert elevation, and pervious gravel formation made it impossible to dewater to grade. In-place fabrication, which was considered in the original plans, proved unsuitable for this operation, and it was decided to erect the culverts alongside the creek and then float them into place as complete units.

To accomplish this construction, a crew of five men and one crane was first employed on the project. When this work was proceeding in a satisfactory manner, a second crew and crane were brought into action. For speed and efficiency, other crews followed the original ones to insert and tighten all the remaining bolts.

Once the erection of the culverts was completed, there still remained the problem of launching and positioning the giant units. To provide buoyancy, plywood bulkheads were inserted into each end of the pipe. Four piles were driven into place on the line that would form the far limit of the first pipe when it was in correct position in the creek.

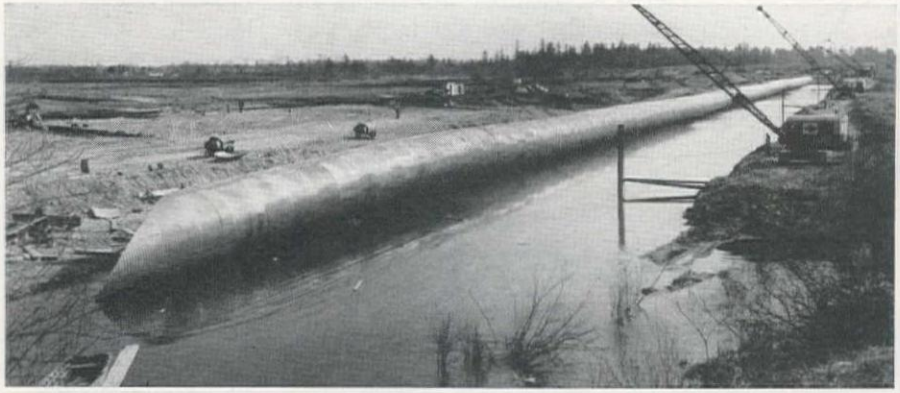
Control operations consisted of positioning four cranes on the opposite side of the bank from the pipe. Each crane was provided with two lines to the pipe. For counter-control, seven tractors with winch lines were in position directly behind the pipe so that the chocks could be pulled. Slack was formed in the cables to allow the pipe to roll from the bulkhead toward the ditch. At this point the cranes were used to haul the pipe into position against the pilings.

Struts and beveled ends of the pipe were jockeyed into correct position by a methodical rotation of the pipe once it had been floated into proper alignment in the ditch. The location of the second pipe was accomplished in the same fashion.

Once the huge culverts were in position against the pilings, the plywood bulkheads, which had provided buoyancy during floating operations, were pulled from the ends of the culverts to allow them to be sunk into position in the bottom of the water covered area.

Armco Multi-Plate Pipe Culverts, made by Armco Drainage and Metal Products, were used in this operation. The contract was issued by the Corps of Engineers.

FINISHING STAGES (right) of erection on one of the 1,500-ft. long, 144-in. culverts which had to be fabricated alongside the water covered excavation area. The preshaped culvert consisted of corrugated steel plates, 3/16 in. thick, 5 ft. wide and 8 ft. long, bolted together to form a 4-in. overlap.



TEAMWORK of seven tractors on the left bank and four cranes on the right bank is used in the launching. Following instructions relayed by radio and from loudspeakers, the tractors pulled the chocks from under the culvert and the cranes took up the slack in cables to haul the unit into position against the pilings.

SIDE BY SIDE, the two giant culverts lie in the channel where they will carry the waters of Clover Creek under the extended runway of McChord Air Force Base.

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Tunnel experts consider adequacy of lining design

DURING the current driving of the 1,616-ft. Broadway Tunnel in San Francisco, which will provide twin, two-lane bores under Russian Hill, the contractor has expressed the opinion that the concrete lining called for in the drawings was inadequate for the loads that developed. This contention received considerable public attention, and caused city officials to have their consultants recheck their findings. Two additional experts were called in to review these opinions.

Basic disagreement related to the distance the heavy (3-ft.) concrete lining should extend in from the portals before the ground developed sufficient supporting power to permit use of the 2-ft. thickness of lining.

The situation was reviewed in an extended letter prepared for the Board of Supervisors by the city's chief administrative officer, and this official statement is published in full. The position of the contractor in this difference in opinion on tunnel lining design is expressed in the concluding letter.—Editor.

San Francisco decides not to modify tunnel lining

FROM: T. A. Brooks, Chief Administrative Officer

TO: The Honorable Board of Supervisors, City and County of San Francisco

SUBJECT: Broadway Tunnel

Gentlemen:

I address you in response to the request of Mr. John R. McGrath, Clerk of the Board, dated September 5, 1951, that I render to your Board a report of my findings and those of my engineers with respect to the charges made by representatives of the Morrison-Knudsen Company, Inc., that the methods being used in the construction of the Broadway Tunnel are improper and that the tunnel itself will be unsafe under certain conditions. The circumstances surrounding the matter and our findings are as follows:

A unit price contract for the construction of the twin bore Broadway Tunnel in the amount of $5,253,552.33 was awarded by the Department of Public Works in February 1950 to the Morrison-Knudsen Company, Inc. The starting date was May 1, 1950, the time allowed for completion was 720 calendar days and the date for completion is April 30, 1952, though an appropriate extension of time for extra work performed by the Contractor is now contemplated.

The Contractor's bid includes the price of $1,625 per foot for 700 feet of Type "A" concrete lining 3 feet thick near the tunnel portals where the heaviest loads were to be expected and the price of $868 per foot for 2,030 feet of Type "B" concrete lining 2 feet thick to be used in the interior part of the tunnel. The foregoing lengths of the two types of lining are estimates and under the contract are subject to change during the progress of the work at the discretion of the City Engineer. These estimates were based on the findings of our Consulting Geologist, Mr. Hyde Forbes, in his report of February 1945, on the results of diamond drill exploratory borings along the line of the tunnel. The estimates were approved, as were the plans and specifications for the tunnel, by our Consulting Engineer, Mr. Ole Singstad of New York.

On November 10, 1950 the Contractor advised the City Engineer that the kind of rock found in one of his drifts (the drifts are small tunnels which are driven in advance of the excavations of the full tunnel bores) was unsound and was not as expected nor as represented in the Forbes Report. This report had been made available without warranty by the City to all bidders. The Contractor expressed his belief that Type "A" lining should be substituted for Type "B" lining and should be continued until there was a change in the kind of rock.

The matter was very fully investigated by the Director of Public Works, Mr. Sherman P. Duckel, and by the City Engineer, Mr. Ralph G. Wadsworth, who had the benefit of the counsel of Mr. Singstad, and Mr. Forbes, and of Mr. Roy C. Hackley, the City's consulting engineer on the actual construction operations at the tunnel.

Due consideration was given to all the representations and arguments of the Contractor and to the reports and opinions of his consultants. Consideration was also given to the opinions of several engineers still employed by the City who have had wide tunneling experience on the Hetch Hetchy Project and in the construction of the Stockton Street, Twin Peaks and Duboce tunnels as well as several other smaller tunnels under the City's hills.

In addition an opportunity for frank discussion and a free exchange of ideas was afforded by a conference in the City Engineer's office attended by the engineers and consultants of the Contractor on the one hand and by those of the City on the other hand.

As a result of the investigations, the stronger and more expensive Type "A" lining is being substituted in place of Type "B" lining for an aggregate distance of 70 feet in the twin bores near the east portal. Such a change is, I understand, in no way unusual in works of this nature, nor does it reflect adversely on the validity of the Forbes report or the estimates based thereon.

The contractor, however, remained of the opinion that the change should be more extensive and, as the drifts progressed through the full length of the tunnel, he maintained that no change from the expensive Type "A" lining was justified.

An extensive interchange of correspondence and opinions culminated in a letter dated August 27, 1951 from the Contractor to the Director and to the City Engineer repeating his emphatic protests against the City's directives and against the City's failure to eliminate the Type "B" lining. The Contractor stated that he considered the City's directives and its failure to change the lining to be breaches of the contract and that he reserved the right to receive full compensation for all delays and additional cost which might be attributable thereto or to any failure of the structure during or after construction.

These protests were rejected by the City Engineer on August 30, 1951.

On the same date the Contractor advised me in writing of his protests to the Director of Public Works and to the City Engineer, so that I, as the officer controlling the affairs of the Department of Public Works, could take action appropriate to protect the interests of the City. The Contractor expressed the opinion that the City would be well advised to incur the added expense of strengthening the tunnel. He also specifically requested me (1) to afford him and his consultants an opportunity to present their views in detail and (2) to effect changes in the design of the tunnel and modifications of the contract, supported by proper appropriations, to conform to such changes. Copies of this letter were given to the press by the Contractor and its contents were publicized in the daily newspapers.

On September 11, at the suggestion of Mr. Ben G. Kline, Director of Finance and Records, acting for me in my absence from the City, a conference was held in the office of Mr. Dion R. Holm, City Attorney. There were also present, the Contractor with his attorney, Mr. Lloyd W. Dinkelspiel and the Director of Public Works, as well as representatives of the press. It was agreed that a meeting would be held between the engineers and consultants on both sides with a view to a reconciliation of the conflicting technical views of the tunnel construction. This meeting, however, was called off by the Contractor for the reason it was impracticable to arrange for the attendance of the City's consultants from out of town and out of the State.

In the meantime, as an added precaution, Mr. Duckel has obtained the written opinions of two expert consultants in addition to those named above. They are Dr. John P. Buwalda of the California Institute of Technology at Pasadena and Dr. Karl Terzaghi of Harvard University.

These additional opinions very definitely substantiate the position consistently taken by the City Engineer that (1) the ground disclosed by the tunnel excavations is not unsound and is at

least as good as the ground predicted in the Forbes report and (2) that the less expensive Type "B" lining is adequate for the locations at which it is to be constructed.

Without exception the City's consultants are outstanding members of their professions who enjoy established reputations. They have had that wide and practical experience which justifies reliance on their opinions regarding the several phases of the matter at hand.

It is therefore with confidence, not alone in our consultants, but equally in the ability and sound judgment of the Director of Public Works and of the City Engineer and his staff, that I find no reason to intervene in this controversy which has been ably handled in the City's behalf with a due and proper regard for the best interest of the City and for the safety and welfare of both persons and property. Only in case the Contractor should produce new and incontrovertible support for his protest would I depart from the position.

While I hold that the safety and adequacy of the City's structures is paramount, I am satisfied in this instance that the elimination of the disputed Type "B" lining, which would add about $1,500,000 to the cost of the project, would be a totally unwarranted waste of the taxpayer's money.

It is regretted that this issue has been made the subject of public controversy and alarm. Such issues must be calmly resolved by those professionally and technically qualified to pass on their merits.

In conclusion, I respectfully submit my finding that there is no cause for fear or apprehension for the safety of the design or construction of the Broadway Tunnel. It will stand as a monument to civic progress and take its place with the Stockton Street, Twin Peaks and Duboce Tunnels, and the dams, bridges and other useful structures which have been so successfully engineered and built by the City through the years.

Very truly yours,
T. A. BROOKS
Chief Administrative Officer
October 5, 1951

Contractor reaffirms belief lining inadequate

Sir:

While we have no desire to publicize the controversy on the Broadway Tunnel, we do necessarily take issue with the conclusions expressed by Mr. Brooks in his letter.

Mr. Brooks has outlined the points at issue between the Contractor and the City, and concluded that the City's Consultant, Dr. Karl Terzaghi, substantiates the position taken by the City Engineer that the Type "B" lining is adequate for the locations at which it is to be constructed. However, Dr. Terzaghi made a number of recommendations, involving costly work not required by the contract, that were conditions precedent to any favorable opinion by him and that should be followed if the Type "B" section was to be made adequate. The City has not as yet instructed the Contractor to follow these recommendations.

The Contractor has not taken the stand that the tunnel should be constructed only of Type "A" section, but has insisted that the Type "B" section was inadequate. Possibly some intermediate section, costing much less than the extra $1,500,000 for a full Type "A" project, would suffice.

Core removal has proceeded in the north tunnel bore and should be completed in January 1952. Developments during this core removal have proven heavy side pressures against the tunnel walls and settlement to the ground surface near the point of maximum cover, contrary, we think, to Dr. Terzaghi's forecast of probable loads and settlement. These are conditions that were forecast by the Contractor and on which it based its conclusions.

The Contractor still believes the Type "B" section to be inadequate.

Morrison-Knudsen Company, Inc.
Lyman D. Wilbur, Vice President.
Jan. 5, 1952

AT PRESENT one of the twin bores has been excavated to full section and the specially designed jumbo is being started underground in the other tunnel. A review of driving methods, equipment and procedure will appear in the April issue of *Western Construction*.

$52,000,000 expansion plan for So. Calif. water area

A $52,000,000 expansion plan for facilities of the Colorado River Aqueduct and its distribution system has been announced by Joseph Jensen, chairman of the Metropolitan Water District of Southern California board of directors.

The tremendous growth of the area served by the water district makes such expansion necessary in the opinion of the board.

Already under way in Los Angeles County is engineering work on distribution lines and reservoirs. Approximately $16,000,000 of the expansion funds will be spent in Los Angeles County. About $11,000,000 will be spent in Orange County on distribution lines to carry both natural and softened Colorado River water to the area. An additional $25,000,000 will be spent on pumping plants in Los Angeles and San Diego counties.

FPC grants license for Pelton hydro project

THE FEDERAL Power Commission has ordered issuance of a 50-year license, conditioned to conserve the fishery resources of the Deschutes River, to Portland General Electric Co., Portland, Ore., for the construction and operation of the proposed Pelton hydroelectric project in Jefferson County, Ore.

Only two years will be required to put the project into operation with a dependable capacity of 108,000 kw. This makes the project the most readily available source of new power supply in the Pacific Northwest.

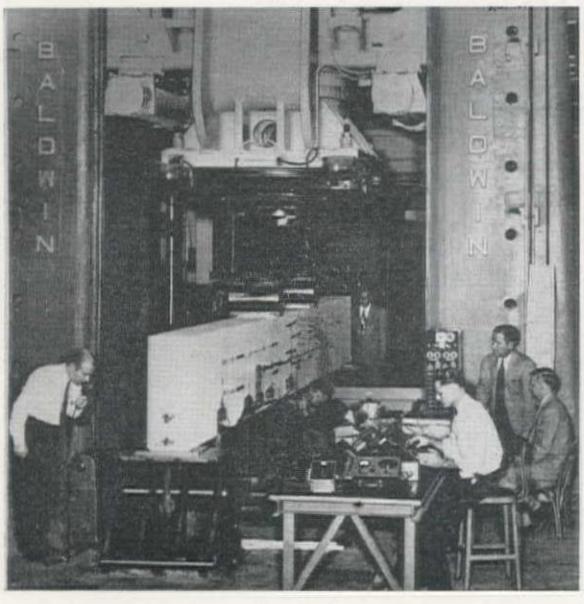
The project, estimated to cost approximately $22,070,000, includes a 205-ft. high concrete arch dam; reservoir; a side channel and tunnel spillway; 3 short penstocks; an outdoor type powerhouse, located immediately downstream from the dam containing three 52,000-hp. turbines connected to three 36,000-kw. generators; a switching station; a 7-mi., 230-kv. transmission line; and a reregulating dam and reservoir about 3 mi. downstream from the main dam. The total cost of the project includes $4,430,000 which the company will spend for the reregulating dam and other fishery conservation facilities.

Contracts let in Alaska for Eklutna Project generators

THE PACIFIC Oerlikon Co., Tacoma, Wash., received the contract for furnishing and installing two 15,000-kw. capacity generators for the Eklutna, Alaska, hydroelectric project, according to Bureau of Reclamation spokesmen.

The Tacoma firm's bid provided for a maximum saving of $245,681 over the lowest comparable domestic supplier's bid. The Newport News Shipbuilding and Dry Dock Co., Newport News, Va., received a contract for furnishing two 25,000-hp. hydraulic turbines for the Eklutna plant.

The Pacific Oerlikon Co. is a domestic representative of the Oerlikon Engineering Co., Zurich, Switzerland. The generators will be manufactured abroad and installed by an Alaskan subcontracting firm. Second low bidder was English Electric Co., Ltd., of Stafford, England.



THE LARGEST TESTING MACHINE in the U. S., left, was used by the Bureau of Reclamation for extensive tests of a 25-ft. long reinforced concrete beam at the Denver, Colo. headquarters. After hundreds of measurements the beam was stressed to failure at 229,000 lb. under two-point loading. Maximum deflection was 2 in. The Baldwin testing machine has a maximum load capacity of 5,000,000 lb., stands 49 ft. high and extends 16 ft. below floor level. It accommodates specimens up to 32 ft. high, 10 ft. wide between columns and up to 50 ft. long for flexure tests.

Diemer succeeds Hinds in So. Calif. Water District post

ROBERT B. DIEMER is now general manager and chief engineer of the Metropolitan Water District of Southern California. His appointment was by unanimous action of the District board of directors. Diemer succeeds Julian Hinds, who retired December 31.

Hinds

Diemer

Diemer has been with the Metropolitan Water District since July 1929, when he came to Los Angeles to work on the preliminary studies of the Colorado River aqueduct. He has been assistant general manager since June 1950.

From 1911 to 1926 Diemer worked on construction of canals and dams for the U. S. Reclamation Service on the North Platte and Riverton projects in Nebraska and Wyoming.

Before and during construction days on the Metropolitan aqueduct, Diemer was in charge of estimates and preliminary surveys on studies of many of the routes proposed for the aqueduct from the Colorado River to the Los Angeles area, and was finally in charge of topographic surveys and the final location of the aqueduct from Parker Dam to Lake Mathews. When construction began, Diemer was in charge of the construction of 40 mi. of tunnels in Division 4 near Indio.

Hinds was one of the first members of the engineering staff that designed and built the $200,000,000 Metropolitan aqueduct. His services started in 1929, and he was chief designing engineer prior to his appointment as general manager and chief engineer in August 1941. Hinds, a nationally known authority on design and construction of dams, has been actively engaged in the engineering profession for 42 years. He will take up residence in Santa Paula.

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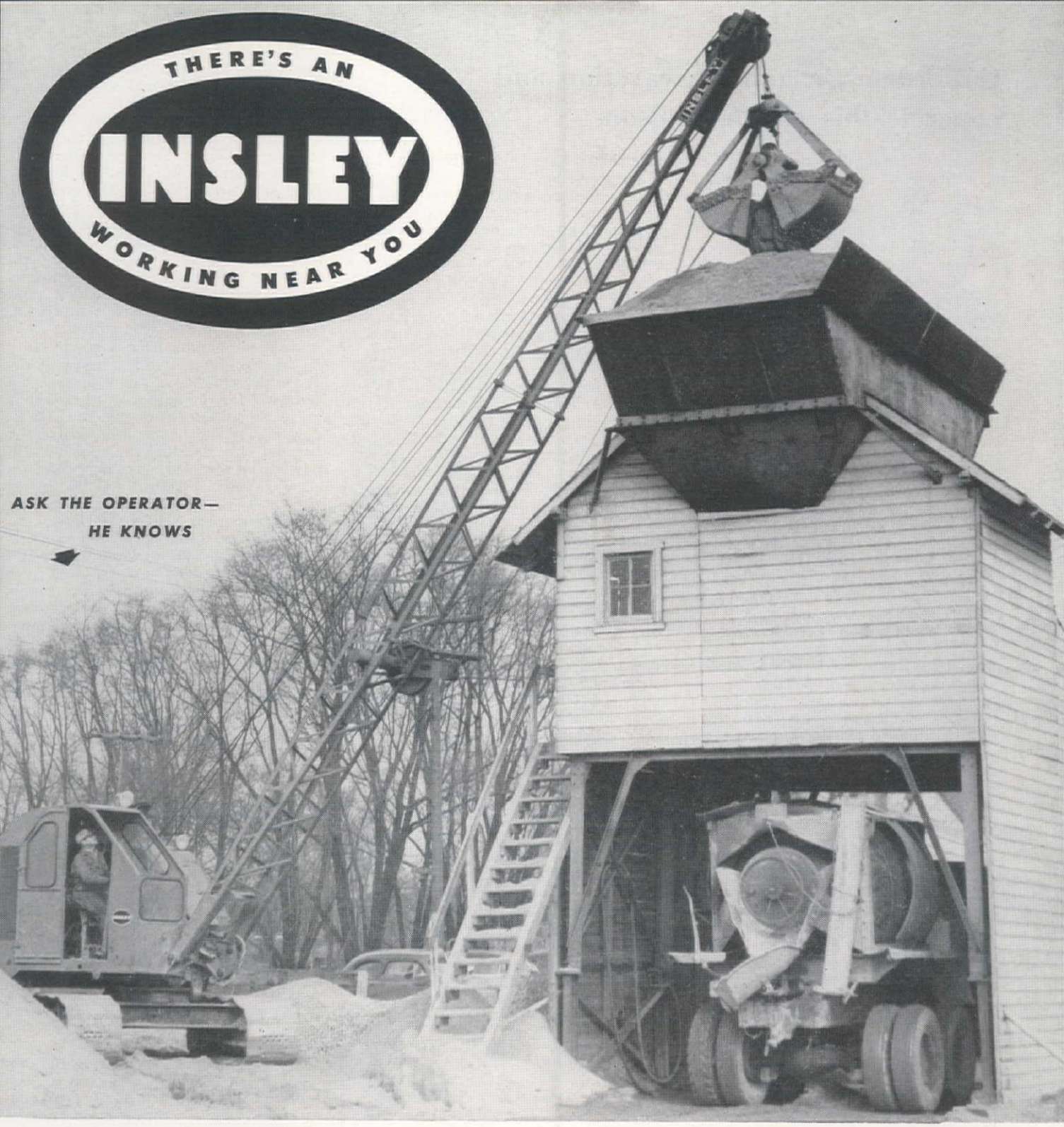

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Cofferdams, channel excavation and concrete this year at Folsom

WITH RIVER diversion and commencement of main dam construction scheduled for this spring and summer at Folsom Dam, three affective Corps of Engineers contracts are presently under way on the American River site above Folsom, California. In addition, auxiliary dam construction elsewhere in the reservoir area is continuing under Army sponsorship, while tailrace channel excavation downstream for the Bureau of Reclamation's power facilities is in abeyance during the winter and spring seasons of high river flow.

The $29,444,000 prime contract is being actively worked only in a small way, with drilling crews setting up a clamor on the left bank just downstream from the dam axis in preparation for spillway excavation. Principal efforts of Merritt-Chapman Scott Corp., and The Savin Construction Corp. are in building up the plant site, also on the left bank downstream, and in securing personnel and equipment for the big work ahead. Basically, this will include three minor dikes on the reservoir rim and the big dam itself, a combination affair having a concrete river section 1,500 ft. long flanked by wing dams of earthfill construction. The wing dams, about 6,700 ft. long on the right river bank and 2,000 ft. on the left, are well above the river level. Critical item in the 1,200-day contract schedule is the river section. Cofferdam construction, and its completion for unwatering the dam site, hinge on the weather and on progress in diversion tunnel work.

T. E. Connolly, Inc., of San Francisco, at $642,690, is working from two headings on the right bank, pushing the 1,500-ft. tunnel toward its scheduled April completion date. However, as the tunnel is limited in capacity to about 12,000 cfs., it is problematical whether river diversion can even then be effected. Above normal Sierra snowpacks indicate that the American River may have a "long spring," even if no damaging floods, and manageable flows may not occur until summer.

Cofferdams, to be built when feasible, will be of earthen construction, with concrete and rip-rap protection on the slopes. Channel excavation for these, as for the main dam, will include removal of as much as 60 ft. of river gravels, hydraulic mining debris from an earlier day in California's history. Minimum crest elevations of these cofferdams will be 237 ft. upstream, and 218 ft. downstream. It is anticipated that one season of work in the unwatered river section of the dam site will see gravel and bedrock excavation completed and concrete brought back up a total of some 90 ft. to elev. 225 ft. The resulting structure, as exposed to winter floods of 1952-53, will be a low, thick weir.

For concreting operations, the general scheme planned by Merritt-Chapman Scott and Savin begins at an aggregate source in a river bar some 3 mi. downstream. Aggregates will be trucked on existing construction roads along the right bank to a point just below the downstream cofferdam. From there a suspended belt conveyor will bridge the river, carrying the rock to a batch plant near the contractor's headquarters, high on the left bank. The batched concrete will be deposited in conventional buckets and these transported by rail car onto a trestle paralleling the dam axis and slightly downstream. This trestle, of steel construction, will be at about elev. 380 ft., 250 ft. above the dam foundation, and will gradually be encased in concrete as the dam is built. The sloping downstream face of the river section will never completely cover the trestle tracks, and pours at the dam crest will eventually be achieved at heights about 90 ft. above the tracks. Gantry cranes will handle the concrete buckets from cars to the points of pour. Design and operation of this construction scheme will be reported more fully in a future issue of *Western Construction.*

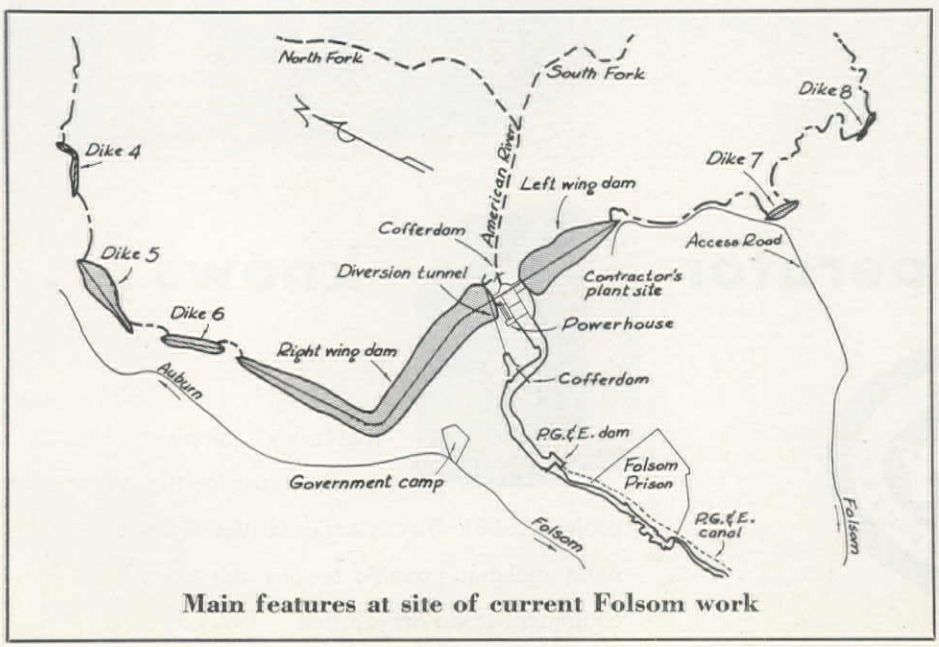
Abutment excavation for the river section has been handled under successive contracts, the final one held by H. Earl Parker Co. of Marysville at $342,737. On the right bank, satisfactory bedrock has been exposed and requires only dental excavation and cleaning. On the left, men and machines are still knocking out overburden between river level, presently about elev. 210 ft., and the specified end of the river section, some 260 ft. up the steep slope.

Tailrace channel excavation by Guy F. Atkinson Co. of San Francisco, working under a $1,463,720 contract, is at a standstill for the winter, as the river is presently spilling from the P. G. & E. power diversion dam just below the Folsom site. During the summer, all flows were diverted, enabling Atkinson crews to work practically in the dry at their task of digging out river gravels and blasting out bedrock to lower the streambed by some 30 ft. The work is necessitated by the powerhouse design which, taking advantage of a steep river gradient in this reach, calls for a tailrace elevation far below the existing river level. Therefore, a deeper channel must be cut, extending more than a mile downstream at a lesser gradient.

Around the reservoir rim, eight saddle dikes and one auxiliary dam are in various stages of construction. Dikes 1, 2, 3, 4, and 6 are finished except for rip-rap slope protection. Dikes 5, 7, and 8 will be built by the prime contractor, but at a later stage in the construction program. The auxiliary dam, under contract to a joint venture of M. H. Hasler Construction Co., and D & H Construction Co. of Santa Ana, California, for $2,194,484, is about 70% finished. Known as Mormon Island Dam, this earthen dike is 120 ft. high and a mile long; it fills a major side canyon through which the American River formerly flooded, filling this dam site also with many feet of mining debris. Construction has been hampered not only by the presence of these deposits but also by poor foundation conditions below, requiring a greater scope of work than planned.

Other than dike construction and preliminary abutment excavation, past work has included principally road construction and powerhouse excavation on the right bank. A portion of the right wing dam has been built, though not to full section, and will need repair of weather damage before being carried up to contract height. Spoil from all forms of rock excavation has been stockpiled for later incorporation in these earthen sections.

Resident engineer for the Corps of Engineers is Fred N. Geis, Jr., who came from Buggs Island Dam on the Roanoke River in Virginia. His staff includes Irvin E. Burks, field engineer for concrete construction, and Wilmer G. Clark, field engineer for earthfill construction. The principals for Merritt-Chapman Scott and Savin are D. E. Stinson, project manager, and William Shephard, construction engineer.



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Pacific Gas and Electric gains Kings River rights

THE FEDERAL Power Commission has affirmed, with certain modifications, its licensing orders of November 10, 1949, authorizing hydroelectric power developments by Pacific Gas & Electric Co., San Francisco, Calif., in the Kings River Basin of Central California.

The 1949 orders, subsequently appealed by the Secretary of the Interior on the grounds that the Bureau of Reclamation was contemplating development of the Kings River Basin, authorized (1) a license for a hydroelectric project in the Kings River Basin; (2) an amendment of P. G. & E.'s license to enlarge its existing batch plant on the North Fork of the Kings River and (3) a preliminary permit to Fresno Irrigation District for investigation of the proposed development of a power plant at the Pine Flat Dam on the North Fork of the Kings River.

Additional evidence was presented by the Secretary at a meeting in 1950. The new opinion modifies the earlier authorization by reducing the term of P. G. & E.'s new license from 50 to 30 years, and by conditioning both licenses to require P. G. & E. to reach an agreement by October 15, 1952, with local irrigation interests providing for the use for power purposes of the waters involved.

Further consideration can be given at the time the present licenses expire.

AEC produces electric power from atomic heat

A RECENT experiment concerning the generation of electrical power by the Atomic Energy Commission has proved successful.

Small amounts of electric power have been produced from heat energy released in the operation of the experimental breeder reactor, recently completed at the National Reactor Testing Station in Idaho.

In the trial run electrical power of more than 100 kw. was generated and used to operate the pumps and other reactor equipment and to provide light and electrical facilities for the building that houses it. Test operations are scheduled to continue after further adjustments of the reactor system. The heat energy generated was removed from the reactor by a liquid metal at a temperature high enough to generate steam to drive the turbine.

The principal function of the breeder reactor is the long range goal of converting nonfissionable material into fissionable material more rapidly than nuclear fuel is consumed, a process that would contribute to the expansion of the current atomic weapons program. Spokesmen stated that the cost of this test should not be compared to the cost of producing electricity the conventional way, since this test was not connected with the feasibility of producing electricity by this method. Results of the test may aid in the design of future reactors which could be competitive.

Two 80′ Digester Tanks UNI-FORMED with... *Accuracy Speed Economy!*

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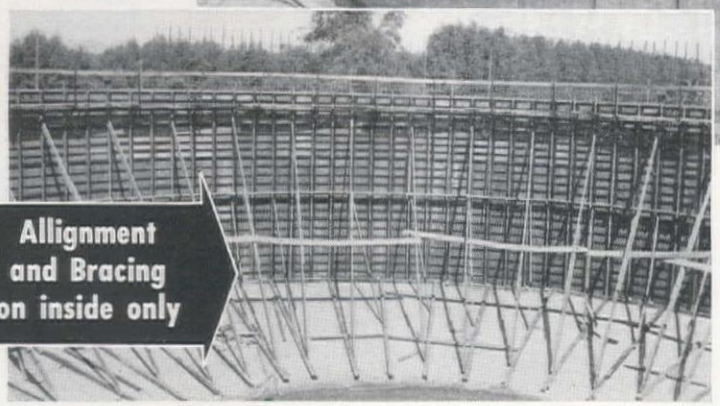
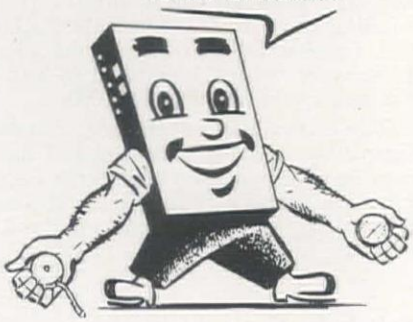
M. M. Sundt Construction Co.,
Contractors



Only UNI-FORMS Provide 3-Way Savings . . . Time . . . Labor . . . Materials



THE JOB: Form and pour two 80′ digester tanks. Walls vary from 15 to 21 inches, are 32 feet high. Tolerance ½". Forms must check within ¼" of true round. Concrete to be high density, watertight consistency with a smooth face.

THE PROBLEM: Maintain required tolerances. Form and hold two pours—18 and 14 ft. high. Obtain maximum speed and economy in entire forming and pouring operation.

THE RESULT: UNI-FORMS were used to form the job. In spite of the high lift and accuracy required, alignment and bracing was necessary on 1 side only. Accuracy was maintained throughout. Erection of panels was fast—5 men erected 4500 sq. ft. of first lift in 20 hours. Finished concrete surface met specifications for smoothness. Contractor expects to finish job several months ahead of schedule. Congratulations to M. M. SUNDT CONSTRUCTION CO. for a job well done!

Universal FORM CLAMP CO.
Concrete Form Specialists Since 1912

General Offices and Factory • 1236-38 NORTH KOSTNER • CHICAGO 51, ILLINOIS • CAPITOL 7-1600

West Coast Branch and Warehouse:
2051-59 Williams Street, San Leandro (San Francisco), Calif.
***Phone:* Lockhaven 2-2051, Enterprise 1-0132**

Engineers' Northwest bid schedule — $100,000,000

MAJOR CIVIL construction work and supply items estimated to cost approximately $100,000,000 will be placed under contract from December through June 1952 by the various districts of the Corps of Engineers in the North Pacific Division area, covering the entire Northwest, Brigadier General O. E. Walsh, North Pacific Division Engineer, announces.

Proposed advertising dates for bids on major new work totaling that amount for the remainder of the fiscal year, ending June 30, 1952, were disclosed in a Division information folder which will be made available to all interested contractors.

Supply and construction contracts ranging from $100,000 to $10,000,000 and over in the Portland, Seattle, and Walla Walla Districts of the Division area are included in a table of proposed new construction work and supply contracts. Many smaller projects costing less than $100,000 are not included in the construction prospectus.

Prepared for the convenience of contractors doing business with the government, the prospectus includes proposed bid advertising date, bid opening date, location of work, estimated cost range, and a brief description of work to be done. The information is classified by districts.

General Walsh said the information folder is designed to assist contractors in planning advance work. In the event certain projects are of interest, they can explore details of the proposed work well in advance, with the result that both contractors and government should benefit.

The prospectus includes building construction, rail, highway and bridge construction, miscellaneous work in connection with dams, levee construction, various machinery and heavy equipment items, channel improvements, excavation, and clearing work.

New construction at Chief Joseph Dam on the Columbia River in Washington, estimated to cost approximately $52,000,000, accounts for a large portion of the total figure. Eight jobs, the largest being for the power and intake structure which will cost between $40,000,000 and $50,000,000, are scheduled by the Seattle District. Bids will be opened for the power and intake structure March 12.

Five jobs aggregating about $12,000,000 will be advertised in connection with Albeni Falls Dam on the Pend Oreille River in Idaho by the Seattle District. Largest is for intake and powerhouse construction, bids for which will be opened March 4.

Two contracts, together estimated to cost approximately $9,000,000, are scheduled by the Portland District in connection with start of construction on The Dalles Dam on the Columbia River between Oregon and Washington. One is for procurement of steel sheet piling and the other for the powerhouse excavation and cofferdam. The excavation for powerhouse and cofferdam bids were opened January 22.

The Walla Walla District will take bids on five jobs costing about $7,000,000 for Lucky Peak Dam on the Boise River in Idaho. Largest, slated for bid opening May 15, is for completion of outlet works, intake tower, penstocks, manifold, intake bridge, and spillway concrete.

The Walla Walla District will call for bids on eleven jobs in connection with McNary Dam on the Columbia River, totaling in cost approximately $12,000,000. Largest job is construction of the Kennewick levees, estimated to cost in the neighborhood of $4,000,000.

The civil works advertising schedule, listing the various jobs and bid dates, may be obtained from the North Pacific Division office of the Corps of Engineers, 500 Pittock Block, Portland 5, Oregon.

Salt Lake Corps of Engineers moves offices to Ft. Douglas

THE SALT LAKE CITY, Utah, office of the Corps of Engineers has been moved from the fifth floor of the Pacific National Life Building to Building 97 at Ft. Douglas. The office's 50 employees and miscellaneous equipment were installed in the new headquarters, and were open for business-as-usual December 31.

Announcement of the move was made by Colonel H. S. Gould, area engineer for the Corps of Engineers.

Duchesne Tunnel holed through

CLEANING UP operations are under way after holing-through of the Duchesne water diversion tunnel in Kamas, Utah, part of the Provo Project. Before concrete can be applied to the project a batching plant must be erected at the west portal, tracks must be raised to permit cleaning of the floor to the proper lining level and air lines must be removed.

The complete lining of the tunnel will make operation and maintenance much easier when Colorado River water begins draining into the Salt Lake Valley of the Great Basin.

Although completion is not scheduled until February 1953 the contractor, Grafe-Callahan and Rhoades Bros. and Shofner, plans to rush concreting operations to completion before cold weather sets in next fall. Diversion of water to the Provo River project will have to be done during high-runoff periods in the late winter.

CALENDAR OF MEETINGS

February 6-8—California Conference on Street and Highway Problems, fourth annual conference sponsored by the Institute of Transportation and Traffic Engineering, University of California. To be held on the Los Angeles campus of the University of California.

February 13-15 — Fifth Northwest Conference on Roadbuilding, More Hall, University of Washington campus.

February 25-28—Associated General Contractors, Annual Convention, Statler Hotel, Detroit, Mich.

February 27, 28—American Concrete Pressure Pipe Association, annual convention and meeting, at Drake Hotel, Chicago, Ill.

February 28, 29, March 1—American Concrete Pipe Association annual convention, at Drake Hotel, Chicago, Ill.

March 3-5—American Concrete Agricultural Pipe Association annual convention and meeting, at The Brown Palace Hotel, Denver.

March 3-7 — American Society of Civil Engineers, Winter Meeting, St. Charles Hotel, New Orleans, La.

June 5-7 — Western Association of State Highway Officials, Annual Meeting, Olympic Hotel, Seattle, Wash.

June 16-21 — American Society of Civil Engineers, Denver Convention, Cosmopolitan Hotel, Denver, Colo.

September 3-13—American Society of Civil Engineers, Centennial Celebration, Conrad Hilton Hotel, Chicago, Ill.

ENGINEERS ON THE MOVE

Dreyer

Walter Dreyer is the new vice president and chief engineer of Pacific Gas & Electric Co. Dreyer, who has been with the firm for almost thirty-six years, replaces **I. C. Steele,** who retires after forty-two years of service.

* * *

Alex Sonnichsen, formerly assistant city engineer in Walla Walla, Wash., is now city engineer, building inspector and an assistant sewer superintendent for Auburn, Wash. Sonnichsen replaces **Earl Forbes,** who held the appointment temporarily after the resignation of **L. C. Stanley.**

* * *

Wade H. Taylor, regional power manager for the Bureau of Reclamation's hydroelectric power system in the lower Colorado River basin, receives a Fellowship in the American Institute of Electrical Engineers. The award is based on Taylor's outstanding administrative and technical work in connection with hydroelectric installations at Hoover, Davis, and Parker dams and their related transmission systems.

* * *

The development of a simplified filing system for cross-referencing complicated contract specifications at Hungry Horse Dam, has won a $100 Department of Interior incentive award for **Harrison M. Tice,** materials engineer at the big Bureau of Reclamation dam. The system makes a set of specifications as easy to use as a dictionary, and this provides a saving of several thousand dollars annually. The system will perhaps be adopted at other Bureau projects.

* * *

P. John MacNaughton has opened an office as consulting engineer, specializing in structural design and construction costs, in Phoenix, Ariz.

* * *

Roland F. Kaser, hydrologist with the Bureau of Reclamation's Region 3 office since May 1946, left in January for Beirut, Lebanon, where he will serve a year as chief hydrologist on a 21-man mission from this country which will engage in preconstruction activities connected with irrigation and power potentialities on Litani River.

* * *

Dr. George A. Kiersch, geological engineer, has joined the faculty of the University of Arizona as assistant professor of geology to teach courses in Structural Geology and the growing field of "Geology Applied to Engineering Practice." Kiersch recently resigned as supervising geologist for the International Boundary and Water Commission's "Upper Dams" investigation along the Rio Grande, and earlier was project geologist for the Folsom Dam and Reservoir Project, Calif., as well as serving on several economic and engineering geology surveys in the Western states. In addition to teaching, he is conducting a limited consulting practice in geological engineering.

* * *

The post of Power Engineer in the Division of Construction and Supply of the U. S. Atomic Energy Commission goes to **Guy W. Thaxton.** He was formerly regional power supply coordinator of the Defense Electric Power Administration.

* * *

K. D. Lytle leaves his post as division state engineer at Roseburg, Ore., to assume new duties as assistant construction engineer at Salem. Lytle will help in the direction of stepped-up highway construction made possible by recent legislative bonds. **Tom Edwards,** assistant division engineer of Roseburg, will assume Lytle's former duties, and **F. B. Morgan** replaces Edwards.

* * *

Sparling

G. E. Sparling, former design engineer for F. N. Holmquist, Phoenix, Ariz., is now operating independently as a consulting engineer at 2923 E. McDowell Rd., Phoenix. Sparling is presently working on the Litchfield Naval Air Facilities project on which Gunther-Shirley-Trepte, Contractors, have the prime contract.

* * *

Warren L. Hanby is the new president of the San Gabriel Valley, Calif., Building Contractors Association.

* * *

J. J. Polivka, consulting engineer, Berkeley, Calif., and lecturer at Stanford University, received an honorary award from the French Legion of Honor as Officer of the Knighthood of Etoile Noire. Polivka received the award from the President of France for outstanding achievements in the field of structural engineering. Polivka and Frank Lloyd Wright recently submitted a design for the second crossing of the San Francisco Bay. Simplicity of design coupled with a new type of precast and prestressed concrete construction, which the two men call the butterfly wing bridge, make the proposed structure light in weight and economical. Polivka has worked with Wright on many famous projects.

* * *

Ralph E. DeSimone is the new president of Merritt-Chapman & Scott Corp., New York, N. Y. De Simone has been with the eastern firm since 1916. Westerners know the corporation as the prime contractor for the construction of Folsom Dam in California.

* * *

A Certificate of Life Membership in the American Society of Civil Engineers was presented to **Thomas E. Stanton,** who recently retired as materials and research engineer for the California Division of Highways (*Western Construction,* September 1951, p. 113). The certificate was presented at ceremonies during the Sacramento Section's meeting of December 4.

* * *

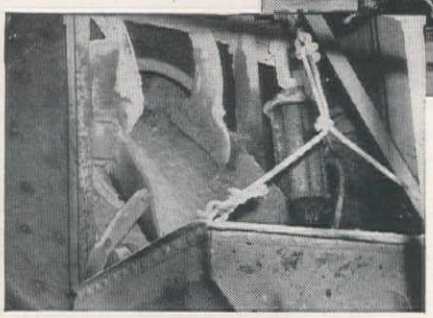
John C. Maguire, Canyon Ferry Dam contractor (left), receives a civic merit award from Lester Loble, Fraternal Order of Eagles, Helena, Mont., during recent ceremonies.

* * *

Major organizational changes in the Los Angeles, Calif., Department of Water and Power resulted in the appointment of **Charles P. Garman** as assistant general manager and chief engineer. Garman has been with the department for 31 years. **William S. Peterson** will fill the position left vacant by Garman's promotion. Peterson will be chief electrical engineer and assistant manager. A new position of assistant manager goes to **George C. Sopp.** The temporary position of assistant controller and chief accountant was given to **Ernest F. Dandridge.** All the other posts are exempt from civil service but a test will be required for Dandridge. The Design and Construction Division announced the following changes: **Arthur L. Williams** becomes administrative assistant to **James D. Laughlin,** division head; **Edward L. Kanouse** becomes engineer of distribution and transmission design, succeeding Williams, and **Ennis G. Olmsted** will succeed Kanouse as engineer of transmission and design research.

17 Years Young and 3,100,000 Cubic Yards to show for it!

126-S Worthington-Ransome Big Mixer at Arundel-Brooks Concrete Corporation's Wolf Street plant, Baltimore, shows hardly any sign of wear after having poured 3,100,000 cu yd in its 17 years.



Worthington-Ransome 126-S discharging full 5 cu yd batch in approximately 30 seconds.

One of Arundel-Brooks' 6⅛ cu yd agitators pouring a retaining wall at General Sam Smith Park, being built to relieve traffic congestion at Light and Pratt Streets, Baltimore.

In 1950—its 17th year—this veteran concrete mixer poured more than 250,000 cu yds on a single set of liners!

This extraordinary performance of a 126-S Worthington-Ransome Blue Brute concrete mixer is attested to by Arundel-Brooks' records. The machine, given proper maintenance over its lifetime, shows virtually no wear after uncounted hours of profitable service.

Arundel-Brooks operates two other Worthington-Ransome Big Mixers—an 84-S at the Sparrow's Point plant, a 56-S at Brooklyn, Md.

And eight of the company's growing fleet of truck-mounted agitators are Worthington-Ransome Blue Brute Hi-Ups, considered "highly satisfactory in every respect."

These eight are used for most long-distance hauls because their light weight* permits carrying a maximum payload with strict adherence to highway load limits.

FIND OUT WHY THERE'S MORE WORTH IN WORTHINGTON

See your nearby Worthington-Ransome distributor. Worthington Pump and Machinery Corporation, Construction Equipment Sales Division, Dunellen, N. J.

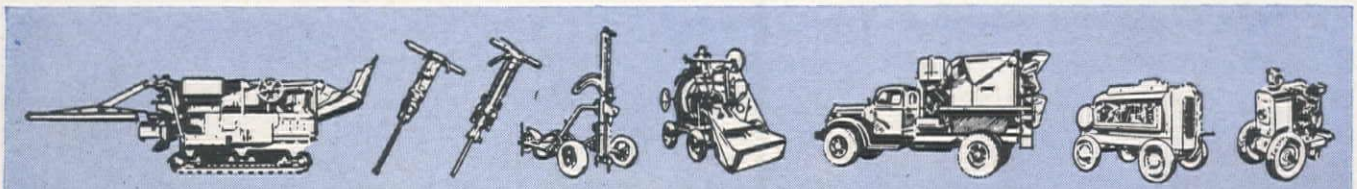
**7,290 lb for the standard 4½ cu yd truck mixer, as little as 6,700 lb for 6⅛ cu yd agitator models.*

WORTHINGTON

BUY BLUE BRUTES

You'll find you, too, can get the real *performance plus* from Worthington and Worthington-Ransome Blue Brutes—a broad line of construction equipment noted for the rugged quality your type of work demands.

R-1-1



IF IT'S A CONSTRUCTION JOB, IT'S A BLUE BRUTE JOB

DEATHS

George H. Dienst, 69, structural engineer and architect for the Colorado State Highway Department, died October 21 in Denver, Colo.

* * *

George Woodman, 76, president of the Woodman Bros. Construction Co., died October 24 in Denver, Colo.

* * *

Eric Ryberg, 67, owner of the Ryberg Bros. Construction Co. and other Utah enterprises, died September 30 in Salt Lake City, Utah. Ryberg's construction company is well-known in northern Utah and southern Idaho. He was also owner of the Utah Sand and Gravel Products Co.

* * *

John B. Sanks, until recently city engineer at LaHabra, Calif., died recently at the age of 61.

* * *

James B. Wallace, 80, contractor and builder, died December 30 in Denver, Colo., after a long illness.

* * *

E. C. Gwillim, 63, city and county engineer of Sheridan, Wyo., from 1919 to 1934, died December 31 of a heart attack. Gwillim had in the past served as irrigation engineer for the Department of Agriculture in the Pacific Northwest.

* * *

Howard S. Reed, 83, prominent Arizona engineer, died November 12 from a heart attack. Reed was at one time chief engineer on the Salt River Valley Irrigation Project. He served during the 1920's as city engineer of Phoenix and later as state director of public works. In 1937, Reed became state engineer of Arizona.

* * *

John A. Casson, 58, Nevada and California contractor, died in Reno, Nevada. Casson, in conjunction with N. M. Ball and Sons, constructed the Reno and Tonopah Air Force bases.

* * *

Wallace H. Puckett, 68, senior vice president of Morrison-Knudsen Co., Inc., died December 16 in Portland, Ore., of a heart attack. Puckett directed many major projects for the construction and engineering firm.

* * *

Helmuth C. Gardett, 73, retired chief electrical engineer, Los Angeles Department of Water and Power, died December 25 in Los Angeles. Gardett directed many of the department's major construction projects, including the Hoover transmission line.

* * *

Lansing W. Althof, 65, Union Pacific Railroad district engineer, died December 11 in Portland, Ore., of a heart ailment. Althof had been with the railroad since 1911.

* * *

Daniel Flamm Knapp, 59, Elko, Nev., builder, died in his home December 12 after a long ilness.

* * *

Earl Free, 60, engineer, died December 13 in Salt Lake City.

* * *

Elijah Thompson, 72, prominent Utah contractor, died November 29 in a Salt Lake City, Utah, hospital.

* * *

Fay B. Eckman, 43, associate engineer, University of California at Los Angeles, office of architects and engineers, died December 13 in Los Angeles.

* * *

William D. Bear, 65, retired construction superintendent, Los Angeles City Department of Water and Power, died December 9 in Los Angeles.

* * *

Fred Akins, 67, Montana state water board engineer, died December 24 in Helena, Mont.

* * *

Mathias Pedersen, 59, construction superintendent for Newstrom-Davis & Co., died November 26, in Denver, Colo.

* * *

Eric Flodine, 64, building contractor, died late in November in Los Angeles.

ELECTIONS, 1952

Northern California Chapter, AGC—Officers for 1952 are: Harold O. Parish, president; Dallas Young, vice president, and B. G. Modglin, treasurer.

Parish

Greene

Tacoma Chapter, ASCE—Officers for 1952 are: Roy L. Greene, president; Arthur M. Buell, vice president; George H. Andrews, secretary-treasurer, and W. T. Robertson, H. J. Whitacre and C. C. McDonald, directors.

Intermountain Section, ASCE—Officers for 1952 are: Robert L. Sanks, president; Jerald E. Christiansen, vice president; F. Marion Warnick, vice president, and Clyde D. Gessel, secretary-treasurer.

Sanks

Anderson

Los Angeles Section, ASCE—Officers for 1952 are: Roy L. Anderson, president; John Q. Jewett, vice president; George E. Brandow, vice president; John C. Merrell, Jr., treasurer, and L. LeRoy Crandall, secretary.

San Francisco Bay Area Junior Forum, ASCE—Officers for 1952 are: Louis Riggs, president; Richard Clark, vice president; James Wilson, vice president; Weston Follett, secretary and Bill Blair, treasurer.

National Reclamation Association—Officers for 1952 are: C. Petrus Peterson, president; Charles L. Kaupke, vice president; Earl T. Bower, vice president; H. L. Buck, treasurer, and Fred E. Wilson and L. E. Coles, executive committee members.

British Columbia General Contractors Association—Officers for 1952 are: J. E. Amundson, president; R. A. Hall, vice president; A. J. Hutchinson, vice president.

SUPERVISING THE JOBS

C. E. Jones is superintendent for R. E. McKee, Inc., on the $4,500,000 construction of a medical building on the Los Angeles campus of the University of California. **B. E. Kunkle** and **John A. Del Pozo** are foremen along with **Jimmy Gatewood. Frank Anding, Warren Ruegg, F. E. Wellin** and **George Fordham** are engineers. On the sub-contract for reinforcing steel **Al Simmons** is superintendent for Anthony C. Meehleis. **Ed Lyon** is superintendent for Abbott Electric Co. on the electrical work.

* * *

Construction of the Kaiser Permanente Hospital at Hollywood Blvd. and Edgemont Ave., Hollywood, Calif., is being supervised by **W. H. Murphy. Gordon Watson, Jim Neubauer** and **George Paul** are foremen. **John Rice** is office manager and **Art Fletcher** is job engineer. **"Blackie" Standard** is another key man with C. L. Peck, contractor. The job is scheduled for completion November 1952.

* * *

The $1,634,000 construction on the Hollywood Freeway in Hollywood, Calif., is being supervised by **Jim Wilson** for Winston Bros. **Charles H. Wicks** is excavation superintendent, **Al Nemitz** is general carpenter foreman and **Harold S. Tuggle** is master mechanic. **Frank Schwarzkepf, A. J. Wright** and **G. C. Yerke** are carpenter foremen. **A. W. Masson** is batch plant foreman and **Leo Peterson** is in charge of cement finishing. **Roe Wilson** is labor foreman and **Elmo Peterson** is grade foreman. **Peter J. Schawark** is office manager and **C. J. Woodbridge** is resident engineer for the State Division of Highways.

* * *

Charles Chamberlin is general superintendent for Guy F. Atkinson Co. on the $3,500,000 highway and railroad relocation project in Oakridge, Ore. **E. L. Ford** is master mechanic and **A. H. Steiner** is project manager on the Corps of Engineers project.

* * *

J. C. (Dinty) Moore is general superintendent for Atkinson-Ostrander, joint venturers, on completion of the $6,600,000 Rock Island Dam near Wenatchee, Wash. **C. R. (Red) Petrie** is rigging superintendent, **Ed Huebotter** is reinforcing steel superintendent, **Gordon Chrudimsky** is fishways superintendent and **Frank Loesch** is plant superintendent. **Milt Wells** is general foreman. **Aubrey Horn, K. H. Center, John Doxey, Ken Dye** and **A. Harrington** are members of the engineering staff. **John A. Kier** is project manager and **Vernon Bradley** is job superintendent. **Norman Johnson** is master mechanic.

* * *

Construction of a warehouse and office in Eugene, Ore., is under the supervision of **A. B. Bower** with **A. F. Heistand** as his assistant. **Elmer Korte** is carpenter foreman and **Lester Brown** is labor foreman. E. E. Settergren holds the $200,000 Eugene Electric and Water Board contract.

* * *

Arthur Smith is job superintendent for Gunther & Shirley on the $3,040,415 construction of an aircraft maintenance hangar at Miramar, Calif. **Carl Oppenheimer** is carpenter superintendent, **John Ivy** is steel superintendent and **Bud Hotaling** is master mechanic.

* * *

Larry Ashworth is superintendent for J. R. Armstrong on grading and surfacing 3.6 mi. of highway south of Danville and Concord in Contra Costa County, Calif. **W. N. Stanley** is assistant superintendent and **William Armstrong** is project manager on the $321,818 project.

* * *

S. W. Blakeley is superintendent on the construction of the $200,000 Bekins Van & Storage Co. warehouse in Phoenix, Ariz. **A. F. Isban** is carpenter foreman, **Charlie Cameron** is labor foreman and **Harris Tackett** is steel foreman on the job. **George Vaughn** is project manager.

* * *

Charles McClure is superintendent for Ashton Building Co. on construction of the business and administration building at the University of Arizona, Tucson. **Bill Thompson** is carpenter foreman, **Edgar E. Truman** is labor foreman and **Al Beesemeyer** is office manager.

* * *

R. F. Reed is general superintendent for Gibbons & Reed Co. on 9.4 mi. of road-mix bituminous surfacing on State Route 48, Midvale-Copperton, Salt Lake County, Utah. **Lee Boyner** is job superintendent on the $294,565 project.

* * *

Railroad relocation at Davis-Monthan Air Base in Tucson, Ariz., is being supervised by **Bill Harrison** for San Xavier Rock Co. **Edward O. Earl** is superintendent of all operations and project manager. **W. H. Barrett** is concrete superintendent.

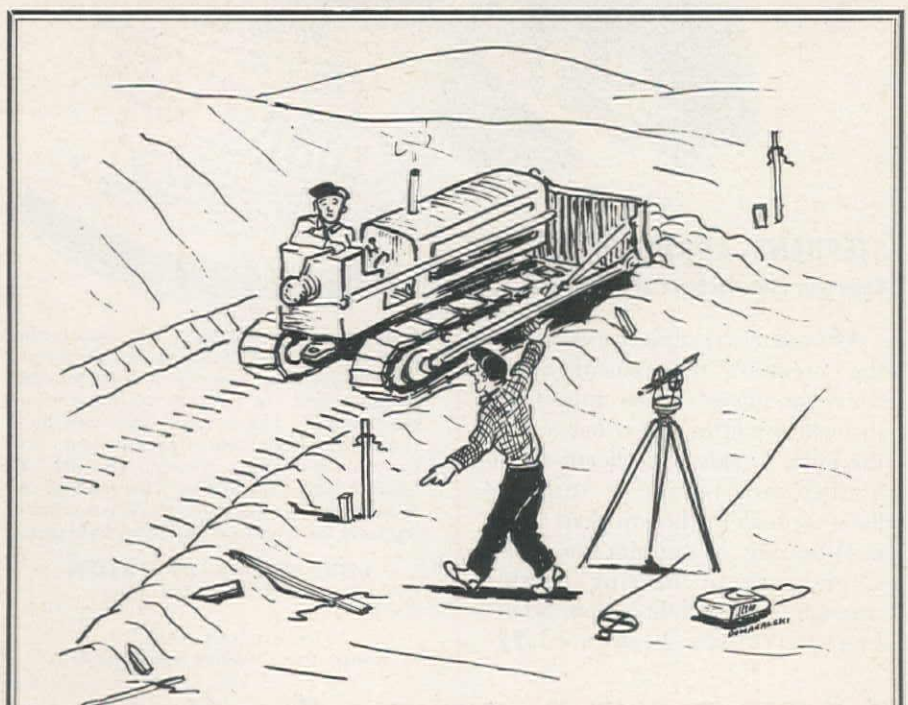
* * *

J. Symons is job superintendent for Morrison-Knudsen Co., Inc., on the improvement of Third Ave. in Ketchikan, Alaska. **H. Hines** is office manager on the $124,712 project.

* * *

Construction of the $884,000 Marion St. Bridge in Salem, Ore., is under the supervision of **G. A. Baty** for General Construction Co. **S. B. Greseth** and **C. J. Weigel** are carpenter foremen, **Al Nearhood** is concrete foreman and **Whitey Caswell** is labor foreman. **Bruce Watt** is in charge of pile driving. The project

Down-time Dopes. . . . . by Domagalski



Go ahead! I'll kick this one over

Drawn especially for Western Construction

began January 1, 1951, and is delayed because of steel shortages.

* * *

Dan Keeler is general superintendent for A. J. Gilbert, contractor, on a secondary highway job near Gila Bend, Ariz. This is a $57,000 project.

* * *

Construction of the new St. Josephs Hospital in Phoenix, Ariz., by Del Webb Construction Co. is under the supervision of **Fred McDowell. Willard Davison** is carpenter foreman; **O. L. Jones,** labor foreman, and **M. T. Riggs,** office manager. **T. L. Rittenhouse** is the engineer. The same firm has **E. G. McIntosh** as general superintendent on the $3,500,000 construction of the new J. C. Penney Co. store in Phoenix. **Clint Smith** is carpenter foreman, **Dick Coley** is labor foreman, and **Tony Kohl** is office manager. **John Evans** and **Dave Saunders** are engineers.

* * *

Harry McCloy is general superintendent for Louis Dunn, Inc., on the construction of two warehouses for the Corps of Engineers at Tracy Annex, Calif. **Abe Bargaehr** and **Andy Bargaehr** are foremen. **Dick Houston** is office manager. **Robert Rathbone** and **Jim Robinson** are engineers on the $2,500,000 project.

* * *

Grading, pipe and sub-base work at the Naval Auxiliary Air Station, El Centro, Calif., is under the supervision of **James Briggs** with **W. S. Kimble** as his assistant. The job began in October 1951 and is scheduled for completion early this year. **John Delphia** holds the subcontract on this work from R. A. Westbrook and Morrison-Knudsen Co., Inc.

* * *

Cleo Latimer is superintendent for McDonald Bros. on the $1,300,000 construction of nine buildings at Oxnard Air Force Base, Oxnard, Calif. **George Underdown** is project manager.

* * *

C. E. Kasler is superintendent for Fredericksen & Kasler on the $600,000 construction of runway extensions at the Oxnard Air Force Base, Oxnard, Calif. **Bill Loy** is grade foreman and **Frank C. Gutierrez** is pipe foreman. **F. H. McBee** is office manager and **George Shaffer** is field engineer.

* * *

Sewer line construction at 9th and Ferguson Sts., Tucson, Ariz., has **Jim Harris** as project manager and **Gus Morens** as foreman. Pioneer Construction Co. has the City of Tucson contract.

* * *

Railroad relocation in Tucson, Ariz., for the Southern Pacific Co. is under the supervision of **Bill Harrison.** Del Webb and Sam Xavier, joint venturers, hold the $835,000 contract.

* * *

T. G. K. Construction Co. has three jobs under way in Phoenix, Ariz. **Ben Greenwood** is superintendent on construction of the Terminal building at the Phoenix Airport. **Marion Hall** is superintendent and **M. A. Stich** is foreman for the firm on construction of a National Guard hangar building at the airport. **Tom Jordan** is supervising construction of the new Public Library building.

* * *

The construction of bridge approaches on Pacific Ave. in Stockton, Calif., is under the supervision of **Ralph Wigle** for Claude C. Wood Co., contractor. **Doug Nelson** is resident engineer on the $160,000 project.

* * *

General construction on the administration building of the Tracy, Calif., pumping plant by Merle C. Baldwin Company is being supervised by **Merle C. Baldwin** with **Merle C. Baldwin, Jr.,** as his assistant. This is a $115,000 Bureau of Reclamation project.

* * *

Charley Bidwell is general superintendent for Trewhitt-Shields and Fisher on sewage disposal plant construction for the Vocational School in Tracy, Calif. **Andy Graham** is project manager.

* * *

Rusty Maynes is superintendent for J. A. Thompson & Son on 2 mi. of construction along Imperial Highway in El Segundo, Calif. **Henry Clayton** is carpenter foreman and **Ralph Willis** is grade foreman. The job is one-half complete.

CONTRACTS

A summary of bids and awards for major projects in the West

★★★

Alaska

$582,158—**S. Birch & Sons,** 208 Central Bldg., Seattle, Wash., and **C. F. Lytle Co. & Green Construction Co.,** 312 Masonic Temple Bldg., Des Moines, Iowa—Low bid for construction of outside utilities at Elmendorf Air Force Base; by C. of E.

$2,108,000—**Denali Construction Co.,** Anchorage—Low bid for automotive maintenance facility at Elmendorf Air Force Base; by C. of E.

$493,700—**Island Homes, Inc.,** and **Nelse Mortensen & Co., Inc.,** 1021 Westlake No., Seattle—Low bid for sewer system and treatment plant construction at Bentley Island, Fairbanks. Work also includes grading and paving and miscellaneous street work; by Alaska Public Works.

$5,248,000—**Puget Sound Bridge & Dredging Co.,** and **Johnson Drake & Piper,** 2929 16th Ave. SW., Seattle—Low bid for construction of direction-finder and transmitter facilities and related work at Kodiak Naval Base; by 17th USN Dist.

$2,128,000—**Valle-Sommers Construction Co.,** Box 4096, Interbay Station, Seattle—Low bid on construction of a converted 500-man barracks for Elmendorf Air Force Base; by C. of E.

Arizona

$119,707—**San Xavier Rock and Sand Co.,** P. O. Box 1031, Tucson—Low bid for 10.5 mi. of resurfacing existing highway with select material aggregate base and bituminous surface treatment, northeast of Douglas on the Douglas-Rodeo highway; by State Highway Department.

California

$1,783,588—**The George W. Carter Co.,** 1721 W. Olympic Blvd., Los Angeles—Low bid for construction of supply and public works buildings at Naval Air Missile Test Station, Point Mugu; by Public Works Office, Point Mugu.

$292,000—**Claude Fisher Co., Ltd.,** 2455 E. 55th St., Los Angeles—Award for clearing and preliminary grading of the 200-ac. Fort Funston Veterans Administration Hospital site, San Francisco; by Veterans Administration.

$2,307,503—**Griffith Company,** 1060 S. Broadway, Los Angeles—Low bid for 1.7 mi. of grading, and paving with portland cement concrete on cement treated subgrade, and with plant-mix surfacing on imported base material. Six bridges to be constructed to provide a 6-lane divided highway with frontage roads, on Ramona Freeway, between 1 mi. east of Jackson Ave. and Rosemead Blvd., Los Angeles County; by State Division of Highways.

$1,196,114—**E. A. Hathaway & Co., Inc.,** 1098 Fifth Ave., San Jose—Award for general construction of Manor School, Palo Alto; by Ravenswood Elementary School District.

$136,260—**Edward Keeble,** Rt. 4, Box 64, San Jose—Low bid, 0.5 mi. of grading between south city limits of San Francisco and 0.6 mi. south, San Mateo County; by State Division of Highways.

$508,656—**R. M. Price Co.,** 2285 Pine Crest Dr., Altadena—Low bid for construction of two reinforced concrete bridges on Los Angeles River Freeway across Del Amo Blvd., and across Compton Creek, about 0.2 mi. west of city limits of Long Beach. Approach embankments for bridge across Compton Creek to be graded; by State Division of Highways.

$310,780—**A. Teichert & Son, Inc.,** 1846 37th St., Sacramento—Low bid for 2.1 mi. of grading and surfacing with road-mix surfacing on untreated rock base north of Secrete Valley; by State Division of Highways.

$412,863—**C. B. Tuttle Co.,** 268 Belmont Ave., Long Beach—Low bid for construction of three reinforced concrete bridges, and one existing bridge to be widened and roadways to be graded and paved with plant-mix surfacing on cement treated base. Location is in San Luis Obispo, between Marsh St. and Morro St., San Luis Obispo County; by State Division of Highways.

$1,370,545—**Webb & White,** 7220½ Melrose Ave., Los Angeles—Low bid for 0.7 mi. of grading and surfacing with portland cement concrete on cement treated base on Hollywood Freeway, between Hollywood Blvd. and Western Ave., Los Angeles County; by State Division of Highways.

$6,754,445—**Western Area Housing Co.,** 1020 Ninth Ave., San Diego—Award for construction, management and financing of 895 housing units at Kearsey Mesa, San Diego; by Public Works Officer, 11th Naval District.

$130,773—**E. C. Young,** 14934 Cobalt, San Fernando—Low bid for 4 mi. of grading and bituminous surfacing treatment application between 0.4 and 6.1 mi. east of Julian, San Diego County; by State Division of Highways.

Colorado

$363,000—**Lowdermilk Bros.,** Box 4150, Denver—Low bid for 1.2 mi. of work on the Boulder-Idaho Springs Route. Work consists of grading, 30 ft. in width, and a tunnel 26 ft. in width in Boulder County, Roosevelt National Forest; by BPR.

Idaho

$353,053—**Hoops Construction Co.,** Box 431, Twin Falls—Low bid for 3.9 mi. of roadway construction and bituminous surface treatment on the Northside Highway from Wendell, Gooding County; by State Department of Highways.

$366,940—**Morrison-Knudsen Co., Inc.,** 319 Broadway, Boise—Low bid for spillway rehabilitation, Black Canyon Dam, Boise Project; by USBR.

$105,130—**Western Construction Co.,** Box 628, Pocatello—Award for 2.6 mi. of roadway construction, a roadmix bituminous surfacing on the Robin West Rd., and 4.6 mi. of the same work on the McCammon Robin Road to Arimo in Bannock County; by State Department of Highways.

Montana

$199,767—**Albert Lalonde Co.,** Sidney—Award for 6.4 mi. of grading, gravel surfacing, road-mix oil on the Big Sandy-South Highway in Chouteau County; by State Highway Commission.

$395,549—**Riedesel Construction Co.,** 2325 9th Ave. No., Billings—Award for 0.3 mi. of grading, gravel and sand surfacing, plant-mix oil and portland cement concrete paving and construction of a steel and concrete underpass, Billings-East and First Ave. So., and approaches; by State Highway Commission.

$201,446—**R. J. Sundling Construction Co.,** Livingston—Award for 6.0 mi. of grading, gravel surfacing with road-mix oil treatment on the Red Lodge-Columbus Highway in Carbon County; by State Highway Commission.

New Mexico

$382,789—**Jack Adams,** P. O. Box 610, Los Alamos—Award for 3.1 mi. of construction on the City of Clovis Rd. in Curry County; by State Highway Department.

$537,202—**Brown Contracting Co.**, P. O. Box 1479, Albuquerque—Award for 3.3 mi. of work on the Santa Fe-Alcodones Rd., Santa Fe County; by State Highway Department.

$186,951—**J. F. Byrd**, Los Alamos—Low bid for construction of a road 5.6 mi. long, 28 ft. wide on the James Canyon route in Lincoln National Forest, Otero County; by BPR.

$120,948—**Wylie Brothers**, 1009 N. 3rd St., Albuquerque—Award for 2.9 mi. of construction on Grants-San Rafael Rd. in Valencia County; by State Highway Department.

Oregon

$236,693—**Guy F. Atkinson Co.**, 806 Cascade Bldg., Portland—Low bid for protection of south wall foundations, Washington Shore Fishway, McNary Lock and Dam; by C. of E.

$182,352—**J. C. Compton Co.**, Box 86, McMinnville—Low bid for grading and paving Sheridan-Deer Creek section of the Salmon River Highway, Yamhill County; by State Highway Department.

$218,174—**Durbin Bros.**, Eugene—Award for construction of the Austin-Squaw Creek Unit of the Austin-Unity Junction section and the Austin Spur section of the John Day Highway, about 12 mi. east of Prairie City. Job includes 5.8 mi. of grading and oil mat surfacing; by State Highway Department.

$386,361—**E. C. Hall Co.**, 12012 S.W. Barbur Blvd., Portland, and **J. C. Compton Co.**, Box 86, McMinnville—Low bid for paving Judkins Point-Goshen section of Pacific Highway in Lane County; by State Highway Department.

$229,594—**Carl M. Halvorson, Inc.**, 218 Builders Exchange Bldg., Portland—Low bid for grading and paving the Tunnel Point section of the Wilson River Highway in Tillamook County; by State Highway Department.

$123,142—**Vernie Jarl**, Box 254, Gresham—Low bid for paving the Big Creek section of the Columbia River Highway in Clatsop County; by State Highway Department.

$106,071—**R. H. Jones**, Hillsboro—Low bid for bridge construction on the Jones Ranch-Mitchell section of the Ochoco Highway in Wheeler County; by State Highway Department.

$1,530,464—**Leonard & Slate Oregon, Ltd.**, P. O. Box 7128, and **E. C. Hall Co.**, 12012 S.W. Barbur Blvd., Portland—Low bid for grading and paving the Divide-Anlauf unit, Divide-Rice Hill section of Pacific Highway in Douglas and Lane counties; by State Highway Department.

$848,677—**Pacific Sand and Gravel Co.**, P. O. Box 628, Centralia, Wash.—Low bid for grading and paving the LeGrande-North Powder section of the Old Oregon Trail in Union and Baker counties; by State Highway Department.

$507,900—**Porter W. Yett**, 6500 N.E. Ainsworth St., Portland—Low bid for paving the Quartz Creek-North Plains unit of the Necanicum Junction-North Plains section of the Sunset Highway in Washington, Clatsop, Tillamook and Columbia counties; by State Highway Department.

$215,434—**Warren Northwest Inc.**, P. O. Box 5072, Portland—Low bid for construction on the Forest Boundary-Gilchrist unit of Lapine-Diamond Lake Junction; by State Highway Dept.

Utah

$261,905—**L. T. Johnson Construction Co.**, 709 Wall Ave., Ogden—Low bid for construction of a gravel surfaced road 16.7 mi. in length, between the Nevada line and 17 mi. southeast of Garrison; by State Road Commission.

$132,601—**Wheelwright Construction Co.**, 2300 East Ave., Ogden—Low bid for construction of a 3-in. road-mix bituminous sur-

face road and concrete bridge, 0.1 mi. in length over Coal Creek, Iron County; by State Road Commission.

$238,306—**Whiting & Haymond, Contractors,** Springville—Low bid for 7.3 mi. 2-in. road-mix bituminous surfacing and one concrete box over 20-ft. span between Gusher and La Point in Uintah County; by State Road Commission.

Washington

$607,605—**Guy F. Atkinson Co.,** 341 Skinner Bldg., Seattle—Award for 0.1 mi. of work on the Great Northern Railway overcrossing on Primary State Highway No. 1, Snohomish County; by State Department of Highways.

$136,852—**J. Arlie Bryant,** 428 Hutton Bldg., Spokane—Award for stockpiling from Castle Rock to Foster Creek on State Highway Nos. 1 and 1-R, Cowlitz County; by State Dept. of Hwys.

$1,186,994—**W. G. Clark & Co.,** 408 Aurora Ave., Seattle—Low bid for bidder-design and construction of 200 x 1200-ft. warehouse, Mount Rainier Ordnance Depot; by C. of E.

$457,960—**N. Fiorito Co.,** 844 W. 48th St., Seattle—Award for 1.2 mi. work on Airport Way Extension, King County; by State Department of Highways.

$274,059—**N. Fiorito Co.,** 844 W. 48th St., Seattle—Award for 3.2 mi. of highway construction on Primary State Highway No. 15, Sultan to Startup, Snohomish County; by State Department of Highways.

$117,914—**General Construction Co.,** Box 3244, Seattle—Award for 5.8 mi. of construction on the Naylor South section of Primary St. Hwy. No. 7, Grant County; by State Dept. of Hwys.

$326,671—**Ben C. Gerwick, Inc.,** 112 Market St., San Francisco, Calif.—Low bid for tailrace excavation below Rock Island Dam in the Columbia River; by Chelan County Public Utility District.

$555,531—**Goodfellow Bros., Inc.,** P. O. Box 1337, Wenatchee—Award for 2.8 mi. of construction on the Monitor-to-Wenatchee section of Primary State Highway Nos. 2 and 10; by State Department of Highways.

$199,740—**Maurice Gredvig,** P. O. Box 355, Yakima—Award for 8.6 mi. of grading, draining and ballasting and surfacing road near Yakima; by Yakima County Commissioners.

$185,736—**Carl M. Halvorson, Inc.,** 218 Builders Exchange Bldg., Portland, Ore.—Award for construction of an undercrossing on PSH No. 8 in Vancouver, Clark County; by State Department of Highways.

$190,042—**Hawkins & Armstrong,** 16274 39th N.E., Seattle—Award for 0.3 mi. of construction on the Naselle River Bridge on Primary State Highway No. 12, Pacific County; by State Department of Highways.

$396,610—**Hunt and Willett, Inc.,** Wenatchee—Award for construction of Lucky Peak Dam intake structures and outlet diversion work; by C. of E.

$106,419—**Peter Kiewit Sons' Co.,** Box 491, Longview—Award for 0.2 mi. of highway construction on west approach to Cowlitz River bridge at Kelso, Cowlitz County; by State Dept. of Hwys.

$186,685—**State Construction Co.,** 1245 Poplar Place, Seattle—Award for construction of the National Ave. overcrossing in Chehalis, Lewis County; by State Department of Highways.

$3,215,360 — **Strand & Sons,** 3938 University Way, Seattle — Award for construction of a reinforced concrete, five-story building to house offices; by Boeing Airplane Co.

$1,346,504—**Zoss Construction Co.,** Portland, Ore.—Low bid for government-design construction of a 200 x 1200-ft. warehouse in Mount Rainier Ordnance Depot; by C. of E.

Wyoming

$707,913—**Big Horn Construction Co.,** P. O. Box 875, Sheridan—Award for grading, draining, cement stabilized base course, plant-mix surface course, 1-3 continuous R. C. girder span bridge and miscellaneous work on 10.1 mi. from Gillette east on the Gillette-Moorcroft Rd. in Campbell County; by State Hwy. Dept.

$199,447—**Leach Bros.,** Box 152, Buffalo—Award (subject to BPR concurrence) for grading, draining, base course surfacing, four treated timber bridges and miscellaneous work on 4.5 mi. of the Upton-Hay Creek Rd. in Weston County; by State Highway Department.

$209,231—**Taggart Construction Co.,** P. O. Box 560, Cody—Award for grading, draining, three 23-in. treated spans over Corral Creek, five 23-in. treated timber spans over Bates Creek, three treated timber single-span stock passes and miscellaneous work on 7.4 mi. of the Bates Creek-Medicine Bow Rd. in Natrona County; by State Highway Department.

BPR reports 1951 highway work in Northwest

THE U. S. BUREAU of Public Roads administered the construction of highways costing about $58,000,000 in 1951 in the four Northwest States, according to a year-end announcement by W. H. Lynch, Division Engineer.

About $33,000,000 of this was direct Federal cash payments from the Portland office to the States and to contractors, the remainder being provided as match money by the States of Washington, Oregon, Montana, and Idaho. This amount is somewhat less than in the previous year due to shortage of steel and other critical materials for highways.

The Bureau also acted as construction agent on highways for other Federal agencies, such as the Forest Service and the National Park Service.

The Oregon Bureau of Public Roads office, headed by C. G. Polk, District Engineer, was moved to the State Highway Building in Salem during the year. Oregon and Washington both have bond-financed highway programs which are under way and administered by the Bureau of Public Roads since future federal funds may be used to retire the bonds.

Three routes were broken through at mountain summits during 1951 on which this Bureau had been working for many years. The first was the Randle-Yakima Highway involving a fifth crossing of the Cascade Range by main roads in the State of Washington. The road serves all of southwestern Washington in vehicular movement to and from eastern Washington. The second road broken through was the Republic-Kettle Falls in northeastern Washington. This route crosses the Kettle range of mountains and is part of a longer route near the Canadian boundary through this part of the State. The third road completed by connecting through was in Oregon on the Ochoco Highway, which serves western Oregon travel into and through the John Day River valley.

Several timber access roads were also constructed, notable among which were jobs on the Clackamas River, which provide transportation for logs from a tremendous stand of virgin fir into the Portland area for milling.

Chief Joe Builders win race against bad weather

CHIEF JOSEPH Builders succeeded in the race against time on second stage construction of the world's second largest hydroelectric development, Chief Joseph Dam.

In order to get the construction far enough along so the weather and high water of the winter would not delay operations, contractors placed 212,000 cu. yd. of concrete in the dam's first spillway section in three months' time.

To set this record, three eight-hour shifts were employed and two cableways spanned the gorge to accelerate the work. As many as 3,600 cu. yd. of concrete was placed during a day.

The huge dam project is not yet half complete, however. The next part of the construction concerns letting water flow over the center blocks through the first spillway, while construction is in progress on a second cofferdam and second spillway. The huge project should be brought to a conclusion in December 1955.

Montana starts surveys for future highway construction

STUDIES on highway projects were authorized by the Montana State Highway Commission in a recent meeting. Included in the authorization, which could lead to the eventual formulation of plans and specifications for bid calls in the future, are eight grade separation structures and one bridge.

Grade separation structures are paid for out of federal aid funds and Montana is permitted to spend up to 10% of federal aid funds per year. First survey under way concerns construction of an overpass and related approaches at Vaughn, where there has been a serious traffic hazard.

Approval was also granted by the Commission for a study of a proposed bridge across the Yellowstone River in the vicinity of Reed Point.

ENGINEERS ON THE MOVE

. . . Continued from page 100

After 37 years of service with the Bureau of Reclamation, **Roger R. Robertson,** chief of the special studies section on irrigation construction, retires from active service. Since joining the Bureau in 1905, Robertson has worked on many important Western projects including those in Gallatin Valley, Mont., and Kendrick, Wyo. Robertson's plans were followed for the construction of the main canals on the Columbia Basin Project. Secretary of Interior Oscar Chapman will present Robertson with a meritorious service award.

* * *

F. T. Bell announces his resignation as a director of the Quincy, Wash., irrigation district. He will no longer serve as a member of the Columbia Basin Commission. Bell was a pioneer in campaigning for the Columbia Basin irrigation project. His successor on the commission will be chosen from the other members of the Quincy irrigation district board.

* * *

Calvin Dodson, city engineer of Sparks, Nev., has been recalled to active duty with the U. S. Army. Dodson's resignation leaves the city engineer post at Sparks vacant, but city councilmen voted unanimously to return Dodson's position to him when he is once again available.

* * *

Scheduled for civilian work with the Alaska District, Corps of Engineers, are **Joseph P. Doetsch, Jr., Arthur C. Peters** and **Clifford M. Pfaffle.** The men will be temporarily in Alaska in connection with military construction activities.

* * *

Lt. Col. C. A. Rust takes over a new assignment as special assistant to **Col. W. H. Mills,** district engineer of the Walla Walla District, Corps of Engineers. Rust retains his post as project engineer at the North Richland Project, Washington.

* * *

A two-months tour of temporary duty in the Washington offices of the Chief of Engineers is under way for **Louis Rydell.** He is chief of the planning and reports branch of the Walla Walla District, Corps of Engineers in the state of Washington.

* * *

C. W. Lindgren, CED, USNR, is now field superintendent at the Construction Equipment Depot, U. S. Naval Construction Battalion Center, Port Hueneme, Calif.

* * *

L. H. Simon takes over as construction engineer for the entire Santa Fe railway system. Simon was formerly construction engineer for the railroad at Los Angeles. **J. W. Cook,** Simon's predecessor, retires from service with the company. **R. B. Wheeler** will take over as construction engineer at Los Angeles.

UNIT BID PRICES

Selected bid abstracts for Western projects

Water Supply

Cement-mortar lining and coating

California—Los Angeles County—City. American Pipe and Construction Co., Southgate, submitted a low bid of approximately $41,038 to the City of Los Angeles, Department of Water and Power for cement mortar lining and cement mortar coating of department-owned 30-in. O.D., 32-in. O.D. and 36-in. I.D. welded steel pipe; store and deliver f.o.b. trucks trenchside, required locations in San Fernando Valley. Unit prices were as follows:

(1) Americn Pipe & Steel Construction Co.....$41,038 (2) United Concrete Pipe Corp.....$45,636

	(1)	(2)
Cement mortar line and cement mortar coat Dept.'s 30-in. O.D. Steel Pipe:		
(a) Approx. 3,054 linear feet of cement mortar linin, for a price per linear foot of.....	2.40	2.65
(b) Approx. 3,013 linear feet of cement mortar coating for a price per linear foot of.....	3.08	3.45
Cement mortar line and cement mortar coat Dept.'s 32-in. O.D. Steel Pipe:		
(a) Approx. 3,034 linear feet of cement mortar lining, for a price per linear foot of.....	2.55	2.90
(b) Approx. 2,980 linear feet of cement mortar coating, for a price per linear foot of.....	3.28	3.70
Cement mortar line and cement mortar coat Dept.'s 36-in. I.D. Steel Pipe:		
(a) Approx. 1,050 linear feet of cement mortar coating, for a price per linear foot of....	2.91	3.10
(b) Approx. 1,030 linear feet of cement mortar coating, for a price per linear foot of....	3.75	3.95

Streets and Highways

Crushing and stockpiling gravel

Wyoming—Crook and Weston Counties—State. Mathison Construction Co., Gillette, received a $22,950 award from the State Highway Department for crushing and stockpiling crushed gravel surfacing Type A and crusher run gravel (⅝-in. maximum) at various locations in the two counties mentioned above. Unit prices were as follows:

(1) Mathison Construction Co.....$22,950
(2) Mullinex Engineering Co..... 26,373
(3) Hopkins & McPherson..... 26,377
(4) Teton Construction Co..... 27,832
(5) Gilpatrick Construction Co..... 29,352
— Wyoming Improvement Co. $35,150
— Big Horn Construction Co..... 37,158
— Boatright-Smith 38,009
(6) Engineer's estimate 27,285

	(1)	(2)	(3)	(4)	(5)	(6)
From Banks pit 9.0 mi. So. of Sundance on Wyo. 385						
Royalty 2c per ton—Haul 0.3 mi.						
5,000 ton crushed gravel surfacing Type A.....	.52	.70	.80	.65	.68	.65
From Clark pit 20 mi. W. of Sundance on U. S. 14						
Royalty 3c per ton—haul 3.7 mi.—addtn. to stkpl. 1119						
5,000 ton crushed gravel surfacing Type A.....	.52	.61	.70	.65	.68	.65
18,500 ton mi. haul of surfacing material.....	.10	.10	.08	.09	.12	.10
From JH Ranch pit 3.0 mi. south of Hulett						
Royalty 2½c per ton—haul 1.3 mi.—addtn. to stkpl. 855						
5,000 ton crushed gravel surfacing Type A.....	.52	.64	.70	.70	.68	.65
6,500 ton mi. haul of surfacing material.....	.10	.15	.18	.10	.12	.10
From Robinson Pit 1.0 mi. west of Moorcroft						
Royalty 2c per ton—haul 2.6 mi.—see spec. prov. for grading—addition to stkpl. 664						
5,000 ton crushed gravel surfacing	.52	.72	.60	.60	.68	.65
13,000 ton haul of surfacing material	.10	.085	.10	.08	.12	.10
From Horton Smith pit 10.8 mi. west of Newcastle						
Royalty 2c per ton—haul 3.8 mi.—addtn. to stkpl. 921						
7,500 ton crushed gravel surfacing Type A.....	.52	.59	.60	.90	.68	.65
28,500 ton mi. haul of surfacing material	.10	.085	.07	.07	.12	.10
Stockpile 1255 7.0 mi. west of Newcastle						
2,000 ton crusher run gravel (⅝-in. max.).....	.62	.80	.70	1.10	.88	1.00
7,600 ton mile haul of surfacing material	.10	.085	.07	.07	.12	.10

Grading, drainage and bituminous surfacing in New Mexico

New Mexico—Torrance County—State. G. I. Martin, Albuquerque, received a contract from the Highway Department for his low bid of $307,599 for construction on 10.6 mi. of highway on the Duran-Corona Rd. Unit prices were as follows:

(1) G. I. Martin $307,599
(2) Skousen-Hise Construction Co..... 308,830
(3) Wylie Bros. Construction Co. 312,894
(4) Floyd Haake 328,294
(5) Brown Construction Co. $331,707
— Lowdermilk Bros. 336,058
— Henry Thygesen & Co. 338,947
(6) Engineer's estimate 345,177

	(1)	(2)	(3)	(4)	(5)	(6)
Lump sum, clearing and grubbing	$10,000	$10,500	$10,000	$5,000	$12,500	$3,000
Lump sum, removal of obstructions	$1,100	100.00	100.00	200.00	200.00	100.00
146,400 cu. yd. excav., unclassified	.24	.24	.30	.30	.27	.30
900 cu. yd. excav. for structs.	2.00	2.00	2.00	2.00	2.50	1.50
560 cu. yd. excav. for pipe culverts	2.00	2.00	2.00	2.00	2.50	1.50
281,000 sta. yd. overhaul	.02	.015	.02	.02	.02	.02
65,000 ¼ mi. yard haul	.05	.07	.06	.08	.05	.06
362,000 ton mile haul	.07	.07	.07	.06	.065	.07
380 hr. mechanical tamping	3.00	5.00	3.00	4.00	5.00	5.00

(Continued on page 112)

taking big bites out of construction costs

The Ingersoll-Rand QUARRY-MASTER saves time, effort and expense on all kinds of big-hole drilling jobs.

It's a job proven fact that Ingersoll-Rand Quarrymaster drills have no equal for all-around *big-hole* rock drilling jobs. These drills will save you time and money on road building, dam construction, diversion canals, air-port work, etc. Here's why:

- **Drill Any Kind of Rock**—from the softest shales or over-burden to the hardest granites.
- **Real Drilling Speed**—uses Carset Bits, manufactured by Ingersoll-Rand—drills 20 to 50 feet per hour in limestone, 9 to 15 feet per hour in granite.
- **Lowest Bit Cost**—per ton of rock broken. Carset Bit life 700 to 1600 feet in granite—up to 14,000 feet in soft and less abrasive formations.
- **Needs No Blacksmith Shop**—Carset Bits can be sharpened by the operator on the spot.
- **Requires No Specialized Labor.**

Compare the Quarrymaster with any other drilling equipment available. You'll find that it is the best answer to your big-hole drilling problems, in *any type of rock.*

Ask your nearest Ingersoll-Rand representative about this completely self-contained, self-propelled outfit that drills 6-inch holes up to 70 feet deep, has continuous hole cleaning and automatic rotation.

INGERSOLL-RAND COMPANY
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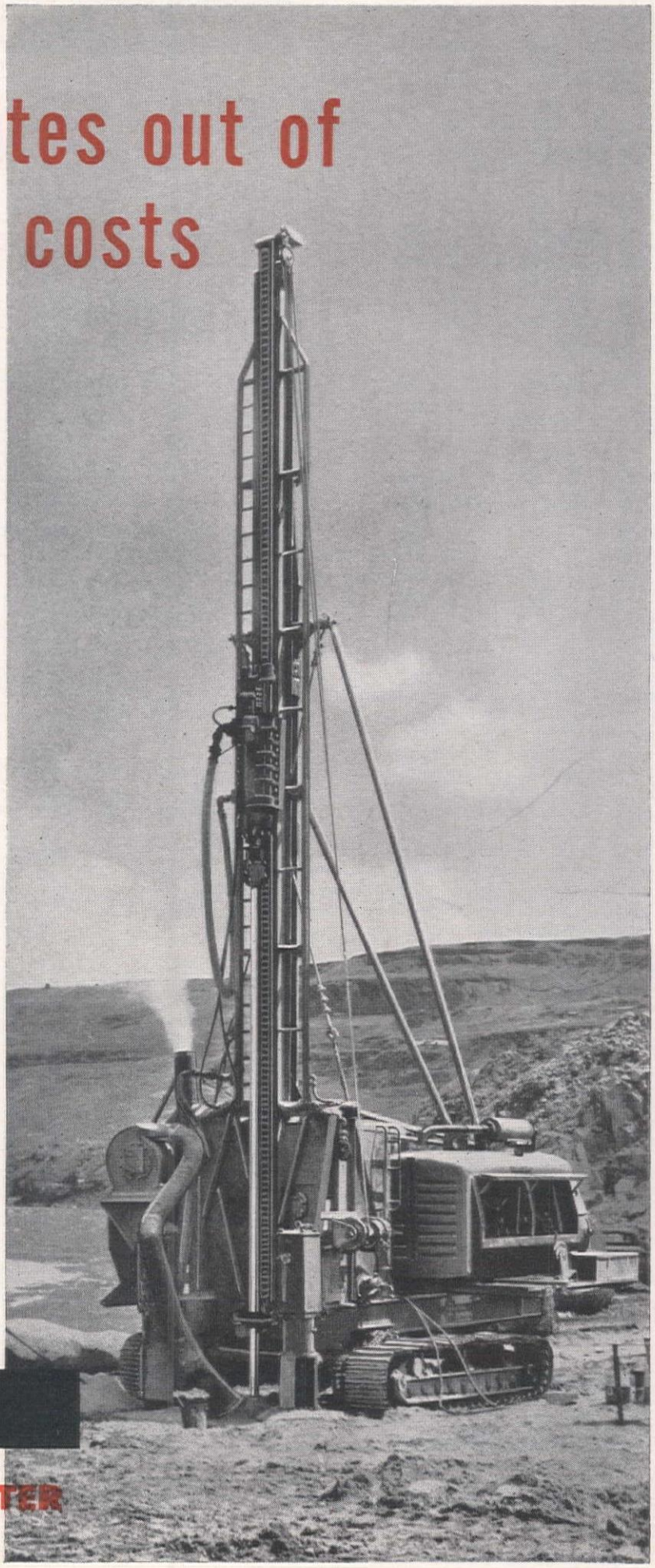

One of the two Quarrymasters being used at the Chief Joseph Dam in Washington.

Ingersoll-Rand
QUARRYMASTER

696-5

Symposium at Port Hueneme

"Airfield Pavements for Jet Aircraft"

A SYMPOSIUM on "Airfield Pavements for Jet Aircraft" will be held at Port Hueneme, California, on April 17-18, sponsored by the U. S. Naval Civil Engineering Research and Evaluation Laboratory of the Bureau of Yards and Docks. The symposium is being conducted to encourage the interchange of information and ideas among various groups concerned with the design or modernizing of airfield pavements to withstand the effects of jet powered aircraft.

The organizing of the program is under the direction of J. A. Bishop, Director, Soils and Pavements Division, Structures Research Department.

Utah declares war on Salt Lake traffic congestion

TRAFFIC BOTTLENECKS in Salt Lake City have to go! At least this is the opinion of the State Road Commission which has dedicated its entire 1952 urban highway construction fund, some $1,900,000, to uncorking congested streets.

First step in the proposed program is the allotment of $650,000 to the improvement of State St., Salt Lake's main artery. Plans call for a general widening of the street along with construction of a neutral zone between the lanes running north and south. This project, between 9th and 33rd South St., will permit turning without halting the straight-ahead traffic going north and south.

In line with the plan to channel truck traffic out of the center of activity, an effort will be made with remaining funds to divert this heavy traffic from 2nd West St. to the proposed divided freeway on the west side of the city. Approximately $500,000 has been set aside for construction of an initial link in the planned expressway.

Social Security benefits for the self-employed

NEARLY five million self-employed people were brought under Social Security in 1951.

Basically, the law provides that if you work for yourself in a trade or business you now have Social Security insurance for yourself and families if you earn at least $400.00 a year net. It is compulsory except for individuals in certain professions who are specifically excluded. You will pay Social Security taxes of 2¼% on all net earnings up to $3,600 a year when you file your 1951 income tax report this March. No Social Security tax is paid on income from rentals, stocks and bonds and other investments.

Payments to you and your family range from $23 to $150 monthly, depending on your earnings.

For further information, or to secure Social Security cards, phone or write to the nearest Social Security office.

UNIT BID PRICES . . . CONTINUED

1,512	hr. rolling—sheepsfoot roller	4.00	4.50	4.00	4.00	5.00	5.00
430	hr. rolling—steel tired roller	5.00	6.00	5.00	7.00	7.00	5.00
1,230	hr. rolling—pneumatic tired roller	3.50	4.00	3.00	4.00	5.00	5.00
133	hr. equipment roller operation	11.00	10.00	9.00	12.00	15.00	20.00
31,300	ton ballast	.52	.53	.45	.60	.55	.70
51,300	ton leveling course	.65	.63	.60	.90	.70	.85
11,350	M. gal. watering	1.00	1.00	1.50	1.00	.50	1.50
295	cu. yd. Class "AE-AR" concrete	54.00	70.00	50.00	55.00	52.00	55.00
34,100	lb. reinforcing steel	.16	.14	.14	.13	.14	.14
1,516	lin. ft. stand. reinf. conc. pipe—24-in. diam.	7.00	7.00	6.75	7.00	8.00	5.50
644	lin. ft. stand. reinf. conc. pipe—30-in. diam.	9.00	9.00	7.75	8.00	10.00	7.00
432	lin. ft. stand. reinf. conc. pipe—36-in. diam.	12.00	12.00	11.25	12.00	13.00	10.00
76	lin. ft. stand. reinf. conc. pipe—42-in. diam.	17.00	15.00	15.00	16.00	17.00	13.00
2	ea. cattle guard 12-ft. roadway	$1,200	$1,200	$1,400	$1,500	$1,300	$1,000
1	ea. monuments and markers	100.00	100.00	50.00	50.00	100.00	50.00
100,500	lin. ft. galv. barbed wire fence	.16	.15	.21	.15	.14	.14
25	ea. gates—Texas type	10.00	10.00	10.00	5.00	10.00	10.00
132	ea. bracing	6.00	7.00	6.00	6.00	5.00	8.00
46	ea. treated timber warn'g posts, 6-in. diam. (refl.)	5.00	6.00	6.00	7.00	6.00	7.50
70	ea. right-of-way markers	8.00	6.00	5.50	6.00	6.00	5.00
2.6	mi. obliterating old road	100.00	100.00	100.00	250.00	100.00	300.00
9,000	lin. ft. contour ditches	.05	.09	.10	.10	.10	.15
26	cu. yd. rock and wire check dams	20.00	20.00	20.00	20.00	20.00	15.00
8,050	bbl. cutback asphalt-type MC-3	5.60	5.75	5.75	5.80	7.00	7.00
10,750	ton top course surfacing	.75	.73	.75	1.00	.70	.85
10.641	mi. mixing asphalt and aggregate	750.00	500.00	600.00	600.00	900.00	$1,000
1,170	bbl. 210-250 penetration asphalt	6.00	7.00	6.25	6.00	7.00	7.00
1,530	ton aggregate for seal coat	4.00	4.00	3.00	5.50	5.00	5.00
10.641	mi. asphalt processed base	750.00	500.00	400.00	600.00	900.00	600.00

P.C.C. paving on cement-treated subgrade; four concrete bridges and pedestrian undercrossing

California—Los Angeles County—State. Griffith Co., Los Angeles, with a bid of $2,381,815 received a contract from the State Division of Highways for construction of a State Highway on Ramona Freeway between 8th St. and 0.1 mi. east of Jackson Ave., about 1.7 mi. long to be graded and paved with portland cement concrete on cement treated subgrade and with plant-mixed surfacing on imported base material, and four bridges and a pedestrian undercrossing to be constructed to provide a six-lane divided highway with frontage roads. Unit prices were as follows:

(1) Griffith Co. $2,381,815
(2) J. E. Haddock, Ltd. 2,517,882
(3) United Concrete Pipe Corp. $2,628,920

		(1)	(2)	(3)
3,040	cu. yd. removing concrete	3.75	5.00	6.00
Lump sum,	clearing and grubbing	$24,000	$40,000	$40,000
225,000	cu. yd. roadway excavation	.54	.75	.60
5,960	cu. yd. structure excavation (bridges)	1.50	2.50	1.50
10,410	cu. yd. structure backfill (bridges)	2.80	2.00	1.80
44,380	cu. yd. structure excavation	2.10	2.20	1.80
106,000	sq. yd. compacting original ground	.04	.03	.04
300,000	sta. yd. overhaul	.005	.005	.005
117,000	ton I.B.M.	1.17	1.18	1.30
10,000	ton imported pervious material	1.70	1.60	1.80
19,000	sq. yd. preparing slopes (erosion control)	.11	.85	.22
38,000	sq. yd. cultivating (prep. landscape)	.07	.04	.17
Lump sum,	dev. water supply and furn. watering equip.	$5,200	$15,000	$10,000
11,000	M. gal. applying water	1.50	1.25	1.45
Lump sum,	finishing roadway	$3,000	$2,000	$4,300
88,000	sq. yd. mixing and compacting (C. T. subgrade)	.26	.20	.18
4,200	bbl. P. C. (C. T. subgrade)	3.85	3.40	4.20
85	ton liq. asph., SC-2 (pr. ct.)	27.00	25.00	27.00
130	ton asph. emul. (pt. bdr., sl. cts. and curing sl.)	45.00	45.00	50.00
14,500	ton mineral aggregate (P.M.S.)	4.15	4.15	3.85
750	ton paving asph. (P.M.S.)	4.15	4.15	20.00
150	lin. ft. raised traffic bars	1.25	1.00	1.20
23	ton screenings (sl. ct.)	4.00	6.25	7.00
210	ton sand (sl. ct.)	3.60	4.50	5.00
21,000	cu. yd. P.C.C. (pavement)	11.00	11.50	12.65
17,500	ea. pavement tie bolt assemblies	.62	.60	.55
11,170	cu. yd. Class "A" P.C.C. (structures)	40.00	44.00	42.00
1,660	lin. ft. rubber waterstops	2.20	2.15	2.50
1,497,000	lb. bar reinf. steel	.10	.106	.11
73,140	lb. miscl. iron and steel	.31	.34	.35
483,000	lb. structural steel	.15	.145	.18
344,000	lb. structural steel (Almansor Ave. br.)	.20	.18	.23
Lump sum,	cleaning and painting structural steel	$11,000	$12,000	$14,000
22,000	lin. ft. furn. concrete piling	3.25	3.20	3.45
800	ea. driving piles	55.00	60.00	60.00
6,800	cu. yd. P.C.C. (curbs, gutters and sidewalks)	25.00	23.00	31.00
3,132	lin. ft. steel railing	8.75	8.30	9.00
369	lin. ft. wall hand railing	7.00	6.00	6.60
246	lin. ft. exterior handrailing	12.00	10.00	11.00
812	lin. ft. metal stair treads	2.15	2.00	2.50
Lump sum,	open steel floor and supports	$1,000	900.00	$1,200
Lump sum,	washing equipment	300.00	500.00	600.00
810	sq. yd. protective covering	1.00	1.20	1.00
844	sq. yd. membrane waterproofing	3.00	3.50	3.40
24,290	lin. ft. chain link fence	2.25	2.15	2.14
1,050	lin. ft. salv. exist. chain link fence	.55	.60	.85
1,050	lin. ft. reconst. salv. chain link fence	.55	1.00	.50
120	lin. ft. 12-in. R.C.P. (std. str.)	2.70	3.40	3.20
5,950	lin. ft. 18-in. R.C.P. (std. str.)	4.00	4.70	4.50
450	lin. ft. 21-in. R.C.P. (std. str.)	4.70	5.70	5.40
2,170	lin. ft. 24-in. R.C.P. (std. str.)	5.40	6.50	6.40
370	lin. ft. 30-in. R.C.P. (std. str.)	7.20	8.50	8.00
40	lin. ft. 30-in. R.C.P. (extra str.)	8.50	10.30	10.00
2,270	lin. ft. 33-in. R.C.P. (std. str.)	8.00	9.60	9.10
40	lin. ft. 33-in. R.C.P. (extra str.)	10.00	11.80	11.20
3,460	lin. ft. 36-in. R.C.P. (std. str.)	9.00	10.80	11.30
40	lin. ft. 36-in. R.C.P. (extra str.)	11.00	13.20	13.00
450	lin. ft. 42-in. R.C.P. (std. str.)	12.00	14.00	12.75
1,000	lin. ft. 48-in. R.C.P. (std. str.)	14.00	16.50	14.85
40	lin. ft. 48-in. R.C.P. (extra str.)	15.50	19.00	18.40
230	lin. ft. 60-in. R.C.P. (std. str.)	19.00	22.00	22.25

(Continued on page 114)

3 TS 200 MOTOR SCRAPERS move 24,000 cubic yards of dirt in 35 hours on a turn-around haul for BOYD CONSTRUCTION COMPANY

"We've been building good roads for almost 50 years and we know what good equipment means to our success. Speed and trouble-free operation are two features we look for in our earthmoving rigs...that's why we have 3 LaPlant-Choate TS 200's on this job. Moving 24,000 yds. in 35 hours on a turn-around haul, and with a 9-12 yd. rig, is speedy production in any language."

Says JOHN BOYD
Boyd Construction Co., Columbia, Miss.

NOW—LaPLANT-CHOATE TS 200's *are improved!*

SINCE John Boyd set this record with his three LaPlant-Choate TS 200 Motor Scrapers on the 500,000-cu. yd. relocation of Mississippi State Highway 7 around the Grenada Dam, capacities of the TS 200 have been raised from 9-yds. to 10-yds. struck, and from 12-yds. to 13-yds. heaped. Now you can also have your choice of power . . . a 176 HP Buda or a 165 HP Cummins diesel . . . to insure top working speeds at all times. Other production-boosting features include full hydraulic operation; positive, double-acting hydraulic steering; easy loading characteristics typical of all LPC earthmovers; positive forced ejection plus high apron lift; large 4-wheel brakes which allow top-speed operation (over 21 mph) with absolute safety. In addition, you get the rugged, sturdy construction that means low maintenance.

Get all the facts about the speedy, agile, powerful TS 200 Motor Scraper . . . the rig that's a money-maker on any size job. See your LaPlant-Choate distributor today.

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UNIT BID PRICES . . . CONTINUED

4,650 lin. ft. 29-in. x 18-in. C.M.P. arch (14 ga.)	5.20	8.60	7.10
1,070 lin. ft. 29-in. x 18-in. C.M.P. arch (10 ga.)	9.60	12.30	10.70
664 lin. ft. 6-in. P.M.P. (16 ga.)	1.60	2.30	4.55
160 lin. ft. 8-in. P.M.P. underdrains (16 ga.)	2.00	2.30	4.00
250 lin. ft. salv. exist. pipe arch culv.	1.20	1.50	8.50
250 lin. ft. relay. salv. C.M.P. arch	1.20	2.50	3.50
60 lin. ft. pipe shaft manholes	16.00	15.00	23.00
1,920 lin. ft. metal plate guard railing	3.30	3.00	3.00
SANITARY SEWERS			
1,650 lin. ft. 4-in. cast iron sewer pipe	5.30	4.20	6.50
6,600 lin. ft. 8-in. clay sewer pipe (std. str.)	4.10	3.60	5.00
2,750 lin. ft. 10-in. clay sewer pipe (extra str.)	7.40	5.25	7.50
37 ea. manholes (san. sew.)	230.00	200.00	250.00
6 ea. drop manholes (san. sew.)	300.00	400.00	360.00
6 ea. flushing manholes (san. sew.)	230.00	275.00	350.00
4 ea. adj. manholes to grade (san. sew.)	25.00	30.00	90.00
44 ea. abandoning manholes (san. sew.)	40.00	50.00	50.00
2 ea. remodeling manholes (san. sew.)	170.00	100.00	110.00
42 ea. house connection caps	12.00	25.00	40.00
PUMPING, ELECTRICAL, LIGHTING AND SIGNAL SYSTEMS			
Lump sum, drainage pump. equip. (6th St.)	$4,400	$4,400	$5,000
Lump sum, drainage pump, equip. (Garfield Ave.)	$7,500	$7,500	$8,500
Lump sum, pumphouse electrical equip. (6th St.)	$2,400	$2,300	$2,500
Lump sum, pumphouse electrical equip. (Garfield Ave.)	$4,800	$4,500	$5,800
Lump sum, traffic signal, highway lighting and illuminated sign systems	$125,000	$120,000	$130,000

Tunnel

Open-cut and tunnel excavation at Palisades Dam

Idaho—Palisades Project—Bureau of Reclamation. J. A. Terteling & Sons, Inc., Boise, submitted the low bid of $1,242,700 to the Bureau of Reclamation for open-cut and tunnel excavation for Palisades Dam, Palisades Project. Unit prices were as follows:

(1) J. A. Terteling & Sons, Inc.	$1,242,700
(2) Macco Corporation	1,576,700
(3) J. A. Jones Construction Co.	1,586,800
(4) Morrison-Knudsen Co., Inc.	1,598,000
(5) Lipsett Incorporated	1,724,685
— S. Birch and Sons Construction co., McLaughlin, Inc., F. & S. Contracting Co., Gate & Cox	1,734,190
— The Shea Co.	1,767,545
— Walsh Construction Co.	1,830,590
— Utah Construction Co.	1,851,000
— Carl M. Halvorson, Inc. and H. Halvorson, Inc.	$1,877,500
— Winston Brothers Co., Foley Bros. Inc. and C. F. Lytle Co.	1,889,500
— Kuckenberg Construction Co.	1,938,000
— Grafe-Callahan Construction Co.	1,975,000
— Wunderlich Contracting Co.	2,204,000
— Guy F. Atkinson Co.	2,577,000
— Western Contracting Corp.	2,599,000
— Peter Kiewit Sons' Co.	3,038,500

	(1)	(2)	(3)	(4)	(5)	(6)
2,000 cu. yd. excav., common, in open cut	10.05	3.00	1.50	6.00	6.00	3.00
5,000 cu. yd. excav., rock, in open cut	10.05	3.00	5.00	6.00	20.00	5.00
83,000 cu. yd. excav., all classes, in tunnels	10.05	13.10	15.10	15.50	13.87	18.00
2,000,000 lb. furn. and placing perm. structl.-steel tunnel supports, steel tunnel liner plates, and steel lagging	.157	.23	.143	.12	.20	.25
3,000 lin. ft. furn. and installing tunnel roof support bolts	1.40	.80	2.50	4.50	3.00	4.00
Lump sum, construction of Palisades Dam construction substation	$20,000	$6,000	$12,000	$16,000	$52,475	$12,000

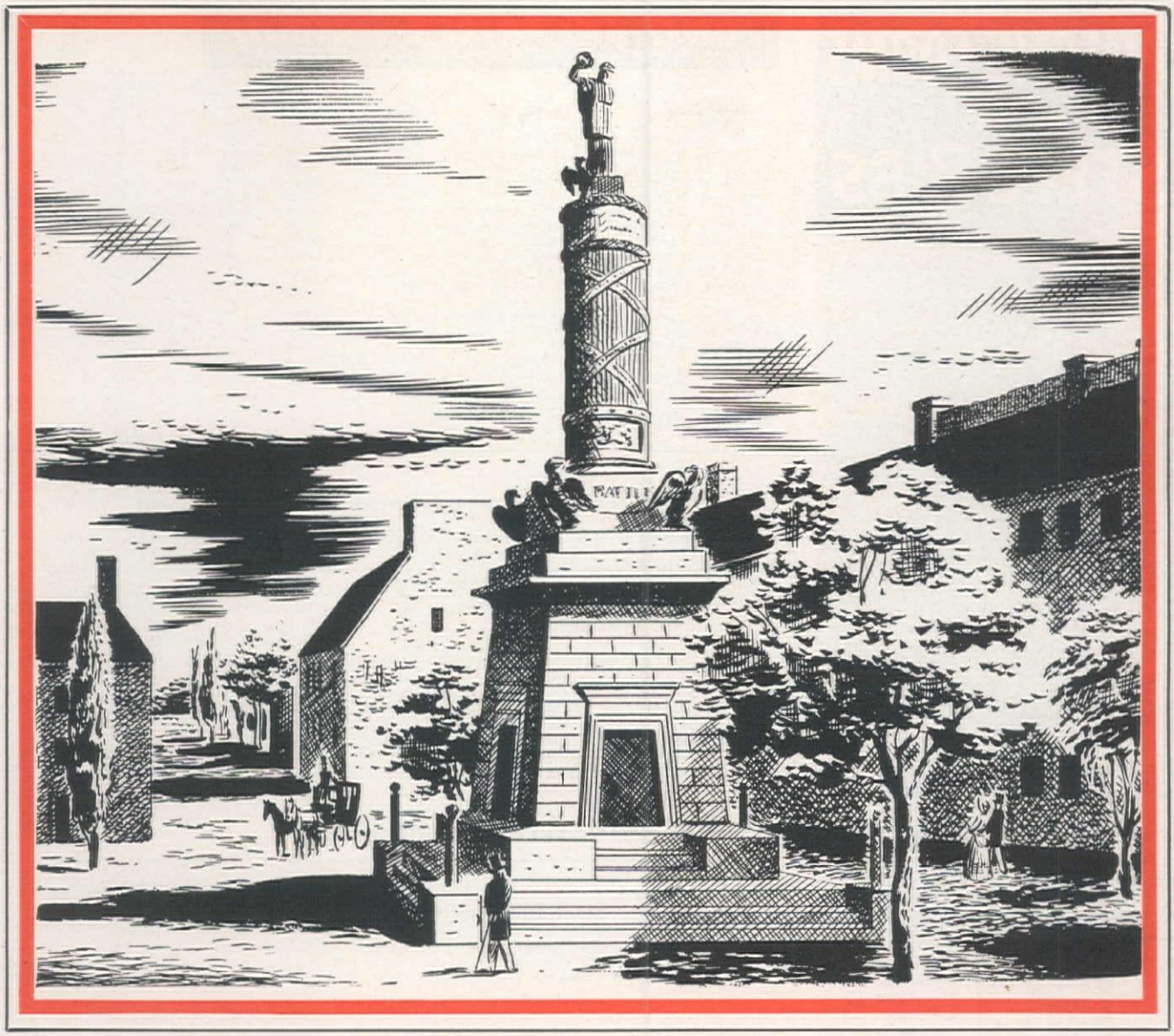
26-ft. wide highway tunnel in Colorado

Colorado—Boulder County—Bureau of Public Roads. Lowdermilk Bros., Denver, submitted the low bid of $329,379 to the Bureau of Public Roads for 1.2 mi. of grading 30-ft. wide roadway and construction of a tunnel 26-ft. wide, on the Boulder-Idaho Springs Route in Roosevelt National Forest. Unit prices were as follows:

(1) Lowdermilk Bros.	$329,379
(2) Colorado Constructions, Inc.	358,361
(3) Hinman Bros. Construction Co.	372,797
(4) Schmidt Construction Co.	381,128
(5) Platt Rogers, Inc.	$389,696
— K. S. Mittry Construction Co.	423,840
(6) Engineer's estimate	353,889

	(1)	(2)	(3)	(4)	(5)	(6)
Lump sum, miscl. force acct. work as authorized in Spec. Prov. and Article 9.4 to be paid for as earned	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
85,000 cu. yd. unclassified excav.	1.55	1.70	1.69	1.64	1.58	1.58
1,100 cu. yd. unclass. excav. for structs.	5.00	5.00	5.40	5.00	6.00	4.00
9,000 cu. yd. unclass. excav. for borrow, Case 1	.60	.70	.82	.80	1.00	.60
115,000 sta. yd. overhaul (1,000 ft. free haul)	.02	.03	.02	.03	.02	.02
5,000 cu. yd. mi. overhaul (1,000 ft. free haul)	.20	.30	.20	.25	.20	.25
16,000 cu. yd. mi. spec. overhaul of borrow (1,000 ft. free haul)	.30	.10	.20	.25	.20	.25
650 cu. yd. replacing topsoil	.75	.80	1.40	.50	.80	1.00
6,500 ton selected material for subgrade	1.10	1.75	.90	1.00	1.30	1.00
300 cu. yd. conc. Class A (air-entrained conc. low-alkali cement)	50.00	85.00	90.00	60.00	60.00	70.00
34,100 lb. reinforcing steel	.16	.15	.16	.18	.14	.20
240 ton fine aggregate for shotcrete	30.00	4.00	18.00	3.00	20.00	15.00
205 bbl. cement for shotcrete (Type II, low-alkali) (base)	10.00	27.00	24.50	34.00	25.00	25.00
75 bbl. white cement for shotcrete (finish)	20.00	37.00	33.00	36.00	34.00	35.00
1,000 sq. yd. concrete pavement	7.00	5.50	6.65	5.00	5.00	6.00
1,715 lb. structural steel-furn., fabricated, and erected	.60	.30	.40	.30	.40	.30
23 M. ft. B.M. untreated timber	300.00	300.00	335.00	400.00	250.00	190.00
41 cu. yd. cement rubble masonry	65.00	70.00	80.00	60.00	70.00	50.00
32 cu. yd. Class "A" stone masonry facing for concrete (arch ring)	120.00	250.00	154.00	135.00	230.00	140.00
67 cu. yd. Class "B" stone masonry facing for concrete (spandrel wall)	85.00	120.00	134.00	100.00	110.00	80.00

(Continued on page 116)



Baltimore's Battle Monument to her heroic dead in the War of 1812, as it looked 100 years ago.

Baltimore, Maryland has cast iron water and gas mains in service that were installed more than a century ago. In addition, there are more than 28 other cast iron water or gas mains with known records of continuous service for more than 100 years in the older cities of the United States and Canada. Such service records prove that cast iron pipe not only resists corrosion effectively, but is endowed with all the strength factors that pipe laid under city streets must have to meet the stresses imposed by modern conditions of traffic and underground services.

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FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE

NUMBER TWO OF A SERIES

UNIT BID PRICES . . . CONTINUED

258 lin. ft. 18-in. C.G.S.M. culvert pipe	5.00	4.00	4.60	4.00	4.00	4.00
560 lin. ft. 24-in. C.G.S.M. culvert pipe	6.00	6.00	6.55	7.00	5.50	6.00
230 lin. ft. 30-in. C.G.S.M. culvert pipe	7.50	8.00	8.00	9.00	8.00	7.00
66 lin. ft. 48-in. C.G.S.M. culvert pipe	20.00	15.00	17.00	14.00	14.00	16.00
25 cu. yd. hand-laid rock embankment	10.00	20.00	10.70	10.00	20.00	12.00
4,000 sq. ft. log cribbing	2.00	2.50	2.65	3.00	3.20	2.50
710 lin. ft. 6-in. perforated C.G.S.M. pipe underdrain	6.50	4.00	8.00	6.00	8.00	7.00
735 lin. ft. combination concrete curb and gutter	3.00	3.00	6.30	3.00	3.00	3.00
110 sq. yd. concrete sidewalk	6.00	5.00	8.00	4.00	4.00	4.50
6 ea. conc. maintenance marker posts	12.00	15.00	13.35	15.00	20.00	15.00
5,100 lin. ft. barbed wire fence, Type 1	.30	.40	.35	.40	.30	.25
180 ea. timber guide posts with warning reflectors (treated)	7.50	6.00	5.40	7.00	5.00	5.00
38 ea. reflectorized traffic lane markers	10.00	10.00	6.70	5.00	5.00	4.00
6,900 cu. yd. tunnel excavation	12.00	12.00	13.00	17.00	18.00	15.00
600 cu. yd. portal backfill	3.50	2.00	4.00	3.00	6.00	2.00

Waterway

Placing rock and derrick stone embankment

Oregon—Lane County—Corps of Engineers. Cox Construction Co., Oswego, submitted the low bid of $47,500 to the Corps of Engineers for construction of rock embankment along the right bank of the Middle Fork Willamette River on the relocated Southern Pacific Co.'s Cascade Line railroad approximately 10 mi. northwest of Oakridge. Unit prices were as follows:

(1) Cox Construction Co. $47,500
(2) Groesbeck & Hickson 54,500
(3) Miller & Strong, Inc. 62,000
(4) Scott, Hatfield and Welding 63,900
(5) Harbert Bros. ..... $ 65,500
— Buchanan Construction Co. 108,800
(6) Contracting Officer's estimate 45,800

	(1)	(2)	(3)	(4)	(5)	(6)
1 job mobilization, demobilization and constr. of haul road	$5,000	$24,000	$3,900	$6,000	$8,500	$5,800
4,000 cu. yd. stripping	1.00	1.50	2.50	2.00	1.25	.75
10,000 cu. yd. embankment rock, in place	2.50	2.00	4.25	3.00	4.00	2.65
3,000 cu. yd. derrick stone, in place	4.50	4.00	2.50	3.50	4.00	3.50

Bridge and Grade Separation

Steel and concrete pedestrian overcrossing

California—Los Angeles County—State. J. E. Haddock, Ltd., Pasadena, submitted the low bid of $72,047 to the Division of Highways for construction of a structural steel and reinforced concrete bridge for a pedestrian overcrossing over Ramona Freeway and tracks of the Pacific Electric Railway at Evergreen Ave. Unit prices were as follows:

(1) J. E. Haddock, Ltd. $72,047
(2) O. B. Pierson 72,765
(3) Byerts & Sons & George K. Thatcher .. $79,584

	(1)	(2)	(3)
30 cu. yd. removing concrete	12.00	15.00	16.00
Lump sum, clearing and grubbing	600.00	$1,000	700.00
500 cu. yd. roadway excav.	1.50	2.00	2.00
230 cu. yd. structure excav. (bridge)	3.00	5.00	4.00
165 cu. yd. structure backfill (bridge)	2.75	2.00	3.00
Lump sum, finishing roadway	40.00	600.00	$1,000
233 cu. yd. Class "A" P.C.C.	82.00	98.00	88.00
95,500 lb. structural steel	.28	.26	.30
Lump sum, cleaning and painting str. steel	$5,800	$2,000	$5,000
216 lin. ft. furnishing conc. piling	4.50	4.00	4.00
12 ea. driving piles	210.00	200.00	300.00
510 lb. miscl. iron and steel	.55	.50	.50
80 cu. yd. Class "B" P.C.C. (curbs, gutters and sidewalks)	33.00	50.00	45.00
25,000 lb. bar reinforcing steel	.13	.14	.12
220 each curb dowels	1.50	.50	2.00
29 lin. ft. interior wall handrailing	6.50	8.00	8.00
234 lin. ft. exterior handrailing	10.50	10.00	11.00
510 lin. ft. metal stair treads	2.00	2.00	2 00
0.25 mi. removing and reconstr. chain link fence	$5,000	$1,000	$5,000
Lump sum, lighting equipment	$2,600	$3,600	$4,000

Approach embankment on Columbia River Bridge at Longview

Washington—Cowlitz County—State. P. J. Anderson & Sons, Seattle, received an award from the State Department of Highways for construction of an approach embankment on the Columbia River Bridge at Longview. Unit prices were as follows:

(1) P. J. Anderson & Sons $127,268
(2) R. A. Heintz Construction Co. 129,545
(3) John Haulik Jr. 130,168
(4) Fiorito Bros. 136,123
(5) Peter Kiewit Sons' Co. 141,672
(6) White Bros. Company $154,429
— J. N. Conley 166,221
— Erland & Blickle 184,326
— Lige Dickson Co. 187,932

	(1)	(2)	(3)	(4)	(5)	(6)
136,650 cu. yd. common borrow, including haul	.38	.45	.45	.50	.52	.65
40 cu. yd. struct. excav.	3.00	3.00	3.00	3.00	4.00	3.00
10 days pneumatic-tired roller	70.00	55.00	50.00	60.00	45.00	60.00
5 days mechanical tamper	50.00	50.00	40.00	50 00	40.00	50.00
6.4 stas. (100 ft.) finishing roadway	30.00	15.00	20 00	15.00	15.00	20.00
20 M. gal. water in place	5.00	3.00	4.00	4.00	3.00	4.00

(Continued on page 117)

UNIT BID PRICES . . . CONTINUED

		(1)	(2)	(3)	(4)	(5)	(6)
470	ton crushed stone surf. top course in place	2.50	3.40	3.00	3.00	3.00	2.50
1,800	ton ballast in place	2.50	3.00	3.00	3.00	3.00	2.50
	LIGHT BITUMINOUS SURFACE TREATMENT METHOD A						
0.12	mi. preparation, construction, finishing	$3,000	$1,000	$1,000	$1,000	$1,000	$1,000
6	ton asphalt cement MC-3 in place	60.00	80.00	75.00	60.00	75.00	16.00
70	ton furn. and placing crushed cover stone	6.00	7.00	5.00	3.00	5.00	3.50
	OTHER ITEMS						
2,293	lin. ft. asphaltic shoulder curb in place	.50	1.15	1.00	.70	1.00	1.25
24	lin. ft. plain conc. or V.C. sewer pipe 8-in. diam. in place	2.50	1.20	2.00	3.00	1.00	2.50
57	lin. ft. bit. ctd. cor. met. culv. pipe No. 16 ga. 10-in. diam. Type No. 2 in place	3.00	2.50	4.00	4.00	3.00	4.00
2	only catch basins in place	150.00	150.00	150.00	150.00	150.00	150.00
26	only reinf. conc. spot posts in place	10.00	9.00	10.00	20.00	11.00	12.00
7,600	ton blanket slope protection in place	3.25	2.75	3.00	2.75	2.50	2.50
Lump sum,	removing portions of exist. struct.	$10,000	$4,000	$6,000	$5,000	$8,000	$5,000
	RETAINING WALL						
390	cu. yd. structure excav.	2.50	2.50	3.00	2.50	1.75	2.50
370	cu. yd. concrete Class B in place	40.00	40.00	40.00	40.00	42.00	40.00
24,000	lb. steel reinf. bars in place	.115	.12	.115	.115	.12	.115
5,990	lin. ft. furn. timber piling (creosote treated)	1.37	1.37	1.37	1.37	1.45	1.37
208	only driving timber piles (creosote tr.) in place	18.20	18.20	18.20	18.20	19.50	18.20

Timber bridges on timber piles

Montana—Blaine County—State. L. V. Lockwood, Glasgow, received a contract on his low bid of $25,623 to the Highway Commission for construction of 38.0-ft. and 76.0-ft. timber bridges on the Chinook-Canadian Line Highway. Unit prices were as follows:

(1) L. V. Lockwood $25,623
(2) Walter Mackin & Son 26,203
(3) Ed Tangmo 29,009
(4) Montana Engineering and Construction Co. $32,552

		(1)	(2)	(3)	(4)
57.12	M.B.M. treated timber	310.00	330.00	334.00	400.00
3.68	M.B.M. untreated timber	310.00	300.00	300.00	300.00
18	ea. 25.0-ft. tr. timber piles	70.00	60.00	69.00	80.00
17	ea. 30.0-ft. tr. timber piles	80.00	65.00	72.00	85.00
5	ea. 35.0-ft. tr. timber piles	85.00	75.00	80.00	88.00
14	ea. 40.0-ft. tr. timber piles	95.00	85.00	99.00	85.00
15	ea. 45.0-ft. tr. timber piles	100.00	90.00	115.00	98.00
450	cu. yd. uncl. excavation	1.00	1.00	2.00	1.50
Lump sum,	rem. ex. str. plan st. 14 plus 93	150.00	200.00	600.00	600.00
Lump sum,	rem. ex. str. plan st. 22 plus 54	150.00	300.00	900.00	600.00
Lump sum,	rem. ex. str. plan st. 24 plus 84	150.00	200.00	450.00	600.00

Schedule D of Seattle's Alaskan Way Viaduct

Washington—King County—State. MacRae Bros., Seattle, received an award from the State Department of Highways on its low bid of $1,063,659 for Schedule D construction on the Alaskan Way Viaduct, Primary State Highway No. 1. Unit prices were as follows:

(1) MacRae Bros. $1,063,659
(2) Guy F. Atkinson Co. 1,172,364
(3) Morrison-Knudsen Co., Inc. $1,216,649

		(1)	(2)	(3)
Lump sum,	preparation of site	$9,750	$3,000	$6,050
1,655	cu. yd. approach backfill in place	1.85	4.00	2.40
1,670	ton cr. stone surfacing top course in place	3.90	3.60	3.80
2,005	ton ballast in place	3.90	3.20	3.90
1,580	ton Type I-1 asph. conc. pvt. Cl. C wear. crse. in place	9.70	10.00	9.70
1,165	ton Type I-1 asph. conc. pvt. Cl. L level. crse. in place	9.70	10.00	9.70
3,649	sq. yd. cem. conc. pvt. stand. 14 da. mix 9-in. sect. in place	5.30	3.25	4.75
285	cu. yd. cem. conc. pvt. std. 14 da. mix variable thickness on exist. base in place	.....	.....	.....
1,475	lin. ft. cement conc. curb in place	1.40	.80	2.40
3,575	lin. ft. integral cement conc. curb in place	.60	.80	1.20
50	cu. yd. special cement conc. curb in place	60.00	22.00	44.00
1,570	lin. ft. plain conc. or V.C. sewer pipe 6-in. diam. in place	2.65	2.40	2.80
280	lin. ft. plain conc. or V.C. sewer pipe 8-in. diam. in place	3.00	2.75	3.80
810	lin. ft. plain conc. or V.C. sewer pipe 12-in. diam. in place	6.35	3.50	8.30
200	lin. ft. cast iron sewer pipe 6-in. diam. in place	4.15	4.00	6.65
6,000	lb. cast iron special in place	.27	.30	.40
10	only removing and resetting standard inlets	30.00	35.00	24.20
4	only street inlets (City of Seattle std.) in place	51.00	25.00	60.00
7	only manholes (City of Seattle std.) in place	200.00	220.00	300.00
6	only catch basins (City of Seattle std.) in place	230.00	300.00	300.00
1	only manhole (City of Seattle std.) with reclmd. cov. in place	165.00	200.00	250.00
3	only catch basins (City of Seattle std.) with reclaimed covers in pl.	.....	.....	.....
6	only catch basins inlet top (City of Seattle std.)	230.00	300.00	300.00
3	lin. ft. addtl. depth of catch basin beyond std. depth	30.00	30.00	60.00
14	only. adj. manholes, catch basin, or gate valve covers	22.00	20.00	60.00
1	only removing catch basin	30.00	100.00	60.00
1	only removing manhole	30.00	125.00	60.00
12,640	sq. yd. removing exist. pvt., gutter, sidewalk, etc.	.95	.80	2.40
1,105	sq. yd. one crs. portland cem. conc. sidewalk in place	3.00	1.20	3.80
	BRIDGE—MAIN STRUCTURAL ITEMS			
26	only bridge inlets Type 1 complete in place	35.00	30.00	35.00
14	only bridge inlets Type 2 complete in place	75.00	110.00	115.00
1	only bridge inlet Type 3 complete in place	75.00	100.00	105.00
1,250	lin. ft. downspouts in place	6.50	9.00	9.00
3,160	cu. yd. structure excavation	8.40	8.00	8.25
42	only driving steel piles first 10-ft. of pen. in place	53.25	50.00	42.00
2,310	lin. ft. driving steel piles beyond 10-ft. of pen. in place	.20	.10	.12
505	only driving reinf. conc. piles first 10-ft. of pen. in place	64.00	50.00	48.00
20,330	lin. ft. driving reinf. conc. piles beyond 10-ft. of pen. in place	.10	.10	.12
30	only steel pile splices	25.00	50.00	30.00

(Continued on page 118)

UNIT BID PRICES . . . CONTINUED

	(1)	(2)	(3)
26,280 lin. ft. furn. reinf. conc. piling	3.10	3.20	3.70
3,410 cu. yd. conc. Class AS in place	57.60	78.00	83.00
3,200 cu. yd. conc. Class ES in foundations, in place	57.60	32.00	23.00
2,060,000 lb. steel reinforcing bars in place	.12	.135	.1225
222,000 lb. structural carbon steel in place	.25	.22	.23
4,610 lin. ft. reinf. conc. bridge railing in place	6.00	6.50	3.70
5 M.B.M. timber and lumber (untreated) in place	200.00	350.00	485.00
1 only twin danger light (City of Seattle std.) in place	75.00	120.00	67.00

Miscellaneous

Drainage holes for Black Canyon Dam in Idaho

Idaho—Boise Project—Bureau of Reclamation. Lynch Bros., Seattle, Wash., submitted the low bid of $19,095 to the Bureau of Reclamation for drilling drainage holes for Black Canyon Dam. Unit prices were as follows:

(1) Lynch Bros.	$19,095
(2) R. S. McClintock	20,100
(3) Fred Cannon Co.	26,450
(4) Boyles Bros. Drilling Co.	28,475
(5) Nichols & Thompson Core Drilling Co.	31,770
— C. M. Hanes Construction Co.	$31,815
— Russel Cowe	46,900
— Harold P. Doty	82,678
(6) Engineer's estimate	33,150

	(1)	(2)	(3)	(4)	(5)	(6)
1,850 lin. ft. drilling drainage holes from gallery	5.70	6.00	7.00	8.50	10.20	9.00
1,500 lin. ft. drilling drainage holes for downstream face of dam	5.70	6.00	9.00	8.50	8.60	11.00

Steel sheet piling cofferdam

Colorado—Denver County—State. Western Foundation Construction Co., Denver, submitted the low bid of $57,141 to the Highway Department for construction of a steel sheet piling cofferdam near 5th and Market Sts. between Market St. Interchange and Valley Highway. Unit prices were as follows:

(1) Western Foundation Construction Co.	$57,141
(2) Van Winkle Construction Co.	62,650
(3) Macco Corp.	63,465
(4) Hutcheson Construction Co.	$73,777
(5) Colorado Constructors, Inc.	74,083
(6) Engineer's estimate	65,527

	(1)	(2)	(3)	(4)	(5)	(6)
Lump sum, clearing and grubbing	$1,000	$2,750	$2,600	$1,000	$3,000	500.00
62,020 lin. ft. drive steel S. piling	.63	.64	.75	.88	.86	.75
1 ea. drop inlet, Type 2, 7-ft.	450.00	675.00	772.34	410.00	650.00	600.00
1 ea. drop inlet, Type 2A, 4-ft.	350.00	475.00	548.59	380.00	550.00	450.00
1 ea. drop inlet, Type 2A, 6-ft.	435.00	575.00	574.37	410.00	600.00	550.00
355 lin. ft. 30-in. R.C.P. storm sewer	9.15	11.00	7.10	10.45	10.00	10.00
1,056 lin. ft. 36-in. R.C.P. storm sewer	11.35	13.00	8.65	12.15	11.00	12.00
2 ea. 4 manhole, Type 1, 4-ft.	190.00	275.00	250.00	150.00	250.00	220.00
1 ea. 5 manhole, Type 1, 5-ft.	220.00	300.00	300.00	160.00	280.00	250.00

Missouri River storms power house at Canyon Ferry dam

FOR THE SECOND time in two years, the Missouri River has sabotaged operations at the Bureau of Reclamation's Canyon Ferry Dam project. This time flood waters entered the power house at the dam and caused work stoppages.

The prime contractor, Canyon Constructors, planned to seal off the water and keep the newest delay from being serious. In June 1950 waters undermined the flume and flooded the area behind the cofferdams at the project and caused a delay of six weeks.

The multi-purpose project is now about 50% complete. It was during second-stage diversion operations that the flooding occurred. The river was supposed to flow through the completed portion of the dam. Two conduits were to carry the water through the dam and more was to pour over the center block. However, after the cutting of the upstream cofferdam, a dike, designed to protect the flume entrance, washed out. The water lifted the flume and carried it into the excavation area and ultimately cascaded down upon the powerhouse area.

Operations ceased until a concrete wall could be constructed to hold the water while pumping operations proceed in the powerhouse area.

N. Mex. highway gets go-ahead after three months' dispute

WAY has now been cleared for the beginning of the $316,000, 3-mi. paving job on U. S. 285, between Carlsbad and Artesia in New Mexico.

Work is getting under way after a 3 months' dispute between the State Highway Commission and federal government agencies, including the Bureau of Reclamation, delayed operations. Federal agencies feared that the proposed project would interfere with present and future water projects. The Commission, however, alleviated these objections with the assurance that the road project elevations would not drop to a point where any water plans would be affected.

Brown Construction Co. is holder of the contract on this project and bids were called January 25 for a related project on approximately 8 mi. of the same road.

USBR bid calls issued during January

BID CALLS were issued January 15 by the Bureau of Reclamation for construction of pumping plants at Lake Lenore near Soap Lake, Wash., in connection with the Columbia Basin Project.

Invitations to bidders went out January 31 for construction of Pole Hill Canal, 9 mi. east of Estes Park, Colo., Colorado-Big Thompson Project. Work includes construction of about 500 ft. of bench flume and 2,000 ft. of canal to carry a flow of 550 cfs.

Calls for bids on construction of the Carpenteria Conduit, Cachuma Project, Calif., were issued about January 25. Work involves construction of 16 mi. of concrete pipe conduit varying in size from 36- to 27-in. diameter, and 1 control station, part of the Carpenteria Section of the South Coast conduit near Santa Barbara, Calif.

Firms awarded B. C. pipeline contracts

CONTRACTS for laying the pipe of Trans Mountain Oil Pipe Line Co.'s $80,000,000 pipe line between Edmonton, Alberta and Vancouver, British Columbia, have been awarded to Mannix Ltd., of Calgary, Alberta—and to Comstock Midwestern Limited of Toronto, Ontario.

Van W. Rosendahl, president of Canadian Bechtel Limited, agent for Trans Mountain, announced the contract awards soon after The Board of Transport Commissioners for Canada granted Trans Mountain the necessary permit to construct the first crude oil pipe line between Alberta and the Pacific Coast.

The pipe line will be built of 24-in. diameter pipe. At the start two pump stations will be constructed providing an initial capacity of 75,000 bbl. per day. Ultimate capacity will be 200,000 bbl. per day, made possible by the construction of additional pump stations.

Right-of-way clearing will begin as soon as weather permits this year. If necessary priorities are obtained, pipe laying will begin about June 1, and will be limited to five or six months in summer and early fall due to the dry weather requirement in pipe laying operations.

Fate of Sutherland Dam goes to San Diego voters

VOTERS in San Diego, Calif., will have an opportunity in a forthcoming special election to decide the fate of partially completed Sutherland Dam on the San Ysabel River.

The dam foundation has stood deserted for almost 25 years after financial and political difficulties halted construction on the project. Now the city council of San Diego feels the dam offers a means of increasing the city water supply at a time when civilian and military population growth have made present supplies inadequate.

Engineers inspecting the dam have found it in good condition, and with the erection of a multi-arch type structure on top of the seven already completed buttresses, the dam would offer 53 sq. mi. of draining basin. The dam would store about 12,000,000,000 gal.

Horner firm gets Alcova Dam power plant award

AWARD of a contract to the A. S. Horner Construction Co., of Denver, Colo., for construction of a power plant and appurtenant works at Alcova Dam on the Kendrick Reclamation Project near Casper, Wyo., is announced by the Bureau of Reclamation.

The project will provide an additional 95,000,000 kw-hr of electric energy for areas in Wyoming, Colorado and Nebraska. Horner's low bid was $2,324,224. The work is already under way and is scheduled for completion by July 1954.

Containing 22 major construction features, the contract calls for work ranging from excavation and building erection to installation of a 125-ton traveling crane, interior and exterior painting, lighting of the power plant grounds, and other details.

NEW LITERATURE

201

Foundation booklets offer practical "how-to" information

Two booklets just issued by **Casey & Case Foundation Co.** are designed to give a complete outline of the company's activities along with helpful engineering information. The first booklet is a general view, but it contains diagrams and useful suggestions throughout, including tables which give statistical information on the cubic content and skin friction area, etc. The second booklet is a complete compilation of tables prepared for the assistance of engineers in estimating drilled and poured foundation piling and caissons. The first table shows the volume per lineal foot of various diameter shafts, with the area of skin friction available for that particular size shaft. The second table gives the volume of different diameter caisson bells in relation to various size shafts. This booklet should be of great value for estimating purposes.

202

Complete profile of new 2-cycle diesel engine

For those interested in keeping up with major developments in diesel power, **Lever Motors Corp.** offers an excellent booklet on its new 2-cycle diesel engine. The booklet gives specifications, textual descriptions, diagrams and tables which serve to properly portray the abilities of this new device. Photographic details aid the reader in understanding the different features offered in this new engine.

203

Rugged spur gear hoist guide

A concise folder on the Challenger spur gear hoist has been released by **Coffing Hoist Co.** The literature tells the rugged, safe, economical and light weight qualities of this new hoist and includes complete specifications. A good look at the inner workings of the hoist is provided in diagrammatic form. This release tells its story quickly and thoroughly.

204

Manual of design and welding engineering offered

The "Manual of Design and Welding Engineering" released by **Eutectic Welding Alloys Corp.** is a 66-page guide well worth the attention of the field. The manual is divided into four complete sections which deal with design, procedure, materials and conclusions. It is designed particularly to eliminate a certain confusion which has arisen as a result of the increasing complexities of welding, materials, methods and apparatus. Each part of the manual is subtitled in the table of contents for easy reference and the sections are fully illustrated with photographs, diagrams and charts. The procedure section covers preparation of material, procedures for thin-flowing alloys, bead-forming alloys, etc., fluxing and removing of flux, etc. The materials section is a re-

sume' of the firm's Low Temperature Welding Alloys for the various metals, along with joining alloy selector charts, and many other details. The conclusions sum up the Eutectic service program and give maintenance information.

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205

28-page maintenance guide in "Cat" color-cartoon style

Small engine maintenance facts told in this latest **Caterpillar Tractor Co.** guide should be of aid to operators of the six smaller sizes of Caterpillar diesel engines, marine engines and electric sets. The booklet tells the story of a service man's visit to the construction field where he tells an illustrated story of good maintenance practices. The details presented in this interesting booklet are very easy to follow, and the information is invaluable to equipment users. Many points which would probably not be considered by the users of equipment are brought out in this guide. The booklet is the first in a series to be dedicated to proper equipment maintenance, and the entire set when complete should provide an excellent library.

206

Statistical guide to good soil compaction

Detailed information, including useful new production data, for figuring work schedules and costs on soil compaction jobs is contained in a new bulletin just published by **Barco Manufacturing Co.** The bulletin covers the use of the Barco portable gasoline rammer for tamping fill or back-fill in restricted areas. Of special interest to builders, contractors, supervisory engineers and project managers is a discussion of the use of "soil compaction" as a means of attaining (1) greater permanence, (2) lower costs, and (3) earlier completion dates on many construction projects.

207

Heil commemorative booklet

In honor of 50 years of service in the equipment industry, this attractive booklet offers a fine collection of drawings of **The Heil Co.** equipment. The booklet is more of a family portrait than a description of any particular Heil product. Seven pages are devoted to product lines while the remaining 13 are given over to a description of policy, facilities, history, etc.

208

Digging deeper

Portable Earth Auger Co. is offering a 4-page descriptive folder to introduce the features of its new Ground Hog digger. The various models and their capabilities are described and pictured in this compact folder. The service, safety clutch, speed control and gear transmission are explained.

209

Beating shock problem in hydraulically-operated equipment

The elimination of shocks in hydraulically operated bucket loaders, power shovels, and other tracked or rubber-tired equipment is described in a new bulletin just released by **Greer Hydraulics, Inc.** The method works on the principle that hydraulic fluid is practically incompressible and so the vehicle itself must absorb impacts caused when the loaded bucket is moved or stopped suddenly. The booklet explains how Greer Hydro-pneumatic Accumulators, installed in the system, fully absorb these shocks. Sizes and capacities are included in the literature.

210

Highway clean-up

The Eimco Corp. has issued a 4-page color folder to introduce the Eimco 104 loading machine in its new capacity as a highway clearer. The illustrations and information contained offer a good picture of the capabilities of the equipment on the job.

211

Drill data

A folder has been issued by **The California Welding and Blacksmith Shop, Inc.**, showing pictures, sketches and diagrams of the operation of the Calweld Earth Drill Model 150-A. The text gives specifications and explains the various uses of the drill in heavy construction.

212

Snow-melting crystals

Ice Rem, ice and snow melting crystals, is described in a new technical bulletin issued by **Speco, Inc.** The thawing capacity of Ice Rem is said to be 30 times greater than that of salt. Application of the chemical crystals is explained simply as well as its quick action, which is harmless to tires, shoes, asphalt, etc.

213

Capable car unloader

In a 4-page color bulletin just issued by **Lippmann Engineering Works** the advantages of the True Belt Type Hopper car unloader are pointed out in pictures and textual material. Specifications are included.

214

Jack statistics

In an 8-page bulletin just issued by **Templeton, Kenly and Co.**, complete information, including specifications and application data, is offered on hydraulic jacks. Photographs, detail drawings and tabulated data in capacities of from 10 to 100 tons, appear in the letter-size folder. Information should be of particular interest to construction men.

215

Self-propelled scraper

The new Wooldridge model TC-S142 Terra Cobra self-propelled scraper is described in an 8-page bulletin available from **Wooldridge Manufacturing Co.** Operational features and mechanical details are shown in a series of sectional, cutaway and assembly views.

216

Speaking of sprockets—

Morse Chain Co. is offering a new catalog discussing stock Roller Chains and sprockets. Catalog C 55-50 gives details on list prices, available sizes of types A, B, and C Morse stock sprockets, and pertinent information on stock roller chain from ⅜-in. pitch to 2-in. pitch. Data is included on drive selection, service factors, installation and service.

217

Pocket-size equipment guide

In a 44-page pocket-size folder **Syntron Company** offers a complete description of electrical equipment including vibrators, packers and jolters, feeders, hammers, etc., and their variations. Pictures are used to present the material in a compact and interesting fashion, and specifications are included.

Literature briefs . . .

218

WORTHY WORTHINGTON — The complete story on the new **Worthington Pump and Machinery Corp.** WP paver is available in a new bulletin being offered. Put key number on coupon for your copy.

219

BLAST IT!—A thorough description of the V.A.Q. blasting meter and a set of complete instructions regarding its use are contained in a new bulletin made available by **Hercules Powder Company.**

220

SPACING STUDS—Catalog 500, now available from **Superior Concrete Accessories, Inc.,** provides the reader with a valuable table on the spacing of studs, wales and form ties.

221

BLASTING WORKS FOR YOU — The way in which delay timing on blasting operations can aid your construction operations is fully explained in a 20-page book containing diagrams and illustrating the possible control of Rockmaster blasting. **Atlas Powder Co.** offers this book.

222

WIRE ROPE SAVINGS—In an interesting, illustrated booklet, **Macwhyte Co.** offers advice on how to save money on wire rope. The book contains an interview technique which is easy to read and understand.

223

STARTING FLUID—This book tells you where and how to apply Chevron starting fluid on various machines. It is a nice how-to-do-it package. Offered by **Standard Oil Company of California.**

224

BITS OF INFO—Illustrating the full line of bits offered by **The Timken Roller Bearing Co.,** and containing useful data on rock bits, this booklet is yours for good bit information.

225

ROLLING ALONG—**Huber Manufacturing Co.** is offering a 20-page bulletin which fully describes the various features and capabilities of the firm's general purpose 3-wheel rollers.

226

WIRE ROPE STATISTICS—Here's a little book called "How to Order Wire Rope" which really offers the reader good advice. It tells him exactly what to consider when ordering wire rope and includes the statistics on sizes, constructions, strengths, etc., which make it possible for him to know in advance exactly what he is after. **Macwhyte Company** is offering this helpful booklet.

227

EXTEND PIPE LIFE—**Pipe Lining, Inc.,** offers information from hydraulic engineers on ways to extend the life of present pipe through rehabilitation with this patented cement-mortar lining process.

228

SAND DRAINS—Sand drain equipment manufactured by **McKiernan-Terry Corp.** is described in a bulletin issued by the firm. The bulletin tells about the operation of this equipment in marsh and swamp reclamation work.

229

TAGLINES—Literature and complete details on taglines and Rud-O-Matic tagline combinations are available from **McCaffrey-Ruddock Tagline Corp.**

230

PORTABLE COMPRESSORS—Catalog 758, issued by **Chicago Pneumatic Tool Co.,** gives details on CP Portable Compressors' cost-cutting operations.

231

VIBRATING STIFF MIXES—In Bulletin 511, **Stow Manufacturing Co.** tells the way in which its gasoline and electric vibrators make possible the rapid placement of stiff mixes.

232

HIGHWAY GUARD RAILS — The different types of highway guard railings, their installations and specifications, are presented in a folder issued by **United States Spring & Bumper Co.**

233

BUCKET BANTER — **The Wellman Engineering Co.** is offering free descriptive bulletins on its fast bucket opening which speeds operations.

234

HY-JACK—A bulletin is available from **Duff-Norton Manufacturing Co.** which describes and illustrates Hy-Power Hydraulic Jacks.

235

TRUCK SHOVEL INFO—Details on the uses and performance of truck-mounted shovels of 3- to 10-ton capacity are offered in a series of booklets by **"Quick-Way" Truck Shovel Co.**

236

REPRODUCTIONS—Here's a bulletin which tells all about the Spee-Dee process of whiteprinting anything. Exact duplicates of anything drawn, typed, printed or written can be made quickly by using this new machine by **Peck & Harvey.** Positive copies are obtained from translucent originals. The process and operation features of this machine are explained in this fully illustrated brochure.

237

LIQUID STAINLESS STEEL—The facts on this protective coating against rust and corrosion are explained in a folder released by **Slip-On, Inc.** The method of liquefying is explained, and the way in which the product offers chemical resistance, moisture resistance, abrasion resistance, etc., is outlined in easily readable textual and table material.

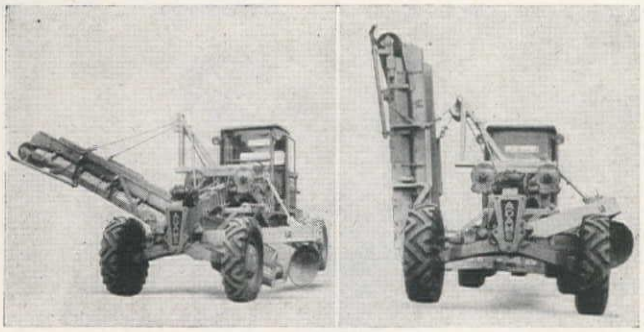
NEW EQUIPMENT

More information on any of the items in this section may be obtained by using coupon on page 121.

238

New elevating grader attachment with hinged carrier for mobility

The Elegrader is the name given this new attachment for the heavy construction field. The exclusive hinged carrier design rules out time-taking and troublesome dismantling to allow for highway travel, and clearance is no problem for oncoming traffic. Just 15 minutes is required to raise the

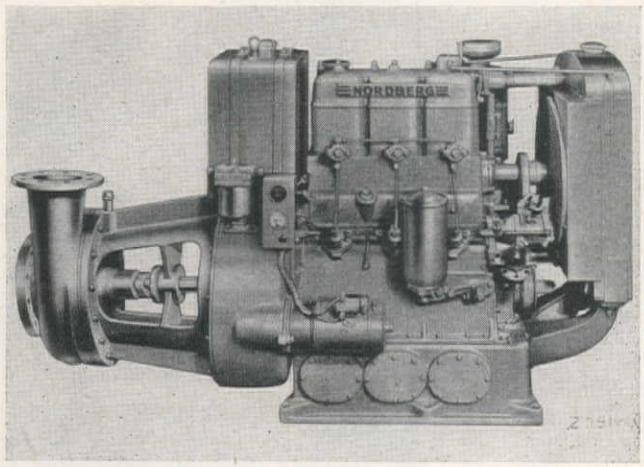


hinged carrier to traveling position, and in this position the Elegrader has the same center of gravity as the motor grader alone. The carrier is equipped with 36-in. trough-type belt which is an innovation in elevating grader design and has equal capacity to a 48-in. conventional flat-type belt. All troughing rollers are mounted on self-lubricated, permanently sealed ball bearings which do not require any servicing, and all other moving parts are mounted on either ball or roller bearings. No welding or major alterations to the motor grader are necessary to mount the Elegrader, a product of **Williams & Reisser Co.**

239

4-cycle, 3-cylinder diesel engine joins Nordberg line

Rated 30 to 45 hp. at 1,200 to 1,800 rpm., the new 4FS3 4-cycle, 3-cylinder diesel engine by **Nordberg Manufacturing Co.** is a complete, self-contained, ready to operate unit for



stationary and portable applications. The engine features a 4½-in. bore and 5¼-in. stroke. It is available as an electric generator set, pumping unit and with clutch or stub shaft power take-off for direct connection or belt drive. Can be obtained, ready to connect to a load, in direct or alternating current models from 20-30 kw. in all standard voltages, 50 or 60 cycle. The capacity is 500 to 3,000 gpm. at 20- to 220-ft. head, and its compact design makes it particularly applicable for washing, draining, dredging and general pumping service in the contracting and quarry industries.

240

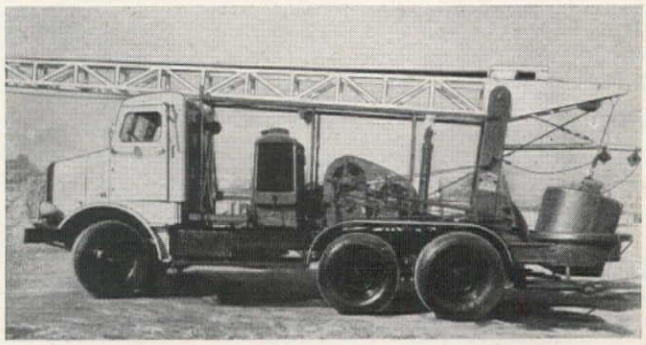
Trencher unit gives economical and versatile service

Universal Trencher Co. is now manufacturing an efficient and maneuverable trencher unit which provides the smooth operation of the wheel-type trencher and the vertical advantages of the ladder type. The unit is designed for digging building foundations, water and gas mains, service lines, irrigation and drainage ditches, etc. It can dig in close to buildings, curbings, pipes, etc. When mounted on an Oliver HG or OC3 crawler tractor, the trencher becomes a convenient and economical unit. The use of standard parts in the machine make it easy to maintain. The machine offers a digging depth of 0-4 ft., and digging width of 14 in., 16 in., 18 in., with bolt on clearance teeth.

241

Bucket-type earth drill bores 16- to 84-in. holes to 200 ft.

This Calweld Earth Drill Model 150-A removes 21.5 cu. ft. of earth per pass in addition to drilling 16- to 84-in. holes to 200 ft. Of great use to the construction industry as well as



mining and oil field work, this drill digs caisson pier-holes with belled footings, pre-bores concrete piles, drills water wells and cesspools, explores mineral deposits and tests soil conditions. A variety of interchangeable bucket-drills permit boring in almost every soil condition. All controls are centered in a single unit for raising the derrick, lowering the drill, lifting the bucket and powering the drill. The device is built on a skid frame to permit mounting on any truck chassis two-ton or larger. **California Welding & Blacksmith Shop, Inc.** developed the drill.

242

Opportunity to apply silicone materials to masonry for water repellency

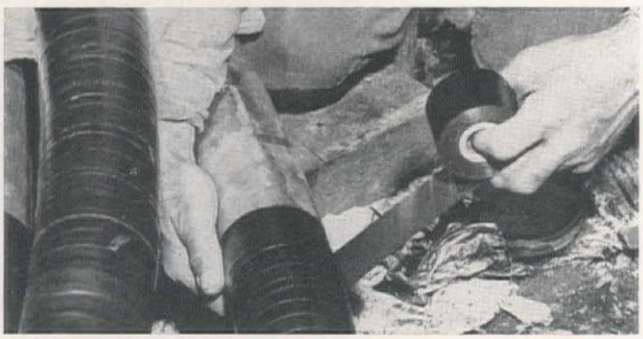
Crystal, a transparent liquid preparation which applies silicone materials to masonry for water repellency, has been patented by **Wurdack Chemical Co.** The process can be applied to buildings without marring the beauty of the exterior surfaces. The repellent is practically unchanged by extreme heat or cold and may be sprayed on at any temperature. It protects mortar joints, as well as seepage through

above grade brick, stucco, concrete block and other masonry materials. It prevents efflorescence, staining and spalling and makes masonry surfaces stain resistant. With masonry joints safeguarded, tuck pointing is held to a minimum. The company has announced it will grant licenses to applicators of silicone masonry water repellents under its patent rights.

243

Plastic electrical tape designed to give above-average strength

Recommended for anti-corrosion protection for pipes, cables and equipment laid underground where resistance to cuts and abrasion by rocks during back-fill is important, this



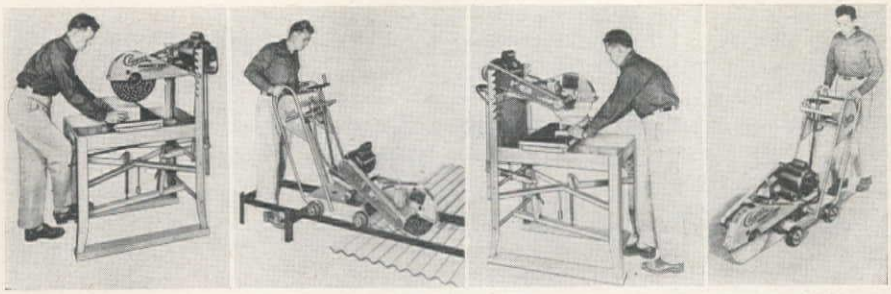
new Scotch brand tape No. 21 offers more-than-average strength. **Minnesota Mining and Manufacturing Co.** also recommends this new tape for protecting and insulating cable and high tension leads subject to wear, abrasion, rough handling, and for bus bars carrying high voltage. The tape has a black, vinyl plastic backing that is 20 mils thick—more than twice the thickness of previous tapes of its type. It has a dielectric strength of 22,500 volts, an insulation resistance of 200,000 megohms, and an electrolytic corrosion factor of 1.0. Available in 36-yd. rolls ranging from ¼ in. to 16 in. in width.

244

GMC announces 3-cylinder diesel truck—lightest highway diesel

The economy and increased efficiency truckers will gain from this **General Motors Corp.** Truck & Coach Division announcement are easily seen. This GMC D450-37 is a 2½-ton unit, the lightest and smallest diesel ever commercialized

for use on American highways. Five wheelbases are available for either truck or highway tractor models. As a truck this model will be invaluable to construction companies hauling cement, bricks and other building materials. As a tractor it offers operating economy, durability. A maximum geared speed of 54.4 mph. with 9:00/20-10 ply tires offers speed while a total gear reduction of 46.9 provides the pulling power for any circumstance. Two new features are: an electrically-operated shift control for models with two-speed axles and an air-actuated hydraulic brake system, which combines air actuation with hydraulic brakes.



245

Masonry saw is now convertible to concrete saw and track saw

The "Convertible" Model HD Masonry Saw, which is both a wet and a dry saw, can now be converted to both a concrete and track saw. At any time the cutting head of the Model HD Masonry Saw can be placed on the convertible (4-wheeled) cart. The equipment is then ready for sawing concrete or asphalt patches, etc. Through this conversion, it is possible to switch from sawing glazed tile, concrete block, etc., to sewer, water or gas lines and floor patches in a few minutes. When placing the model on tracks, stone slabs, transite sheets, pre-cast stone, etc., can be placed under the elevated tracks and sawed with this convertible track saw.

246

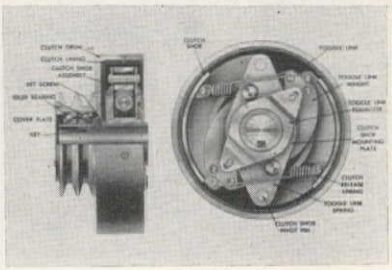
Portable electric drills for construction and maintenance

These drills are built in different power and speed models to cover the speed and torque requirements in production, construction and maintenance use of ¼-in., ⅜-in., and ½-in. capacity portable electric drills. The body is of aluminum die castings for combined strength and light weight. There is the dynamically balanced armature for smoothest running and precision-cut plus heat-treated alloy steel gears. There is adequate forced ventilation for coolest operation at peak power in continuous use. All the ¼-in. models and the extra heavy-duty models in the ⅜-in. and ½-in. capacities have ball and needle bearings throughout. The ¼-in. capacity drills are offered in standard duty, heavy duty and extra heavy duty models with a choice of eight speeds (500 to 5,000 rpm. no load) and pistol grip or saw type handle to suit operator preference. The ⅜-in. capacity drill is available in a heavy duty and an extra heavy duty model with no-load speeds from 400 to 1,000 rpm. The ½-in. capacity drill is made in a standard duty, heavy duty, and extra heavy duty model with a speed range of 500 to 600 rpm. Manufactured by **Portable Electric Tools, Inc.**

247

Clutches for 7- to 15-hp. engines disengage at as low as 800 rpm.

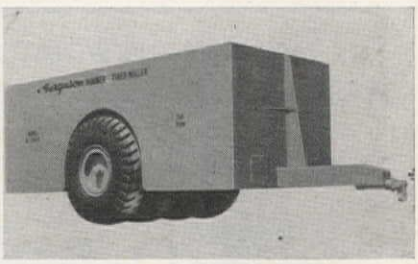
Something new in clutches is announced by **Salisbury Corp.** with this addition to its Tog-o-loc series. For any 7- to 15-hp. engine with 1⅛, 1-7/16 or 1½-in. standard shaft, these clutches have a normal engagement speed, but disengage at as low as 800 rpm. This differential is facilitated by an exclusive mechanism—a linkage connecting heel and toe of the two opposing shoes. This toggle lock is centrifugally actuated and equalized on both the pick-up and release of the load. Both clutch drum and pulley assembly ride free on dual ball bearings during idling periods. Available with standard size pulleys with single and double grooves or with plain hubs onto which special service pulleys may be mounted.



248

50-ton rubber tired roller gives good compaction results

Compaction of earthfill dams, fills for airfield runways, etc., is less of a problem with this new 50-ton rubber tired roller.



It is equipped with four 18:00 x 24-in. heavy duty tires which, when inflated to 90 lb., give the roller 1,250 lb. pressure per inch of tire width or 25,000 lb. per wheel. Rollers are furnished for either sand or cast-iron ballast and are extremely simple in design. Maintenance is held to an absolute minimum. **Shovel Supply Co.** is the manufacturer.

249

Series of small, lightweight portable air drills available

The outstanding features of this new series of air drills by **Ingersoll-Rand Co.** include one-piece housing which provides a compact, well-balanced, exceptionally short and lightweight drill. A

more powerful, redesigned five-vane air motor to give a constantly smooth flow of power, and a built-in automatic lubricator, are provided. An advancement in throttle valve design eliminates air leakage. The specially designed muffler minimizes exhaust noise, and an adjustable exhaust deflector permits the operator to direct exhaust air in any direction. The drills have palm-fitting handles for operator comfort.

250

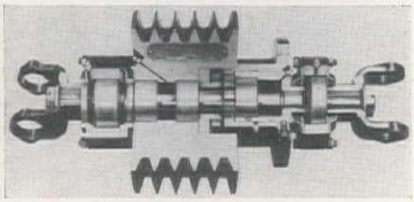
Invisible silicone coating for exterior masonry surfaces

Silipruf is a clear, non-staining water repellant coating for porous exterior masonry surfaces such as brick, concrete, stucco, limestone, sandstone and mortar. The material is easily applied by brush or spray and, unlike conventional transparent waterproofings, does not change the color or texture of the surface to which it is applied. It does not stop the masonry surface from breathing although it has resistance to water penetration. **Preco Chemical Corp.** is the manufacturer.

251

Packaged power take-off fits all standard trucks

The P-80, a new "packaged" heavy duty power take-off by **Davey Compressor Co.**, is guaranteed to transmit full engine power to the driving of heavy



duty truck-mounted equipment. It contains 12 less parts than its predecessor, the Davey 75, and is 25 lb. lighter. Another new feature is a vacuum shift control which is offered as optional equipment. The take-off unit itself is identical for all trucks. The P-80 is 18 in. long and weighs 140 lb.

252

Something new available in medium class graders

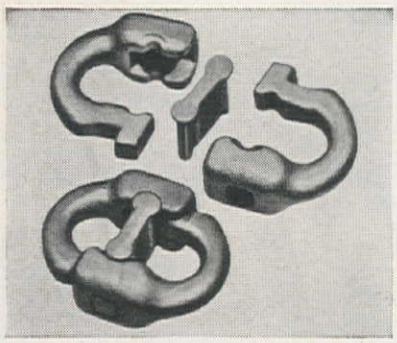
Models 42, single drive, and 44, tandem drive, graders are now in production by **Meili-Blumberg Corp.** This series of graders in the 40-hp. class weigh up to

15,000 lb., carry 10- or 12-ft. blade and are perfectly suited for medium class, ditch to ditch service, with 1:1 slopes. Unique feature of these units is that they can be purchased to fit particular job requirements . . . the price depending upon the feature selected (i.e., single or

tandem drive, gasoline or diesel engine, with or without power circle turn, etc.). Mechanical features include: hydraulic control; chain driven tandem with extra heavy axles; 5 travel speeds forward and one reverse; 90-ft. tubular frame; 86-in. blade base; 19-in. front axle clearance and 7,350-lb. blade pressure.

253
Connecting links can be rapidly assembled

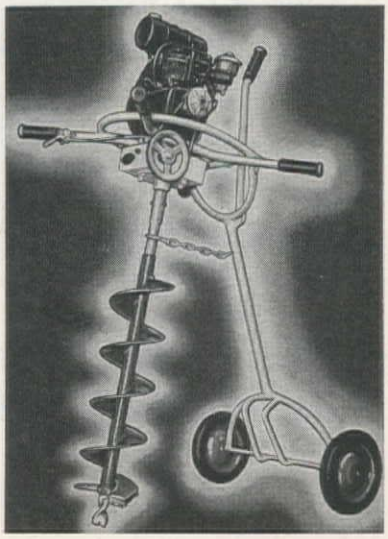
Wedglok safety connecting links can be assembled rapidly without use of special equipment. They offer a tensile strength which exceeds published



strength of comparable alloy chain. The Wedglok spacer is in compression when the link is carrying a load, and it will not shear or loosen if the projecting spacer points are properly positioned. Only two sizes of Wedglok Universal links are needed to connect any size chain from ¼ in. to ¾ in., depending upon the type of chain used. Users can make up chain slings safely from running lengths of chain. They can assemble slings quickly right on the job—without special equipment. The links are manufactured by **Interstate Drop Forge Co.**

254
Holes produced faster by hand-portable auger

The Ground-Hog Digger uses slow speed and limited feed to produce holes faster with less horsepower. Weighing



just over 100 lb. and folding on a wheel cart for easy handling, the auger is powered by a stripped-down 3-hp. air-cooled engine which drives the unit cutter head by means of a V-belt and an automatic saftey clutch. There is a conveniently placed hand throttle and dual handle for two-man operation. Although the augers are designed with a limit-plate to regulate cut depth and the cutting head revolves at only 60 to 90 rpm., a 3- or 4-ft. hole can be completed through the toughest adobe or hard pan in a very few minutes. Digging auger for the machine are manufactured in diameter variations from 6 to 12 in., and are interchangeable by removing the shear pin. **Portable Earth Auger Co.** is the manufacturer.

255
Tamps concrete which is partially set up

Effective tamping of concrete for floors, sidewalks and tilt-up slabs is speeded with the new Gar-Bro Power-tamp. This machine eliminates voids and provides a vibratory action which tamps in rock and brings up mortar to make the finishing job easier. Because it enables the operator to tamp concrete which is partially set up, Power-tamp saves many jobs which would otherwise

be lost with a hand tamp. The tamper is designed for one-man operation. It has an automatic clutch and governor-controlled speed, adjustable from 500 to 1,500 tamps per minute. Surfaces of all bearings are fully protected from mortar and dust. Two-quart capacity gasoline tank permits continuous operation for four hours without refueling. Float is of abrasion resistant moly steel. **Gar-Bro Manufacturing Co.** is the manufacturer.

256
Hoist series developed with hydraulic control

Hoisting control in this new series of hoists by **King Manufacturing Corp.**, is obtained through the use of an oversized hydraulically operated clutch. External contracting 3-in. hand brakes are used to insure safe stopping power. Automatic safety ratchets used in conjunction with the brake are standard equipment on all models. Model 2500-H features a capacity of 6,000 lb. at 100 fpm. A wide range of speeds and capacities are available. Power is a 25-hp. Wisconsin gasoline engine. Model 1300-H has a capacity of 3,000 lb. at 100 fpm. as standard gearing and also has a wide range of speeds and capacities. The power is a 13-hp. Wisconsin gasoline engine. All units are equipped with anti-friction ball and roller bearings to reduce friction loss to a minimum.

NEWS of DISTRIBUTORS AND FACTORY BRANCHES

Otterness new sales manager

R. A. (Bob) Otterness is the new sales manager of Contractors' Equipment & Supply Co., Albuquerque, N. Mex. He will represent the firm's lines of Baldwin-Lima-Hamilton Corp., Barber-Greene Co., Chain Belt Co., Ingersoll-Rand Co., R. G. LeTourneau, Inc., and Michigan Power Shovel Co., etc., in the entire state of New Mexico. Otterness comes to his new position from a job as district manager for Lima in the Dallas, Tex., district.

Otterness

Guthrie

Gar Wood Western manager

A. M. Guthrie returns to the Findlay Division of Gar Wood Industries as district manager of the West Coast Area for the Gar Wood line of Tipdozers, Dozecasters and scrapers for Allis-Chalmers industrial tractors, and the Buckeye line of ditchers, highway wideners, crane-shovels, spreaders and fine-graders. Guthrie's territory consists of California, Washington, Oregon, Utah, Arizona, Nevada, Montana, Wyoming and Idaho.

W-A scaffolding distributors

Exclusive distribution rights for Wilson-Albrecht "WACO" brand sectional steel scaffolding equipment in Colorado and four southern Wyoming counties are granted Professional Paints, Inc., Denver, Colo. A separate WACO division, with Edward Madigan as president and Alvin D. Lichenstein and Martin Trotsky as assistants, has been established by Wilson-Albrecht. Bud Rifkin will be Denver representative for the new division.

Garlinghouse adds Lincoln line

The complete line of Lincoln lubricating equipment has been added to the stock of Garlinghouse Brothers, 2415 E. Washington Blvd., Los Angeles, Calif. These products will supplement Lubriplate Lubricants for which the firm was recently appointed distributor.

"Cat" distributor in Montana

The Nash-Davis Machinery Co., Billings, Mont., will serve southern Montana and northern Wyoming as a Caterpillar Tractor Co. distributor. The firm

maintains stores in Sheridan and Greybull, Wyo. This territory was previously covered by Wortham Machinery Co., which will continue as a Caterpillar distributor in the southern portion of Wyoming. D. O. Nash is president of the new distributor firm and K. H. Davis is vice president and sales manager.

Lull district sales mgr. in West

Aubrey L. Stains is the recently appointed district manager in sales for Lull Manufacturing Co. His territory includes the states of Arizona, California, Nevada, Utah, Wyoming, Idaho, Oregon, Montana, Washington, Colorado and the Canadian Provinces of British Columbia and Alberta. Stains will headquarter in Sacramento, Calif.

Stains

Long

Long is mgr. for Pioneer in L. A.

The Los Angeles, Calif., branch of Pioneer Rubber Mills will be managed by William S. Long. Long offers many years of experience in the rubber industry. He replaces Harry T. Jackson, who is promoted to the position of assistant general sales manager at Pioneer's San Francisco, Calif., headquarters.

BAY CITIES EQUIPMENT CO. OPEN HOUSE

In celebration of its appointment as Northern California distributor for R. G. Le Tourneau, Inc., Bay Cities Equipment Co. gave an open house for nearly 1,000 people. At left, below is a general view of the gathering showing the facilities in the midst of the festivities. Visiting contractors, operators, business men, etc., saw demonstrations and displays and enjoyed the evening barbeque. Right, below, *George McIntosh*, sales manager, chats with *Andy Clausen* and *C. W. Cooper*, visitors. Bay Cities' new headquarters are at 2606 Cypress St., Oakland, Calif.

Sterling names Western distributors

Sterling Electric Motors, Inc., has appointed several new distributors in the West. Firms which will handle Sterling's power drives are: Industrial Electrical Co., 1244 McHenry Ave., Box 1025, Modesto, Calif.; Butte Machinery Co., 510 E. Aluminum, Butte, Mont.; Pomona Electrical Machinery Co., 260 N. E. End Ave., Pomona, and Industrial Motor Electric, 449 West St., Woodland, Calif.

NEWS of MANUFACTURERS

Wilkinson heads Soule' research

James D. Wilkinson becomes the manager of the commercial research division of Soule' Steel Co. He will head the firm's steel building product marketing research throughout the eleven Western States.

Calmec expansion

Calmec Manufacturing Co., 5825 District Blvd., Maywood, Calif., has nearly completed an addition to its machine shop. A. S. McIntyre is the owner.

Nat'l mgr. for Barnes Co.

William D. Schneider becomes national manager of pump and water system sales for Barnes Company. He will headquarter in Mansfield, Ohio. Schneider spent 15 years with Flint & Walling Co., recently as Western regional sales manager.

McElroy pres. of Western Round Chain

William J. McElroy is the new president of the West Coast companies of Round Associate Chain Companies. He will head the Seattle Chain & Mfg. Co., Round California Chain Co., and Round Los Angeles Chain Co. McElroy will continue as general manager of Seattle Chain.

Ryerson steel companies' stocks

Joseph T. Ryerson & Son, Inc., steel distributor, acquires the stocks and warehouse facilities formerly owned by Seattle Steel Co. and Inland Empire Steel Co. The executives and other personnel of the two steel warehousing

Space is sold as advertisers' inches. All advertisements in this section are 1/8 in. short of contracted space to allow for borders and composition.

CLASSIFIED SECTION

Rates are $6.50 a column inch. Copy should be sent in by the 10th of preceding month if proofs are required; by the 15th if no proofs are required.

firms will continue on under the new organization.

Smith Eng. Works president dies

Smith

Charles F. Smith, 70, president of Smith Engineering Works, died December 10 in Pasadena, Calif., while on a winter vacation. Smith developed his firm from a company owning only a few patents to one of the leaders in the field of machinery for mines, quarries and gravel pits. Smith became president of the company in 1915. He was also a vice president of the Sterling Wheelbarrow Co.

More space for steel fabricators

Fought & Gray, Inc., steel fabricators and miscellaneous iron products manufacturers, move to larger quarters on Swan Island, Portland, Ore. Building 9 on Swan Island now houses the firm and provides over 40,000 sq. ft. of shop space. The firm offers steel fabrication for all purposes as well as custom built iron products. They serve the Northwest and along the Pacific Coast.

Universal Form's gen. sales mgr.

D. M. DeCanio, chief engineer, Universal Form Clamp Co., will assume new duties with the firm as general sales manager. He will continue in his present capacity also.

Turner heads Bitumuls Co.

C. W. Turner is the new president of American Bitumuls and Asphalt Co. C. W. Stewart, former president, will serve in the newly created position of vice-chairman of the board of directors.

"Cat" acquires Trackson Co.

Caterpillar Tractor Co., San Leandro, Calif., announces that it has acquired the Trackson Company, Milwaukee, Wis., and will operate the concern as a wholly-owned subsidiary. Manufacture of the line of loaders and pipelayers will continue as auxiliary equipment for Caterpillar Diesel Tractors. Walter H. Stiemke, Trackson president, and L. E. Dauer, vice president, will continue in their positions under the new arrangement.

Hyster, Portland, open house

Formal opening of the new general assembly building of Hyster Company was marked by an open house December 15. The new building, 2902 N.E. Clackamas St., Portland, Ore., was open for inspection from 1:00 to 5:00 p. m.

USS merges subsidiaries

Columbia Steel Co. of California and Geneva Steel Co. of Utah, United States Steel Corp. subsidiaries, will henceforth be known as the Columbia-Geneva Steel Division of United States Steel Co., another USS subsidiary. Consolidated Western Steel Corp. will also become a division of United States Steel Co. Alden G. Roach will serve as president of the two new operating divisions.

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