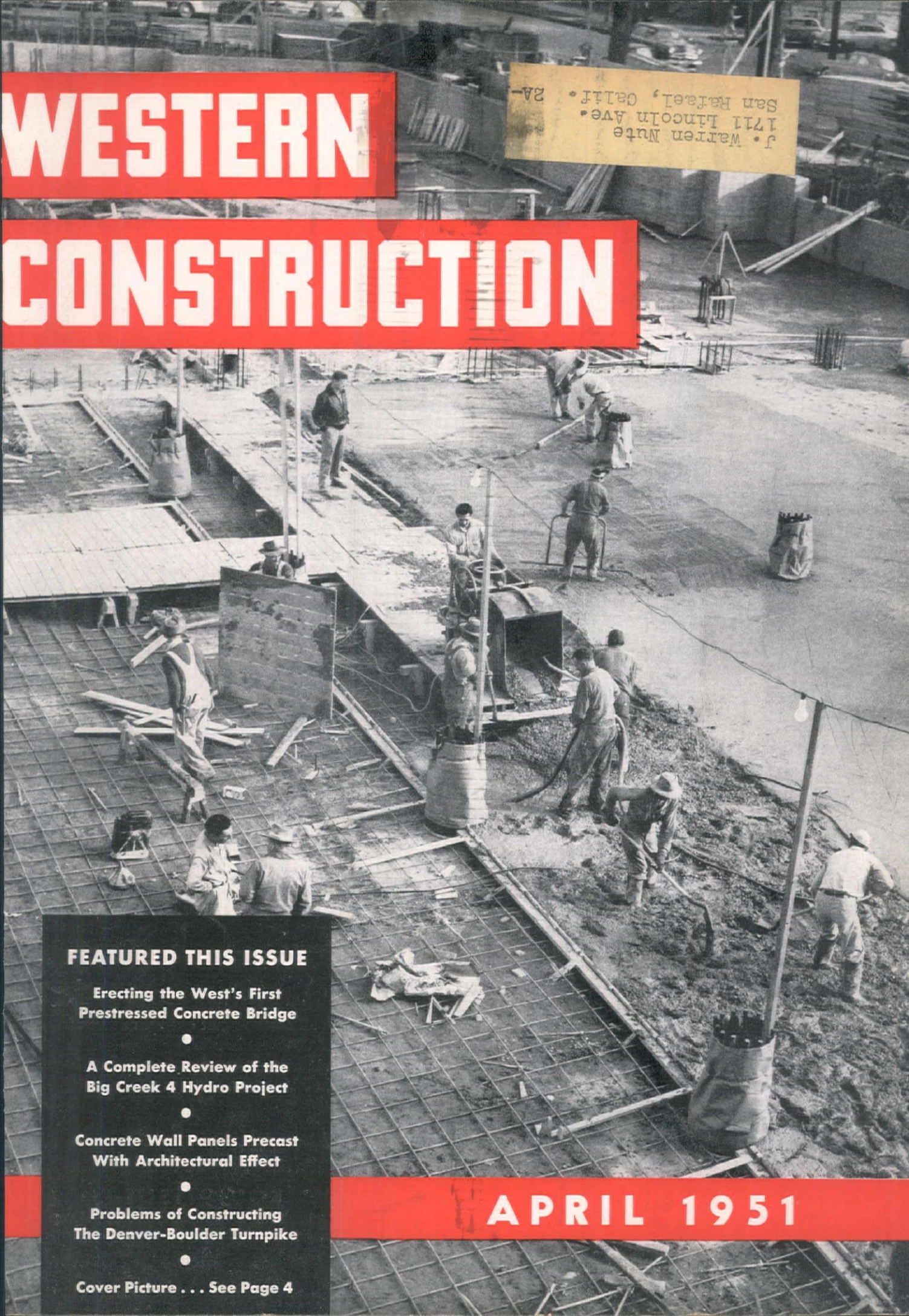
WESTERN CONSTRUCTION



FEATURED THIS ISSUE

APRIL 1951

EVEN IN ROUGH, TOUGH SERVICE

Maintenance costs come down when bearings are protected by TEXACO MARFAK

When you use *Texaco Marfak,* your bearings get real protection, and — *the protection lasts!* This tough, tenacious lubricant *stays in the bearings* in spite of heavy loads, the pounding jolts of off-highway service, or puddle splash. *Texaco Marfak* wards off both wear and rust . . . assures longer parts life . . . lower maintenance costs.

You can also assure similar long-lasting protection for wheel bearings by using *Texaco Marfak Heavy Duty.* It seals out dirt and moisture . . . seals itself *in* the bearings and stays *off* the brakes. You thus get greater operating safety as well as greater protection against wear and rust. Lower maintenance costs are assured. No seasonal change is necessary.

TWO MORE ECONOMIES

Engines — heavy-duty gasoline or Diesel — run better and more economically when lubricated with *Texaco Ursa Oil X**.* Its fully detergent-dispersive properties keep engines clean . . . keep maintenance costs and fuel consumption low.

Lower maintenance costs for crawler track mechanisms are yours when you use *Texaco Track Roll Lubricant.* It's especially designed for this strenuous service — protects bearings by forming an effective seal against dirt and moisture.

Adopt Texaco's Simplified Lubrication Plan and gain cost-saving efficiency. A Texaco Lubrication Engineer will gladly tell you all about it. 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, N. Y.

TEXACO

TEXACO Lubricants and Fuels

FOR ALL CONTRACTORS' EQUIPMENT

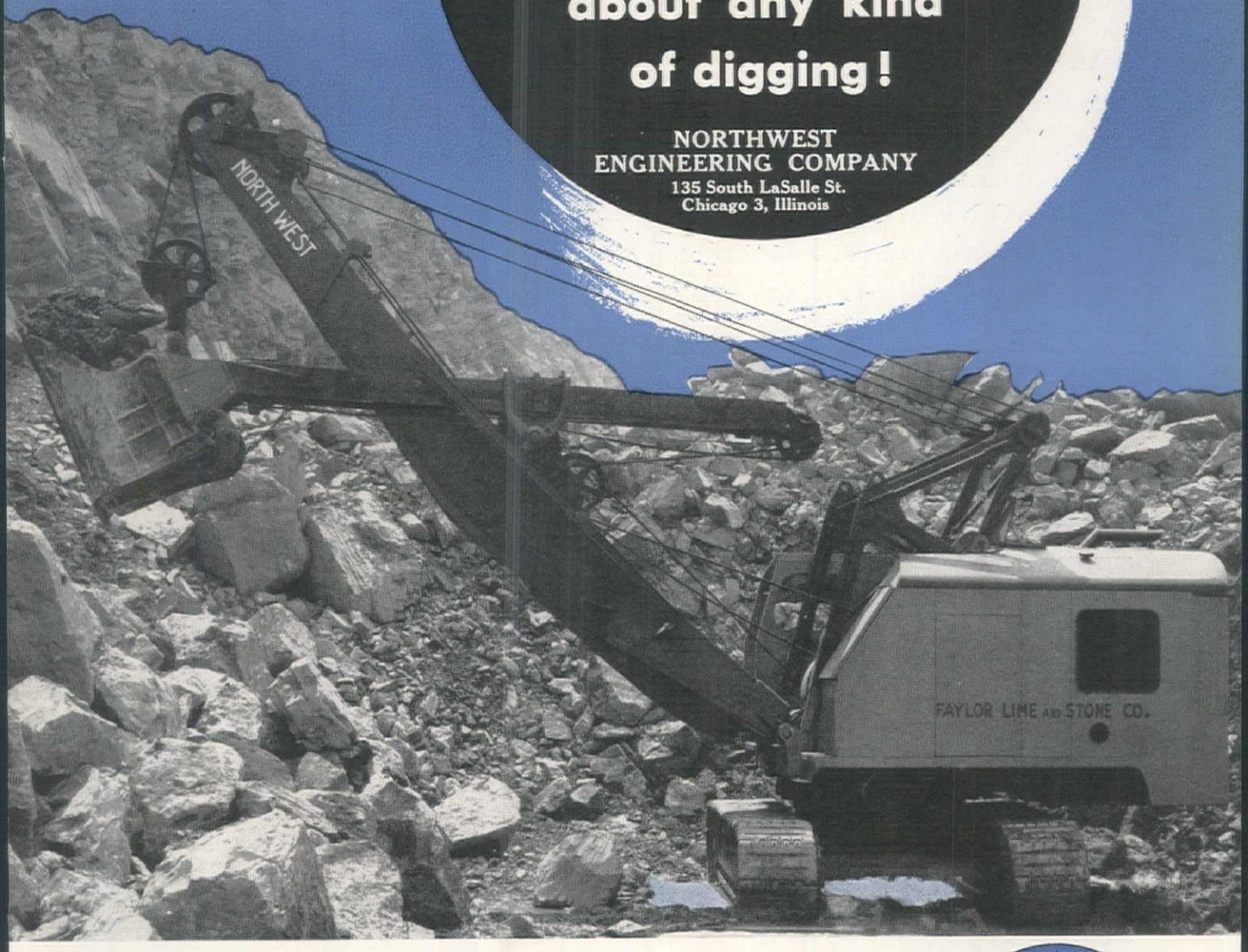
TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. See newspaper for time and station.

If you have a

REAL ROCK SHOVEL

you never have to worry about any kind of digging!

NORTHWEST
ENGINEERING COMPANY
135 South LaSalle St.
Chicago 3, Illinois



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Hall-Perry Machinery Co.

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Northland Machinery Co.

MEDFORD, OREGON
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255 Tenth Street

SEATTLE, WASHINGTON
1234 Sixth Ave., South

WESTERN CONSTRUCTION

Volume 26 **APRIL 1951** Number 4

ARTICLES

DEPARTMENTS

FRONT COVER

CONCRETE was placed in a hurry for the basement floor slab of the new annex for the Public Works Building at Sacramento. Reason—two manufacturers of concrete handling equipment staged a competitive demonstration of motor-driven buggies for the benefit of Ray LaBrea, superintendent for Haas and Rothschild, general contractor for the building job. View on the cover shows a number of operations proceeding simultaneously. For a more complete description of the job and the competition, see this month's How It Was Done section, page 96.

The Construction and Civil Engineering Publication of the West

★

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★

Entered as Second Class Matter at the Post Office in San Francisco, California under the Act of March 3, 1879.

B.F.Goodrich

Ready for 45 tons on a 60,000-mile trip

MIKE WEATHERBY, shown left above, is supervisor of a man-sized moving job.

As an operator of off-the-road equipment for the Basalt Rock Company, Napa, California, he hauls average gross loads of 45 tons of sand and gravel from the pits to the company's processing plant.

And because the BFG Universal tires on his rig can take it, he moves more materials farther, at less cost to his company.

These big tires have greater bruise resistance — greater ability to absorb and withstand the shocks encountered in drive wheel service under such heavy loads. This is because these BFG tires have the patented *double nylon shock shield* built between the tread and rayon cord body. Yet this added protection (which is exclusive with B. F. Goodrich) is provided at no extra cost to his company.

While pulling 90,000 pounds to the plant, Mike's equipment encounters soft, wet dirt and gravel — hard on traction — with an occasional sharp rock thrown in as a surprise package. Yet the special rubber compound built into the husky, wedge-shape tread lugs resists cutting while giving positive two-way traction.

And these tires have been giving an average of 60,000 miles of service!

B. F. Goodrich builds special off-the-road tires for every type of hauling job. See your local B. F. Goodrich dealer. Start now to enjoy the benefits of longer tire life and lower operating overhead. *The B.F.Goodrich Company, Akron, Ohio.*

RESEARCH KEEPS
B.F.Goodrich
FIRST IN RUBBER

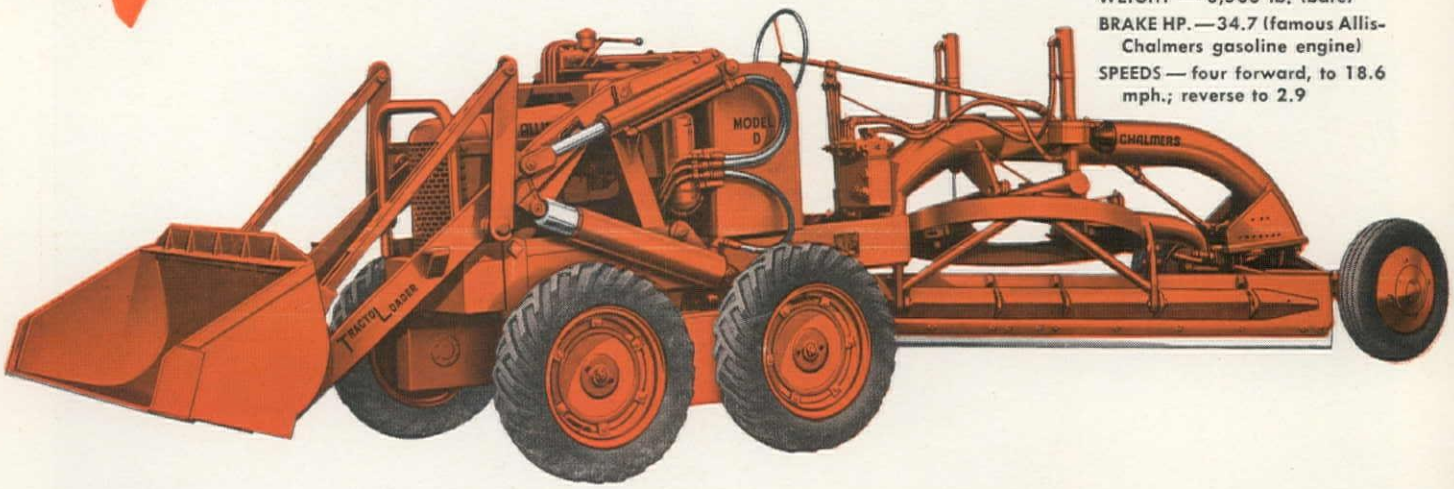
Maintains Roads and Streets

Loads From Stockpiles

Scarifies Toughest Surfaces

only the ALLIS-CHALMERS model D

WEIGHT — 8,500 lb. (bare)
BRAKE HP.—34.7 (famous Allis-Chalmers gasoline engine)
SPEEDS — four forward, to 18.6 mph.; reverse to 2.9



More than a highly efficient, low-cost motor grader with big grader features... the "D" is an all-year, many-job machine . . . the most useful grader on the market today with easily mounted, matched attachments:

REAR-END LOADER 5/8-cu. yd. bucket, hydraulically operated . . . tandem drive traction.

V OR BLADE-TYPE SNOWPLOWS Interchangeable, hydraulically operated. Blade plow may also be used for backfilling and light 'dozing.

SCARIFIER Mounts behind grader blade . . . makes full use of weight and traction . . . steering is positive, easier.

WINDROW ELIMINATOR Hydraulically controlled, saves extra passes by feathering out windrow left by grader blade.

Let your Allis-Chalmers dealer show you what the Model D can do for you

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—Peerless Tractor and Equipment, Food Machinery and Chemical Corp.; Salinas and King City—Livingston Bros. Tractor Co.; No. Sacramento, Stockton, Redding—Moore Equipment Company, Inc.; Mountain View—Redwine Tractor Co.; Visalia—Tulare County Tractor Co. **SOUTHERN CALIFORNIA**: Bakersfield—San Joaquin Tractor Co.; 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 Co.; 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 Company; 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 Company, Inc.—American Machine Company. **WYOMING**: Casper—Studer Tractor & Equipment **WASHINGTON**: Seattle, Tacoma and Wenatchee—A. H. Cox & Company; Spokane Company.

Slopes Banks — up to 2:1

Cuts and Cleans Ditches

Strips Sod

can handle so great a variety of jobs —at a new low cost

Finishes Between Forms

Grades Shoulders

Feathers Out Windrows

Levels Subdivisions

Handles Terracing

Works and Spreads Oil Mix

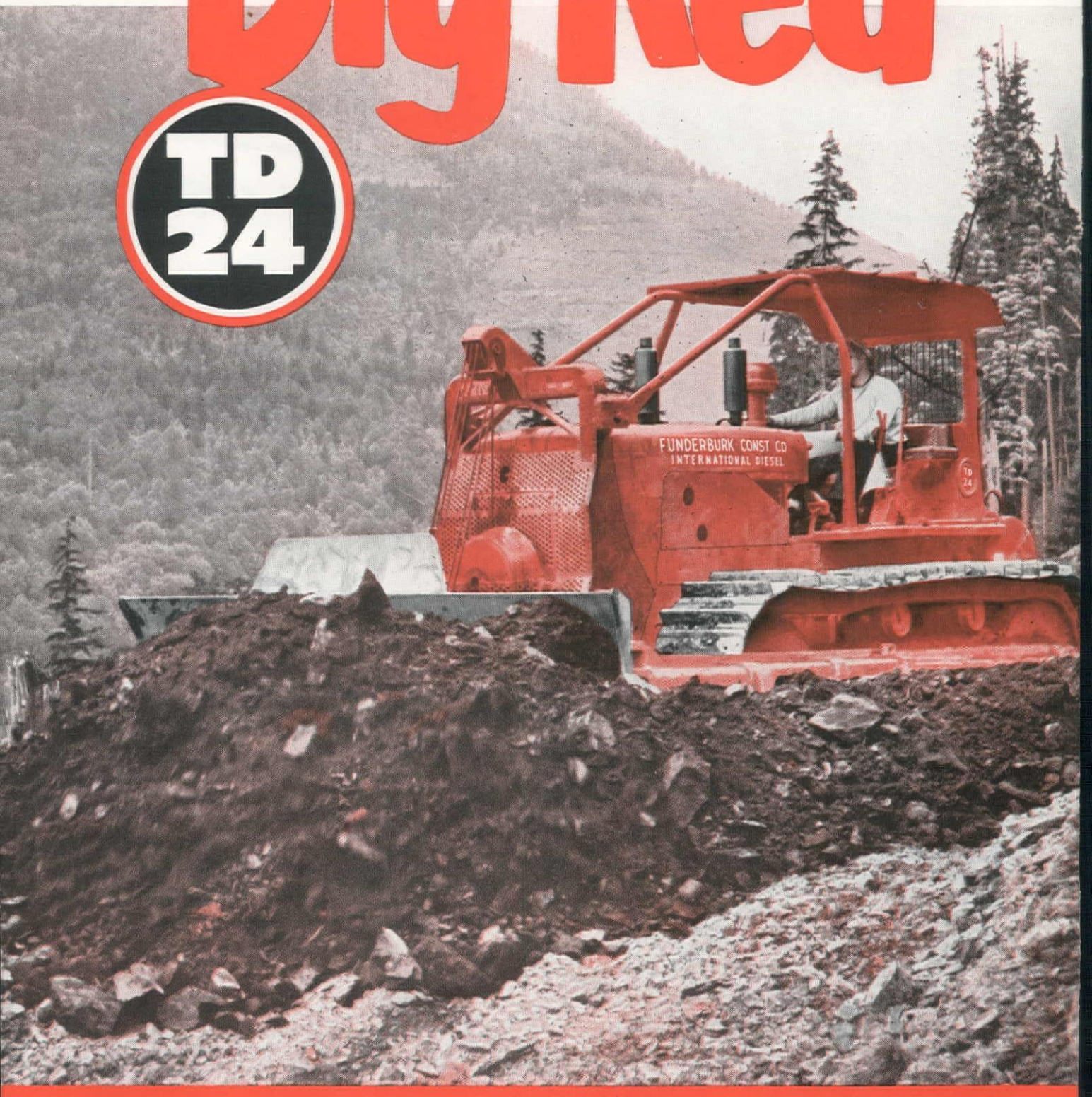
Plows Snow

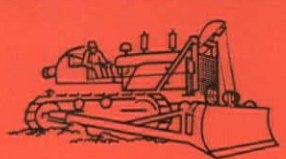
Loads Surplus Dirt

Loads Snow

"Big Red"

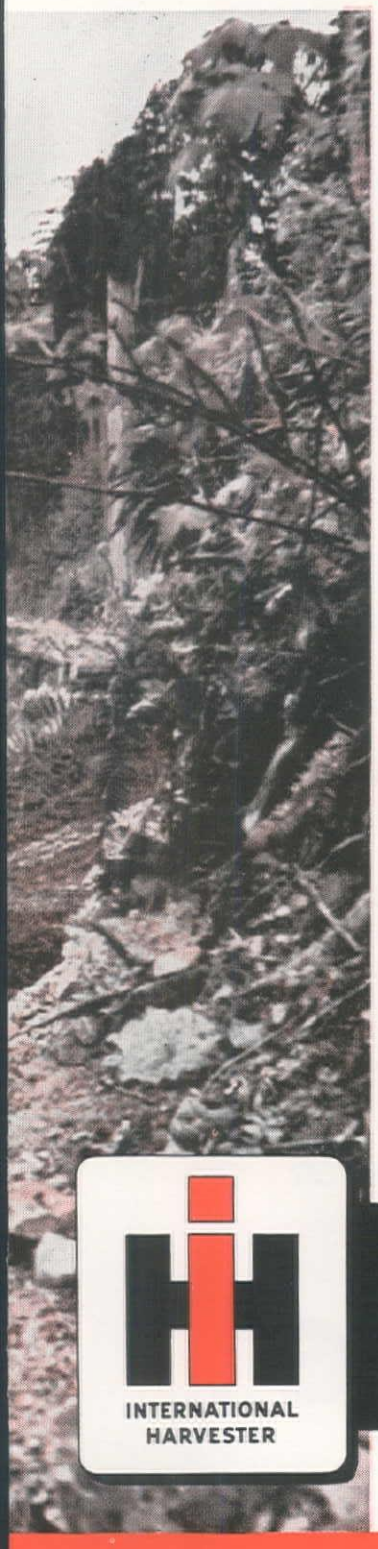
TD 24





Beats Blue Mountain

Read how the International TD-24 pays off, helping build mountain-top radio station.



Out near Seattle rise two 3,000-foot peaks that have suddenly become mighty important. Blue Mountain and Wheeler Mountain, a mile apart, are the bases for new antenna towers of what will be one of the most powerful radio stations ever built.

Toughest part of the construction job was building roads up the mountains. First the Funderburk Construction Company conquered Mt. Wheeler. Then they bought a new International TD-24 and started gouging out the rocky road to the top of Blue Mountain. And with the big red champ on the job, they moved faster, easier, more profitably.

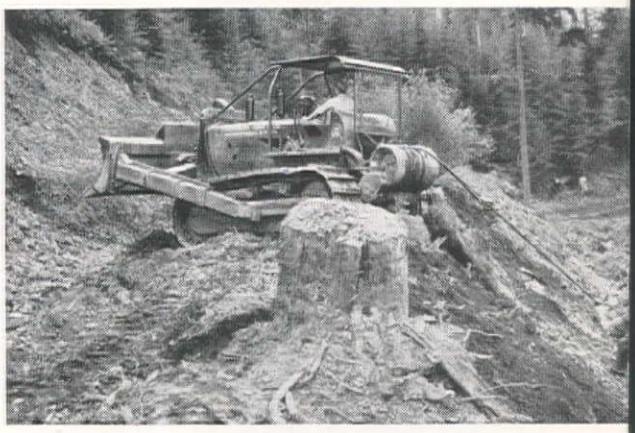
"It's the TD-24's power and Planet Power steering that pay off," says Ed Funderburk. "The TD-24 stays up in the bank easier and pushes bigger bladefuls farther than any other tractor can. This means lots more material moved at the end of the day."

It means more work done on any job. See for yourself. See your International Industrial Distributor and get the real low-down on the TD-24. And check up on the service your distributor can give you over the hard-working years ahead. With factory-trained mechanics and ample shop facilities, backed up by International's strategic network of parts depots across the country, your International Industrial Distributor is all set to keep your International power on the job for you and the nation!

INTERNATIONAL HARVESTER COMPANY
CHICAGO 1, ILLINOIS

TOP THIS ONE! Building a 14-mile road to "top" Blue Mountain means dozing down 250,000 cubic yards of material—mostly rock. It's a job that calls for the brute power of the world's most powerful crawler—the International TD-24.

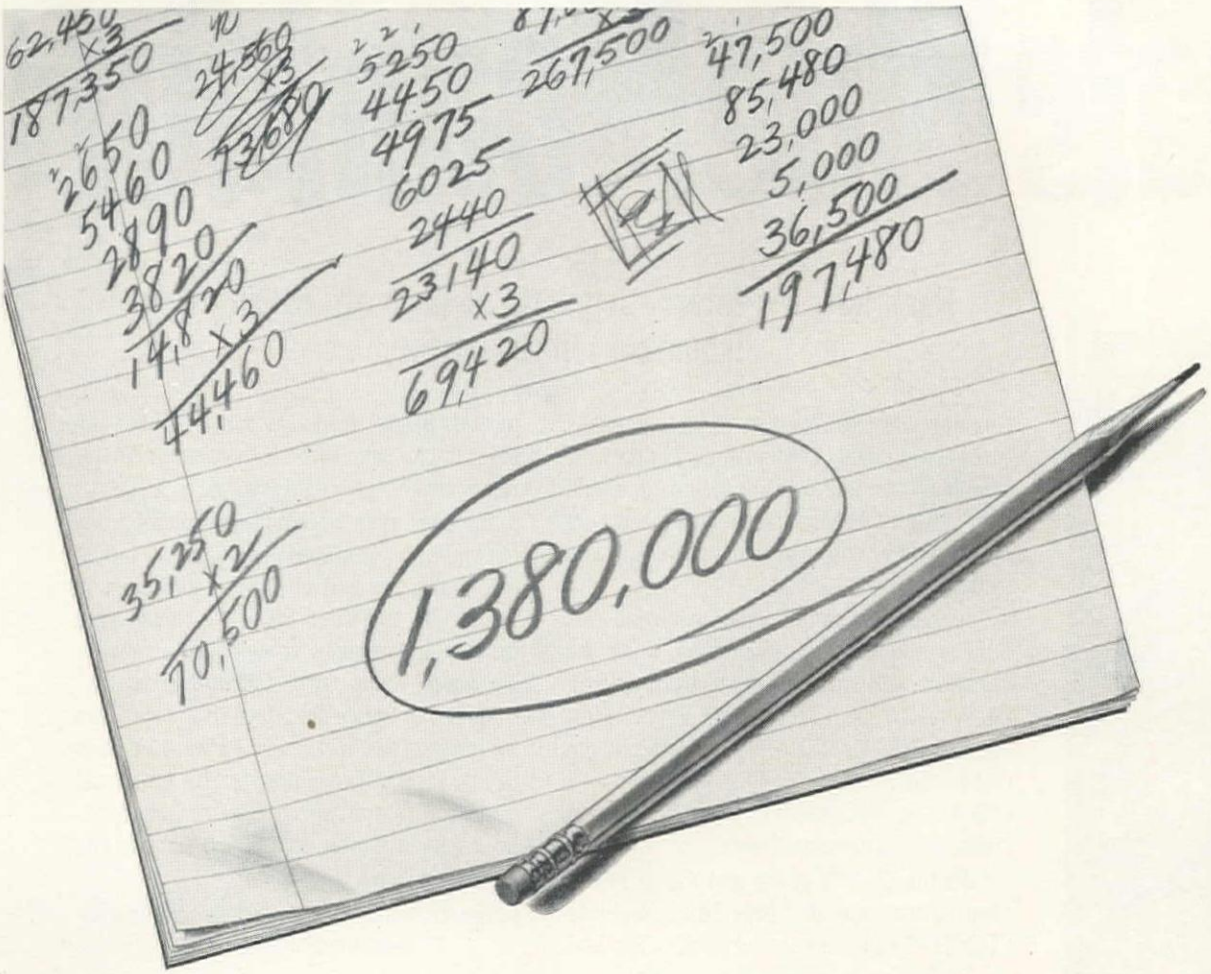
RECESS FOR THE CHAMP! It's child's play for Ed Funderburk's TD-24 when the skinner lays off dozing long enough to pull stumps from the new road's right-of-way.



INTERNATIONAL HARVESTER

INTERNATIONAL

POWER THAT PAYS



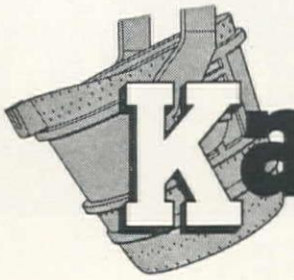
Important figure to the West

THAT total is the annual capacity in tons of ingots that Kaiser Steel will attain in 1951 to meet the growing needs of the West. It's more than *double* the amount produced in 1944, the peak war year!

This remarkable record is the result of a continuous expansion program. This program includes the construction of a second blast furnace; the building of additional coke ovens and two more open hearth furnaces; the acquisition of extensive iron ore and coal deposits.

Backing up this expansion is an around-the-clock, 24-hour work schedule to produce more steel to meet pressing Western demands for many products —including Kaiser Steel structural shapes.

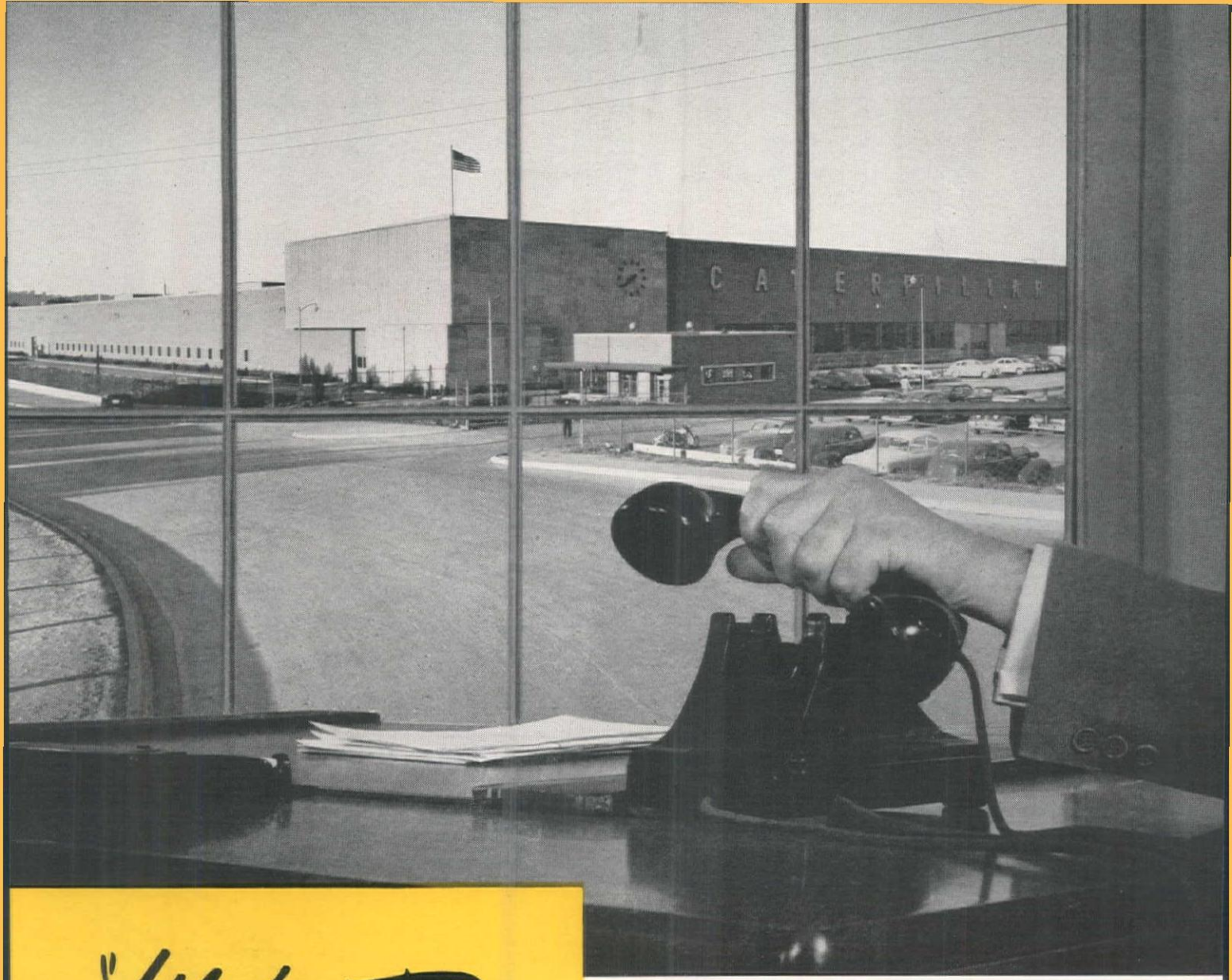
It's good business to do business with



Kaiser Steel

built to serve the West

PROMPT, DEPENDABLE DELIVERY AT COMPETITIVE PRICES • plates • continuous weld pipe • electric weld pipe • hot rolled strip • hot rolled sheet • alloy bars carbon bars • structural shapes • cold rolled strip • cold rolled sheet • special bar sections • semi-finished steels • pig iron • coke oven by-products
For details and specifications, write: **KAISER STEEL CORPORATION, LOS ANGELES, OAKLAND, SEATTLE, PORTLAND, HOUSTON, TULSA, NEW YORK**



"Washington calling!"

We were expecting this call. In a sense it is the people of America on the other end of the telephone. For some time they have been calling upon our government to take whatever steps are necessary to equip our fighting men for any job they may have to do.

Korea has proved the fallacy of limited preparedness. You know now that the nation is girding for survival. The people of America have said—and rightly—that private industry should provide the Armed Forces with whatever is necessary.

Machines are being mobilized. "Caterpillar" products are wearing olive drab once more. Because of large military demands your present machines may have to work longer than you had anticipated.

You can get many extra hours of machine service life if you:

1. Follow a sound program of operation and maintenance.
2. Consult your Operator's Instruction Book, using it as a constant guide in caring for your machines.
3. Secure the assistance of your "Caterpillar" dealer who now, more than ever before, is your working partner for the grim job that may lie ahead.

• • •

CATERPILLAR TRACTOR CO., SAN LEANDRO, CALIF.; PEORIA, ILL.

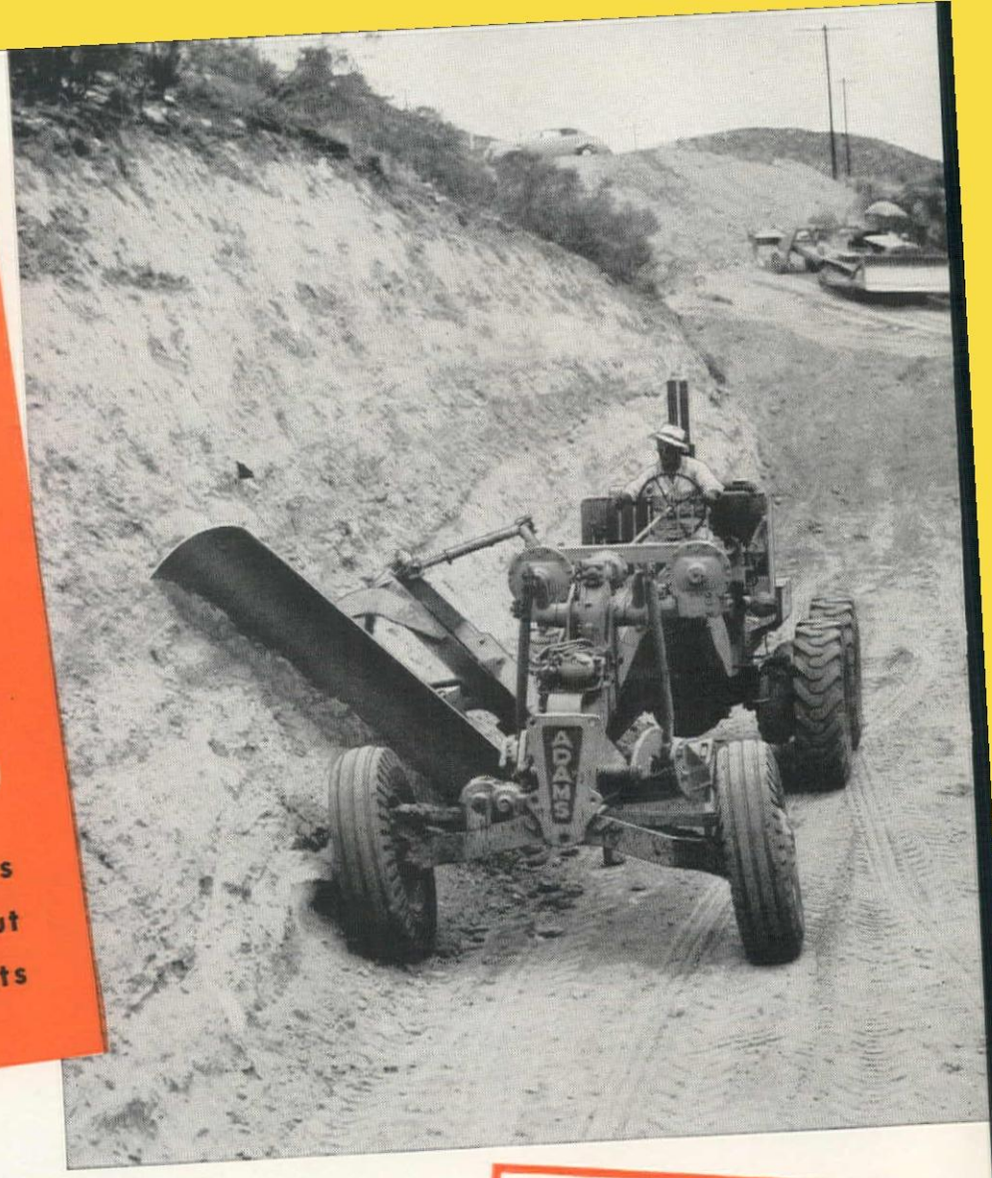
CATERPILLAR

REG. U. S. PAT. OFF.

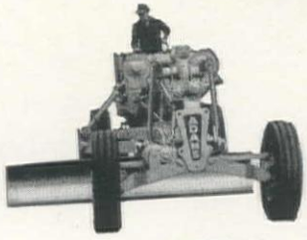
Diesel Engines • Tractors • Motor Graders • Earthmoving Equipment

Adams Motor Graders

All these blade positions —and more too—without mechanical adjustments



Ditch Cutting



Reach Outside Wheels

Reverse Ditching or Blading

● On most construction work—ditching, low and high bank slopes, wide shoulder reach, etc.—the operator of an Adams Motor Grader quickly and easily obtains all necessary blade positions through convenient cab controls—*without mechanical adjustments.* Only occasional work, calling for extreme reach, requires operator to shift blade on circle or change lift linkage.

The ability of Adams Motor Graders to provide this wide range of blade positions—*without mechanical adjustments*—is one of the big reasons why they are the fastest, most efficient and economical graders on the market. Ask your local Adams dealer for complete information.

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

CALIFORNIA DISTRIBUTORS

Bakersfield—Kern County Eqpt. Co., Inc.
Eureka—Tony Gosselin
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Salinas—Farmers Mercantile Company
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San Jose—Valley Equipment Co.
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Santa Rosa—Stevenson Eqpt. Co.
Stockton—Inland Equipment Corp.
Stratford—Orton's Eqpt. Co.
Visalia—Exeter Mercantile Co.
Woodland—Graco

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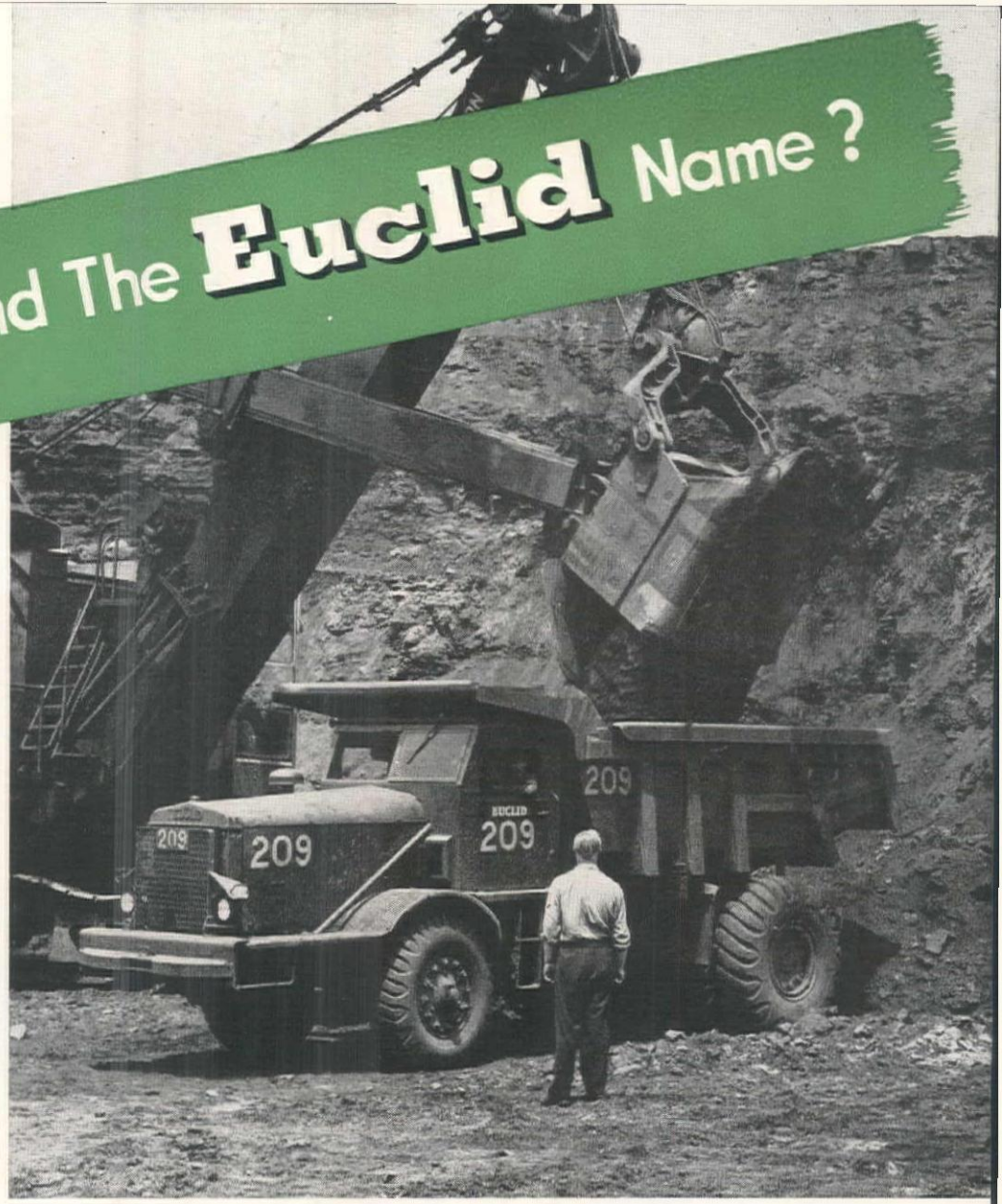
What's Behind The Euclid Name?



* Dependability

Euclids are engineered for the job . . . built for efficient, long life performance in off-the-highway service. In mines and quarries, on construction and industrial jobs, "Eucs" have earned their reputation for durability and low cost operation.

Plenty of power . . . large capacity for bigger loads . . . body designs for all types of materials . . . earth, ore, rock, or coal. Rear-Dump Euclids range in capacity from 10 to 34 tons, have diesel engines from 125 to 400 h.p. Bottom-Dump Euclids have capacities of 13 to 50 cu. yds., 20 to 40 tons with diesel engines to 300 h.p.

Repeat orders prove customer satisfaction. Owners say that "Eucs" actually cost less to own than any other hauling equipment. Euclid dependability will pay off on your present or future jobs. Write for complete information on the Euclid line, or call your distributor today.

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

MORE LOADS PER HOUR— MORE PROFIT PER LOAD

EUCLIDS *Move the Earth*

BIG RED

Beats Tough Loading — And Competition —

BUCYRUS ERIE

BLUE shale so hard it often had to be shot and ripped before loading . . . scraper maintenance costs way up, yardage output down . . . pushers not used to avoid damage to scrapers. That was the picture on a tough highway job until one of the contractor's International TD-24 Tractors was teamed with a Bucyrus-Erie B-250 scraper. Look what happened when the Big Red team went into action.

On a 60-day run, this 22-yd. outfit not only scraped out heaping loads of shale, but did it without blasting. Big Red team loads averaged 13.5 to 20% higher than competitive units — and two of these scrapers had greater apparent rated capacities than the B-250. Loading time of the B-250 averaged 1¾ minutes with a pusher. In spite of heavy shock loads, the B-250 showed no signs of failure.

This is one of many jobs on which the Big Red team has performed with complete satisfaction to the owner. Performance details on this job, or any other job on which records have been carefully compiled, are yours for the asking. Study these records . . . and let us demonstrate the Big Red team *on your own job*. Then you'll have convincing proof that this combination gives you the ultimate in crawler tractor earthmoving performance.

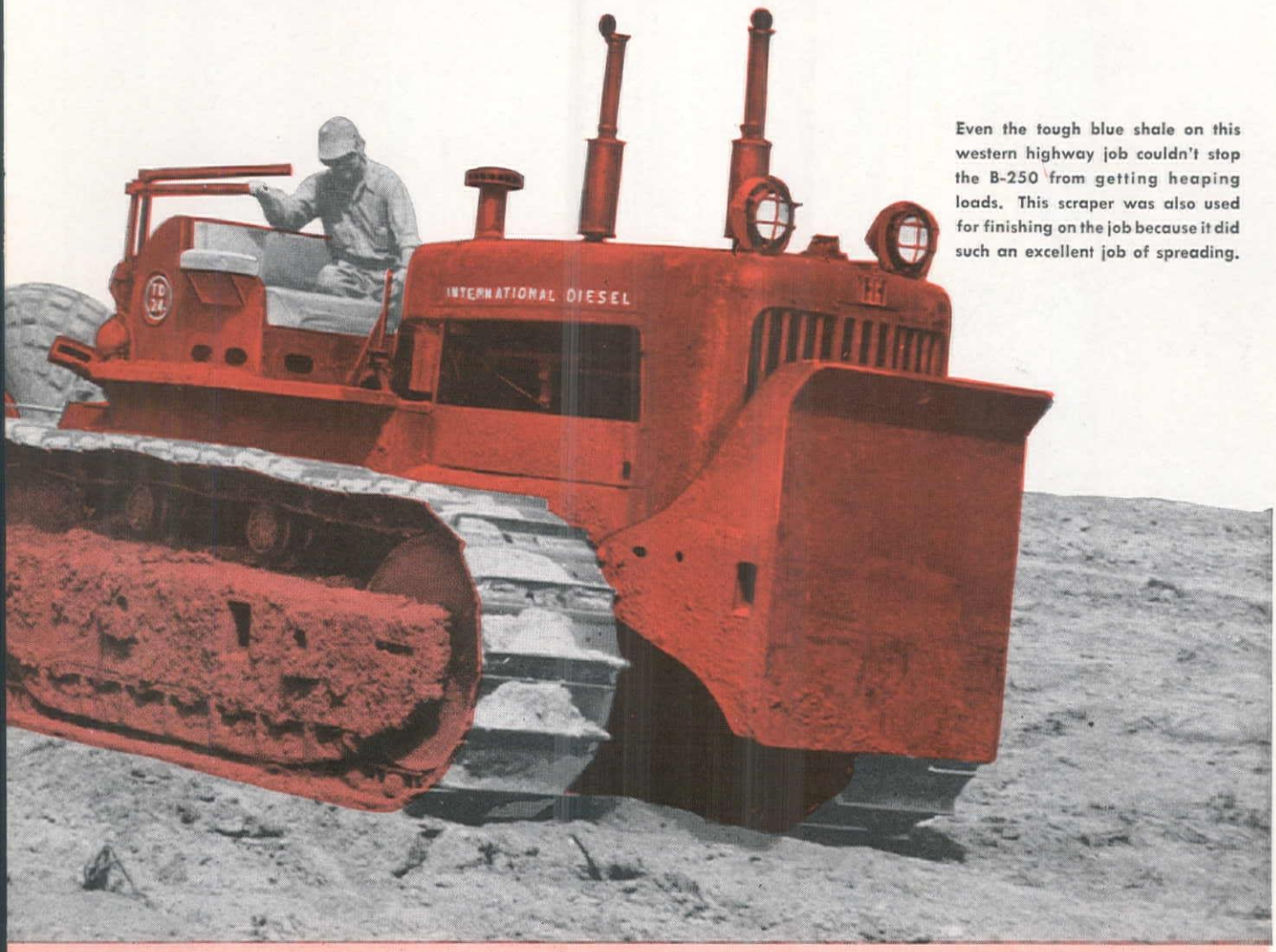
BUCYRUS-ERIE COMPANY

South Milwaukee, Wisconsin

245T51C

TEAM

On Million-Yard Highway Project

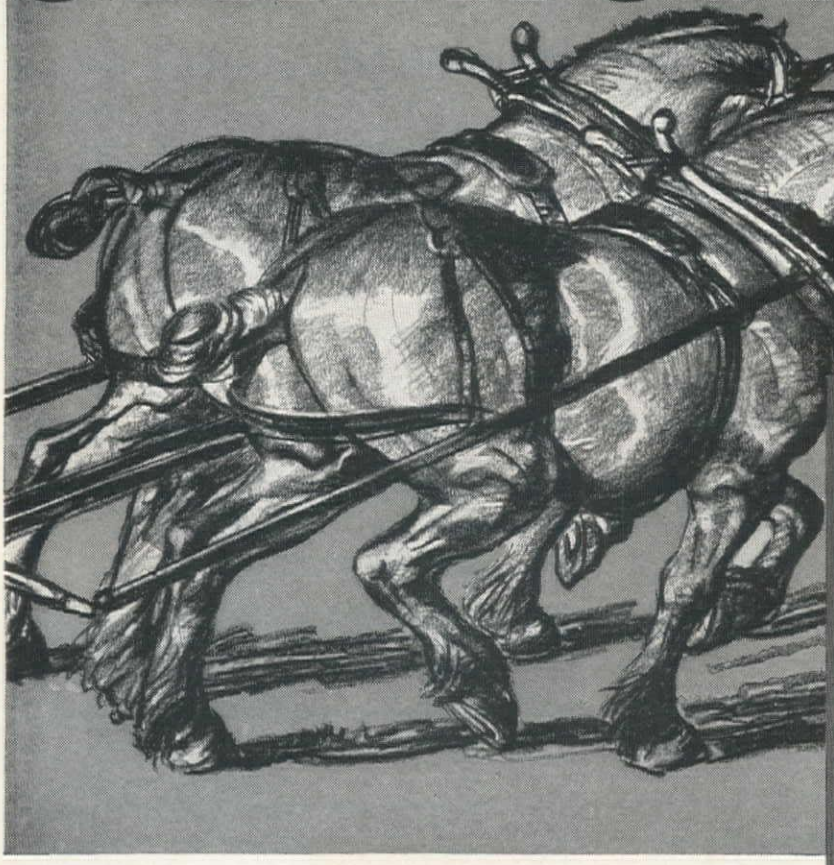


Even the tough blue shale on this western highway job couldn't stop the B-250 from getting heaping loads. This scraper was also used for finishing on the job because it did such an excellent job of spreading.

See Your INTERNATIONAL

Industrial Tractor Distributor

STRENGTH is vital



STRENGTH
is vital in pipe for city streets

CRUSHING STRENGTH

The ability of cast iron pipe to withstand external loads imposed by heavy fill and unusual traffic loads is proved by the Ring Compression Test. Standard 6-inch cast iron pipe withstands a crushing weight of more than 14,000 lbs. per foot.

BEAM STRENGTH

When cast iron pipe is subjected to beam stress caused by soil settlement, or disturbance of soil by other utilities, or resting on an obstruction, tests prove that standard 6-inch cast iron pipe in 10-foot span sustains a load of 15,000 lbs.

SHOCK STRENGTH

The toughness of cast iron pipe which enables it to withstand impact and traffic shocks, as well as the hazards in handling, is demonstrated by the Impact Test. While under hydrostatic pressure and the heavy blows from a 50 pound hammer, standard 6-inch cast iron pipe does not crack until the hammer is dropped 6 times *on the same spot* from progressively increased heights of 6 inches.

BURSTING STRENGTH

In full length bursting tests standard 6-inch cast iron pipe withstands more than 2500 lbs. per square inch internal hydrostatic pressure, which proves ample ability to resist water-hammer or unusual working pressures.

Be doubly sure when you specify pipe for mains to be laid under city pavements. Sure that it effectively resists corrosion. Sure, also, that it has the four strength factors, listed opposite, that pipe must have to withstand beam stresses, external loads, traffic shocks and severe working pressures. *No pipe, deficient in any of these strength factors, should ever be laid in paved streets of cities, towns or villages.* Cast iron water and gas mains, laid over a century ago, are serving in the streets of more than 30 cities in North America. These attested service records prove that cast iron pipe not only assures you of effective resistance to corrosion but all of the vital strength factors of long life and economy.

CAST IRON

CAST IRON PIPE RESEARCH ASSOCIATION, THOS. F. WOLFE, MANAGING DIRECTOR, 122 SO. MICHIGAN AVE., CHICAGO 3.

CAST IRON PIPE SERVES FOR CENTURIES

25 PROFIT MAKING FEATURES

The new BLAW-KNOX light-weight Hi-Boy LITE-WEIGHT is the only truck mixer which can give you all these advantages:

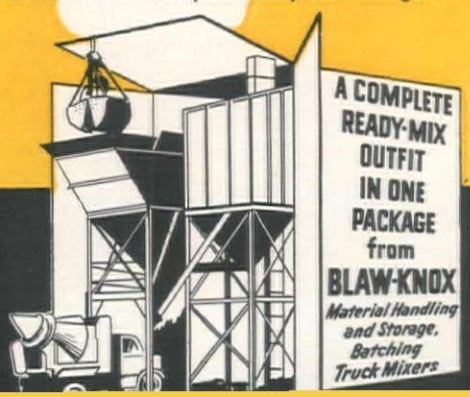
1. The lightest weight, complete, standard truck mixer.
2. Maintenance-free revolving hopper.
3. Hopper seal guaranteed for one year.
4. Single lever drum control operated from ground or walkway.
5. Single discharge control operated from ground or walkway.
6. Split-second charging through 32" unrestricted opening.
7. Complete end-to-end mixing, even of zero slump concrete.
8. Back-mixing if desired, with hopper in charging position.
9. Convenient visual inspection of batch before discharge.
10. Fast discharge without segregation, even with zero slump concrete.
11. Blade system that discharges entire batch without residue.
12. Fastest and easiest control of discharge.
13. Higher discharge—no confining chutes.
14. Easily replaceable mixing blades.
15. Grout-proof automatic water nozzle, properly located.
16. New silent, automotive transmission—the standard of comparison.
17. All metal clutches running in oil.
18. Finger-tip control for reversing drum rotation.
19. Extreme accessibility for maintenance or repair.
20. Double roller chain drum drive.
21. Clutch controlled V-belt driven water pump.
22. 2-compartment, splash-proof, tilt-proof automatic water measuring tank.
23. 2-compartment flush tank.
24. 3-position, quick-acting, stainless steel water valve.
25. Washout hose included.

Keep your units on the road . . . keep them working!

THE Revolving Hopper assures faster charging, faster discharging. A flick of the latch automatically inverts the hopper for discharge. Another flick and it is upright for charging. The Hi-Boy's exclusive Revolving Hopper ends tail gate trouble by eliminating the tail gate! It is the *only* rear end hopper with a SEAL GUARANTEED FOR ONE YEAR . . . the *only* seal that operates safely while submerged in concrete!

Get the "COMPLETE PACKAGE" of ready-mix equipment

You'll like the advantages of getting *all* your equipment . . . clamshell buckets, batching 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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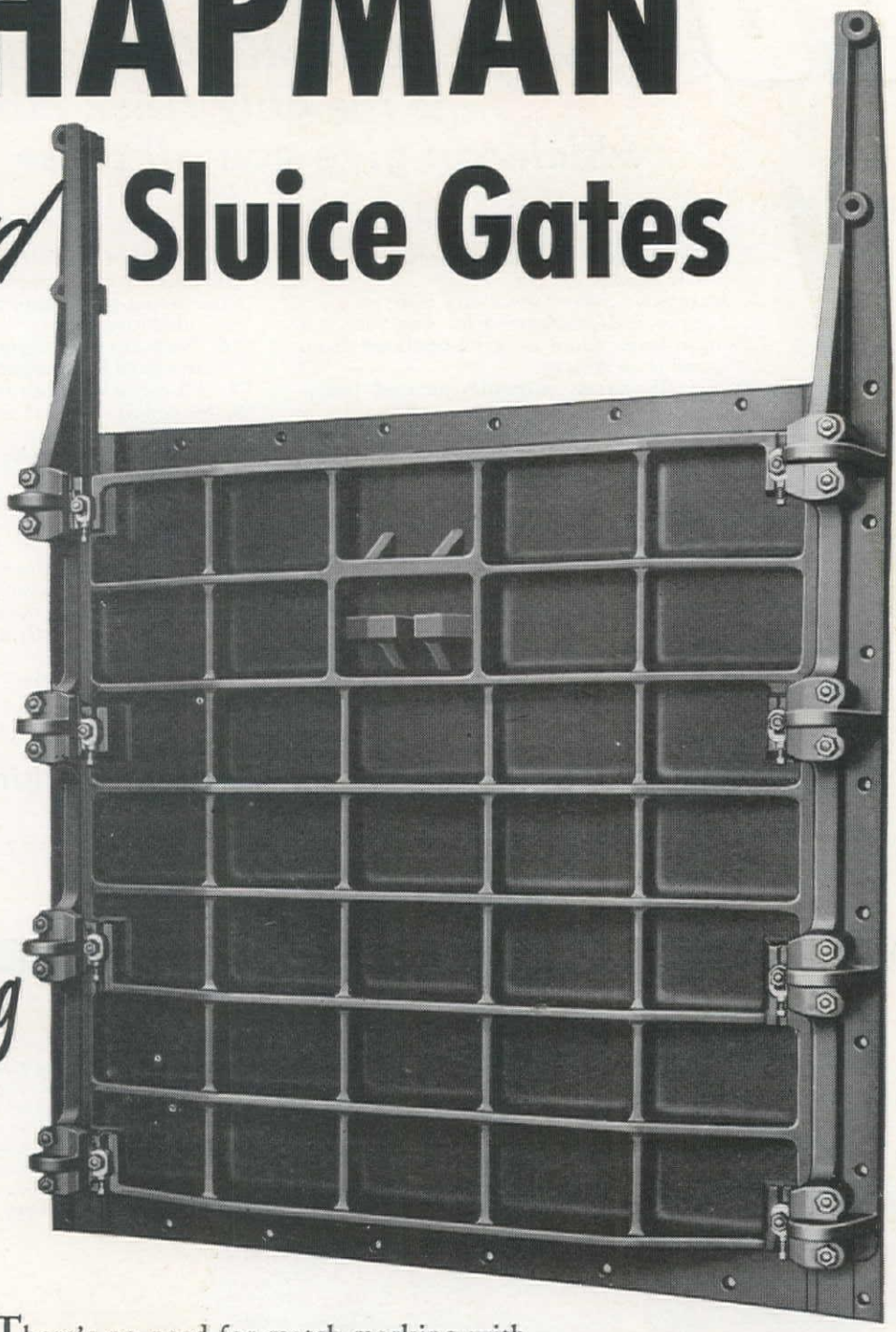
Standard Sluice Gates



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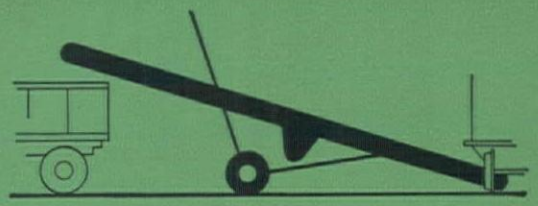

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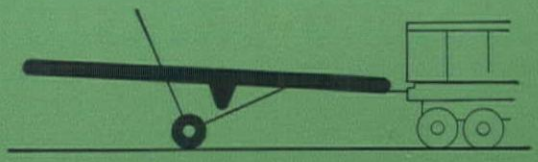

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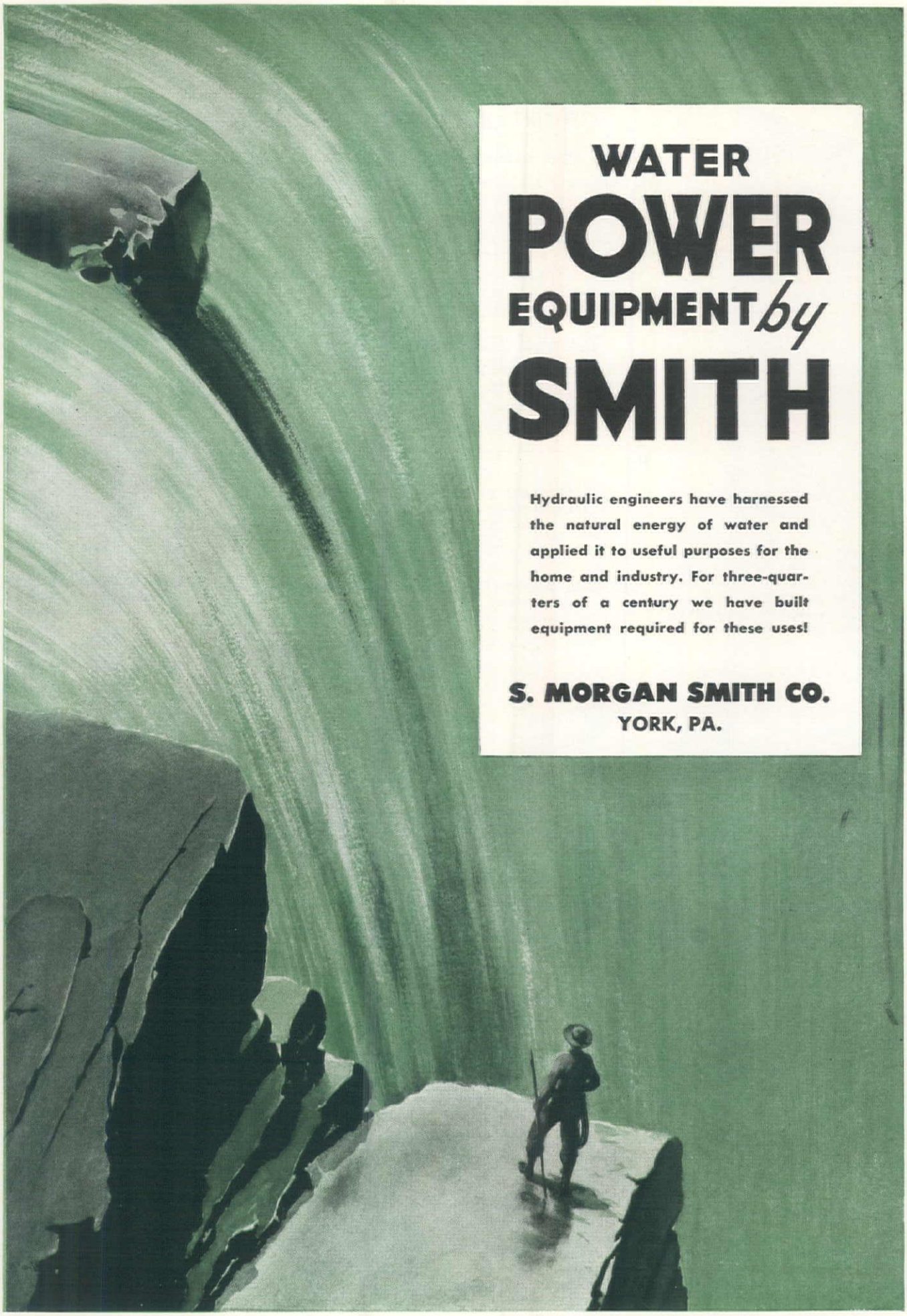
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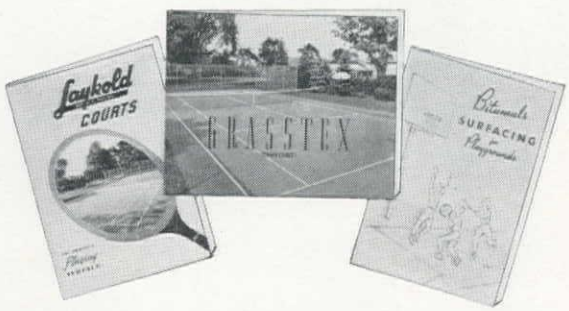

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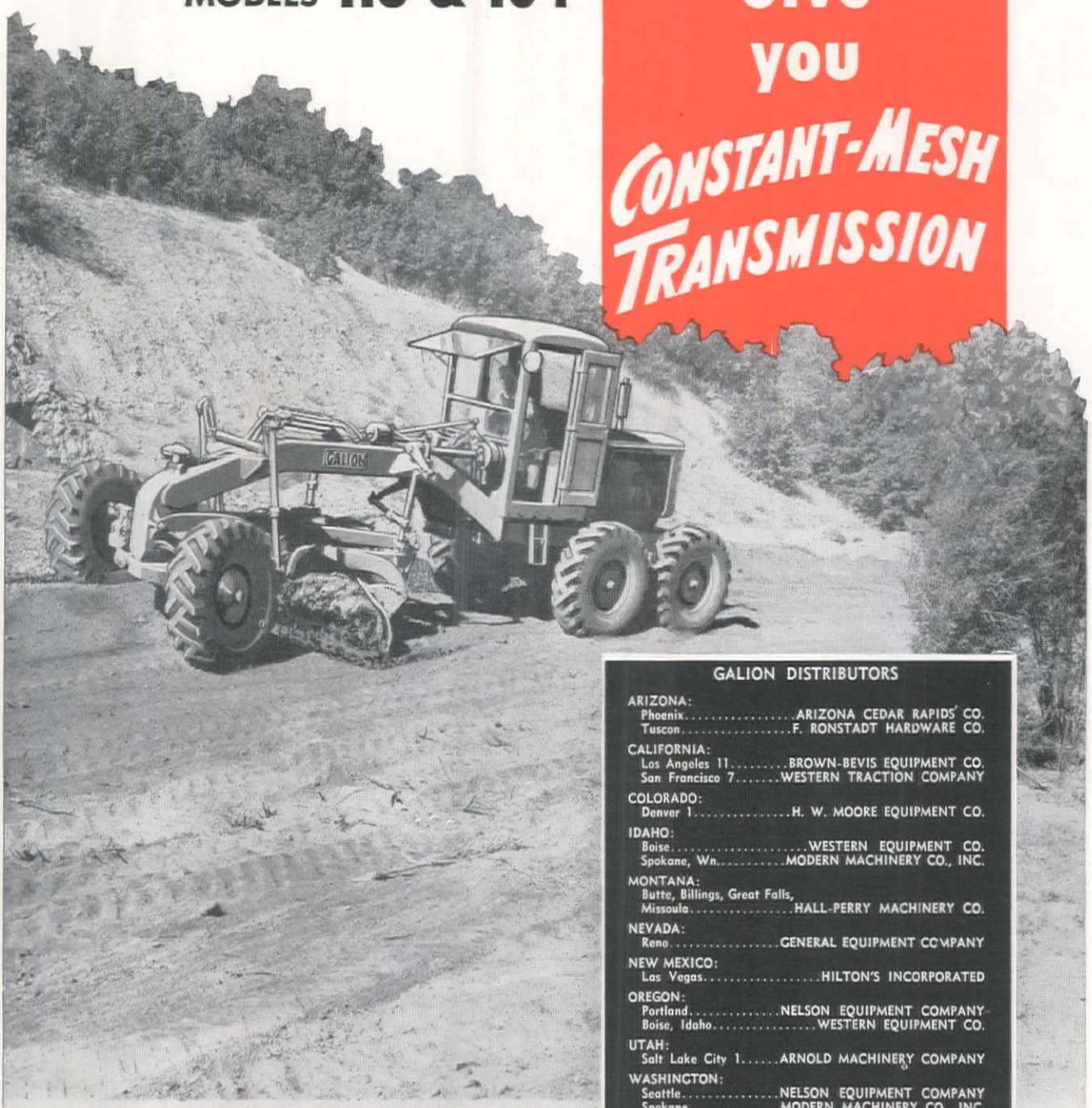

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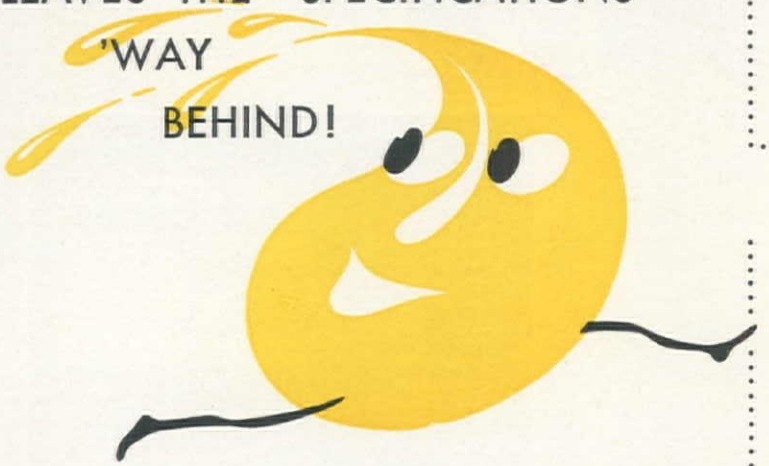

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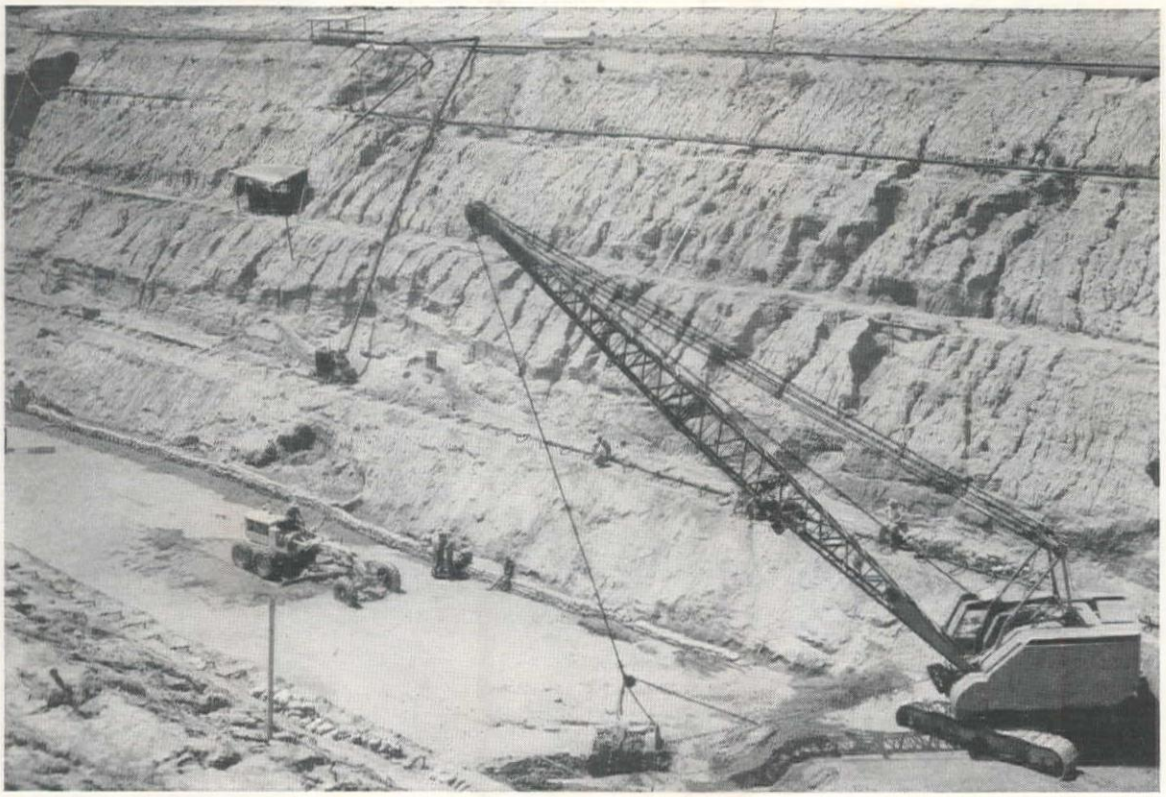

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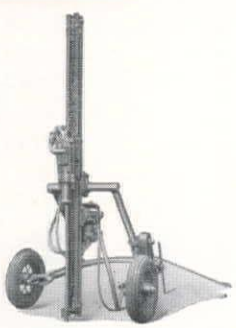

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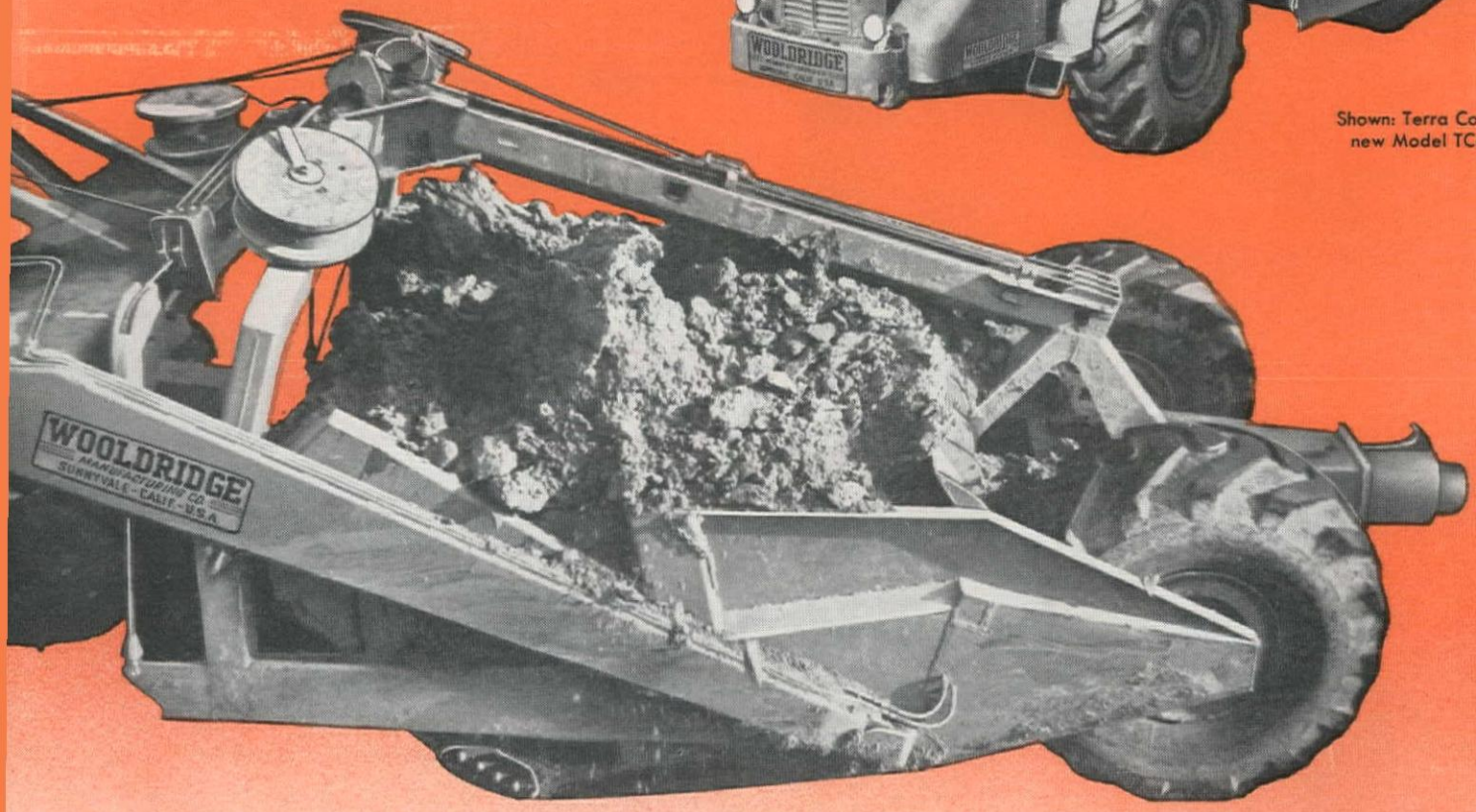
Shown: Terra Cobras new Model TC-S142



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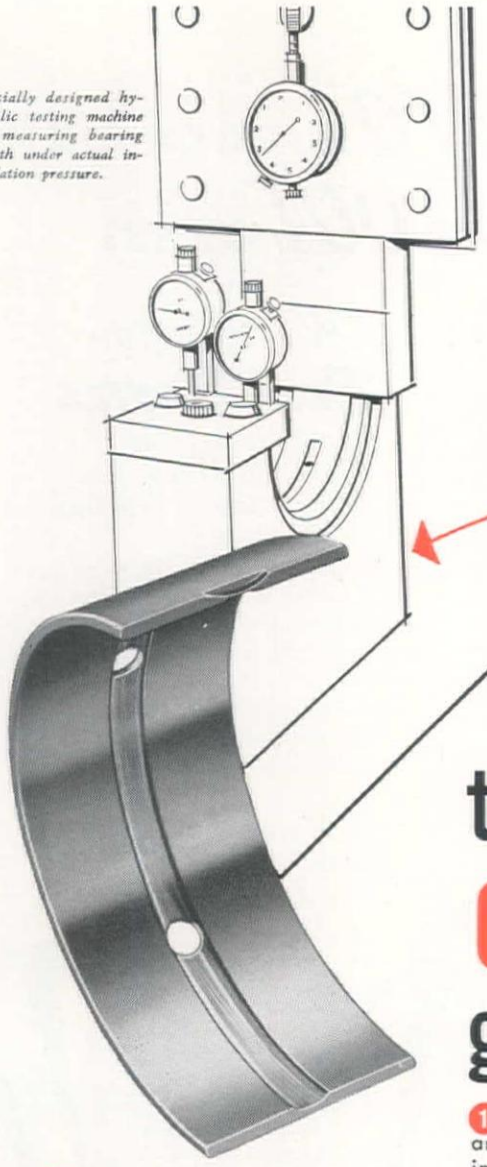

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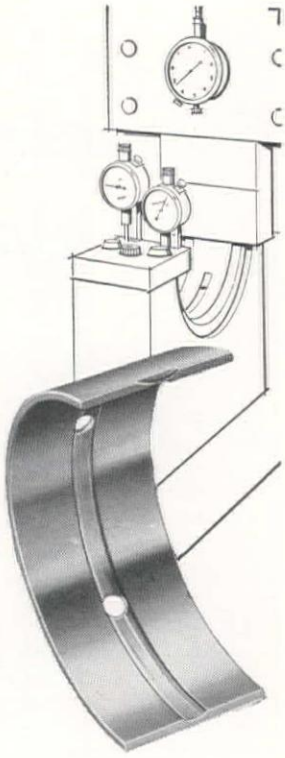

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Branch: 1921 North Broadway, Albuquerque, New Mexico. *Authorized Sales & Service:* Cooper Tractor Service, Yuma, Arizona; Stirling Diesel Service, Las Vegas, Nevada; Willis Diesel Engine Service, El Paso, Texas.

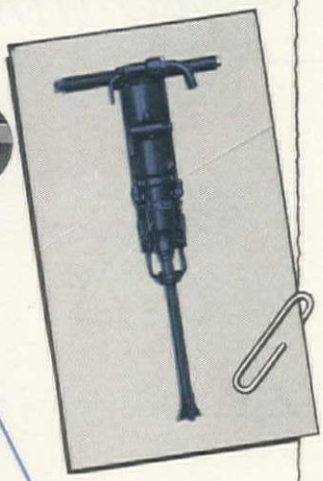
CUMMINS DIESEL SALES OF OREGON, INC.
1225-1235 Southeast Grand Avenue
Portland 14, Oregon • Telephone East 7146

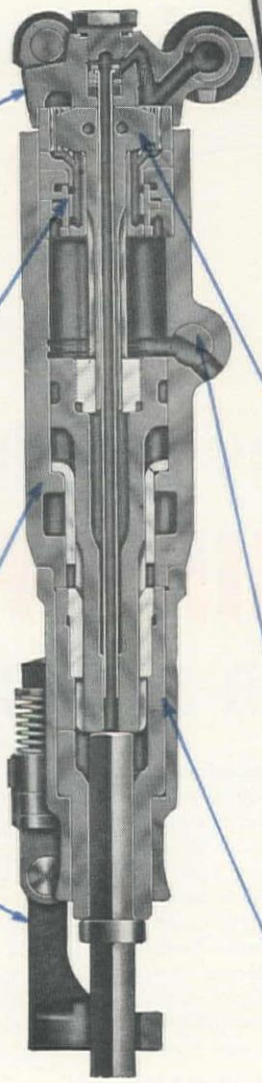
Branches: 731 Garfield Street, P. O. Box 367, Eugene, Oregon; Medford, Oregon. *Authorized Sales & Service:* Coos Bay Boat Shop, Coos Bay, Oregon.

CUMMINS INTERMOUNTAIN DIESEL SALES COMPANY
1030 Gale Street • Salt Lake City, Utah
Telephone 9-3768

Authorized Sales & Service: Wally's Chevron Truck Service, Cedar City, Utah.

HERE'S WHAT WE PUT *INTO* A ROCK DRILL ...SO YOU CAN GET MORE *OUT* OF IT!





Combination Backhead for blast rod, air tube or water tube operation greatly reduces cost of change-over parts. Air-operated automatic water valve is optional on same backhead.

Jet Valve is instantaneous, positive-acting, end-seating. Thrown by a jet of air, it provides precise timing. Increased piston hammer velocity results in high drilling speed, low air consumption, strong rotation and easy holding.

Integral Cylinder. All hammer bores are ground in line at one operation, allowing piston hammer to run in true alignment. Replaceable bronze cylinder bushing maintains the front cushion.

Resilient Retainer. Yoke-type, held in replaceable hardened steel bushings and spring-cushioned to dampen vibrations when pulling drill rods. Easily opened and closed, can't wear the chuck housing, and has positive lock-on nuts.

Four-Pawl Rotation. Four reversible pawls give maximum service at four rotation speeds — extra fast, fast, slow, extra slow.

Independent Blow Control changes from drill to blow with ease. Full line pressure available for emergency blowing. Large diameter air tube assures strong, constant blow. Side outlet exhaust is possible with optional blow valve.

Three-Piece Chuck. Chuck, sleeve and nut. Replaceable bronze chuck nut held in a steel sleeve checks piston flute wear.

Worthington BLUE BRUTES *Have Everything You Need For Hard, Fast, Money-Saving Drilling*

With every detail designed to make air do more work, Blue Brute Rock Drills combine the ruggedest construction with the easy handling that goes over big with operators. The WS-55, illustrated, is right for average jobs. For lighter work, use the WS-45 — for heavy duty, the WS-30.

3 More Reasons Why There's More Worth In A BLUE BRUTE!

WB-34 Paving Breaker
Hardest-hitting, easiest handling breaker in the 35-lb. class. Ideal where the operator has to lift the tool frequently in guiding its work.

W-14 Clay Digger
Developed in the field by men with practical experience in clay, and thoroughly proved by long, rigorous job-testing.

W-8 Backfill Tamper
Medium weight, with simple horseshoe valve and ample oil reservoir. A good "walker" that does a finished backfill job, ready for immediate paving.

Immediate deliveries from your nearby Worthington Distributor See him, or write us direct

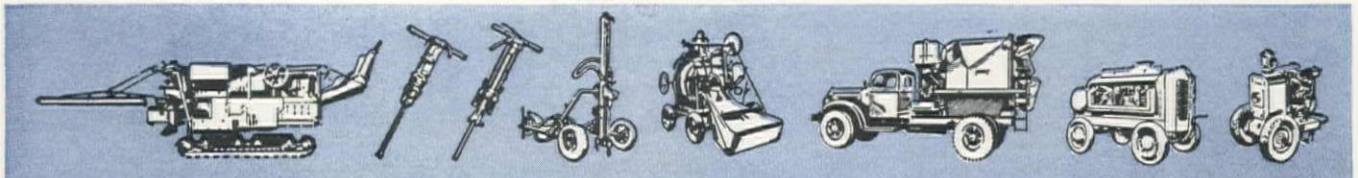
BUY WORTHINGTON BLUE BRUTES

Worthington Pump and Machinery Corporation
Construction Equipment Sales Department
Dunellen, New Jersey

Distributors In All Principal Cities

WORTHINGTON

H1-1



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

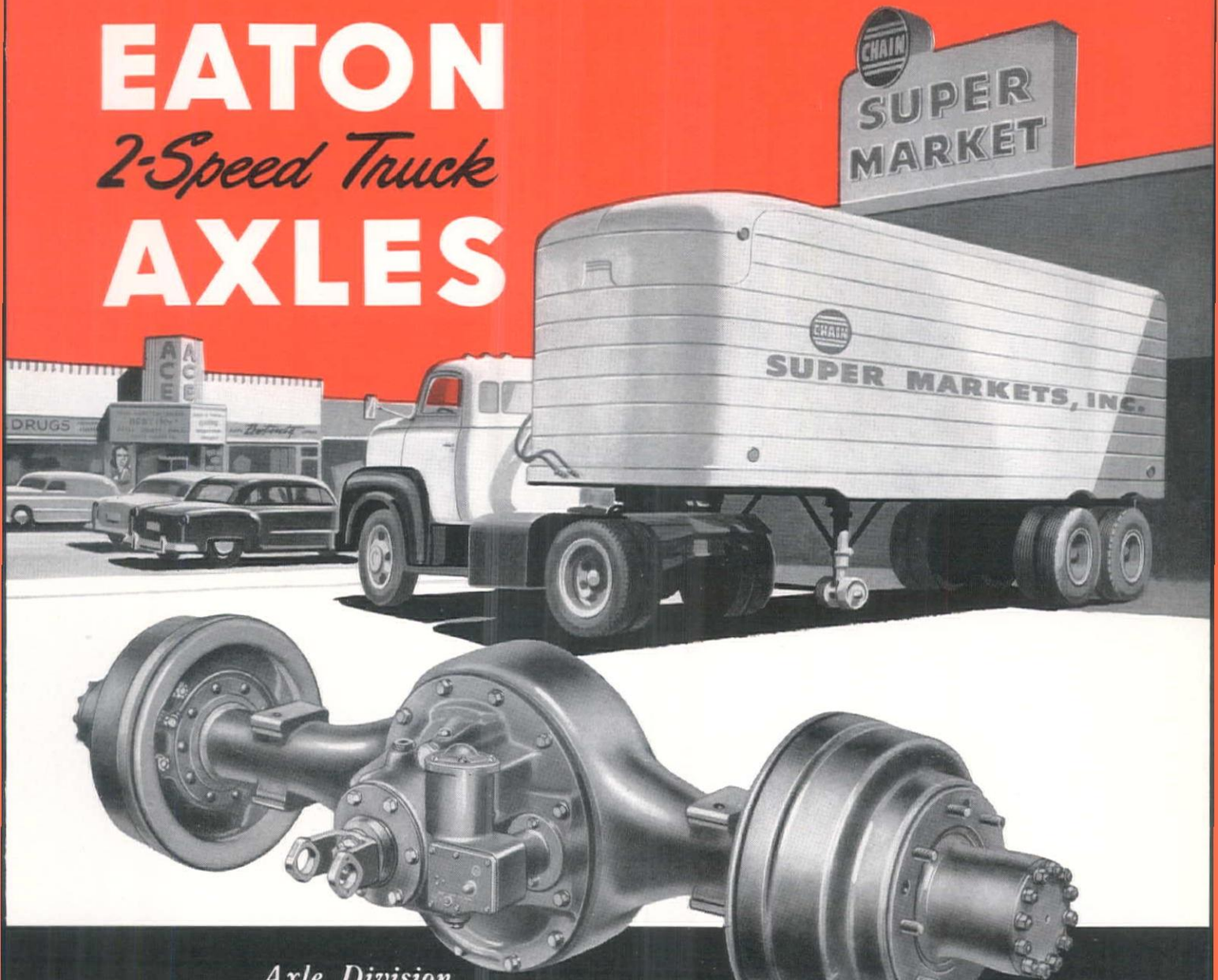
Speed Trucks in "Stop and Go" Traffic

The steady increase in traffic volume is of growing concern to truck operators. Unless trucks can keep pace with the flow of cars, schedules are slowed down and operating costs rise expensively.

Eaton 2-Speed Axles help truck owners solve this problem. Their vehicles have twice the conventional number of gear ratios. That means they can use a "low" gear for quick pick-up under full load. It means easier maneuvering in tight spots. It means climbing most hills faster. It means highballing on the open road. These advantages also result in operating economies—fewer stops for gas and oil—less time in the shop, because engines and all power transmitting parts last longer.

Your dealer will be happy to explain the value of Eaton 2-Speed Axles and tell you how Eaton's exclusive planetary gearing and positive lubrication assure long axle life.

EATON
2-Speed Truck
AXLES



Axle Division

EATON MANUFACTURING COMPANY

CLEVELAND, OHIO

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

ROCKMASTER *blast by Fauzio Brothers at Lehigh Navigation Coal Company's Nesquehoning, Pa., stripping operation.*

No rock pile this . . .

but the high point of a blast!

THE machine-gun camera reels off twelve photos—one every 1/3 second—to "freeze" at its peak this typical ROCKMASTER "16" blast—three seconds after initiation of the shot. Here you see no wasted explosives gas, no wild rock—proof that ROCKMASTER "16" blasting can mean true *controlled force . . . controlled throw . . . controlled breakage!*

ROCKMASTER "16" may be the answer to *your* problems whether your job calls for blasting coal, rock, ore. The free ROCKMASTER "16" booklet shows how you can profit through the use of the correct numbers of the *sixteen* ROCKMASTER milli-second delay electric blasting caps teamed with the ROCKMASTER system of explosives choice and loading methods. Write for your copy. Our technicians will be glad to assist you in applying ROCKMASTER "16" to your operations.

Less Bark

More Bite

ROCKMASTER "16" TIMINGS

Rockmaster No.	Avg. Time of Each Delay from Zero (milli-seconds)
0 (zero)	0 (inst.)
1	8
2	25
3	50
4	75
5	100
6	125
7	150
8	175
9	200
10	250
11	300
12	350
13	400
14	450
15	500
16	550

ROCKMASTER: Reg. U.S. Pat. Off.

Offices in Principal Cities

ATLAS EXPLOSIVES

"Everything for Blasting"

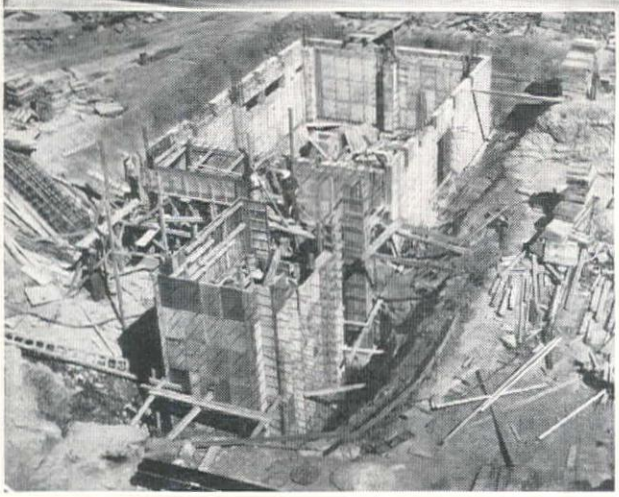
CHEMICALS ATLAS EXPLOSIVES

SAN FRANCISCO 4, CAL. ATLAS POWDER COMPANY SEATTLE 1, WASH.

UNI-FORMS form BIG areas faster...

save labor...save materials!

LINED AND BRACED ON 1 SIDE . . . LEAVES UNOBSTRUCTED WORKING AREA ON OTHER SIDE.



VERSATILITY—EVERY CONCEIVABLE WALL DETAIL . . . UNI-FORMED

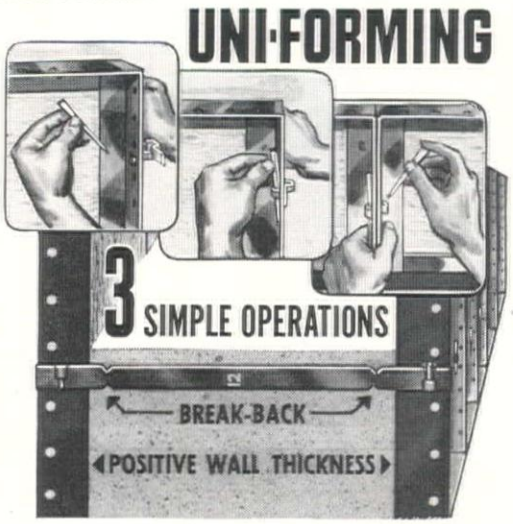
Faster erection . . . automatically accurate wall widths . . . minimum 1 side alignment and easy adaptability to any forming requirement makes UNI-FORMING the most economical method of forming any type of concrete.

You can form bigger areas, using less man hours and materials with UNI-FORMS . . . steel-framed UNI-FORMS comprise a tight, rigid form that requires no additional structural members.

Let us prove our point. Send a set of plans for an estimate of your UNI-FORMING costs. There is no obligation.

WRITE FOR THE NEW UNI-FORM CATALOG

Rented . . . Sold . . . or Rented With A Purchase Option



UNIVERSAL FORM CLAMP CO.

SAN LEANDRO (San Francisco), CALIF.
2051-59 WILLIAMS ST., SAN LEANDRO
Phone: LOckhaven 2-2051 ENterprise 1-0132

GENERAL OFFICES AND FACTORY 1236-38 N. KOSTNER, CHICAGO 31, ILL.
Phone: CApitol 7-1600

BIG YARDAGE

AT LITTLE COST

Ask Your GAR WOOD—ALLIS-CHALMERS DEALER FOR A DEMONSTRATION

Gar Wood 625 SCRAPER

Matched with the NEW Allis-Chalmers HD-20 Tractor

Because it loads more dirt quicker . . . takes a full heaping load every time . . . dumps faster and spreads under accurate control, the entirely new Gar Wood 625 Scraper puts the bite on yardage costs. A typical contractor comment is: "Fastest loading and dumping scraper for its size on the market."

The new 625 with its bowed cutting edge loads easily with less tractive effort due to the live boiling action. Positive forced ejection wipes the bowl clean every trip.

Used on the most gruelling jobs, the 625 has proved its ability to handle sand, muck, wet clay and other soils in all kinds of weather. Construction is extra heavy in all details. Design is completely modern and includes every feature for lower earthmoving costs. Get full information on the new 625 . . . use the coupon below.

COST-CUTTING FEATURES

- 24.5 cu yd heaped capacity
- 19.2 cu yd struck capacity
- Open bowl
- Live boiling action
- Extra large apron opening
- Forced ejection under power
- High clearance and low center of gravity
- Closely controlled ejection for accurate spreading
- Large tires for greater flotation
- Extra strength throughout . . . plenty of "beef" where needed

GAR WOOD INDUSTRIES

GAR WOOD INDUSTRIES, INC.

Findlay Division • Findlay, Ohio

MANUFACTURERS OF GAR WOOD TRACTOR EQUIPMENT
FOR ALLIS-CHALMERS INDUSTRIAL TRACTORS

A-C ALLIS-CHALMERS

SEE YOUR GAR WOOD–ALLIS-CHALMERS DEALER OR *Mail this Coupon*

GAR WOOD INDUSTRIES, INC.
Findlay Division, Dept. 022-4, Findlay, Ohio

Please send me bulletin describing the new Gar Wood 625 Scraper.

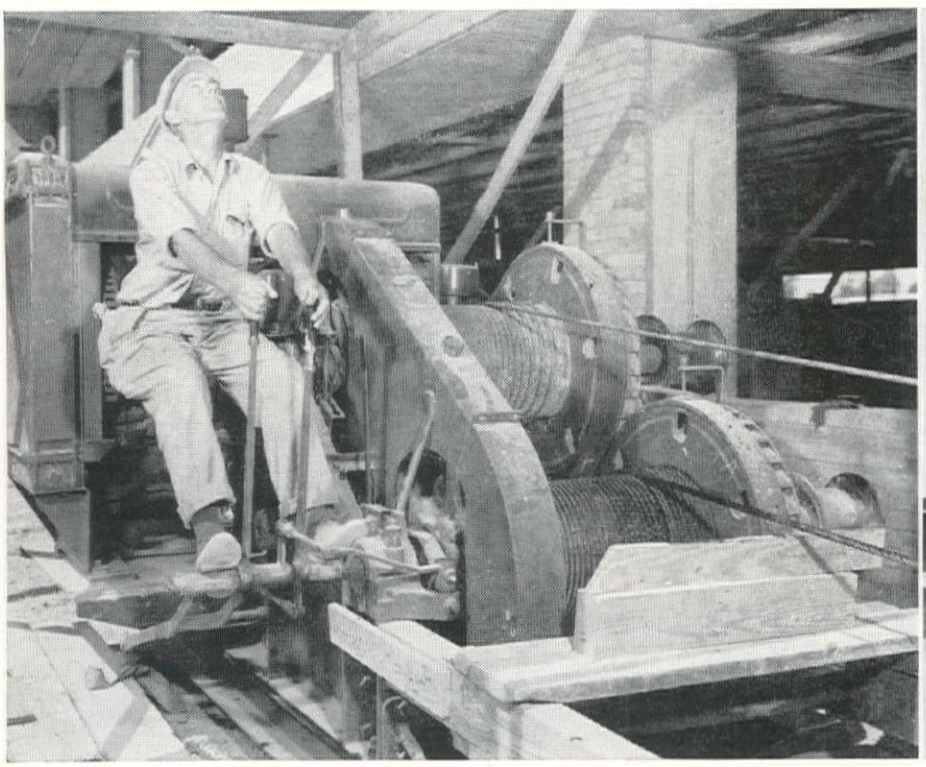
Name _____

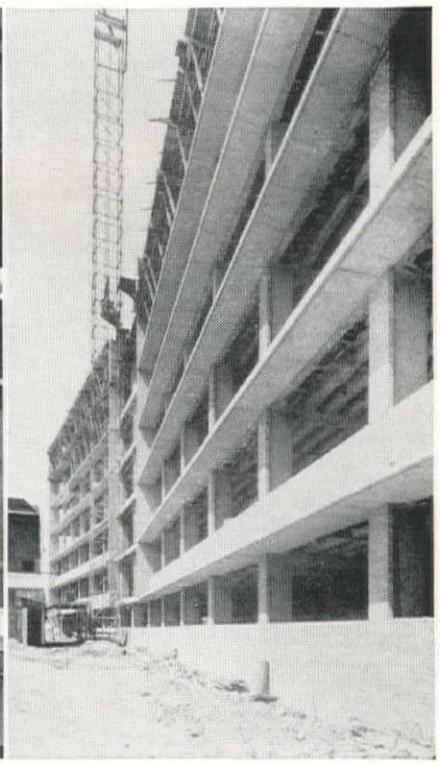
Company _____

Address _____

FORM P-625-4 10-50 LITHO IN USA

15,000 trips -on schedule





SOMETIME this spring, the 15,000th trip will be made by a pair of one-yard concrete buckets . . . and pouring will be completed on the State of Michigan's new 10-story Northville mental hospital, near Detroit.

O. W. Burke Co. of Detroit, general contractors on this job, wanted absolute assurance of steady, dependable hoist performance. So they made the same decision that thousands of other builders have made . . . to use American General Purpose Hoists.

This $6,500,000 project is moving smoothly toward on-schedule completion. For such jobs—or $6500 jobs—or $65,000,000 jobs—you cannot make a safer choice than American hoisting power!

Modernize...economize...with

American Hoist
& Derrick Company
ST. PAUL 1, MINNESOTA

Mail this coupon

17 American Hoist & Derrick Co. 1102
St. Paul 1, Minnesota

● Please send catalog on

AMERICAN GENERAL PURPOSE HOISTS

☐ 5 to 40 H. P. ☐ 50 to 100 H. P.

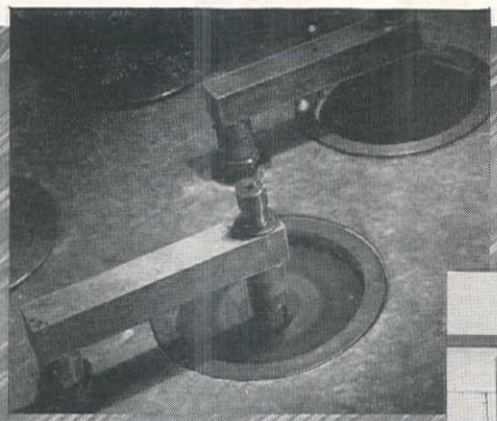
NAME_____

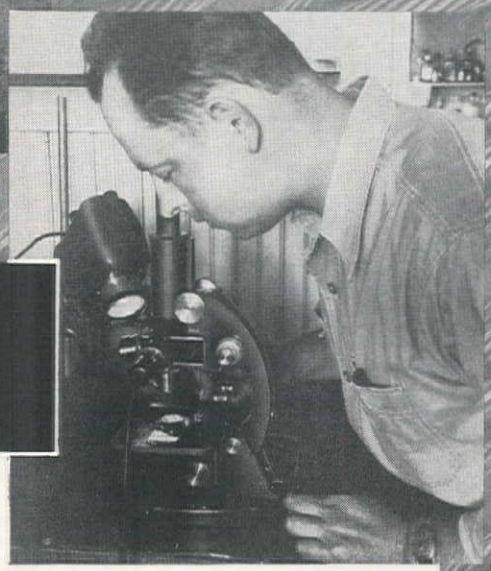
COMPANY_____

ADDRESS_____

CITY_____ STATE_____

ALL ROPES look ALIKE... but





IN Wickwire Rope

TESTING GOES

Precision polishing and high powered magnification enable us to go 100 times beyond normal vision in examining Wickwire Rope steel for classification of grain size to McQuaid-Ehn* standards.

100 times beyond normal vision

Uniformity of grain size in steel assures longer life and greater reliability in Wickwire Rope.

Right down the line...starting with the melting and refining of our steel ...and continuing through heat treating processes and cold drawing of the wire, we maintain complete control over the grain size of steel used in Wickwire Rope.

This quality control of basic properties is possible only with a company whose operations are fully integrated from the actual making of the steel to the stranding of the finished rope. It's just one more example of how Wickwire goes "beyond specifications" to give you—at market prices—wire rope that is unsurpassed for reliability, safety and longer life.

See your local Wickwire distributor for the right rope for your particular requirements. Wickwire Rope is available in all sizes and constructions, both regular lay and WISSCOLAY *Pre*formed.

*For detailed information on the McQuaid-Ehn test and what it means to you in superior rope performance, write to Wire Rope Sales Office, Wickwire Spencer Steel Division of C. F. & I., Palmer, Mass.

WICKWIRE ROPE

CF&I & SUBSIDIARIES

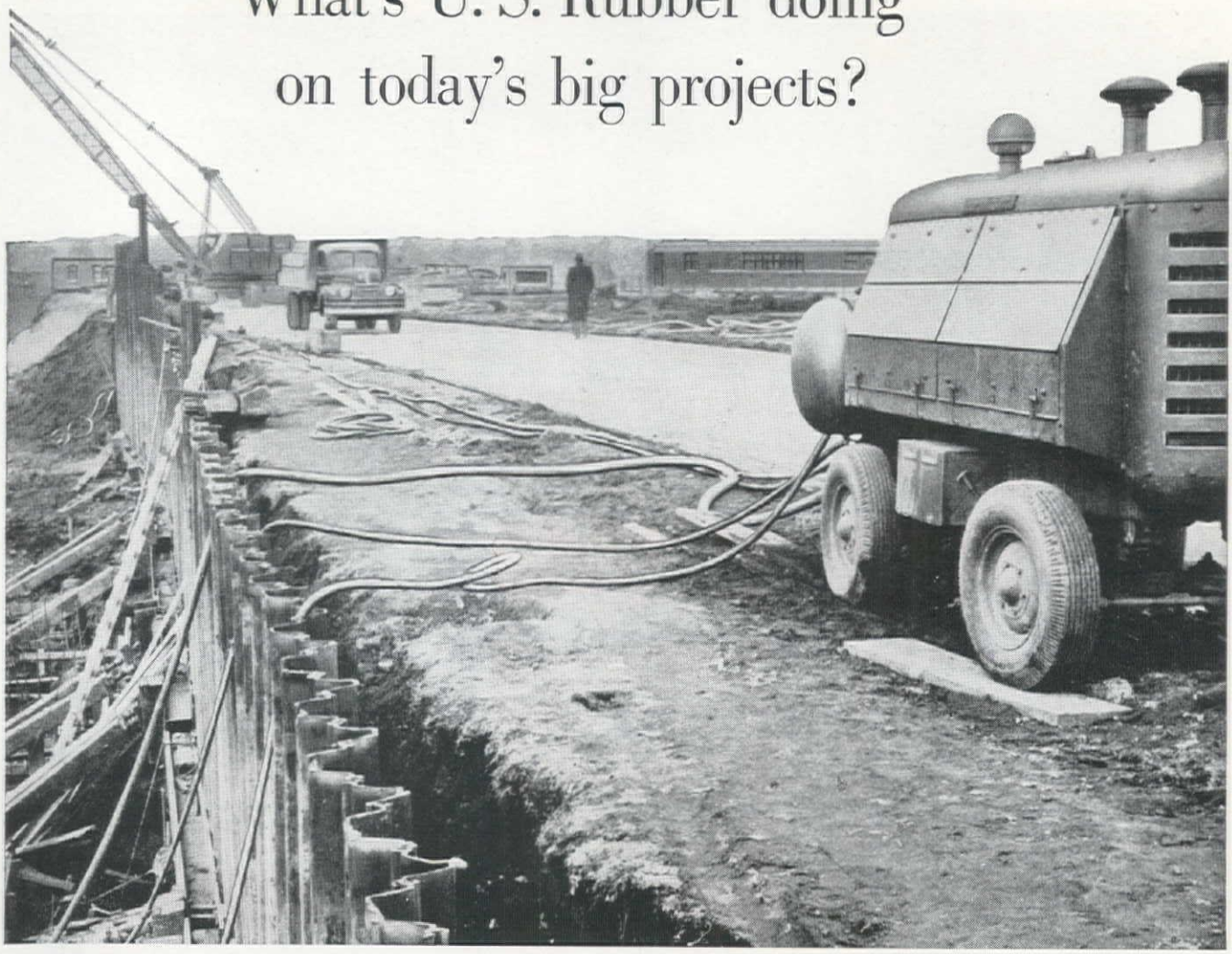
A PRODUCT OF THE WICKWIRE SPENCER STEEL DIVISION OF THE COLORADO FUEL AND IRON CORPORATION

WIRE ROPE SALES OFFICE AND PLANT—Palmer, Mass. EXECUTIVE OFFICE—500 Fifth Avenue, New York 18, N. Y.

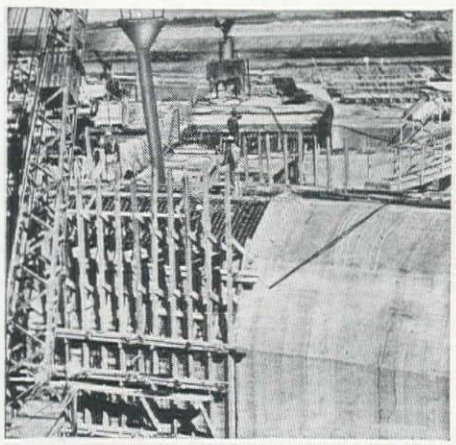
SALES OFFICES—Abilene (Tex.) • Boston • Buffalo • Casper • Chattanooga • Chicago • Denver • Detroit • Emlenton (Pa.) • Houston • New York Odessa (Tex.) • Philadelphia • Phoenix • Salt Lake City • Tulsa

PACIFIC COAST SUBSIDIARY—The California Wire Cloth Corporation, Oakland 6, California

What's U. S. Rubber doing on today's big projects?



U.S. BULL LINE AIR HOSE is practically standard for tunnel contractors. Also used for compressor work, acting as manifold line supplying compressed air to portable tools.



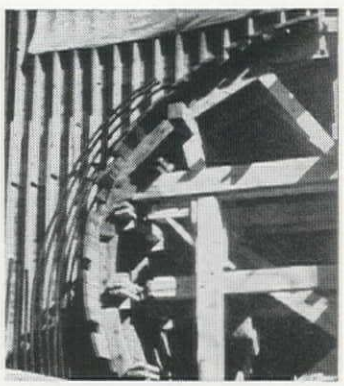
CONTRACTORS on the big dam construction job in the Middle West used several varieties of U.S. Rubber Hose, to carry air, water, oil and cement. Workmen find "U.S." hose flexible, rugged and easy to handle.

On almost every phase of construction, "U.S." products are at work. Hose of every type, in dozens of specifications, packings from the most complete line in industry, Hydron absorptive form linings, "U.S." flexible form strips, conveyor belts large and small, transmission and elevator belts, and the remarkable U.S. Rainbow V-Belts with the unique Equa-Tensil Cord Section ...these are some of the many "U.S." items contractors rely on to keep the job moving faster. For further information, write to address below.

PRODUCTS OF

U.S.RUBBER

SERVING THROUGH SCIENCE



TUNNEL SECTION of a large dam in Texas. Hydron form linings, a "U.S." development, provide a smooth, pit-free surface, enabling the concrete to withstand the grinding action of high-velocity, silt-laden waters.

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Macks ARE Masters

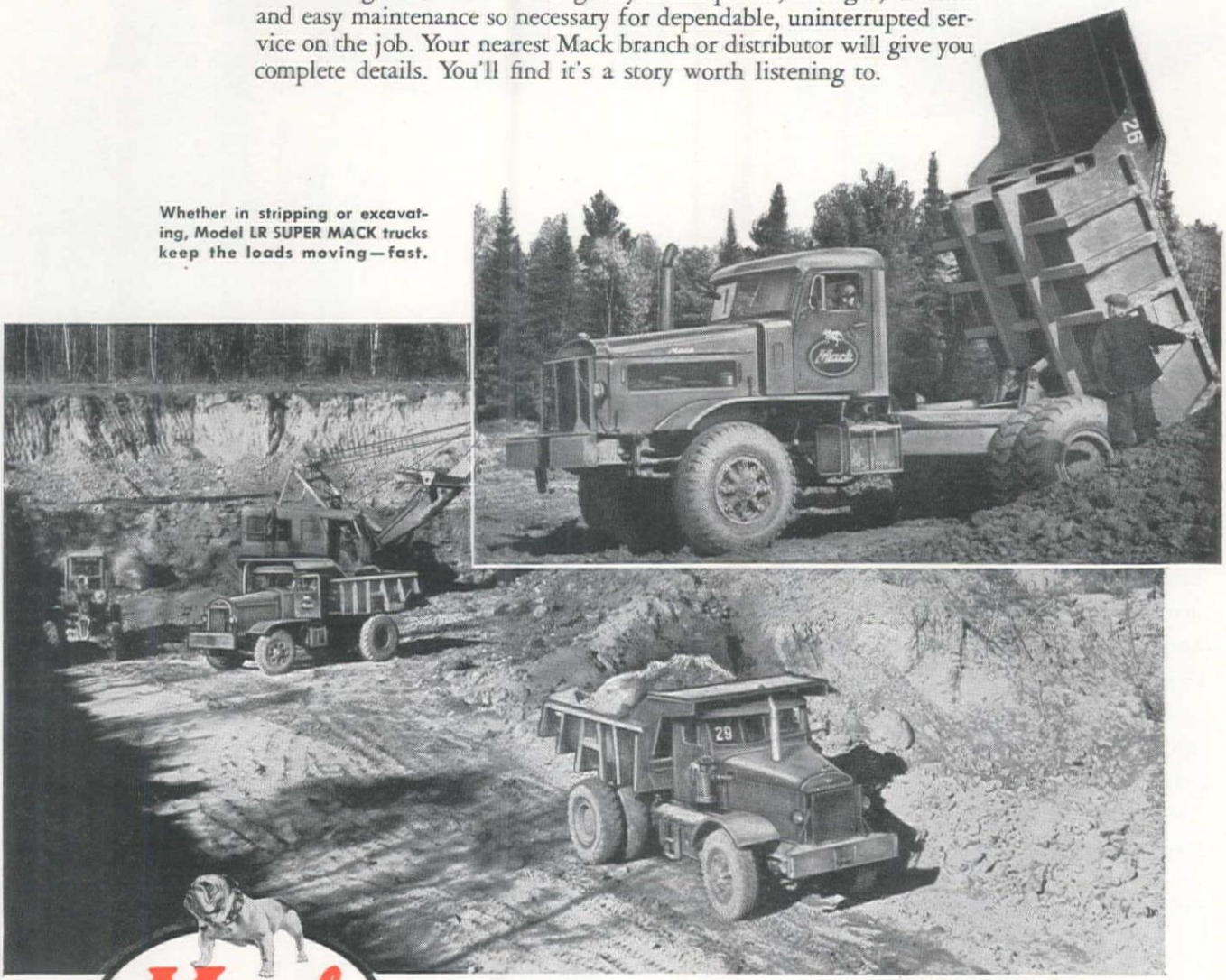
OF THE TOUGHEST TERRAIN

No matter how tough the going... under the worst of weather conditions... through slippery mire or shifting sand... or over rutted, uneven ground — big SUPER MACK trucks keep the payloads moving on time... at less cost and with less absenteeism.

One big reason why Mack trucks lick the toughest terrain is the exclusive Mack Power Divider. Where unequal tractive requirements are encountered, the Power Divider differential distributes torque to favor the driving wheel having the most traction, thus eliminating power dissipation in useless wheel slippage.

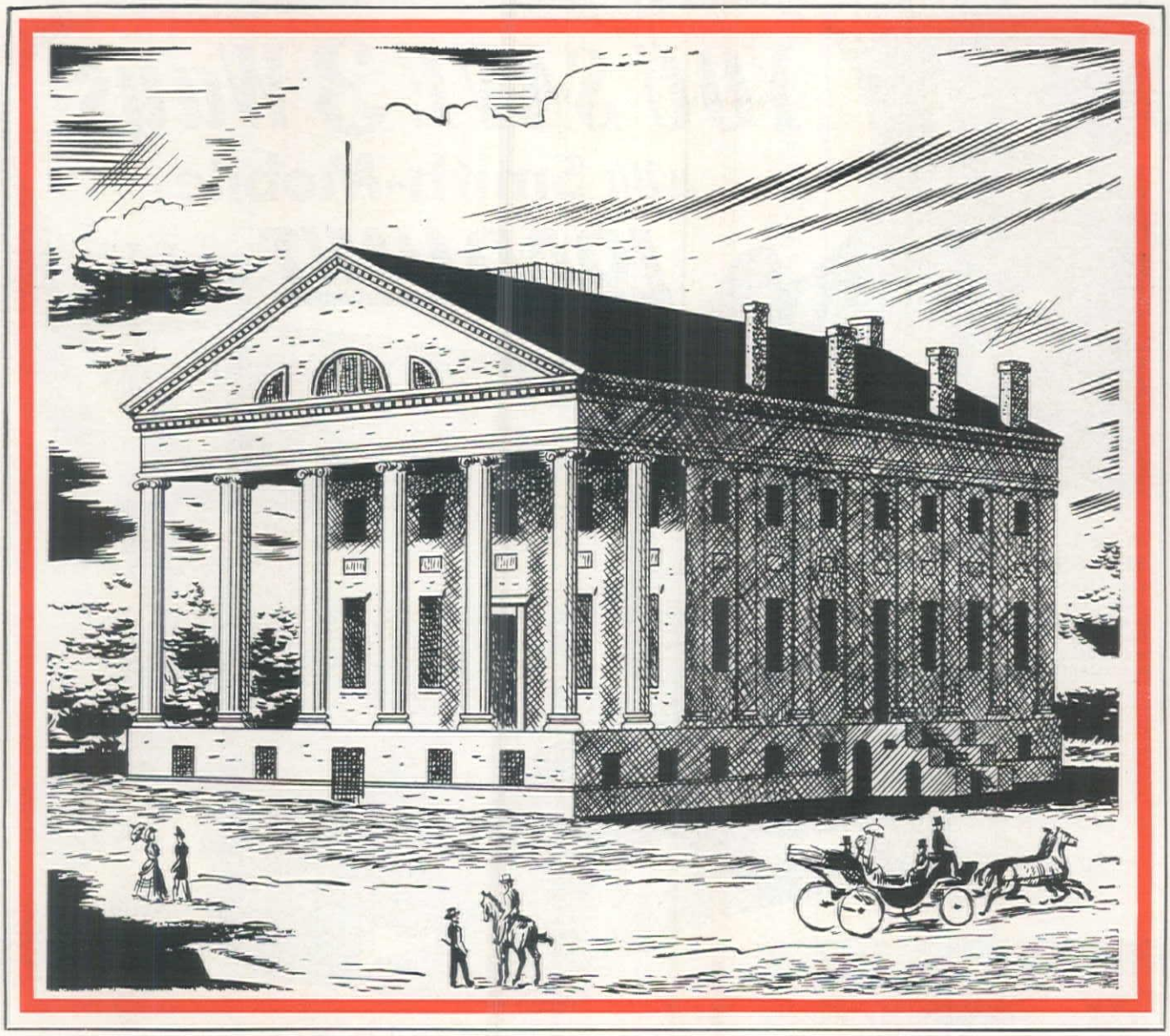
Mack's exclusive Power Divider combines with numerous other outstanding Mack features to give you the power, strength, traction and easy maintenance so necessary for dependable, uninterrupted service on the job. Your nearest Mack branch or distributor will give you complete details. You'll find it's a story worth listening to.

Whether in stripping or excavating, Model LR SUPER MACK trucks keep the loads moving—fast.



Mack TRUCKS ***... outlast them all***

Mack Trucks — Los Angeles • Denver • San Francisco
Seattle • Portland • Salt Lake City • Factory branches
and distributors in all principal cities for service and parts.



Richmond's State Capitol, completed in 1792, as it looked 100 years ago

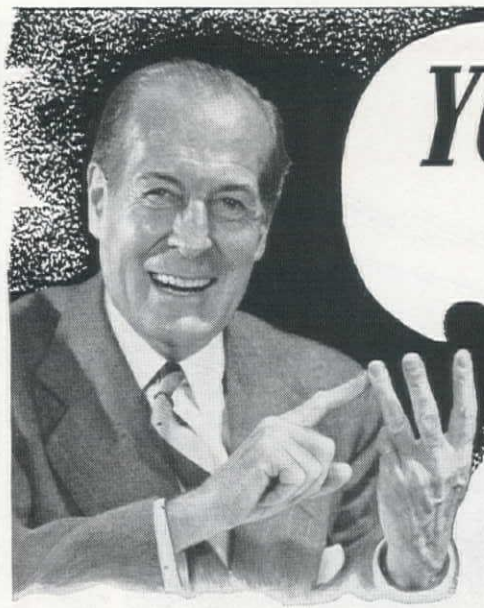
Richmond, Virginia, has a cast iron water main in service that was installed well over a century ago. In those stage-coach days, *traffic shock* caused by heavy trucks and buses was, of course, undreamed of. There were no sewers and other underground conduits to cause soil disturbances and settlement. Yet this rugged old pipe had what it takes in shock-strength and beam-strength to meet unforeseen stresses. Strength, as well as effective resistance to corrosion, are prerequisites of long life in pipe to be laid under city streets. This is evidenced by the fact that cast iron water and gas mains, laid over a century ago, are still serving in the streets of more than 30 cities in the United States and Canada.

United States Pipe and Foundry Co.,
General Offices, Burlington, N. J.
Plants and Sales Offices Throughout the U. S. A.

U.S. cast iron PIPE

FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE

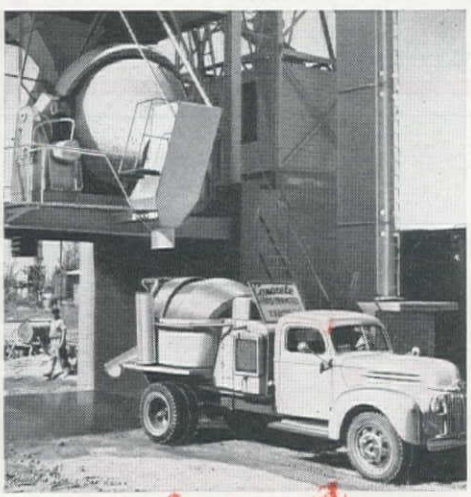
NUMBER FOUR OF A SERIES



YOU SAVE 3 Ways with Smith-Mobile LOADLIMIT models

MEET HIGHWAY WEIGHT LIMITS
with a Smith-Mobile LOADLIMIT Model. You can easily convert it to a Standard Smith-Mobile Truck Mixer or Agitator. And a Standard Model can easily be converted to a LOADLIMIT Model.

LOADLIMIT Models are available in 3, 4½, 5½ and 6½ yard sizes, with higher ratings for agitators. All carry NRMCA rating plates.



HERE'S a WINNING COMBINATION!
Smith Tilting Mixers and Smith-Mobile Agitators enable you to deliver better concrete with speed and certainty, at low cost. They have a record of achievement that has never been equaled in the industry.

1 **LOWER INITIAL COST** — By eliminating parts and units not absolutely vital to mixer operation, price of mixer is greatly reduced. A less expensive LOADLIMIT Model can be mounted on a lighter truck, resulting in a further saving in initial investment.

2 **LOWER OPERATING COSTS** — Less dead weight means bigger payloads without exceeding highway weight limits. A lightweight LOADLIMIT Model has less overall width, maneuvers more easily, travels faster. Discharge is easier since there is no closing door to open and close.

3 **LOWER MAINTENANCE COSTS** — Replacements and repairs are seldom necessary. A LOADLIMIT Model has the same sturdy construction as a Standard Smith-Mobile and carries the same guarantee. With unnecessary parts removed, there is less to maintain. The closing door is eliminated. No seal troubles.

Ask your nearby Smith Distributor to give you all the LOADLIMIT facts.

THE T. L. SMITH COMPANY
2071 N. 32nd St., Milwaukee 45, Wis., U. S. A.

SMITH MOBILE

For BIGGER and BETTER Concrete Mixers and Truck Mixers Look to SMITH

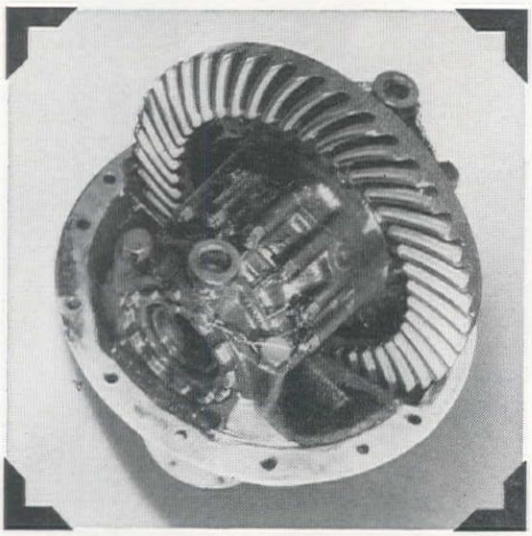
A 5884-1P

STANDARD ENGINEER'S REPORT

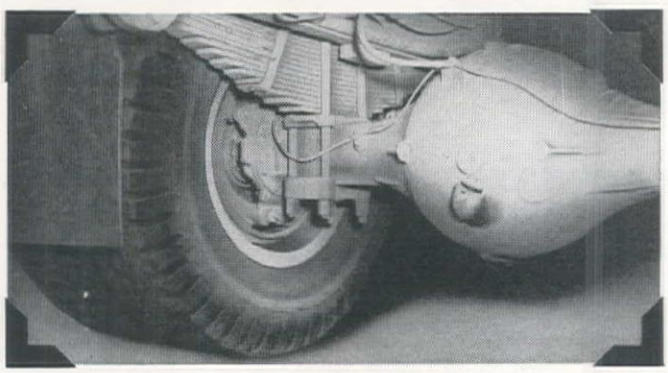
DATA

LUBRICANT	RPM Gear Lubricant (Compounded)
UNIT	13 "Semi" trucks
PART	Transmissions & differentials
CONDITIONS	Hauling out of woods (mostly low gears)
LOCATION	Eugene, Oregon
FIRM	H.B.&M. Trucking Co.

Gears show little wear after year in logging service!



IN A LOGGING TRUCK DIFFERENTIAL lubricated with RPM Gear Lubricant (Compounded), the gear unit at left is one of 13 that worked for a year in trucks pulling loads up to 36 tons out of the woods. All the operation was off the highway on soft and often steep temporary roads where lowest gears were required. No gear trouble of any kind was encountered during the year. This unit was pulled to replace a seal.



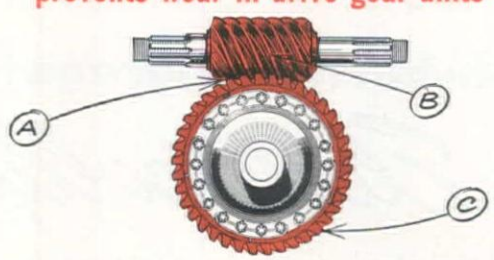
REAR AXLES of these tractor and trailer outfits carry a load most of the time. It is only a short haul from the woods to the mill so a truck can deliver as many as six loads a day.

REMARKS: High oiliness qualities in RPM Gear Lubricant (Compounded) provide extra gear tooth protection in most abnormal operating conditions. Its lubricating qualities and stability make it an excellent lubricant for bronze worm gears. (For hypoids, RPM Multi-Service Gear Lubricant is recommended.)

RPM

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

How RPM Gear Lubricant (Compounded) prevents wear in drive gear units



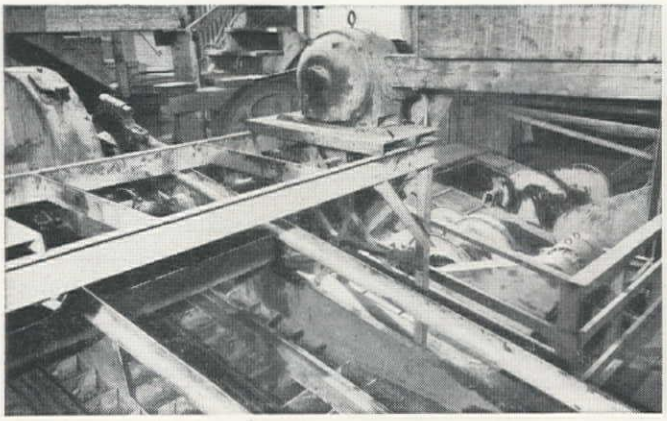
A. Made from paraffin stocks with special compounds that help provide a tough film—gives extra tooth protection, withstands shock and overloads.

B. Has high resistance to oxidation as well as deposit formation—assures lubrication in high temperatures.

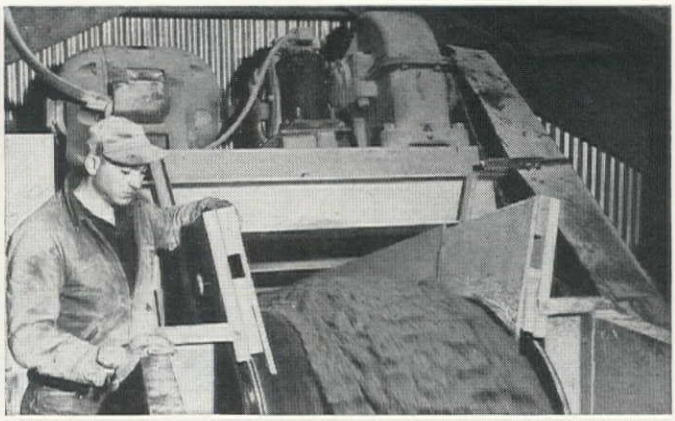
C. Contains foam inhibitor—prevents high gear-case pressures.

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.

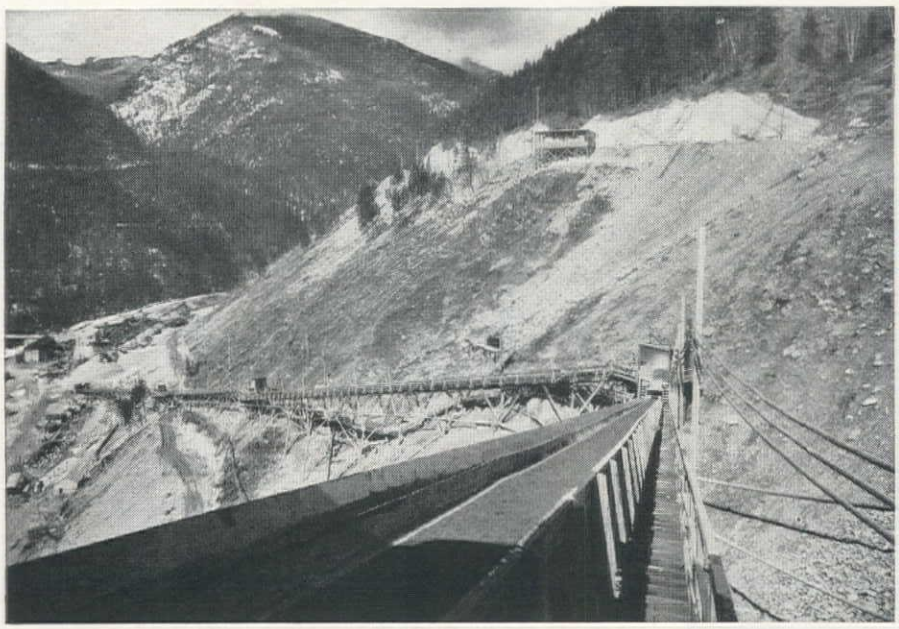
STANDARD OIL COMPANY OF CALIFORNIA



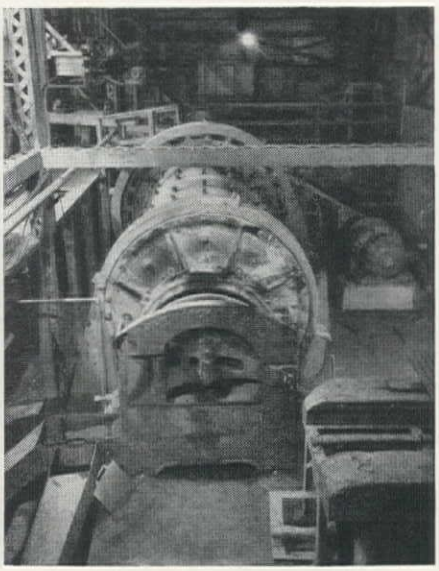
Aggregate under 6 inches is separated in shakers at screening plant. A G-E 5-hp motor drives shakers. Plant is completely automatic.



Carrying cement mix along this indoor conveyor system is a crucial step in construction of the dam. Sturdy G-E 100-hp motor drives the belt.



Aggregate for batching plant at Hungry Horse Dam is carried 1600 feet up the canyon wall by conveyor, driven by reliable G-E 100-hp motors in wooden sheds at intervals of 250 to 300 feet.



This Marcy rod mill, used in the gravel-crushing operation at the screening plant, is driven by a G-E 200-hp motor (right center). The motor is protected against heavy dust.

push-button aggregate processing at 700 tons/hr.

. . . Electrically

General-Shea-Morrison, contractors for the Bureau of Reclamation's Hungry Horse Dam, are going all-out with electric equipment. Best example is their aggregate plant with its network of interconnecting conveyors geared to process 700 tons of raw aggregate every hour. It's one of the most modern installations of its kind in the country—strictly a push-button operation from raw aggregate handling to mixing. Only with modern electric drives can this world's fourth largest dam be completed on schedule in 1952.

As time goes on, contractors are discovering more and more that it pays to electrify. With co-ordinated use of G-E motors and control and G-E power-distribution systems, they're getting safer, more flexible, and more efficient operation. *Apparatus Department, General Electric Company, Schenectady 5, N.Y.*

Ask him Today!

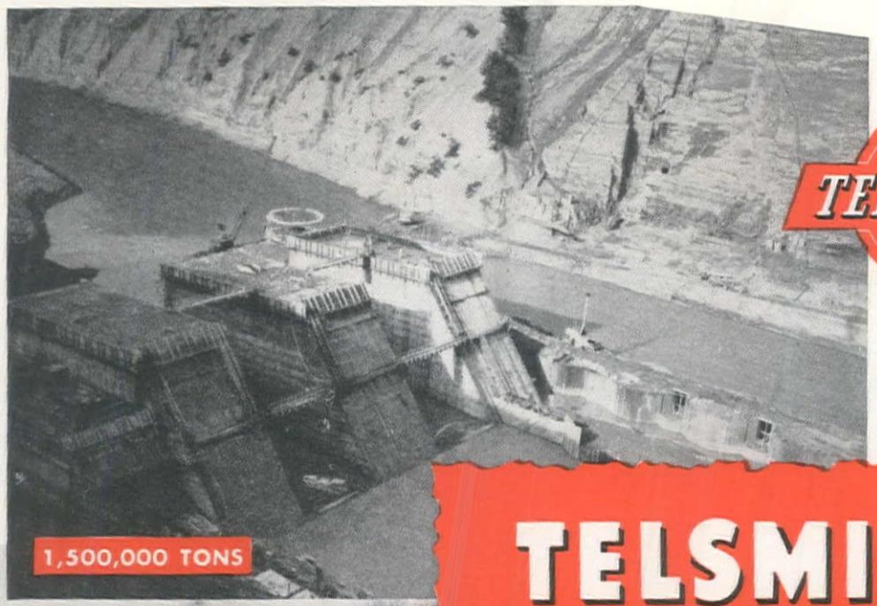
Whether you buy or build construction equipment, your G-E representative can show you how to do a better job —at lower cost—by complete electrification. Write him now, and he'll call on you at your convenience.

WESTERN PLANTS OR SERVICE SHOPS: Anaheim, Denver, Los Angeles, Oakland, Ontario, Portland, Richland, Salt Lake City, San Diego, San Francisco, San Jose, Seattle. WESTERN SALES OFFICES: Albuquerque, Bakersfield, Butte, Denver, Eugene, Fresno, Los Angeles, Medford, Oakland, Pasco, Phoenix, Portland, Riverside, Sacramento, Salt Lake City, San Diego, San Francisco, San Jose, Seattle, Spokane, Stockton, Tacoma.

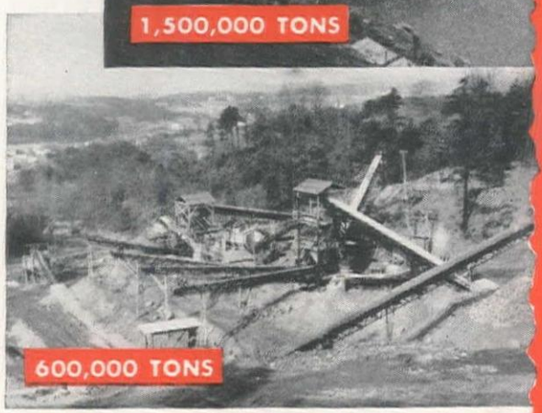
ELECTRIFIED EQUIPMENT Speeds Construction— Cuts Costs

GENERAL ELECTRIC

664-16



Mount Morris Dam, N. Y. The 300-350 tons per hour rock crushing plant is Telsmith designed and equipped.



Philpott Dam, Va. Here, too, the crushing-screening equipment is Telsmith.

TELSMITH® EQUIPMENT FOR DAMS

● Huge dam projects and Telsmith Aggregate Plants go together. Many dam builders call in Telsmith engineers for consultation as to the proper plant layout and the right equipment to use. Then Telsmith makes the detailed drawings for the erection of the plant and furnishes most of the machinery. Telsmith designed plants have proven their efficiency on many large projects and Telsmith equipment has a world-wide reputation for the production of low-cost aggregate. The ruggedness of Telsmith equipment is strikingly demonstrated by long life in severest service, on successive projects. After producing 1,500,000 tons of aggregate at Center Hill Dam, the same Telsmith equipment is now turning out about the same amount of aggregate at Buggs Island Dam.

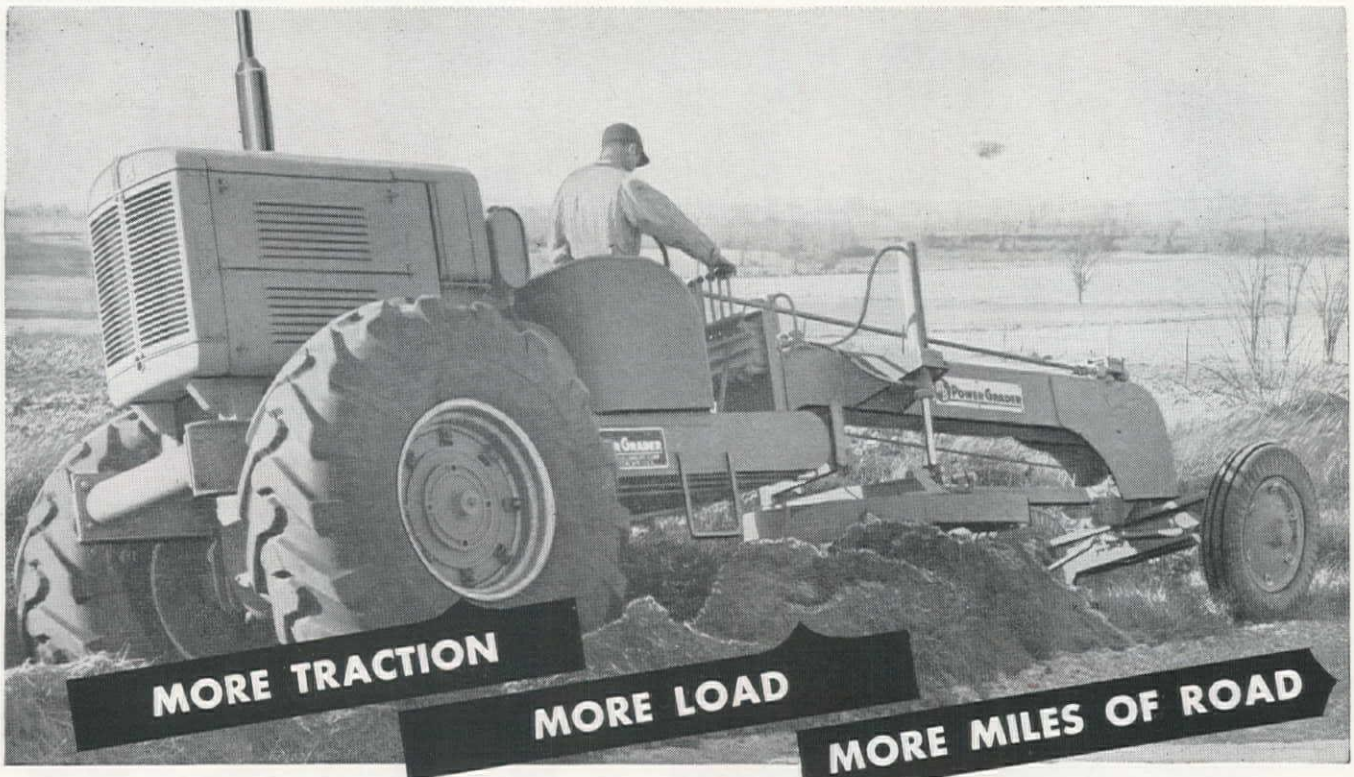
Save time and money. Consult Telsmith Engineers. Ask for Bulletin 266. MP-8

OTHER DAMS BUILT WITH TELSMITH EQUIPMENT

- Alatoona Dam, Georgia
- Boysen Dam, Shoshoni, Wyo.
- Buggs Island Dam, Virginia
- Carpenter Dam, Arkansas
- Cascade Dam, Washington
- Center Hill Dam, Tennessee
- Clark Hill Dam, Augusta, Ga.
- Conowingo Dam, Conowingo, Md.
- Dale Hollow Dam, Tennessee
- Davis Dam, Nevada
- El Presidente Dam, Mexico
- Fort Gibson Dam, Oklahoma
- Grand Coulee Dam, Washington
- Kortes Dam, Wyoming
- Norfork Dam, Arkansas
- South Holston Dam, Tennesse
- Watauga Dam, Tennessee

MINES ENGINEERING & EQUIPMENT CO.
369 Pine Street • SUtter 1-7224
SAN FRANCISCO 4, CALIFORNIA

Manufactured by SMITH ENGINEERING WORKS, MILWAUKEE 12, WISCONSIN



More miles of road at lowest cost per mile makes this husky Model 501 the decided choice of contractors and public bodies, who have taken the time to check up and compare.

It will be your decision too, for this No. 501 gives you tremendous ground gripping traction on its huge 18:00x26 tires, tremendous blade pressure for tough going, plenty of weight on front and rear, plenty of over-all weight for rugged strength and long life.

It has all the important basic features of the highest price machine, yet none of the seldom used extras which add to the original cost of a grader. It will handle rough grading, fine grading, maintaining and ditching — and do the job to anyone's satisfaction, at the lowest obtainable cost.

Before you invest in any grader it will pay you to investigate the M-B line, and the various attachments which make it an all around, year around performer. Send for literature today!

traction

Huge, low pressure, 10 ply 18:00 x 26 tires provide 613.6 square inches of ground contact.

weight

17,180 lbs. of rugged strength. Heavy front (4,970 lbs.) and rear (12,120 lbs.) provide stability and traction under all conditions.

blade pressure

8,040 lbs. of pressure on the blade produces full loads and positive action in tough going.

power

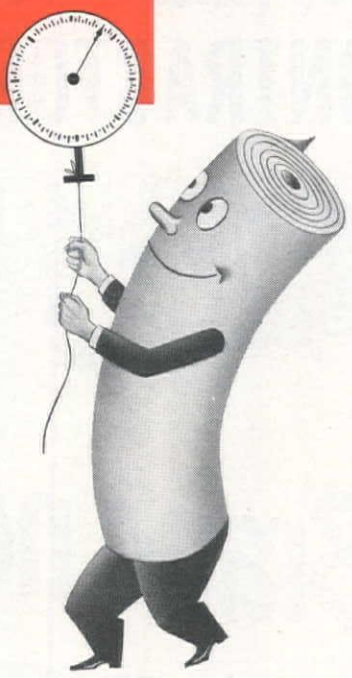
51 H.P. Gasoline or Diesel, heavy duty engines that are built for road work. Simple, trouble-free, economical.

MEILI-BLUMBERG CORPORATION

1633 WISCONSIN STREET • NEW HOLSTEIN, WISCONSIN

COAST EQUIPMENT CO. ..... San Francisco, Calif.	NEVADA EQUIPMENT SERVICE ..... Reno, Nevada
CASEY METCALF MACH. CO. ..... Los Angeles, Calif.	KIMBALL EQUIPMENT CO. ..... Salt Lake City, Utah
CONSTRUCTORS EQUIPMENT CO. .. Denver, Colorado	HOWARD-COOPER CORP. ..... Seattle, Washington
SAWTOOTH CO. ..... Boise, Idaho, Twin Falls, Idaho	WESTERN MACHINERY CO. ..... Spokane, Washington
CLARK COUNTY MER. CO. ..... Las Vegas, Nevada	HOWARD-COOPER CORP. ..... Portland, Roseburg, Central Pt., Eugene, Albany, Oregon

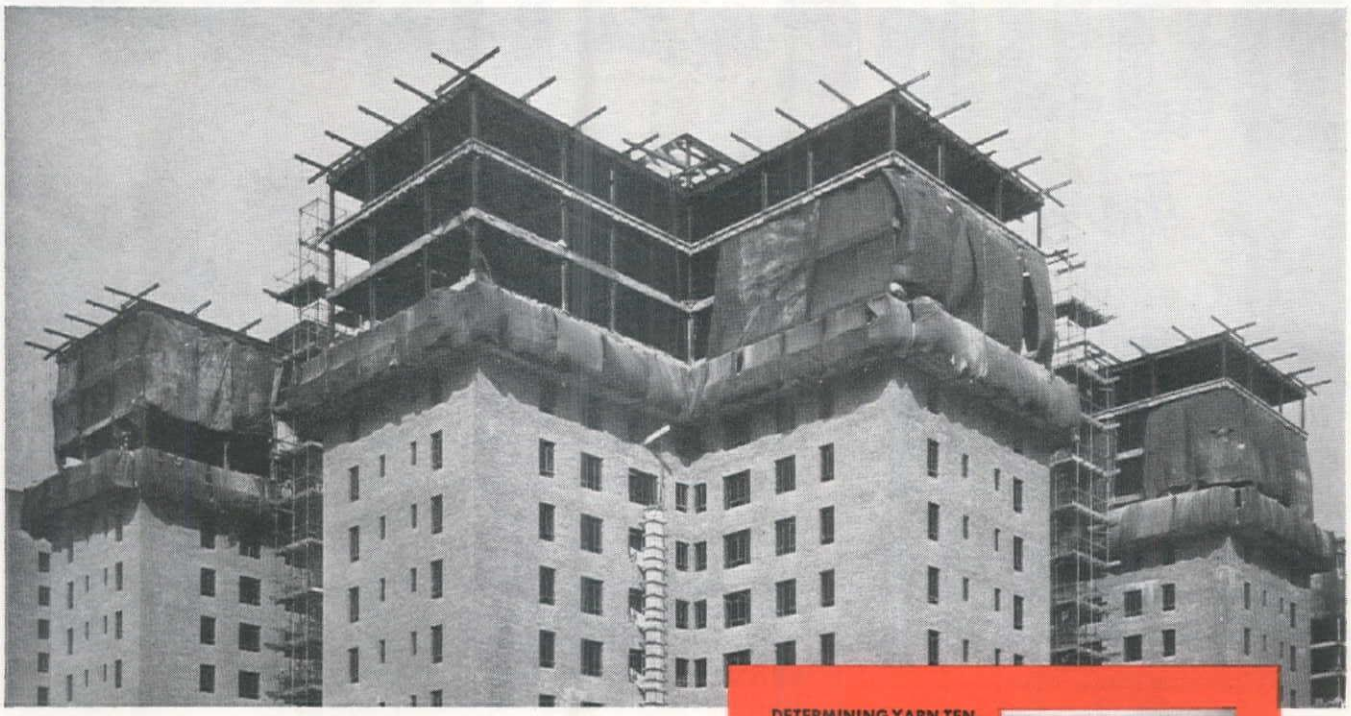
UNIFORMITY
Makes the Big Difference in TARPAULINS



MT. VERNON — EXTRA

Gives You Greater Fabric Uniformity

The greater uniformity of Mt. Vernon Extra Duck assures you the two most important qualities you want in tarps—top protection and top wear. You'll find your repair and replacement costs reduced considerably.



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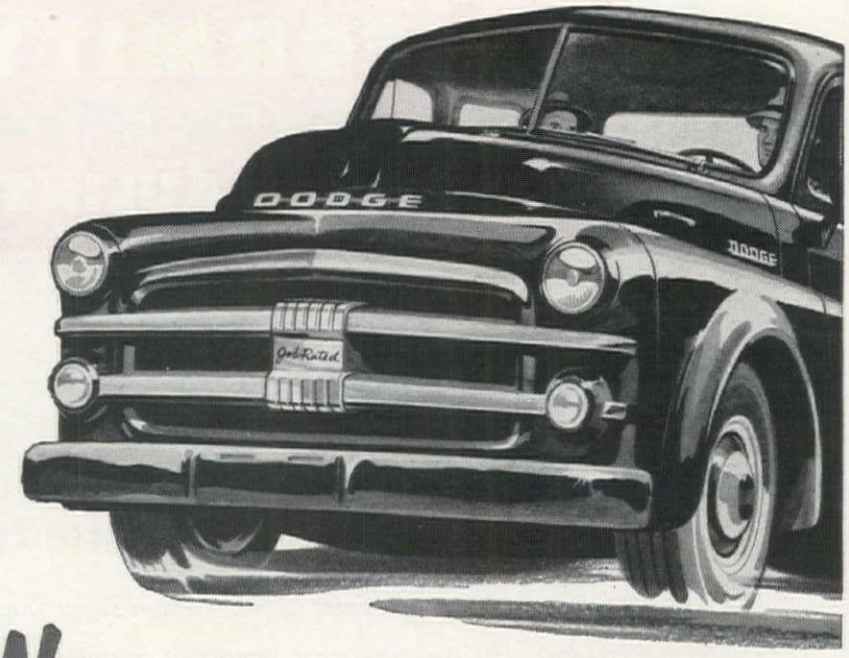
DETERMINING YARN TENSILE STRENGTH WITH 300-LB. VERTICAL TEST. One of a series of comprehensive laboratory controls throughout production to assure uniformity in all Mt. Vernon-Woodberry products.

"Job-Rated" for CONTRACTORS



Brand new DODGE "Job-Rated" TRUCKS

The trucks that do the most for you!

More than 50 BRAND-NEW improvements . . . including

NEW! SMOOTHER RIDE with new, "Oriflow" shock absorbers—standard equipment on ½-, ¾-, and 1-ton models.

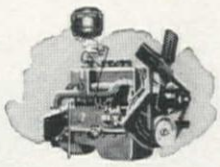
NEW! EASIER LOADING with lower ground-to-floor height—on all models through 2 tons.

NEW! EASIER BAD-WEATHER STARTING with new moistureproof ignition and high-torque starting motor.

NEW! MORE ECONOMICAL PERFORMANCE with higher (7.0 to 1) compression ratio—on all models through 1 ton.

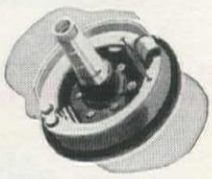
NEW! SMOOTHER ENGINE IDLING with "hotter" spark plugs; on all models through 1 ton.

BRAND-NEW POWER—You get more power than ever—engineered for *your* job! Eight great engines—with net horsepower stepped up as much as 20%! You get more of the *right* power for your needs—with top economy! Yet, with all their extra value, new Dodge "*Job-Rated*" trucks are priced with the lowest.



BRAND-NEW EASE-OF-HANDLING—You can turn new Dodge "*Job-Rated*" trucks sharper . . . maneuver them more easily. New shorter turning diameters! New worm-and-roller steering gears! All this—plus cross-steering, wide front tread and short wheelbase.

BRAND-NEW BRAKING SAFETY—New Dodge "*Job-Rated*" trucks are the trucks with new molded, tapered Cyclebond brake linings! New *extra-quiet* action! New extra-smooth, extra-sure stopping! New longer lining life! (On new 1½-ton and up trucks, except air brake models.)



PLUS THIS EXCLUSIVE! gyrol Fluid Drive available on ½-, ¾-, and 1-ton, and Route-Van trucks.

See your Dodge Dealer today for

THE TRUCK THAT FITS YOUR JOB... A DODGE "Job-Rated" TRUCK

Put this PUSH in Your Pocket!

The "big push" you get with an Oliver "FDE" Crawler and Heil Cable Dozer pays off in more dirt moved per day . . . more profit for your pocket!

Look at the profit-making advantages this "dirt-moving" team gives you:

- ★ **Rugged Oliver power that puts more "push" behind the blade.**
- ★ **Oliver exclusive steering principle that always lets you travel a straight line, regardless of the side-pull of off-center loads. No "jackknifing."**
- ★ **Cable power control unit that assures constant operating speed for quick, accurate control of moldboard action. Available in front or rear mounted units.**
- ★ **No operator fatigue. "Air steering," an optional Oliver feature, lets the operator control the tractor with just 2 fingers of one hand. No "footwork" required. Finger-tip dozer control unit on operator's right makes dozer operation easy. Operator faces forward in a natural, non-tiring position. Excellent visibility.**

Check these and the many other advantages of Oliver Crawler Tractors and Heil Cable Dozers with your Oliver Industrial Distributor. He'll show you why you'll profit with the "big push."

Oliver air steering "FDE" with Heil Cable Dozer clearing the way for a new road.

THE OLIVER CORPORATION

Industrial Division: 19300 Euclid Avenue, Cleveland 17, Ohio

State of Arizona: Guerin Implement Co., Phoenix, 1401 S. Central St. _State of California:_ Gustafson Tractor Co., Eureka; Mechanical Farm Equipment Dist., Inc., San Jose; Ashton Implement Co., Salinas; Comber & Mindach, Modesto; Cal-Butte Tractor Company, 820 Broadway, Chico; Tractor & Equipment Co., San Leandro; Flood Equipment Co., Sacramento; W. J. Yandle Co., Santa Rosa; Jim Ingle Co., Fresno, Hanford, and Tulare; Oliver Implement Co., Bakersfield and Shafter; Turner & Chapin, Whittier and Covina; Condosta Tractor Company, Colton. _State of Washington:_ Inland Diesel & Machinery Company, Spokane; Pacific Hoist & Derrick Co., Seattle and Puyallup; Melcher-Ray Machinery Co., 202 East Alder Street, Walla Walla; Central Tractor and Equipment Co., Wenatchee. _State of Oregon:_ Loggers & Contractors Machinery Co., Portland and Eugene. _State of Idaho:_ Idaho Cletrac Sales Co., Lewiston and Cottonwood; Engineering Sales Service, Inc., Boise. _State of Montana:_ Western Construction Equipment Company, Billings and Missoula. _State of Nevada:_ B & M Tractor & Equipment, Corp., 1420 S. Virginia St., Reno. _British Columbia:_ Pacific Tractor & Equipment, Ltd., 505 Railway Street, Vancouver.

SAVED...time, money and materials!

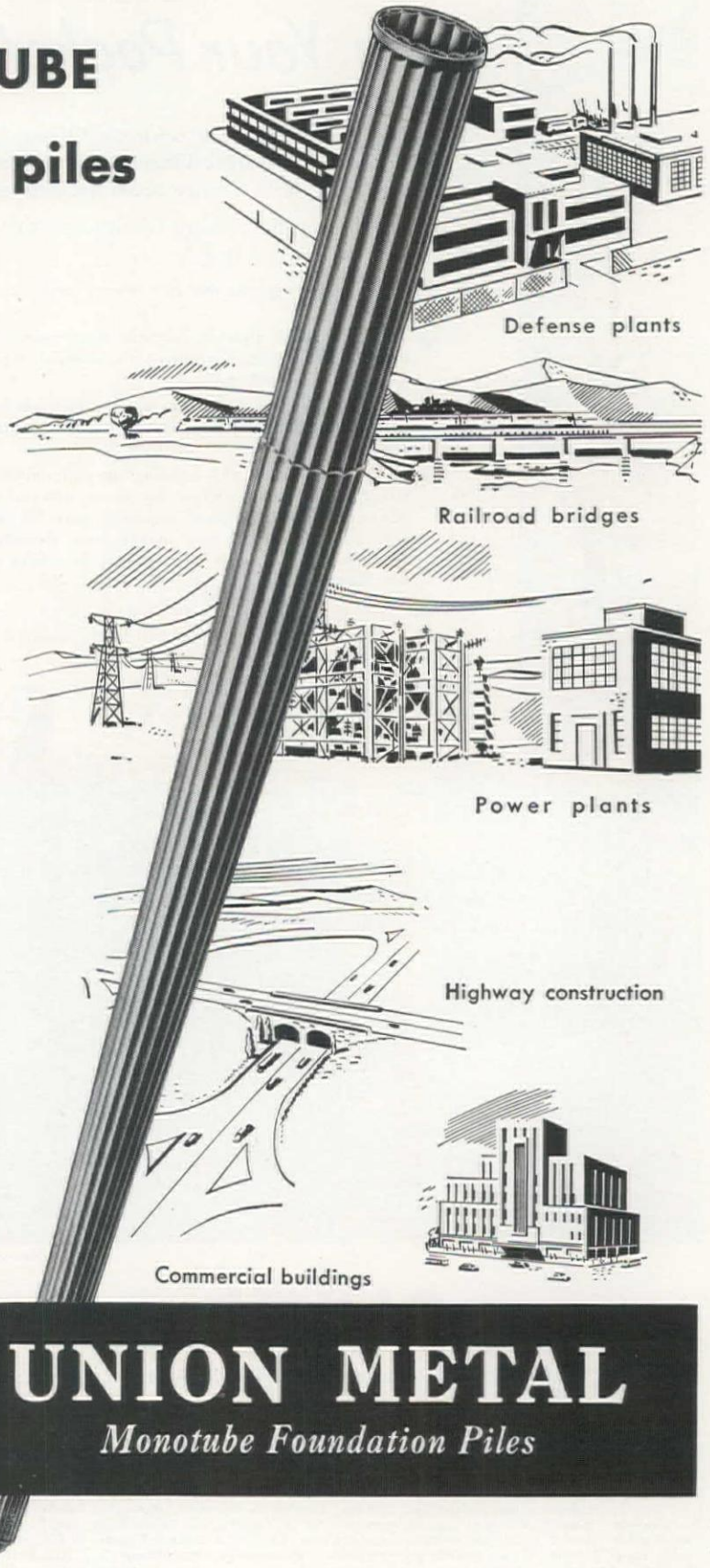
...with MONOTUBE taper-flute steel piles

THESE days, when conservation is a must, you'll want to take a *close* look at Monotube advantages and economies. We can't give you the whole story here, but as a starter, remember these facts . . .

CONSERVING MATERIALS! Due to their tapered design and cold-rolled properties, Monotubes *save steel* while providing unusually high bearing values and exceptional lateral stability. Result? Steel is conserved and required loads can often be carried by *fewer* Monotubes. Moreover, Monotube on-the-job extendibility, with easy cut-off and simplified weld-splicing, is another *big* factor in conserving materials.

SAVING TIME AND MONEY! Naturally, the above advantages save time and money as well as materials. But, *in addition,* Monotube taper-flute design results in *faster* driving. Lighter, standard driving equipment generally suffices even on the *tough* jobs! Then, too, because Monotubes are lighter in weight, they're easier, faster to transport, handle and locate.

Weigh these advantages. Then get *all* the facts and check them against your important construction projects ahead. You'll see many ways in which Monotube taper-flute steel piles offer material conservation as well as unusual economy all along the line. For complete data, write to The Union Metal Manufacturing Company, Canton 5, Ohio.



UNION METAL

Monotube Foundation Piles

40% FASTER
with GM DIESEL POWER

A 2-CYCLE GM 4-71 Diesel engine, replacing a slow-turning 4-cycle Diesel, put brand-new life and zip in this 10-year-old crane, owned by Dennis Materials Co., St. Louis.

It used to take 50 to 75 minutes to unload a 100-ton sand barge on the Meramec River. Now it takes only 35 to 45 minutes, depending upon river stage. Rigged with a 1¼-yd. bucket, the machine can lift and swing at the same time—something it couldn't do with the original engine.

That's the beauty of GM Diesels. Their efficient 2-cycle operation (power at every piston downstroke) makes them smooth and powerful, quick to respond to a wide range of loads. They are easy to start, cost little to operate and maintain, and they seem to run forever.

Whatever power you need, in new equipment or old, investigate General Motors 2-cycle Diesel engines. They are offered as standard or optional equipment in over 500 kinds of power machinery by 120 different manufacturers. They are available for replacement installations through your nearby GM Diesel distributor.

DETROIT DIESEL ENGINE DIVISION

SINGLE ENGINES... *Up to 275 H. P.* **DETROIT 28, MICHIGAN** MULTIPLE UNITS... *Up to 800 . HP*

GENERAL MOTORS

GM GENERAL MOTORS DIESEL POWER

DIESEL BRAWN WITHOUT THE BULK

Equipment Supply Company, Inc. EL PASO, TEXAS
Moore Equipment Co., Inc. STOCKTON, CALIF.
Modern Machinery Co., Inc. SPOKANE, WASHINGTON
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Anderson-O'Brien Co. LOS ANGELES 21, CALIF.
Haynes Machinery Company PLAINVIEW, TEXAS
Southern Idaho Equipment Co. BOISE, IDAHO
Fehrs Tractor and Equipment Co. OMAHA 2, NEBRASKA
West Coast Engine & Equipment Co. BERKELEY, CALIF.
Evans Engine & Equipment Co., Inc. SEATTLE 9, WASHINGTON
Empire Machinery Co., Ltd. ODESSA, TEXAS
Sweeney Bros. Tractor Co. FARGO, N. D.
Stewart & Stevenson Services, Inc. HOUSTON 1, TEXAS
Gunderson Bros. Engineering Corp. PORTLAND 9, OREGON
Seitz Machinery Co., Inc. BILLINGS, MONTANA
Colorado Builders' Supply Co. CASPER, WYO.
Cate Equipment Co., Inc. SALT LAKE CITY 4, UTAH
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"for more production at less cost you can't beat a Traylor TY . . ."

SAYS

E. C. SWAGGART
Of Eugene, Ore.

after operating a 2'4" and a 3'0" Traylor TY for many years.

Traylor TY Reduction Crushers have made a name for themselves with their trouble-free operation, low power requirements and high quality product. Their outstanding performance is due to several exclusive design features available only in a Traylor TY. For complete details fill out and mail the coupon today.

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Rotary Kilns, Coolers and Dryers · Grinding Mills
Jaw, Reduction and Gyratory Crushers · Crushing Rolls

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Send me a free copy of the Traylor TY bulletin that contains full details and capacities.

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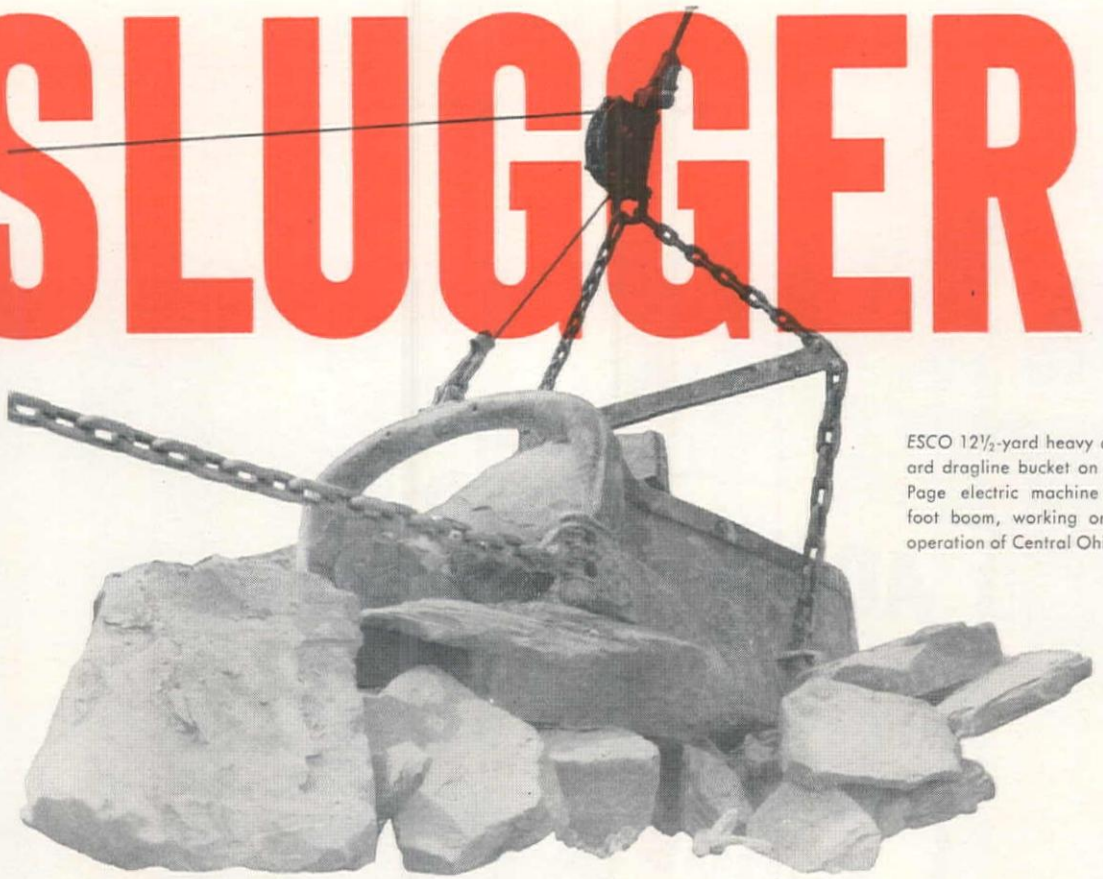
A "TRAYLOR" LEADS TO GREATER PROFITS

SLUGGER



ESCO 12½-yard heavy duty standard dragline bucket on model 627 Page electric machine with 165-foot boom, working on stripping operation of Central Ohio Coal Co.

on the mean, tough jobs

Job cost records that show a profit, and completion dates that run ahead of schedule—that's what *ESCO* dragline buckets mean to contractors throughout the world. For when it comes to slugging it out on tough going, here's what they do—

Take less time for each pass.

Increase machine capacity through oversize loads.

Take punishment of tough digging with least possible maintenance time and expense.

Back of this performance are these strength-giving but weight-saving features of construction:

Hollow arch, which eliminates useless weight.

ESCO Manganese Steel used for all parts subject to wear and shock.

Streamlined cutting lip with flaring outside teeth for clean, full bite and easy digging.

Catalogs fully describing these features are yours for the asking. They also contain data on *ESCO* dragline buckets which are made in four types and in sizes from ⅜ to 17 yards. Get your copies from your nearest *ESCO* representative 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 forward catalogs on ESCO dragline buckets of following types:
☐ Medium; ☐ Stripping; ☐ Standard; ☐ Heavy Duty

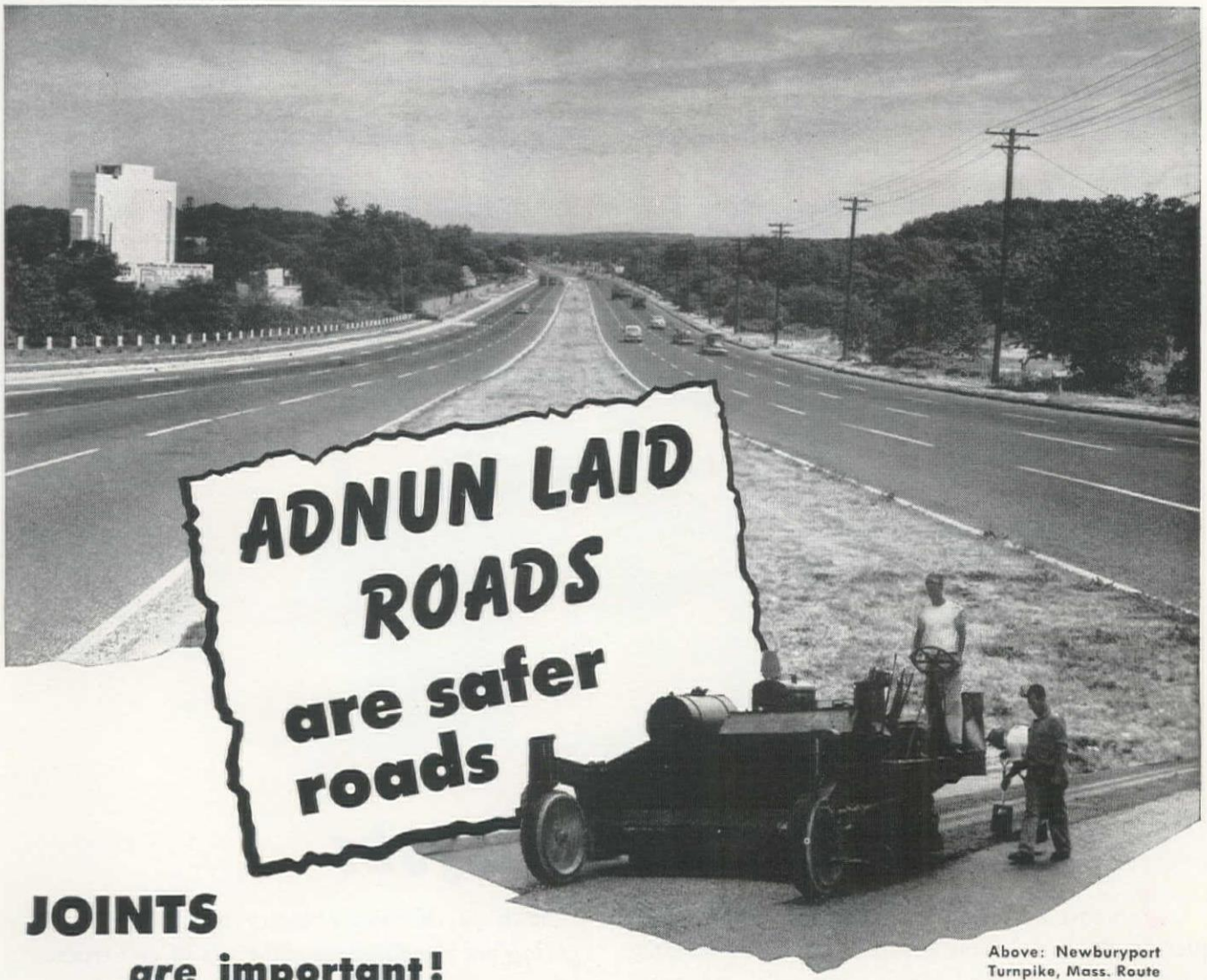
Name_____

Company_____

Address_____ Zone_____

City_____ State_____

Make, model and boom length of machines used_____



Above: Newburyport Turnpike, Mass. Route 1. Adnun laid and traffic loaded since 1936, 15 years ago.

Lower: Joints are going to be tight and safe on this three lane job.

JOINTS *are* important!

IN this day of the increased use of asphalt on high-speed, multi-lane roads, tight, smooth joints mean safer roads.

The Adnun is the only black top paver that makes a tight joint automatically. The oscillating overlapping Cutter Bar carries the material up against the parallel course or curb and compacts it in place. It is not dependent on the eye or human judgment. It is level, tight and positive—a safe joint that will not throw a car off its course or leave thinner spots where breakdown can begin.

This is only one of the many Adnun advantages that has been responsible for the long life of heavily traveled Adnun laid roads. If you don't have them ask for the booklets "Roads That Last" or "11 Basic Things . . ." They tell an interesting story.

Above: Only overlapping Cutter Bar action can produce a joint like this. No raking or hand work is necessary.

THE FOOTE COMPANY, INC.

Subsidiary of Blaw-Knox Co.

1940 State Street Nunda, New York

ADNUN

TRADE MARK REGISTERED

BLACK TOP PAVER

A BLAW-KNOX PRODUCT — FROM FORMS TO PAVER TO FINISHER... ALL YOUR PAVING EQUIPMENT IN ONE PACKAGE from BLAW-KNOX

Tops in sales because they keep costs down!

Month after month, year after year, International Trucks cut hauling costs and give you better on-the-job performance.

Where's the proof?—in the carefully-kept cost records of heavy-duty haulers; the same men who have kept Internationals first in heavy-duty truck sales for 19 years. Their records are black-and-white proof that Internationals give you lower operating and maintenance costs even on the toughest jobs.

Where's the pay-off for you?—every new International Truck is *heavy-duty engineered* with extra stamina in every part to give you this same cost-cutting performance with longer truck life on *your* job.

You get the right truck for your job

When you buy a new International Truck you don't gamble with a "misfit" truck. You get the engine, the transmission, the axle, *everything* specialized to fit your particular job. You get a truck that's built to last and give you more efficient on-the-job performance. That's why over half the Internationals built in the last 45 years are still in operation.

You get a truck that drivers go for

The better a driver likes his truck, the better care he takes of it. That's why every new International is specialized from the driver's standpoint, too. An all-new steering system gives the driver more positive control from a more comfortable position. New Super-maneuverability lets him turn in the shortest *practical* circles—helps him in the tight spots.

The new Comfo-Vision Cab is the "roomiest cab on the road." It has mighty comfortable, fully-adjustable seats. And the driver enjoys full-front visibility through the one-piece Sweepsight windshield.

With 87 basic models, thousands of specialized variations, in the world's most complete line of trucks, you're sure of getting the right truck for your job. See the new International Trucks at your nearest International Truck Dealer or Branch *now*.

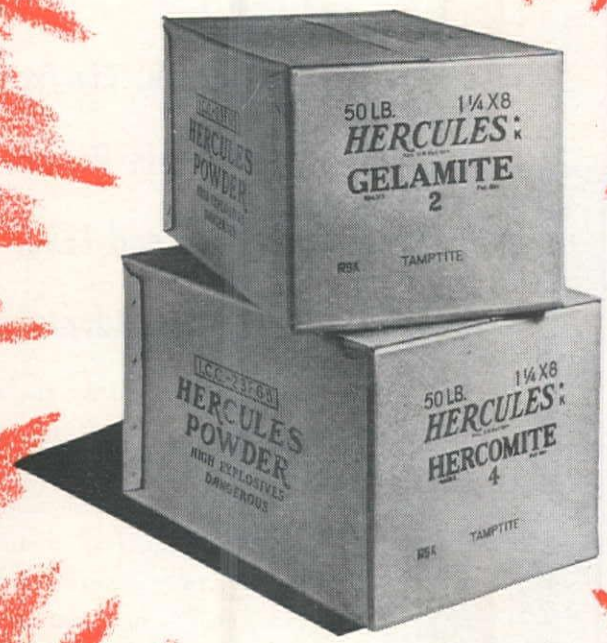
International Harvester Builds McCormick Farm Equipment and Farmall Tractors... Motor Trucks... Industrial Power... Refrigerators and Freezers

International Harvester Company • Chicago

See the new

INTERNATIONAL TRUCKS

Every model heavy-duty engineered for the long haul



GET MORE E.P.* PER DOLLAR

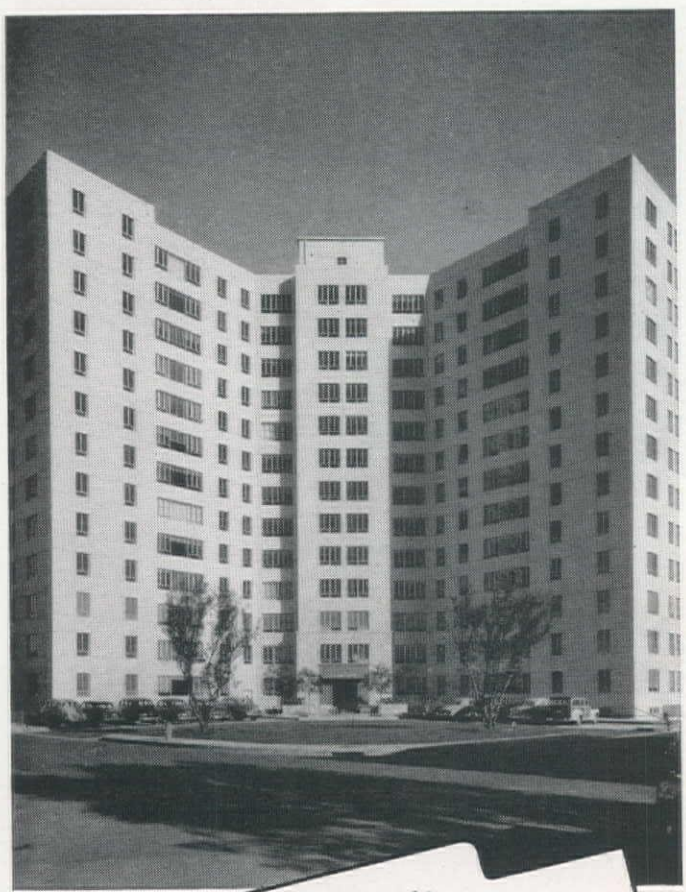
*Explosive Power determines your dynamite dollar's true value. Get more for your money with Hercules Hercomites® and Gelamites®. They give better breakage than older-type explosives . . . are more economical than extra dynamites and gelatins. Among them, there is one for practically every mining, quarrying, and construction need. Write for illustrated booklet, "Hercomites and Gelamites for Lower Blasting Costs."

HERCULES POWDER COMPANY INCORPORATED 973 Market Street, Wilmington, Delaware
EXPLOSIVES DEPARTMENT

XR51-1

These Concrete Project Case Histories Prove

the Advantages of PLYWOOD FORMS



1. Smooth, Fin-Free Concrete

Almost three million square feet of plywood forms were used to form mirror-smooth concrete surfaces on the huge Parklabrea Housing Project, Los Angeles. So smooth were ceiling slabs that the concrete was merely painted and left exposed. Architects report: "We consider the results amazing." Architects on the project: Leonard Shultz and Associates, New York, represented in Los Angeles by Gordon Kaufman & J. E. Stanton. General contractors: Starret Bros. & Eken, New York.

1. Smooth, Fin-Free Concrete

2. Multiple Re-Use

3. Time and Labor Savings

4. Design Adaptability

GIANT APARTMENT DEVELOPMENT, industrial building or heavy construction project—Douglas fir plywood is ideal for *every* type of concrete form work. Versatile and adaptable, plywood forms create smooth, clean, monolithic surfaces . . . speed work . . . contribute to overall job economy through simplified form construction, labor savings and panel re-use. Highly moisture-resistant glues used in PlyForm®—the special concrete form grade of Interior-type plywood—permit multiple panel re-use (as many as 10 to 15 are not unusual). For greatest possible re-use, however, specify EXT-DFPA • CONCRETE FORM® bonded with completely waterproof adhesives which permit panel re-use until the wood itself is literally worn away. For the finest possible concrete surfaces, panels having "A" face veneer, or one of the new plastic faced panels may be used.

® Ply-Form and EXT-DFPA® are registered grade-trademarks of Douglas Fir Plywood Association (DFPA).

Douglas Fir Plywood

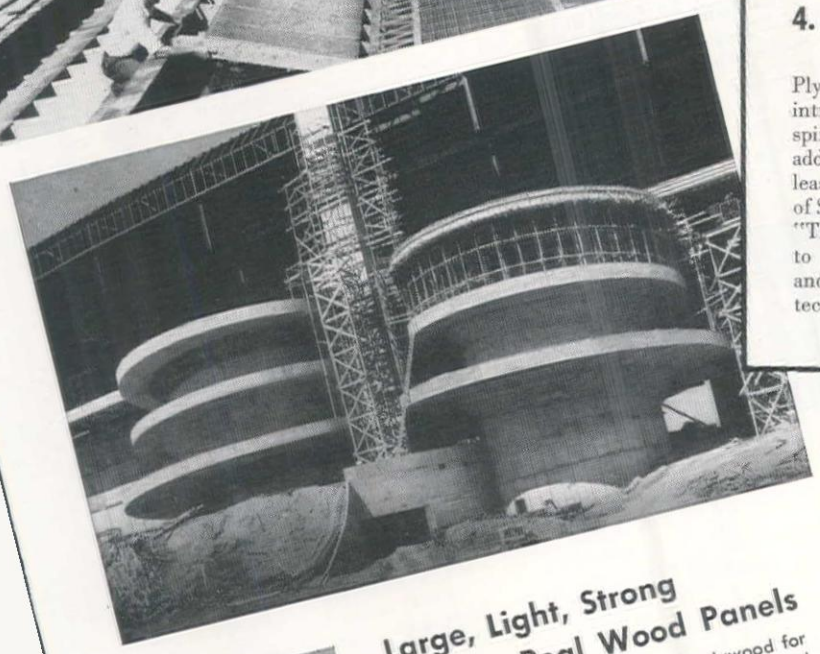
AMERICA'S

2. Multiple Re-Use

"We've found plywood forms to be the most economical for several reasons," says C. J. Rollo, job superintendent for Brown & Root, Inc., contractors for the new Rice Institute Stadium, Houston. "Given proper care, they can be re-used again and again; they're easier to handle, produce better looking concrete." On the job, built-up PlyForm seat forms were still in good condition after up to ten re-uses. An even greater number of re-uses was recorded for PlyForm wall and fence forms. Architects: Floyd & Morgan and Milton McGinty.

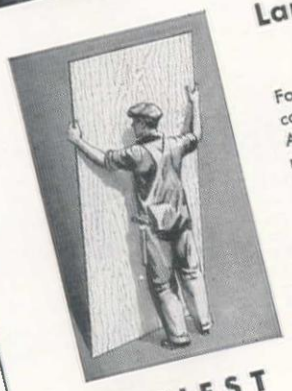
3. Time and Labor Savings

"Plywood speeded form work all along the line," says Earl Starbard, job superintendent of Woodworth & Co., contractors for all concrete work on the new mile-long Tacoma Narrows Bridge. On the job, contractors report, use of built-up plywood form sections "cut time and labor costs by 15%." Plywood forms were used to form the reinforced concrete roadway and for all above ground concrete on the anchors, toll houses, bents and viaduct. Built by Washington State Bridge Authority; Charles E. Andrew, chairman and principal engineer.



4. Design Adaptability

Plywood forms were called on to solve an unusually intricate concrete job in building the spectacular twin-spiral ramps at the University of Washington grid bowl addition. "Plywood forms offered the simplest and least expensive solution," reports Elmer Strand, partner of Strand and Son, General Contractors, Seattle, Wash. "The panels can be re-used many times. They're easy to fabricate into cost-cutting built-up form sections and are easily bent to form curved surfaces." Architects: George W. Stoddard and Associates, Seattle.



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For additional data on Douglas fir plywood for concrete form work, write Douglas Fir Plywood Association, Tacoma 2, Wash. Use coupon at right to obtain your free copies of two plywood form booklets: "Concrete Forms of two plywood Plywood" and "Handling PlyForm." Also available is the new Keely PlyForm Calculator. This handy slide rule gives construction data for plywood forms based on hourly rate of pour. Price (including leaflet, "Design Assumptions For New Keely Calculator"): $1.00.

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Tacoma 2, Washington

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☐ Please send ..... Keely Calculators. I enclose $1.00 each to cover costs.

BUSIEST BUILDING MATERIAL

We're proud of this Western Pedigree

it too covers 25 years of "Western Construction"

Remember the feature "TWENTY-FIVE YEARS of WESTERN CONSTRUCTION" that appeared in the January, 1951, issue of this magazine? It showed how the machine age of Western Construction began about 1926—and reviewed what has happened since.

The list at the right describes some of the jobs handled by Chicago Bridge during that vigorous quarter-century. There are three reasons why it might mean something to you.

First, it is evidence of *versatility*. Notice the variety of structures built and types of customers served.

Second, it is proof of *experience* for which there is no substitute.

Third, it indicates *reputation*, for a concern—like a man—is known by the company it keeps.

May we quote on *your* next job?

1926—1,050,000-gal. differential surge tank for the Washington Water Power Company at Chelan Falls, Wash.

1927—100,000 gal., pineapple-shaped water tank, Hawaiian Pineapple Co. Ltd., Honolulu.

1928—5,000-bbl. riveted Hortonsphere, Shell Oil Co., Wilmington, Calif.

1929—Six elevated water tanks for Southern Pacific Lines.

1930—Cone roof and floating roof tanks for Standard Oil Co. of Texas, El Paso, Tex.

1931—Conical bottom ore tanks, Sierra Magnesite Co., Ingomar, Calif.

1932—Four 32 ft. diam. by 57 ft. high pressure gas holders for Southern Counties Gas Co., Whittier, Calif.

1933—87 domes for caissons for San Francisco Bay bridge foundation piers.

1934—9 floating roofs for Standard of California pipe line, Rio Bravo to Estero, Calif.

1935—Two 10,000-bbl. Hortonspheroids, Superior Oil Co., Kettleman Hills, Calif.

1936—Two 140-ft. diam. steel reservoirs at Alhambra, Calif.

1937—135-ft. diam. observatory dome for 200 in. telescope at Mt. Palomar.

1938—Six 51,000-bbl. fuel tanks for U. S. Navy at San Diego.

1939—1,000,000-gal. elevated water tank at Tucson, Arizona.

1940—22-ft. diam. welded steel penstocks for the Parker Dam.

1941—Two 63½-ft. diam. Hortonspheres for Southern Counties Gas Co. at Fulton and Whittier, Calif.

1942—First YFD floating drydock launched at Eureka, Calif., for U. S. Navy in December.

1943—Reactor, regenerator, fractionating column, Hortonspheres and oil storage tanks for The Texas Company at Wilmington, Calif.

1944—Hortonspheres and Horton Floating Roofs, Standard Oil refinery, Richmond, Calif.

1945—37 tanks for Standard Oil Co. at El Segundo, Calif. refinery.

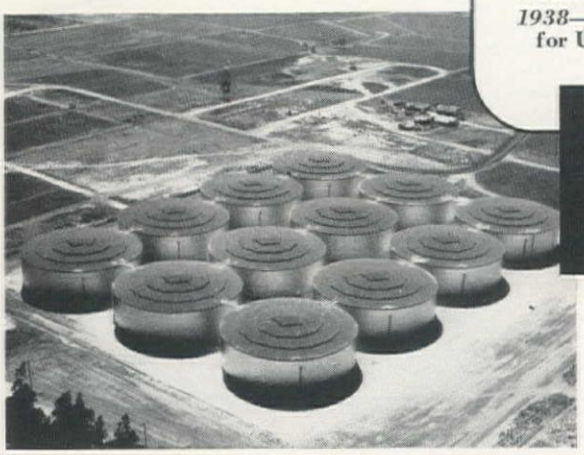
1946—1,000,000-gal. elevated water tank, City of Seattle, Wash.

1947—Nine 80-ft. diam. sugar storage tanks, California and Hawaiian Sugar Refining Co., Crockett, Calif.

1948—All tanks for Standard Oil refinery expansion at Bakersfield, Calif.

1949—Twelve 132-ft. diam. reservoirs at Long Beach, Calif. (see below).

1950—Ten floating covers, a gasholder cover and a 15,000-gal. water tank for San Francisco, Calif., sewage disposal plant.



The structures listed above are a few of the many interesting installations we made in the West during the twenty-five year period from 1926 to 1950

Left: General view of the 12 welded steel reservoirs we fabricated and erected in 1949 for the City of Long Beach, Calif. Each tank is 132 ft. in diam. by 35 ft. deep and holds about 3½ million gallons of water.

HORTON

WELDED STEEL STORAGE TANKS

CHICAGO BRIDGE & IRON COMPANY

Plants in Birmingham, Chicago, Salt Lake City, and Greenville, Pa.

Atlanta 3.....2183 Healey Building	Los Angeles 17..1544 General Petroleum Building
Birmingham 1.....1598 North Fiftieth Street	New York 6.....165 Broadway Building
Boston 10.....201 Devonshire Street	Philadelphia 3.....1700 Walnut Street Building
Chicago 4.....McCormick Building	Salt Lake City 4.....555 West 17th South Street
Cleveland 15.....Guildhall Building	San Francisco 4.....1569—200 Bush Street
Detroit 26.....Lafayette Building	Seattle 1.....1355 Henry Building
Houston 2.....National Standard Building	Tulsa 3.....Hunt Building
Havana.....402 Abreu Building	Washington 6, D. C.....1103 Cafritz Building

WESTERN CONSTRUCTION

April 1951 Vol 26, No. 4

JAMES I. BALLARD . . . . . Editorial Director
JOHN J. TIMMER . . . . . Managing Editor

Stumping the Concrete Experts

ALTHOUGH growing smaller, a noticeable gap still exists between the technical knowledge in the field of concrete, and the everyday problems of using it on the job—particularly the small job. This situation was emphasized in one of the sessions of the American Concrete Institute meetings in San Francisco. The evidence developed during a question-and-answer discussion where practical problems met in the field were put to a panel of outstanding national authorities on concrete technique. The smaller field problems, such as those experienced by the building contractor in matters of sag, contraction, cracks and uniformity of results, produced the most evasive answers. The questions which related to theory, or those which had answers coming out of the laboratory, received definite and complete answers. But those little, annoying construction headaches for the man in the field, where the behavior of the concrete seems to differ with each job, received a minimum of helpful counsel from the experts.

In general the answers to these minor, but ever-present problems were to "watch the water, and try to improve the workmanship on the job." Sound advice, indeed, but it still leaves that gap between theory and practice. Of course the "factor of ignorance" common in all engineering design eliminates any concern over safety, but concrete technique of the laboratory remains at least a short step or two away from the problems of those who wrestle with this material at the buggy-to-the-form level.

Problem of Aluminum-Steel Contact

INCREASING use of aluminum as an engineering material—now curtailed by defense uses—emphasizes a problem when the design calls for its contact with steel. Such direct aluminum-to-steel contact develops slight but continuing electrolytic action which is particularly harmful to the appearance and character of the aluminum.

Engineers and contractors may not be aware of this problem, and the fact that a simple and inexpensive solution is available. An insulating film introduced between the metals will stop any action, and this film can be of minimum thickness since the electric potential caused by the contact is so small. A thin coating of some form of asphaltum is easily applied and is most adequate. The principal precaution is to be sure the film is continuous and does not have breaks. In case the aluminum is attached to steel, as in an architectural facing, the screws or other connectors must also have an insulated coating, or local electrolysis will be set up at these contacts. This simple precaution insures effective and long service in using this combination of engineering materials.

More About Engineers and Registration

THE PROBLEM of professional registration for those young engineers who go to work for contractors deserves further discussion. Last month the elements of the situation, as it exists in California, were outlined in general terms. Now a specific case can be reviewed. The facts are presented on page 75. Briefly a civil engineering graduate of an accredited university was employed by a well-known engineering contractor and worked for 2½ years under the direction of registered engineers on the contractor's staff, as required under the California registration act. His experience included a variety of work which could be described as a substantial apprenticeship in construction engineering. At the end of this period of "in training" his application was rejected by the Board because of "Insufficient engineering experience."

This action and the implied attitude of the California Board of Registration requires examination. In the first place, the law specifies "supervision of the construction of engineering structures" as a part of the definition of civil engineering. The work of this young engineer in his thirty months of training clearly indicates he was qualified to be examined for a license under this part of the definition. Obviously, he was as far along the road toward competency in supervising construction as any designer with similar length of experience would be to assume responsibility in design. This point recognizes that civil engineering includes at least the two major divisions of (1) design and (2) construction. The act was written to cover these branches, and was so construed by the original board.

Those on the present Board who prefer the narrow definition of civil engineering as being merely the "art or science of design" will point to the need for protecting the public. They will express concern over the possibility that an engineer qualified to direct construction might suddenly decide to design a bridge and endanger public safety. The reasoning is as unsound as having the medical profession refuse to license a graduate training to be a diagnostician because he might suddenly decide to perform a surgical operation. If the applicant for license, either doctor or engineer, has shown himself to have integrity and responsibility, he would be the first to know his own competency and limitations.

There is no need to reduce the effectiveness of the California Registration Act, or to lower the bars for licensing. Experience with a contractor which consisted of timekeeping should not be considered any more than a corresponding application from an engineering graduate who spent years in doing only tracing. But adequate experience must receive equal recognition, whether the applicant is concerned with the engineering function of construction or design. Continued discrimination similar to the present case might be corrected by having an outstanding construction engineer on the Board.

BUILT TO OUTPERFORM

The Power Graders That Have Everything

"88-H"—a new model of medium size with all the extra traction and maneuverability of All-Wheel Drive and All-Wheel Steer.

"99-H"—popular with contractors and highway departments for its all around performance, under all conditions, in all seasons.

MASTER "99"—combining the best features of the "99-H" with the extra power, traction and road speed of its 100 horsepower engine.

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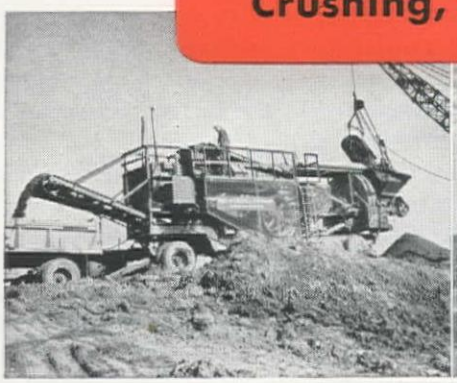
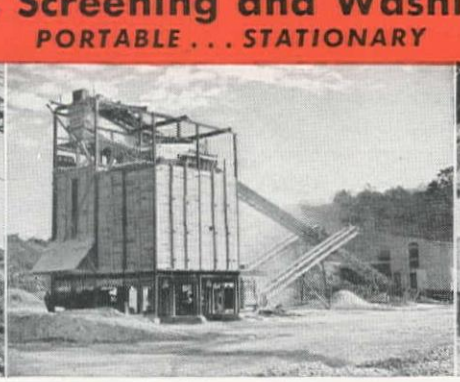
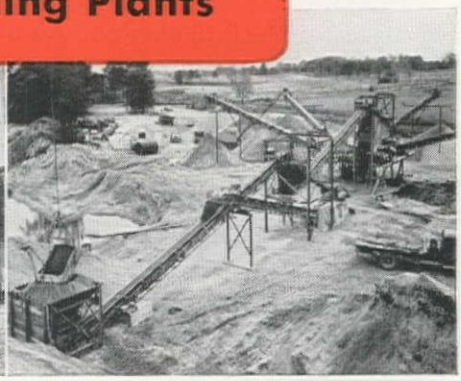






The AUSTIN-WESTERN LINE includes Jaw Crushers and Roll Crushers in a wide range of sizes; plus matching screens, elevators, conveyors and bins. Exclusive features increase output, and reduce maintenance costs.

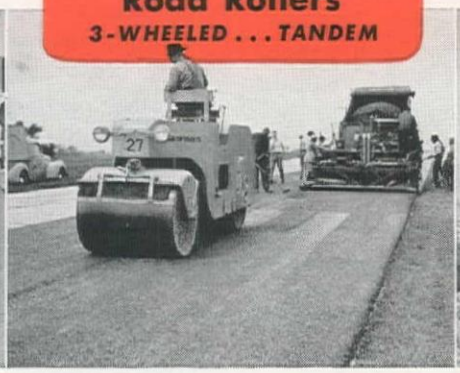
Skilled engineering characterizes each and every Austin-Western crushing, screening and washing plant, which is tailor-made for a particular production problem. We would welcome the opportunity to discuss yours.

Model "40" Sweeper

Fast, maneuverable and economical. Dirt is thrown directly into the 2-yard hopper. Right-hand or left-hand gutter broom, or both.

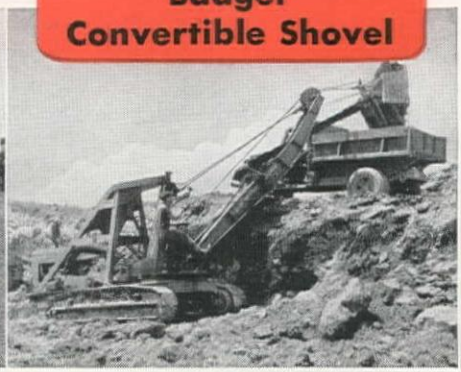
Road Rollers

3-WHEELED . . . TANDEM



3-WHEELED ROLLERS with hydraulic scarifiers. TANDEM ROLLERS of the variable weight type. All with gas or diesel engines.

Badger Convertible Shovel



The ¾-swing Badger wastes no power swinging extra weight; makes more swings per hour; can work in closer quarters.

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Colorado Hurdles Economic Problems to Build—

The West's First Modern Turnpike

The $6,300,000 Denver-Boulder toll road is being built as the best solution to a specific problem—Work on the entire project is in progress under separate contracts for heavy grading, four overpasses, toll houses and 17.3 mi. of paving

THE Denver-Boulder Turnpike, now under construction as a $6,300,000 four-lane highway 17.3 mi. long, is a toll road, the first in the Western States in the modern era of highway building. Toll roads, however, are not new to Colorado. The first was built by the Denver, Auraria and Colorado Toll Road Company. The company was organized to build a toll road from Denver via South Park across the Continental Divide to Hot Sulphur Springs. That was shortly after the gold rush, mistakenly identified by the famous slogan "Pike's Peak or Bust," was precipitated by the discovery in 1858 of pay sand at the confluence of the South Platte River and Cherry Creek where Denver's lower downtown section now is located. By 1859 the road had been built to a point about 20 mi. west of Denver. Between 1860 and 1870, 43 toll roads had been incorporated by specific acts of the territorial legislature; some were two or three miles long, others 150 to 200.

Tolls varied from 50 cents to one dollar per vehicle drawn by a single span of horses, mules or oxen. A charge of 25 cents normally was levied for each additional span, and riding stock was assessed at the rate of 10 cents a head.

Toll roads passed from the picture during the 1880's and were succeeded by county roads, constructed either from bond issues or specific legislative appropriations. The toll road still is in operation to the 14,110-ft. summit of Pikes Peak. A charge of 50 cents per person is levied for use of this highway, but the spectacular drive is maintained by Colorado Springs as a tourist attraction and cannot properly be catalogued as a contemporary highway.

By
MARK U. WATROUS
Colorado State Highway Engineer

In constructing the Denver-Boulder Turnpike, Colorado is not contemplating breaking out in a rash of toll strips running up and down the sides of the Continental Divide, or anywhere else. We expect this to be the one and only official toll road in the state, because it is being built only as the best possible solution to a specific, trying problem.

Offhand, logic and economics appear to oppose the spending of more than $6,000,000 on a toll facility between a metropolitan area with a population of approximately 500,000 and a community 22 mi. away that boasts of but 20,000 souls, plus some 8,000 students in the State University.

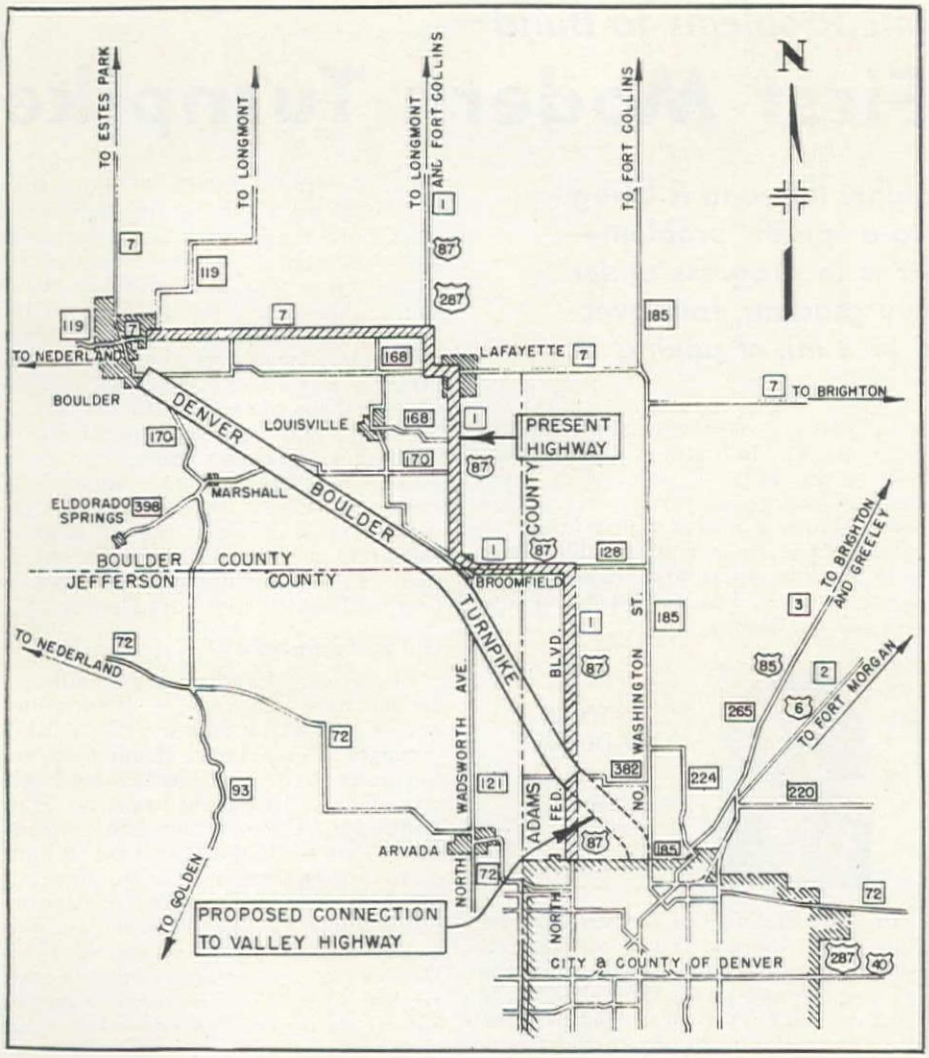
Boulder, located at the base of the foothills where the granite shafts of the Flatirons jut abruptly into the sky, is one of the major gateways to the Rocky Mountain recreation areas. For many years, officials of the University of Colorado, and others interested in the development of Boulder and its adjacent mountain area, had been vigorous in their requests for improved transportation facilities to and from Denver.

Old route obsolete

The principal and most generally accepted route follows U. S. 87 for 19 mi. out of Denver on North Federal Blvd. through Westminster, Broomfield and Lafayette to the junction of State Highway No. 7, then turns west on State Highway No. 7 to traverse the remaining 8½ mi. to Boulder. This route, however, to the junction of State Highway No. 7 carries all principal travel between Denver and the Estes Park region, Fort Collins and Cheyenne, Wyoming. From Denver to the intersection of State Highway No. 7, U. S. 87 carries a greater volume of traffic than any other equal length of road within the state, the traffic count reaching an annual daily average of 5,700 cars just east of Boulder.

The existing highway, although well improved, is obsolete by modern standards. Northward from the northern city limits of Denver for two miles, there is a paved four-lane highway. From that point into Boulder the roadway is con-

GRADES in the rolling country along the Turnpike route necessitate 2,750,000 cu. yd. of excavation. View below is on the Peter Kiewit Sons' Co. portion of the project.



ROUTE of the 17.3-mi. Turnpike. Best previous route (cross hatched) required that motorists drive 25 mi. making three right angle and two 45-deg. turns, all at short radius. Toll houses and cloverleaf interchange will be located at Broomfield, the single access point enroute.

crete, 20 ft. wide. Shoulders are well maintained, but their utility is made hazardous by the occasional culvert having headwalls set close to the pavement edge. The pavement, laid some 25 years ago, has worn and cracked and is now patched with asphalt. The highway makes three right turns and two 45-deg. turns between Denver and Boulder, all at short radius. Grades are easy, but many are quite long with limited sight distances at the crests.

The problems of a toll road

The entire situation has been under serious consideration for many years by the Highway Department and the State Highway Advisory Board, which makes the allocations to projects in annual budgets. Funds had been appropriated for widening bridges on U. S. 87 from Denver to Fort Collins, and that work was completed. But with a maximum construction budget of $18,000,000 with which to attempt to take care of the most critical needs of a state highway system 12,400 mi. long, the Advisory Board felt unable to allocate sufficient funds to the Denver-Boulder road to accomplish worthwhile improvements within a sufficiently short period of time. In a state which contains 75% of all the territory in the nation which is 10,000 ft. high, or higher and where one mile of mountain highway may cost $250,000, an $18,000,000 construction budget is the equivalent of one pat of butter for an entire loaf of bread.

In an effort to find a solution, elaborate traffic studies were conducted and economic surveys were made. In the 1947 session of the State Legislature a measure was passed permitting the construction of toll highways by the State Highway Department and the issuing of revenue bonds by the Department for their financing.

On December 1, 1947, the Planning and Research Division of the Department made a report on the economic feasibility of a Denver-Boulder toll road and held that it would be skating on thin ice to expect the project to be financed entirely by toll revenues. The Department, at the time, was engaged in its greatest construction program, its facilities were taxed to the utmost and all available manpower was being utilized.

To obtain the best possible information on the toll road problem, a subject with which the Department necessarily had no experience, the firm of Howard, Needles, Tammen & Bergendoff, consulting engineers of Kansas City, was employed to delve deeper into the subject. On April 1, 1948, that firm reported that the project would be feasible only if the Department were prepared to subsidize it to the tune of $1,480,000, or contributions averaging $86,000 annually.

Plans, lawsuits, and finally action

Acting on a resolution approved by the Highway Advisory Board, the General Assembly in 1949 adopted a resolution authorizing the Highway Department to issue bonds for the construction of the Denver-Boulder Turnpike, and authorizing the Department to guarantee from its own funds not to exceed 30% of the amount of bonds, up to $5,300,000, and 30% of the bond interest. The resolution did not limit the cost of the project nor the amount of bonds to be issued, although it specified that interest should not exceed 3%. The Advisory Board immediately approved the project and the issuance of the bonds.

To facilitate the turnpike project, the firm of Howard, Needles, Tammen & Bergendoff was engaged to draw plans and to supervise construction under direction of the Highway Department. This move, it was felt, would also aid in the sale of the bonds because of the excellent reputation of the contracting firm.

As was anticipated, several communities to the south and north of Boulder objected to the toll road program in the belief they were being left off the main line, so to speak, and they accordingly brought suit to halt the project. This suit was carried to the state Supreme Court which held in favor of the Department, and this action, instead of hindering the work, proved of benefit because it gave legal clearance to the bond issue and the entire project.

Bids were taken on the bonds in September 1950 and an award was made to a group of Denver and Eastern firms at interest rates ranging from 2⅞% to 3%. The issue, which runs for 30 years, provides that the Highway Department will absorb the cost of maintenance and operation, expected to run approximately $75,000 a year.

At last the Department was ready for action. It already had started the acquiring of right-of-way. Through agricultural land a minimum width of 200 ft. was acquired, and this was increased to 400 ft. at the top of long grades. Total cost of right-of-way was $510,000 for the 17.3 mi. of the turnpike.

Designed as an expressway

The highway itself was designed as a modern expressway, constructed to standards prescribed by the Bureau of Public Roads for highways to carry high-speed interurban traffic. Between the terminus at Federal Blvd., about four miles north of Denver, and 28th Street and Baseline Road on the outskirts of Boulder, the 17.3 mi. of the turnpike will comprise two parallel roadways, one for travel in each direction. The roadways will be separated by a landscaped median strip with a minimum width of 20 ft. All roadways will be 24 ft. wide and bordered with 10-ft. surfaced shoulders for parking.

Access will be provided only at Federal Blvd., Broomfield and the Boulder terminus. Tolls will be collected only at the clover-leaf type interchange near Broomfield, where a connection may be made with U. S. 87. Tentative toll charges being considered are 40 cents for trucks, 25 cents a car between Denver and Boulder, 15 cents between Denver and Broomfield and 10 cents between Boulder and Broomfield.

Entire project under contract

Bids on the first contract were opened September 26, 1950. This project provided for grading, ballast and minor structures on the 10.7 mi. of highway between Boulder and Broomfield. Nine bids were submitted, the lowest by Peter Kiewit Sons' Co. of Denver, in the amount of $1,066,766. Major item was 1,592,000 cu. yd. of excavation. Completion was required in 240 calendar days. The Kiewit bid was $266,000 below the engineers' estimate. Work was begun on October 2 and is 35% completed.

Bids on the second contract for grading, ballast and minor structures on the 6.6 mi. between Broomfield and Federal Blvd. were opened on December 14, 1950, and the project was awarded to J. H. & N. M. Monaghan and Associated Cos. of Derby, Colo., on their low bid of $696,014. This was $133,000 below estimates. Completion is required in 210 days. Principal item in the contract is 1,132,000 cu. yd. of unclassified excavation. Work on this contract is 5% completed.

When bids were advertised on the 13 major structures, the individual items were placed in four groups in order not to freeze out the smaller contractors. Groups 1 and 2, between Boulder and Broomfield, included two bridges to carry the turnpike across streams, three overpasses to carry county or state roads over the turnpike and one overhead crossing for an irrigation ditch. The Kiewit firm, which held the contract for grading on this stretch of highway, was low with a bid of $257,000.

Groups 3 and 4, between Broomfield and Federal Blvd., included the interchange at Broomfield, an overpass to carry the turnpike across the Colorado & Southern Railroad, and four overpasses for existing state highways or county roads. Low, with a bid of $344,000, was the Monaghan organization which had been awarded the grading contract between Broomfield and Federal Blvd. The Kiewit and Monaghan bids combined exceeded estimates by $49,000.

In view of the uncertainties involved in the steel situation, the Highway Department had advertised for bids on 2,011,000 lb. of structural steel in October 1950 and had awarded a contract to the low bidder, Allied Structural Steel Cos. of Chicago, in the sum of $234,000. The Colorado Builders Supply Co. of Denver was low with a bid of $83,633 on 1,117,000 lb. of reinforcing steel. When no bids were received on steel piling, the Department contracted with the Nebraska Bridge Co. for treated timber piling, which submitted a low bid of $48,000.

On Feb. 1, 1951, bids were opened on the largest single item of construction, a project for the concrete paving, eight inches thick, and miscellaneous surface construction for the entire 17.3-mi. length of the turnpike. Seven bids were submitted, the lowest by the Western Constructing Corp. of Sioux City, Iowa, in the amount of $1,987,000, approximately $56,000 above the estimate.

Contract for construction of the toll houses at Broomfield was awarded to the Hudson Construction Co. of Boulder in February on a low bid of $74,000.

The consulting engineers will receive a maximum of $205,000 for engineering, and additional compensation for supervision of construction.

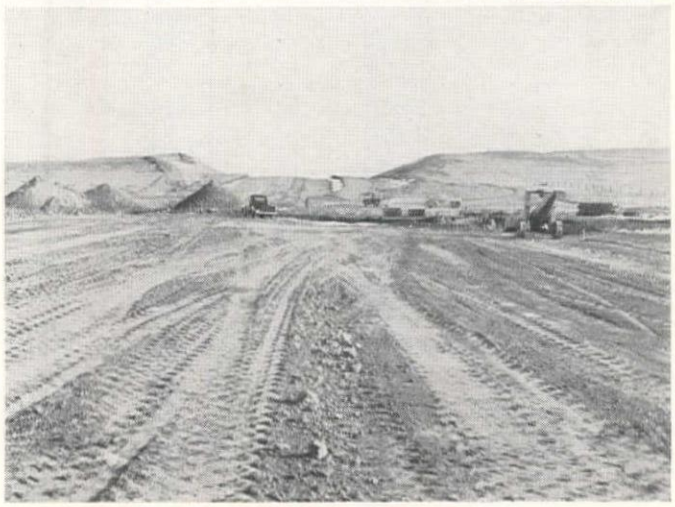
With all construction projects under contract, the unobligated portion of the $6,300,000 bond issue amounts to $494,000, more than enough to meet all costs of the project as planned.

A connection still has to be made from the terminus of the turnpike into Boulder, and an interchange probably will be built at Federal Blvd., where the turnpike connects with U. S. 87. From that point a connection will be constructed to tie in directly with the Denver Valley Highway, and the 1951 highway budget contains an appropriation of $430,000 for this purpose. The Denver

Concluded on page 130

FIRST STEP of the construction was to place concrete pipe for drainage at fill sections. Right-of-way (minimum 200-ft. width) is enclosed by fences. This view is northwest toward Boulder with the famous Flatirons in the background.

A LOOK at one of the big fills between Boulder and Broomfield, with drainage pipes installed.



PETER KIEWIT SONS' Co. moved in a major-sized fleet of tractors and scrapers to handle 1,600,000 cu. yd. of cut and fill within 240 days. Typical grade is shown at right.

Center and bottom photos by Stewart-Lukay, Boulder.

After two years of hard work in the deep narrow canyon of the San Joaquin River, contractors have nearly completed Southern California Edison Company's hydro power development, known as Big Creek 4—Expert use of steel forms for the 248-ft. concrete dam and new record-breaking methods for driving two miles of hard rock tunnel are only two of the job's many engineering and construction highlights

The Complete Story of Big Creek 4

By R. W. SPENCER
Manager of
Engineering Department
and
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Assistant Manager of
Engineering Department
Southern California Edison Company

SPENCER PEECOOK

CONSTRUCTION is now approaching completion on the Southern California Edison Company's 84,000-kilowatt hydro-electric project on the San Joaquin River, known as Big Creek 4. This project is one of a series of power plants conceived many years ago to develop the fall in the San Joaquin River down to the point where it emerges from the mountains. It is located just above the Pacific Gas and Electric Company's Kerchkoff plant and below the Southern California Edison Company's plant No. 3, and it is the lowest plant in a chain of developments beginning at Florence Lake Reservoir at elev. 7300 and ending at the No. 4 tailrace at elev. 985. Its location is such that it will receive full benefit from water released from the Edison company's main storage reservoirs at Florence, Huntington and Shaver Lakes.

The project was originally a part of a scheme for developing power proposed in the early 1900's by John S. Eastwood and others. Preliminary filings were made in 1913 and at various subsequent dates, but actual construction was delayed until 1948. In the 1920's exploratory borings were made at seven possible damsites. Further extensive studies on the overall layout of the project, particularly the damsite, were made in 1941. At that time two additional sites were examined with a view to the possibility of constructing an earth and rock-fill dam instead of a concrete dam.

Choosing the damsite

Since the location of the dam controls the general layout of the project, a brief description of the geology of the region is desirable. The entire project lies in the granitic batholith that makes up the major part of the Sierra Nevada. The rock on the project shows local variations in composition with joints and dikes of various kinds, but in general is a massive granodiorite. The river flows in a deep, crooked and narrow canyon. The stream bed is on solid rock or boulders with only a few small accumulations of sand and gravel. The lower banks of the river are generally in sound

Principal Features of the Big Creek 4 Project

Dam

Concrete gravity type; maximum height 248 ft., crest length 891 ft. Four 40-ft. x 30-ft. radial gates at spillway with capacity of 100,000 cfs. Reservoir storage capacity, 35,000 acre feet. Supervisory control on one spillway gate and both intake gates. Drainage area 1,292 sq. mi.

Tunnels

Horseshoe section, 24-ft. nominal diameter. Six-inch min. concrete invert, reinforced concrete lining at portals. Tunnel No. 1, 2,405 ft. in length connected by 570 lin. ft. of 15½-ft. diameter welded steel pipe to Tunnel No. 2, 8,106 ft. in length.

Surge Chamber

Restricted orifice type 200 ft. in depth varying in diameter from 55 ft. to 40 ft., 10-ft. diameter at concrete orifice.

Penstocks

Welded steel pipe of 15-ft. diameter 631 ft. long, supported by ring girders branching to two 10½-ft. diameter pipes, each 186 ft. long encased with reinforced concrete.

Power Plant

Reinforced concrete building 82 ft. x 135 ft. x 88 ft. in height.

Two 57,500-hp. Francis type turbines.

Two 42,000-kva. generators, 11.5-kv., 60 cycles, 3-phase, 257 rpm.

Static head, 418 ft.; effective head, 383 ft.

Transmission Lines

Tie line Big Creek No. 4 to existing Big Creek No. 3 Plant. 5.9 mi. of steel tower, single circuit, standard 220-kv. construction.

Big Creek No. 4 Magunden-Mesa Line, 227 mi. of steel tower, 220-kv.

granitic rock, but higher up such rock is covered with increasingly thick layers of disintegrated rock and soil. Such disintegrated material is frequently found to depths of from 50 to 100 ft., starting where the ground surface is 250 ft. above the stream bed. This means, of course, that although the river canyon is quite narrow, dams more than 150 ft. high encounter increasing amounts of poor foundation material in the abutments.

Early in 1949 the most promising damsite was extensively explored with 3,020 ft. of diamond drill holes and 89 ft. of 30-in. diameter calyx bore. The results of the drilling proved up the damsite at a location selected 20 years before as being the most promising. At this point it was definitely decided to go ahead with the project and a contract was awarded the Bechtel Corporation and Morrison-Knudsen Co., Inc., a joint venture, to design and construct the project in collaboration with the company staff.

The start of construction

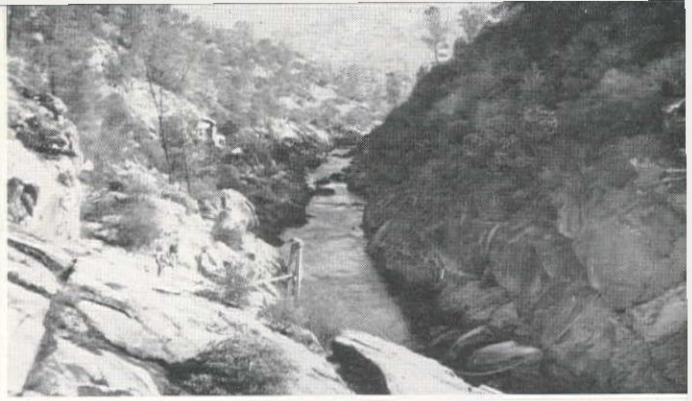
The field work began with the construction of 8¾ mi. of two-lane road over typical Sierra Nevada foothill terrain. Grades were limited to a maximum of 10% and curve radii to 100 ft. A total of 310,000 cu. yd. of excavation was required for the road. Except in the immediate vicinity of the damsite, the roads were paved with 2 in. of oil mix 20 ft. wide.

After the road building was well under way, 12 mi. of 11-kv. line from existing up-river plants were constructed to furnish construction power and provide a permanent auxiliary electric supply to the project.

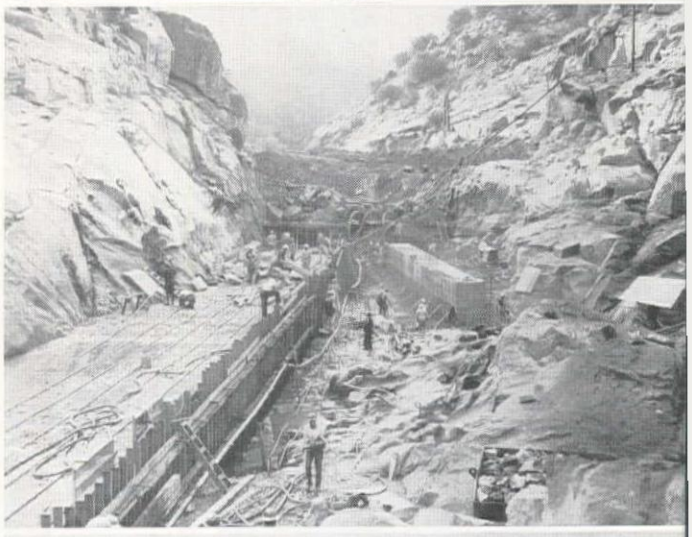
Initial work at the dam was authorized late in May 1949. Excavation was started immediately for the construction plant and the camp site. A 280-man camp was built just north of Willow Creek where it would be convenient to the two tunnel portals and the dam. The camp consisted primarily of five bunk houses, a mess hall, cold storage locker, canteen and first aid station. Although the peak of employment at job and office reached 1,050 men, experience showed that the camp was of ample size because many workmen preferred to drive eight to twelve miles to nearby towns or even as far as Fresno, 50 miles away.

River diversion and unwatering

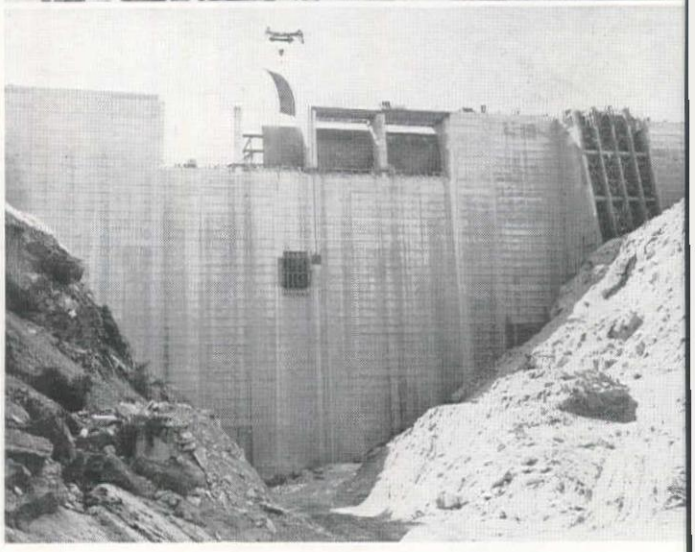
After studying alternate methods of river diversion at the damsite, the contractor elected to drive a 22-ft. diameter horseshoe-shaped tunnel 854 ft. long around the north abutment. Portal excavation was started in July 1949 and the tunnel holed through on September 17, 1949. Several deviations from standard tunneling methods were followed in the use of equipment. Instead of a rail-mounted drill carriage, a special jumbo was constructed and mounted on a diesel truck equipped with an exhaust filter. A 100-hp. Conway mucking machine was used to load the blasted rock into a diesel dump truck, in place of the standard rail-mounted cars. Earth and rock-fill dams 40 to 50 ft. high were constructed across the river above and



DAMSITE prior to start of construction. The deep narrow canyon cuts thru a massive granodiorite.

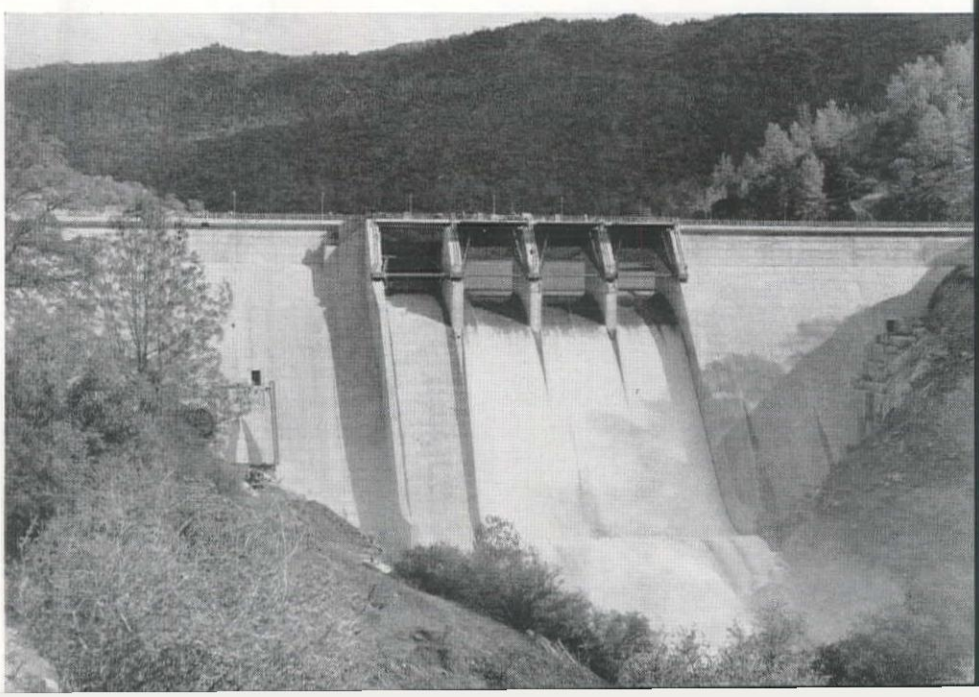


FOUNDATION construction began after an 854-ft. long diversion tunnel of 22-ft. diameter was drilled around the north abutment and 50-ft. high earth- and rock-fill dams were placed above and below the site.



RIGHT—Upstream face of the nearly completed dam. Third of four 30 x 40-ft. radial gates is being swung into position.

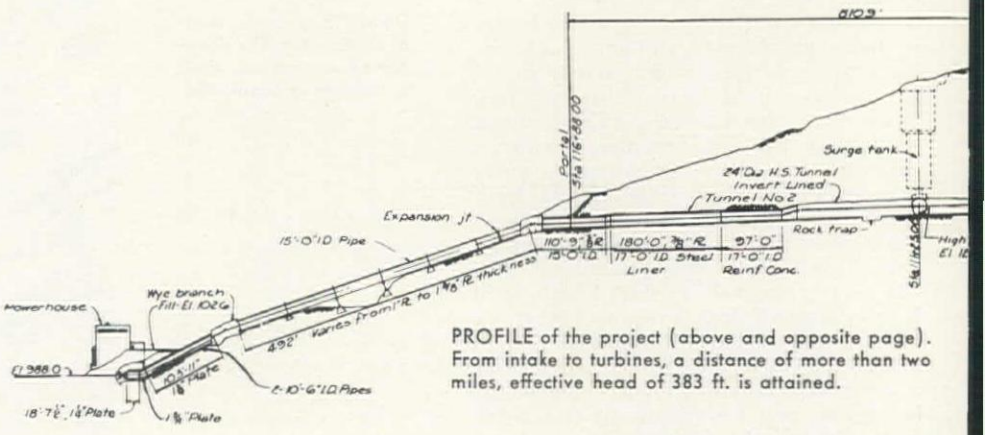
BELOW—Dam completed with first water spilling.



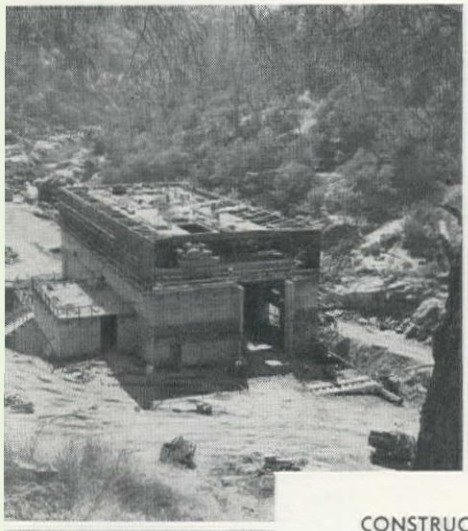
below the damsite to permit unwatering the foundation. Maximum leakage amounted to 1,500 gal. per min., and was handled by conventional turbine pumps. Excavation extended about 40 ft. below the normal river level.

Excavation for the dam

While the diversion tunnel was being driven, excavation for the dam proper began on both sides of the river. On the Fresno County side, a Northwest 80D shovel started at the top of the dam after existing country roads were improved to permit access to the south abutment. Roads for muck disposal were constructed upstream from the dam on various levels because Forest Service



PROFILE of the project (above and opposite page). From intake to turbines, a distance of more than two miles, effective head of 383 ft. is attained.



CONSTRUCTION VIEWS AT BIG CREEK 4

TOP LEFT—Powerhouse was built to house two turbo-generators of total 84,000-kw. capacity.

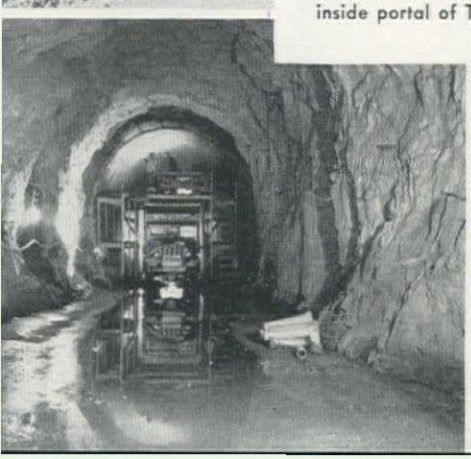
TOP RIGHT—Bulldozer feeds rock and sand to hopper at 100-ton per hour crushing and screening plant.

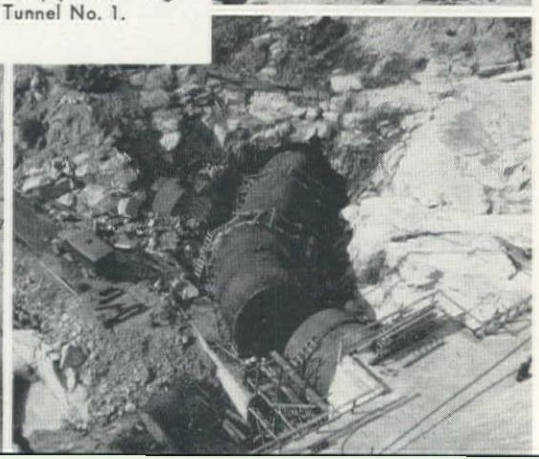
LEFT—Noble batching plant operated at a rate of 9,000 cu. yd. each 5-day working week to feed a single 4-cu. yd. mixer.

RIGHT—Concrete was distributed to the dam by a 15-ton Lidgerwood traveling head tower cableway.

BOTTOM LEFT—Placing gunite in supported section of 24-ft. diameter horseshoe tunnel. Note paved invert.

BOTTOM RIGHT—Intake conduit from the dam consists of 100-ft. long 17-ft. diameter steel pipe extending inside portal of Tunnel No. 1.





restrictions required that all excavated soil be disposed of within the reservoir area and below the minimum operating pool level.

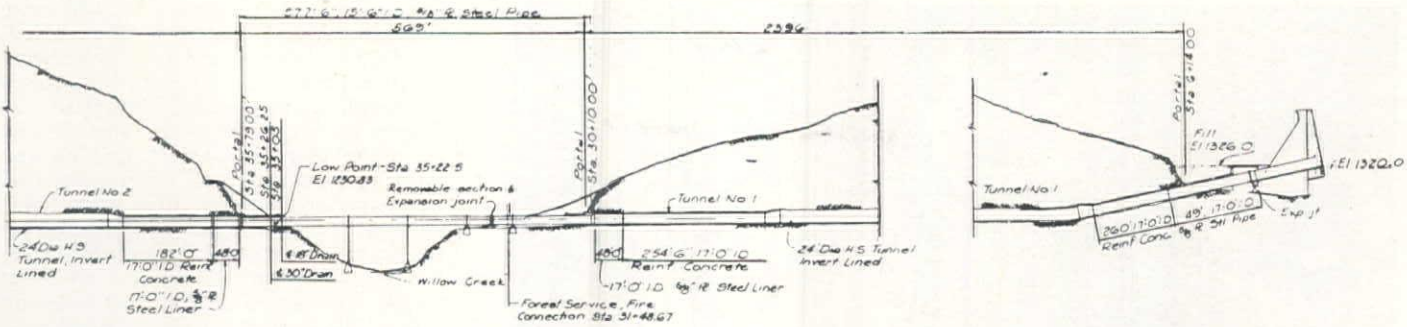
On the south abutment the dam crossed a minor fault zone which showed no indication of recent movement but showed bad fracturing and a tendency to air slack on exposure. The existence of the fault zone resulted in a nearly vertical step almost 50 ft. high after excavation of the poor material. Block lengths were adjusted to make the vertical contraction joint fall on the step. Special pressure grouting in the fault zone below the foundation was effective in consolidating shattered rock and preventing leakage after the reservoir was filled.

Because the major excavation work did not actually get under way until June and because of the close concrete schedule made necessary by possible winter floods, this work was carried on a 3-shift basis. By November, excavation had progressed enough to permit starting of the final hand cleanup for concrete. As a result of blocky or slabby rock, hand excavation and cleanup was considerably greater than planned, although the excavation as a whole came very close to the estimated figure of 100,000 cu. yd.

Aggregate production

In the spring of 1949 extensive studies were made of alternate sources of aggregate. The few scattered deposits of gravel and cobbles in the river bed were eliminated because of their small size. Trucking in aggregate from existing plants near Friant Dam was found too expensive. Exploratory borings were made in an extensive sand and silt deposit in Kerckhoff Reservoir just below powerhouse No. 4 location. Consideration of the deposit was dropped because of the high content of organic material which proved difficult to remove by regular processing methods. After full consideration of the various alternates, the decision was reached to base the design of the construction plant on the use of manufactured aggregates, obtained from tunnel muck or from a quarry near the construction plant site.

A 100-ton per hour crushing and screening plant was constructed on a relatively gentle slope just east of Willow Creek and less than 1,000 ft. from an exposed granite dome suitable for a



quarry site. The plant was designed to produce aggregates for the mass concrete in the following sizes: minus #12, #12 to ¼-in., ¼-in. to ¾-in., ¾-in. to 1½-in., 1½-in. to 3-in., and 3-in. to 6-in. A 36-in. Kennedy Van Saun gyratory primary crusher reduced the quarry rock or tunnel muck to a maximum of 6 in. with a small amount of over-size. After initial crushing, a system of steel truss conveyor belts carried the material to a secondary Traylor crusher; thence, to a surge pile. The 6-in. rock was removed by screening ahead of the secondary crusher. Material from the surge pile was conveyed to a second set of screens which removed the 1½-in. and 3-in. sizes. A second-stage Symons-cone crusher reduced any over-size between 6 and +3 in. The sand and ¾-in. rock were then taken by belt conveyor to the sand tower where they were washed by double-screw scrubbers. The ¾-in. material was separated by screening and conveyed to a stock-pile. The coarse sand, #12 to ¼-in., was washed for a second time at the screen and removed to the stock-pile. Crusher fines yielded about half of the sand requirements. The other half was manufactured by grinding ¾-in. rock in a Marcy rod mill. The minus #12 mesh product was flumed to a sand classifier and drier where objectionable fines and water were removed. The drier was equipped with a brush filtering medium and the sand was subjected to a vacuum which removed most of the free water.

Because of possible harm to fish life it was necessary to settle out the sand and mud from the wash water. This was accomplished by constructing about a mile of sidehill ditch on a flat gradient followed by two settling ponds. Deposits in the ditch and ponds were removed periodically by a small bulldozer.

Stockpiles were arranged in radial directions around the center of the plant. Trucks were loaded from the stockpiles by belt conveyors, housed in corrugated pipe tunnels under the piles. Aggregates were released to the conveyor belts through slide gates in the crown of the tunnel.

Concrete production

The concrete batching and mixing plant was located near the north end of the dam about 50 ft. in elevation above the crest. The plant was fed by truck haulage of finished aggregates from the batching plant about ½ mi. away and by truck haulage of cement and pozzolanic material from Permanente, Calif. The plant was manufactured by the Noble Co., and contained one Koehring 4-cu. yd. mixer; two 2,500-cu. ft. cement silos and one 3,250-cu. ft. cement silo. Later an additional silo was added for pozzolan. Concrete from the mixer fell into a car-mounted batch hopper and was hauled by gas dinkey to a cableway bucket spotting area. A fast-acting hydraulic hoist, remote controlled by the dinkey operator, dumped the concrete into the waiting bucket. This arrangement made it unnecessary to specially spot the bucket or to unhook it from the cableway at any time.

Concrete was distributed to the dam by a 15-ton Lidgerwood traveling head tower cableway. After the start of concrete placing on November 17, production steadily increased to a maximum of about 37,000 cu. yd. in March 1950. Concreting was on a 3-shift basis until September 1950 at which time approximately 235,000 of the 239,000 cu. yd. in the dam had been placed.

Cement used on the job was ASTM Type II, with an alkali content restricted to not more than 0.6% measured as equivalent sodium oxide. Except for special uses, all cement was handled in bulk tank trucks from the manufacturing plant at Permanente. During the course of the job, it was found that even though the concrete was placed quite dry, excessive bleeding occurred. For this reason and because during hot summer weather it was desired to keep down the maximum temperature reached by the concrete in the center of the dam, it was decided to use a pozzolanic material called "Airox" for all except concrete in the downstream face. Airox is a calcined oil impregnated diatomaceous shale obtained from a deposit near Santa Maria. It was ground at the Permanente plant. Darex air entraining agent was also used in the concrete to maintain between 3% and 5% of entrained air.

Special steel forms

A single suit of steel cantilever type forms was used wherever possible on the dam. Special adjustable steel sections were used in the spillways to obtain the desired curvature of the ogee sections. Hydron absorbent form liner was used on all spillways and other water passage surfaces to provide a dense and durable case-hardened finish. Hydron sheets were held in place by 5-ft. strings of flat bar magnets. These magnets were removed as the concrete was placed in the forms.

Heavy-duty air-operated vibrators were used to compact the fresh concrete. Curing was usually by water spray or, on finished surfaces, by damp sand. Days work joints were prepared by air and water jet cutting of the green concrete surface.

Concrete in the lower one-third of the dam was cooled by passing river water through a system of 1-in. diameter thin-wall tubes located at the bottom of each 5-ft. lift. In most cases a temperature of 55 deg. F. was reached in the cooled sections.

Spillway and intake features

Special features of the dam were spillway gates, the intake gates and the fish-water turbine. The spillway gates consisted of four 30 x 40-ft. radial gates capable of passing a flood of 100,000 sec. ft. An electrically operated cable-type hoist was provided for each gate. One gate of the four was arranged for remote operation from the powerhouse. A Selsyn recorder system was installed to transmit lake elevations to the powerhouse. In this manner the powerhouse operator can have full control of the reservoir elevation and maintain it at the proper level at all times.

The intake gates consist of heavy wheel-type leaves with electrically operated cable hoists. They are arranged for emergency closure even in the event of power failure. A fan brake is used to prevent over-speed during emergency closure.

Because of the requirement by Fish and Game authorities that up to 20 sec. ft. of water must be released into the river channel below the dam at all times to prevent harm to fish life, a 375-kva. turbo-generator was installed in the interior of the dam to pass the water. The turbine utilizes about one-half the total fall available between the reservoir level and the powerhouse. Energy from the installation will feed into the permanent 11-kv. station service line.

The power conduit begins with a concrete intake constructed as a part of one of the blocks in the dam. It is designed for a flow of 3,000 sec. ft. From the dam 100 ft. of 17-ft. diameter steel pipe extends to a point inside the tunnel portal. A circular reinforced concrete section of tunnel, approximately 250 ft. long, drops on a 20% grade to the tunnel proper, at which point the bore becomes a 24-ft. diameter horseshoe section with a paved invert.

Tunnel No. 1, 2,405 ft. long, is followed by a 15½-ft. diameter steel pipe 575 ft. long across Willow Creek. The pipe is supported by ring girders and steel bents about 100 ft. apart. Tunnel No. 2, also a 24-ft. diameter paved invert horseshoe, extends 8,106 ft. to the top of the penstock. Tunnel No. 1 was started September 22, 1949 and was

BIG NAMES on the Big Creek 4 project. Standing, left to right: W. L. CHADWICK, vice president in charge of engineering and construction for the Southern California Edison Company; second man unidentified; PAUL PEECOOK, co-author of this article, who acted as resident construction engineer; JOHN KIELY, project sponsor for the contractors, Bechtel Corp. and Morrison-Knudsen Co., Inc.; RUSS RHODES, welding engineer, and KEITH FULLENWIDER, assistant superintendent for the contractors. Kneeling, left to right: K. O. TAYLOR, general superintendent for the contractors on powerhouse and misc. work, and C. E. PEHL, manager of engineering for the contractors.

holed through on December 23, 1949. Tunnel No. 2 was started September 23, 1949 and was holed through on September 22, 1950 after setting what is believed to be a new record for driving hard rock tunnels of this size. Between March 13 and March 18, 1950 the heading was advanced a total of 241 ft. for an average of 40.2 ft. per day. Tunnel driving was on three-shift 6-day basis. The excellent tunnel driving record achieved by the contractor merits some discussion of equipment and methods.

Tunnel driving methods

Thirteen 3½-in. Ingersoll-Rand Model 535 drifters using a 4-ft. change of 1¼-in. round steel, were mounted at three levels on a 10½-ft. gage drill jumbo. Excellent flexibility was obtained by using three hydraulic drill jibs on the top deck. Clean breaks were obtained in the back instead of the usual offset at each round, thus minimizing overbreak and resulting in a smoother tunnel. Rounds required an average of 94 holes and were generally drilled to a depth of 12 ft., using 2-in. Ingersoll-Rand Carset bits. Nine to ten feet of rock was pulled per round, requiring an average of 3½ lb. of 45% powder per cu. yd. of rock. Blasted rock was loaded by a 100-hp. Conway mucker into 6-cu. yd. Western dump cars. Ten-ton Goodman battery locomotives hauled muck trains of 5 cars each to the tunnel dumps which were located on each bank of Willow Creek upstream from the portals. Rock from the dumps was then loaded into 10-cu. yd. Euclid tracks and hauled to the aggregate manufacturing plant.

About 3,200 ft. underground in Tunnel No. 2 a flow of water was encountered starting with a maximum of 900 gal. per min. and slowly decreasing to a present flow of about 25 gal. per min. Water flowed by gravity to the portal because the tunnel was on a positive slope of 1 in 1,000 from Willow Creek to the surge chamber.

Concurrent with the driving of the downstream heading of Tunnel No. 2, work was in progress at the outlet portal on a single-shift basis. The heading was advanced a total of 950 ft. by the time the tunnel was holed through from the upper end. It is interesting to note that the Tunnel No. 2 was holed through exactly one year to the day from the start of work on Tunnel No. 1. The overall average was 35 ft. advance per day, exclusive of the timbered portal sections.

Except for these sections only 300 ft. of special support was required in the entire length of the two tunnels. Sections requiring support during driving were concreted or gunited to provide permanent support. The invert of both tunnels was paved with 6 in. of concrete to prevent ravel of the muck floor by flowing water.

Surge chamber construction

An orifice type surge chamber was constructed near the lower end of Tunnel No. 2. It is approximately 200 ft. high and varies from 55 ft. to 40 ft. in diameter except for the orifice, which is 10 ft. in diameter. A departure from standard methods was used for excavating the 10,000 cu. yd. of rock in the surge chamber. First, two 3-in. diamond drill core holes were drilled from the surface to the 32-ft. long lateral from the main tunnel. These holes provided access for a hoist and communication lines used in driving an 8 x 10-ft. raise from the lateral. A skip used as a drill platform was attached to a wire rope extending through the core hole to an air hoist on the surface. The raise was driven within 40 ft. of the surface and the remainder removed by drilling and blasting from the top. Two rings of 1⅜-in. diameter diamond drill core holes were drilled to a depth of 63 ft. and on 4½-ft. centers around the circumference of the chamber. Additional rows of wagon drill and diamond drill holes on 6-ft. to 5.2-ft. centers were drilled near the center raise. Blasting was started at the center and the rock dropped through the raise to the lateral tunnel. From this point the muck was removed by a regular Conway mucking machine and hauled to the dump. The same procedure was used on the second lift in the 40-ft. diameter section of the surge tank. The surge chamber excavation was subcontracted to Boyles Bros. of Salt Lake City, Utah.

All-welded steel penstock

The penstock is a single 15-ft. diameter all weldel steel pipe 631 ft. long branching to two 10½-ft. diameter pipes each 186 ft. in length from the wye anchor to the butterfly valves.

The single 15-ft. diameter pipe varies in wall thickness from ⅞ in. at the upper anchor to 1⅝ in. at the lower end, and will be supported by ring girders on 85-ft. centers.

The twin branching lines are encased with reinforced concrete from the building line to and including the wye.

A subcontract was let to the Consolidated Western Steel Corp. and Chicago Bridge & Iron Co. for fabrication and erection of the steel liners used at the tunnel portals, the intake conduit, Willow Creek crossing and the penstock.

The pipe was fabricated and rolled at both the Vernon and Fresno plants of Consolidated Western Steel with some plate rolled and welded by Chicago Bridge & Iron at its Salt Lake City, Utah, plant. Transportation to the job from Vernon and Fresno by truck equipped with special cradles offered no problems except that escort cars had to be provided to warn approaching traffic of following wide loads.

Pipe sections for the inlet conduit between the dam and Tunnel No. 1 were placed with the dam cableway. The steel liners and Willow Creek crossing pipe were placed by skidding and handling with a truck crane. The penstock sections were placed with a 100-ton capacity guy derrick which was moved to a new position as work progressed from the powerhouse to the tunnel portal.

Specifications limited pipe temperatures to 40 deg. F. in the concrete encased section from the wye to the butterfly valves to eliminate as much tension in the plate as possible under normal operating conditions. Inasmuch as water in the river was 45 deg. F., it was necessary to add a sufficient amount of ice to produce the required 40 deg. F.

Field welds were radiographed as required and the circumferential joints in the penstock were stress relieved by

Concluded on page 131

Is He Qualified for a C. E. License?

The facts of the case . . .

A GRADUATE in civil engineering from a recognized university, this young engineer served 2½ years of "in-training," working for a firm of engineering contractors. The organization includes several executives who are engineers registered in the State of California. These engineers directed and supervised his work, in accord with the California law, as a preliminary to registration.

His experience included work on form design and cost estimating for a concrete bridge; responsibility for designing special handling and placing equipment for heavy sections of pipe; superintendent of a pile-driving job, including conducting of bearing tests; field engineer for the contractor on an extensive aqueduct job.

In these 2½ years he demonstrated, to his employer's satisfaction, a high degree of sound engineering judgment, ability to assume responsibility and an aptitude in organizing and executing the direction of construction on engineering projects.

When he applied to the California State Board for Professional Registration for permission to take the examination for licensing, his request was refused with the comment, "Insufficient engineering experience."

YES . . .

The California Registration Act states that civil engineering includes, among its several branches . . . *"the supervision of the construction of engineering structures."* Surely, this young engineer had "in-training" experience which was as intensive and effective, in this particular phase of legally-defined civil engineering, as any graduate who served an equal time learning elements of design in an engineering office. Further, this young engineer, who worked in the field under the supervision of registered engineering executives of the contracting organization, acquired broad engineering experience, equal to that of a young inspector who may have run line-and-grade on the same project, or counted the blows of the pile driver.

Civil engineering represents the combined science of designing and constructing fixed works. It is ridiculous for an engineer practicing one branch of this science to contend that those working in other divisions are not civil engineers. Not so many years ago, the properly qualified engineer of the profession had to be able to do both. The day of specialists has now superseded those days when real civil engineers would design a structure, and then go out in the field and build it. Today, the design engineers have their representatives on the job—resident engineers and inspectors—to insure that the design half of the broad function of civil engineering is properly carried out.

The American economic system, with its emphasis on competition, has developed the function of the general contractor, who makes a business of assembling materials and men to carry out these design plans, for a profit. In this process of bringing a modern engineering project from blueprint stage to the completed structure, a contractor requires civil engineering talent. With each succeeding year more and more of such engineering skill must be added to construction organizations, as plans become more intricate and specifications more complex. The engineers in these construction organizations carry out the second part of the broad function of civil engineering.

In this two-part team it is as ridiculous for one to say that the other is not a civil engineer as it is for a surgeon to say that a diagnostician is not a doctor. They are both practitioners of the science with adequate education and training in their particular branch. They are both—or should be—legally identified. In the broad approach to the science of civil engineering, it will be to the interest of the profession and the general public if properly qualified applicants for registration receive equal recognition, regardless of the branch they have elected to follow.

NO . . .

There should be no confusion as to the obvious fact that engineering-is-engineering and contracting-is-contracting. The first is the science of the professional engineer; the second represents the field work involved in carrying out the operations called for in the plans and specifications. The contractor's sole function is to execute the work of the designer as directed by his representatives on the job. He is not concerned with the engineering problems.

It is true that certain operations performed by a contractor will be aided by having some employees with engineering educations. There can be no objection if young civil engineering graduates desire to take jobs with contracting organizations—or even make careers of contracting. But they do not need engineering registration for this kind of work and should accept the fact that they are divorcing themselves from professional engineering activity and the training required for licensing, having elected to go into contracting. Engineering colleges which are now offering courses in construction should make this situation clear to those students electing this option.

The basic function of registration for civil engineers is to provide a measure of protection and safety to the general public. Only properly qualified and carefully trained and examined engineers should be allowed to design and direct the building of structures such as buildings, bridges and dams where lives and property are involved in the adequacy of the structures. Registration is the legal means of obtaining this control over those who would undertake to design structures which could endanger the public. This question of providing protection to the general public is quite distinct from the business of contracting.

Any tendency to add registered engineers to contracting organizations would increase the possibility of contractors taking on jobs involving problems of design which they would not be qualified to perform. This would also eliminate the well-known advantages of having an engineer in professional practice act for the client and the contractor.

If contractors have need for the specialized talents of registered civil engineers, they can readily avail themselves of the services of consulting engineers. Such services provide contractors with engineering assistance as and when it is needed. This eliminates the necessity for contractors building up engineering staffs for the occasional work which actually requires the services of registered engineers. Contractors should not be concerned with extending their normal functions to encompass the unrelated field of professional engineering.

Erecting the West's First Prestressed Concrete Bridge

Three cranes swing the two 50-ton girders across flood channel at Los Angeles— Wires stretched to provide 106% of design stress, to allow for plastic flow and creep

ON MONDAY, February 19, prestressing of two concrete girders was completed adjacent to the site of the footbridge under construction over the flood channel at Avenue 58, east of Arroyo Seco Parkway, which joins Los Angeles and Pasadena.

Described in L. C. Hollister's article published in the December 1950 issue of *Western Construction*, the bridge was planned and designed by the Bridge Department of the California Division of Highways. It is serving as a small scale demonstration of prestressed concrete theory and practice, as applied to bridge construction, and has been viewed by great numbers of interested observers.

The two prestressed concrete girders were precast on a convenient section of park roadway east of the channel, and have been lifted and moved into place on prepared abutments, where they will constitute a simple span of 110 ft. and will carry a walking slab 8 ft. in width.

The girders were cast in wood forms consisting of a soffit built up to desired curvature and side forms principally of plywood. Form surfaces of the main sections of outer faces were of milled wood to produce a uniform vertical light fluting of the exposed concrete surface.

Nominal web reinforcement was installed with heavier bars at girder ends in the region of concentrated stresses. The wires used were of ¼-in. diameter and the method of installation described in the Hollister article was followed. The wires were threaded through a cast-iron stressing block and button heads formed at the wire end by a die in a high pressure hydraulic press. Samples tested at 150% of design load gave negligible slip, though specifications allowed ⅛ in. Wires were assembled in metal sheaths before the placing of concrete.

Concrete for the girders was ready-mix with cement factor of 7 sacks per cubic yard and aggregate maximum size was one inch. The consistency was such as to give an average slump of 2½ in. and internal tube vibration was used. Placement was by means of a truck crane with ½-cu. yd. bucket.

Concrete strength

Concrete tests showed 28-day compressive strengths in excess of 5,500 psi., well over the required minimum. At the age of 6 days, light stress was applied to stretch wires about one inch. Transit line measurement showed that girder length shortened ⅜ in., though shrinkage had not developed noticeable cracks.

Casting of the second girder was completed 15 days after the first, and the two girders were prestressed concurrently when the concrete of the second girder reached its 28th day.

Stretching of the wires was performed by a Hannifan double-acting hydraulic jack of 25-ton capacity, suspended by a pull-lift. A crosshead or yoke was mounted on the plunger of the jack with pulling arms attached by pins to the crosshead in a manner to permit automatic adjustment of the arms when

FORMS FOR casting the two 110-ft. girders were built on a soffit to provide curvature. Concrete strength exceeded 5,500 psi. in 28 days.

under stress. A reaction frame made up of four 1½-in. angle legs transferred load from the jack to the steel bearing plates which were 18 in. high, 10 in. wide and 3½ in. thick. These plates were designed for load distribution to keep compressive stress under the bearing plate area below a value of 3,000 psi.

Pressure was supplied by a 1,000-lb. Vickers Power Pack run by a 5-hp. electric motor. The pressure was regulated by a balanced piston-type relief valve and read direct on a crane gage. The plunger at the stressing side of the jack had an area of 43.2 sq. in., and a pressure of 730 lb. furnished the required anchoring stress for each of 5 wires in a unit.

Each set of wires was stretched to 110% of design stress and so held for 2 minutes by the hydraulic jack, pressure being supplied and metered to constant value by means of a Vickers pressure relief valve. This overstressing and holding interval was employed to reduce loss of stress due to creep. Stress was then released to 106% of design stress and the wires anchored at that point by means of U-shaped cast-iron wedges. The purpose of anchorage at 6% excess stress over design is to compensate for shrinkage and plastic flow in the concrete and for future creep in the wires.

Gages to study stress

Carlson gages installed in the girders will make possible a thorough study of stresses and changes of stress over a period of time. Each girder has 3 gages embedded at midspan at top, center and bottom areas of the section. Each girder has 4 such gages at one ¼-point of the span, arranged at top, bottom, and ¼- and ¾-points in the vertical plane.

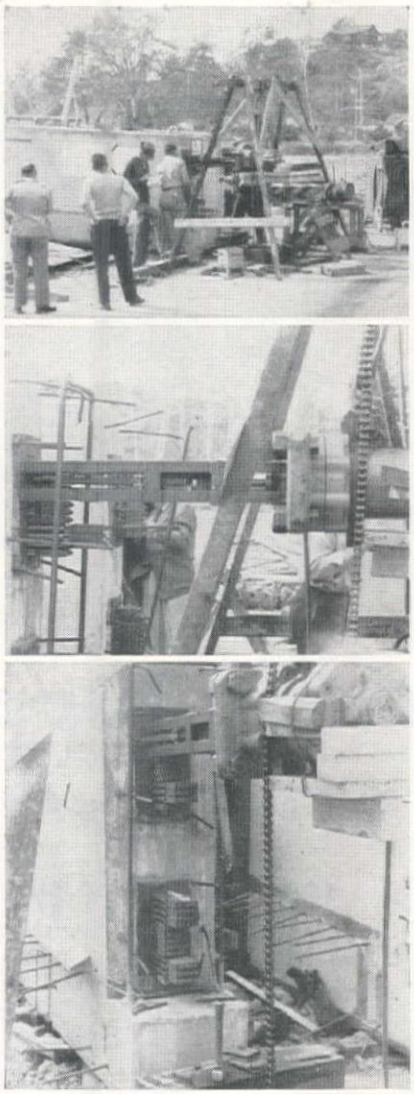
The effect of eccentric prestress loading is well shown by observation of these girders. When the full prestress force had been applied, girders had lifted at midspan ¼ to ⅜ in. from the soffit forms.

Grouting procedure

Following the completion of prestressing, it was required that the channels containing the stretched wires should be completely filled by grouting. This procedure provides for protection against long-time corrosion and distributes stress by bond from wire to grout, grout to metal form, and metal form to concrete.

The formed wire channels in these two girders had a total volume of only about 2 cu. yd., but for the sake of speed and efficiency, some rather high powered equipment was used. Halliburton Oil Well Cementing Co. brought in truck-mounted units and accessories such as are used in oil field operations. Cement and sand mixture was contained in the dry material unit, delivered by screw feed to a cone-shaped hopper where water was added. The mixture was piped to the grout chamber, then the pumping unit forced the mixed grout through the bearing block openings and quickly filled the spaces containing the wires from end to end of the girders.

The spectacular operation of placing the completed girders, weighing over 50 tons each, began on Friday, March 9



JACKING MECHANISM (top) was supported on a pull-lift. Reaction against the girder (center) was taken on a steel bearing plate during the stretching of each row of 5 wires. After pulling to 106% of design stress the wires were anchored by inserting cast-iron wedges.

and was completed during the week-end. Cranes were furnished and operated by Hesse Crane Service. One crane, said to be the largest in use in the West, was a 45-ton mobile Lorain with all-wheel drive. Two 35-ton cranes were used, a Manitowoc Speedcrane and a Northwest. A fourth unit, a 25-ton Lorain, was available as a standby and was used for holding and steadying when required.

Moving the girders

As the girders were cast some little distance from the bridge site where roadway width was available, the first move was to bring each girder to a position with one end adjacent to the east abutment. The first girder was "walked" to its place north of the site, using the 45-ton unit as tail crane and the two 35s at the head. The second was moved past it to a position south of the site, using the cranes in the opposite order.

Placing the girders in position across the channel required some maneuvering. The 45-ton crane handled the end of each girder lying away from the abutment. A high crib to provide temporary support at the center of the channel was built up of crossed rows of timbers and leveled. The two 35-ton cranes went down a ramp and were set and braced north and south of the line of the bridge on the channel bottom east of the central depression. Using high booms, they lifted a girder and brought one end to rest on the crib as the heavy crane moved in with its end. The two 35-ton cranes were then set similarly on the west side of the channel and the girder picked up and moved on to span the channel. These operations were repeated in placing the second girder.

In order to minimize whipping and lateral vibration in these long girders, side frames were attached at midspan of each and heavy cables were stretched from end to end passing over the frames. Tightening of the cables provided a force to resist lateral movement during the lifting and moving of the girders.

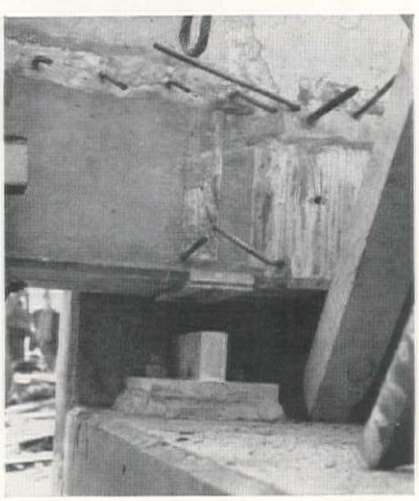
Plates on the girder ends were set accurately on bearing blocks provided at the abutments, with simple rocker bearing at one end and hinge action at the other.

With the girder placement a satisfactorily completed operation, the remaining work is routine. The walkway slab will be cast-in-place by means of forms hung from the girders. Steel extends from the girders for splicing with the slab reinforcement. At the midspan point and at two intermediate points in each half-span, steel extends to be embedded in cross beams as additional support and stiffening.

Personnel

The project is under the direction of F. C. Panhorst, Assistant State Highway Engineer and in charge of the Division of Highways Bridge Department. The work is being performed by Walter Kaucher of Los Angeles as contractor. The entire prestressing work has been carried out as a sub-contract by the Prestressed Concrete Corporation of Kansas City, and the technique and method of operation developed by that organization has been used. T. C. Gut has represented the Prestressed Concrete Corporation in the performance of the work.

LOWERING ONE END onto a steel bearing block. Exposed steel is for splicing to the cast-in-place sidewalk slab.



Atomic Energy Project in Idaho Provided With a

Concrete Plant to Supply Four Jobs

Separated by miles of desert, contractors for the Reactor Testing Station at Arco are supplied concrete meeting standard specifications from a mixing plant operated under separate contract — Trucks traveled 144,350 cu. yd.-miles to haul 32,363 cu. yd.

By J. WARREN EVANS
Chief, Construction Branch
Idaho Operations Office
U. S. Atomic Energy Commission

THERE ARE four projects under way for the Reactor Testing Station of the Atomic Energy Commission in Idaho, and each project represents several millions of dollars in construction costs alone. Since the individual projects are separated by several miles and spread over an area of some 430,000 ac. for safety requirements, it was early recognized that supplying concrete to all projects would be a difficult problem.

Usually this problem is left to the individual contractor to solve as he sees fit. However, because of the remoteness of the Reactor Testing Station from established ready-mix concrete plants, plus the fact that many different contractors would be simultaneously engaged on separate projects, it seemed apparent that a consolidated plant would be the only feasible solution.

Economy of a single plant

This plant would have to be so designed and operated as to be available to all contractors, lump and fixed fee alike, on both large and small projects. Economically, the plant would reduce costs by making it unnecessary for the three or four large projects to set up duplicate facilities.

From an engineering point of view a consolidated plant operating under the direct supervision of the Idaho Operations Office would make it possible to obtain uniform, adequate control of concrete quality. Accordingly, all architect-engineers were instructed to specify concrete by compressive strength required, i.e., 2,500 psi., 3,000 psi., etc., rather than

Contractors and the Work Program at Arco

THE REACTOR Testing Station of the Atomic Energy Commission is situated on the Snake River plain in Southeastern Idaho, on U. S. Highway 20 between Blackfoot and Arco. Some 430,000 ac., part of which formerly constituted a naval proving ground, has been set aside as an area upon which to build nuclear energy reactors.

At the present time there are four technical projects under way, each representing several millions of dollars in construction costs alone. The Bechtel Corporation of San Francisco, Calif., is under contract for building the Experimental Breeder Reactor (EBR) and the Chemical Processing Plant (CPP). The EBR was designed by the Austin Company, Chicago, in conjunction with the Argonne National Laboratory in Lemont, Ill. The CPP is being designed by Foster Wheeler Corporation, New York City, in conjunction with Oak Ridge National Laboratory in Tennessee.

The Fluor Corporation, Los Angeles, is constructing the Materials Testing Reactor (MTR) which is being designed by Blaw-Knox Construction Company, Pittsburgh, in cooperation with both ANL and ORNL. Westinghouse Corporation, Pittsburgh, has a prime contract for the Ship Thermal Reactor (STR) for which Rust Engineering Company, Pittsburgh, has designed the buildings now being erected at RTS. Construction has been sublet to F. H. McGraw and Company, Hartford, Conn., and M. J. Brock and Sons, Inc., Los Angeles.

In addition, several contracts have been awarded by the Idaho Operations Office for structures in the central facilities area, at the railhead of the former naval proving ground. Now under construction are a fire station, service building, communications building, equipment repair shop, boiler houses, fuel and water storage tanks, plus other buildings, most of which were designed by Ashton, Evans and Brazier of Salt Lake City, Utah.

In the overall picture, much of the construction work, money-wise, has been awarded on a cost-plus-fixed-fee basis, due to the classified nature of the work and the stiff time schedules set up by the Commission. However, where possible, lump sum contracts have been awarded and at this writing there are ten lump sum contractors at work on the site. In addition, the cost-plus-fixed-fee contractors have, wherever it was possible, sublet certain trades on a lump sum basis.

by mix. It was planned to design all concrete mixes under IDO supervision in accordance with strengths specified.

A surplus concrete batch plant was immediately available at the AEC Hanford, Wash., Operations Office. Although this plant appeared to be slightly oversized for our needs, it could be obtained at a reduced cost, and so arrangements were made for its transfer.

One of the first contracts entered into by the fledgling IDO covered the dismantling, transporting and re-erecting of this plant. Puget Sound-Macco Company, a joint venture firm of Seattle, Wash., was the successful low bidder. Dismantling was begun at Hanford in August 1949, and the plant was ready for operation at the Reactor Testing Station in January, 1950.

Batching plant

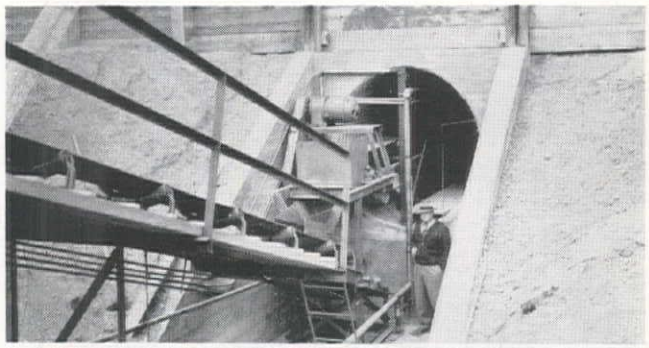
The layout consisted of a Noble No. 150 dual batch plant with a 225-ft. inclined Link-Belt conveyor which is fed by a horizontal conveyor running under four charging bunkers. A 3-cu. yd. Smith tilting mixer with a 75-cu. yd. per hr. capacity is installed in one side of the dual plant, the other side being used for dry batching. Weigh-batching is automatically controlled by photoelectric devices. Storage facilities are available for 6,000 bbl. of cement.

A total of 20,000 cu. yd. of unwashed aggregate was produced and stockpiled by Morrison-Knudsen Company as a supplement to a road building contract in order to supply concrete in January. Bechtel Corporation was temporarily assigned to operate the set-up, and the first concrete was delivered on January 31, 1950, in —20-deg. weather.

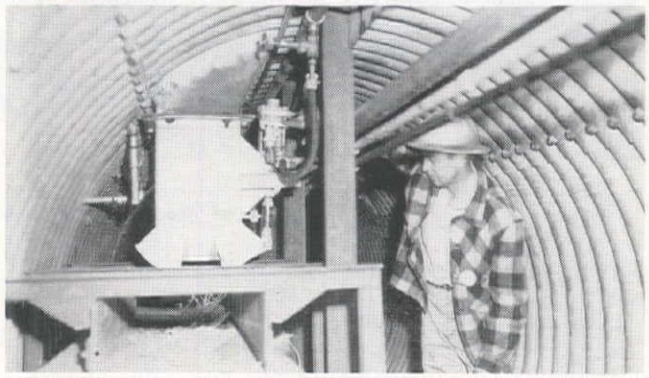
Bids called for aggregates

Meanwhile, the Construction Branch was at work on plans for an integrated plant set-up. Bid invitations were prepared for the installation of a reclaiming tunnel and for the production of 100,000 to 400,000 cu. yd. of aggregate. It was later decided to produce 200,000 cu. yd., 50% in 1950 and the balance at a later date. Morrison-Knudsen Company was successful low bidder on both jobs. Accordingly, in the spring a 7-ft. diameter reclaiming tunnel, 200 ft. long, was installed, complete with six air-controlled discharge gates, horizontal conveyor belt, plus an inclined belt to dump aggregate into the bunkers of the existing plant. The six discharge gates feed the conveyor from three stockpiles which were staggered over the tunnel to reduce its length. Steam coils were installed to permit winter operation. Movement of aggregate from stockpiles to bunkers is automatically controlled from a panel board at the base of the large inclined conveyor leading to batch plant proper.

Providing aggregate was an easy matter. The greater portion of the Testing Station area is overlaid with alluvial gravel, interspersed with thin lenses of clay and topped with a silty topsoil. Below the gravel is lava rock, which breaks the surface in many places. The top five to six feet of gravel is badly coated and when tested, proved to be slightly re-



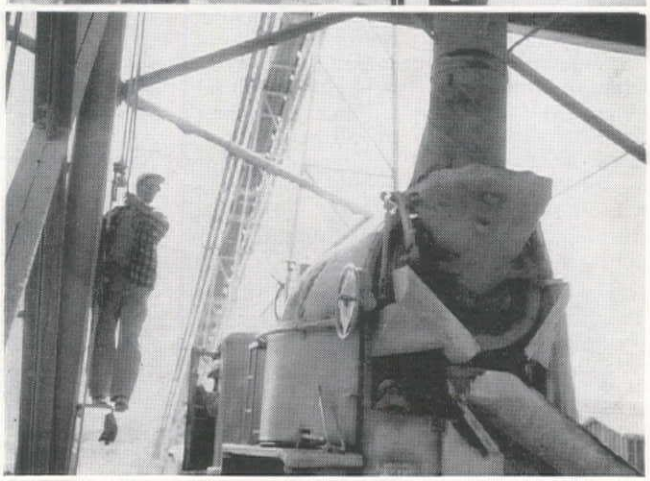
AGGREGATE leaves the reclaiming tunnel, which is 7 ft. in diameter and 700 ft. long. Steam coils are provided for winter operation.



ONE OF THE SIX discharge gates in the tunnel feeding from three stockpiles. Feed is controlled from single panel board.

FROM THE TUNNEL the aggregate moves up to a distributor to supply the 100-cu. yd. bunkers which feed the batch plant.

WEIGHING the batch for the 3-yd. mixer. Standard mixes are ordered by contractors 24 hr. in advance, specifying yardage and time for beginning pour.



DRY BATCHES can be obtained via a separate discharge from the batching plant. Any special mixes ordered by contractors are paid for on a time-materials rate.

A FLEET of more than 20 truck mixers is available to haul concrete from the central plant to locations scattered over 430,000 ac. of the Reactor Testing Station.

active. As a result, low alkali cement was specified and purchased by the IDO procurement group. The pit designated for use was only 450 yards from the batch plant. Morrison-Knudsen Company was directed to strip off the badly coated overburden, following which they trucked the pit-run gravel to a washing and screening plant where sand, ¾-in. maximum, and 1½-in. maximum material was stockpiled.

The pit was excellent in that the natural gradation very nearly approached the required graduation and very little wastage resulted. The only disadvantage was the absence of gravel of over 1½-in. diameter. Larger material was available in the area, but from pits which were nearer the bordering mountains and consequently several miles from the batch plant. It was considered more economical to use the smaller stone and increase the cement content of the concrete.

Bids called to operate

IDO decided to solicit bids from a list of bonafide ready-mix contractors covering the operation of the batch plant. This was in line with AEC policy to contract out all technical operations in order to utilize the experience and knowledge of established commercial organizations. All materials were to be furnished by IDO. Aggregate would be supplied as described herein. Cement would also be procured directly by IDO. This would eliminate the transportation tax which a lump sum or unit price contractor would have to pay, and would enable IDO to set up a materials testing laboratory in which to design all concrete mixes. Thus, all savings of cement resulting from such mix designing would revert 100% to AEC without a complicated accounting arrangement with the operator.

On July 10, 1950, operation of the batch plant was transferred to Central Premix Concrete Company, Spokane, Wash., this company being the lowest bidder out of eleven for the job. Bids were received on the basis of unit cost per cubic yard of concrete produced, cubic yard mile hauling rate, plus a lump sum for setting up an organization. (For a summary of the unit bid prices, see page 119, August 1950 issue of *Western Construction.*) Original contract period was six months, which has recently been extended to July 1, 1951. The entire operation is supervised for IDO by H. J. Bezette, concrete engineer from Hanford, Wash., assisted by John C. Cook, formerly attached to the materials laboratory of the Idaho State Highway Department.

Hauling equipment

Arrangements for hauling concrete from the batch plant to the various jobs had been considered early in the game. Several surplus transit trucks, obtained elsewhere, were on hand in January 1950, and these were supplemented from time to time with replacements and new units. This equipment was furnished free of charge to the plant operator as a condition of the bid invitation. At the present time, a minimum of twenty units is kept on the line. Carrying capacities vary from four to six cubic yards. Mixers are of Challenger, Jaeger, Ransome and Smith manufacture. The large units are mounted on West Coast Internationals, the smaller ones on White and Corbett military type chassis and engines.

Maintenance is the responsibility of Western Equipment Company, which holds a contract for maintenance and repair of all Government-owned equipment at the station. George Grant is general superintendent for Western and this contract is administered by the IDO Division of Maintenance and Common Services, headed by Philip C. Leahy.

Winter problems

By the end of last February 32,363 cu. yd. of concrete had been produced, and 144,350 cubic yard-miles have been travelled. Winter conditions brought to light some bottlenecks. It was found that the steam coils above the reclaiming tunnel gates were inadequate, as was the capacity of the steam heating plant. Consequently, an oil burning steam locomotive was rented, side-lined and hooked into the plant. Steam jets into the aggregate pits served to loosen up the material. Head bolt heaters were attached to the transit trucks in the parking lot and connected up to an electric timer so that, at 8 a. m. each morning, the truck and mixer engines were already warmed up. However, on the coldest nights it was also found necessary to put two to three trucks under cover so that the grease would be soft enough to permit operations at 8 a. m. without delay.

Requisitions for concrete must be placed twenty-four hours in advance, specifying time pour is to start, cubic yards required and time pour is to be finished. All lump sum and fixed-fee contractors buy concrete by strength according to a fixed price schedule. Each requisition must be signed by the resident engineer assigned to the project in question or by the field representative of the architect-engineer before the batch plant will honor it. This serves to prevent the placing of concrete without proper approval.

Special mixtures are produced on a time-material basis. In the past these have included concrete made with pumice and other aggregates. By careful control and constant checking of design mixes, cement content has been kept to a very economical level. For example, a 2,500-psi. mix with 1½-in. maximum aggregate contains only four sacks of cement. At the present time tests are being run to determine the advisability of using additives to further reduce cement content and conserve this critical material.

All things considered, it is felt that the plant fulfills two aims of Idaho Operations Office. Except for minor items, the plant organization and operation is as efficient and economical as could be expected at such an installation. Furthermore, private enterprise has been relied upon wherever possible in connection with the plant.

Supervision

General supervision of concrete producing facilities at the site, as well as all construction activities, is the responsibility of the Construction Branch, headed by J. Warren Evans. The Construction Branch in turn answers to Allan C. Johnson, Director of the Division of Engineering and Construction.

The entire installation of the Reactor Testing Station is headed by L. E. Johnston, Manager, Idaho Operations Office, with headquarters in Idaho Falls.

MORE THAN $25,000,000 in net operating revenues, or 8% of the money expended to date on the gigantic Central Valley Project of California, already has been repaid to the federal treasury through water and power sales, despite the fact that the project will not go into integrated operation until July 1951. CVP's exceptionally healthy financial condition is shown in the first annual report to its stockholders, the people of the United States. The report, prepared by Regional Director Richard L. Boke of the Bureau of Reclamation, is available to the public (U. S. Department of Interior, Bureau of Reclamation, Region 2, Sacramento, Calif.).

Quick erection of outer walls during a short session of favorable weather was desired for a school at Truckee, Calif. —So, at a South San Francisco plant, 4-in. thick concrete panels were custom made complete in all structural details and with embedded red quartz aggregate providing an attactive architectural exterior effect

Precast Concrete Wall Panels for School Trucked 210 Miles to Site

TOLERANCES, usually considered normal in building construction, are not permissible during the current erection of the light steel frame for a school having a "skin" of precast concrete slabs welded to these structural members. The school is being constructed for the Tahoe-Truckee Joint School District at a site one mile west of Truckee, Calif., at an elevation of about 6,200 ft. The precast concrete slabs are trucked to the site from a manufacturing plant in South San Francisco, a distance of 210 mi.

Although this method of erection, by attaching precast concrete slabs to a steel frame, has been used in the construction of warehouses and industrial plants, this is understood to be the first time the method has been used under the rigid requirements for California school buildings.

Design considerations

In designing the structure the architect was faced with the problem of finding a method of construction that would permit quick erection of an outer shell of the building during a relatively short period of favorable weather to provide protection for workmen completing the interior during the winter. Lack of adequate source of local aggregate and the limited supply of trained construction men were other factors in the decision to use the precast design.

Consideration had to be given in the design to the facts that the school must withstand a snow load of 60 lb. per sq. ft. (10 ft. of snow is common in the area), a wind load of 15 lb. per sq. ft., and/or an earthquake force of 10% of gravity action on dead load and snow load. Panel connections had to be designed for 100% of gravity in any direction.

Cast-in-place concrete sidewalls for the building (Building Code Type 1), were ruled out as too slow. Instead, 4-in. reinforced concrete precast panels that would facilitate rapid field erection were selected. The outside surface of these panels is cast with exposed red quartz aggregate imbedded in Calaveras White Cement that provides an attractive exterior finish for these structural and functional units.

To facilitate attaching these precast units to the steel frame by welding, a 2½ x 9-in. steel plate is attached, flush with the inner surface of the concrete at each corner of the panel. When fabricated, the horizontal and vertical rods of the reinforcing curtain (those around the perimeter of the panel) are bent towards the inner face of the slab, and these corner plates are welded to each of them. Panels are tongue and grooved to provide additional stability and weather seal.

The P. Grassi & Co., and American Terrazzo Co. undertook the manufacture of the slabs in their South San Francisco plant where constant quality control of both the structural concrete and the architectural facing could be maintained.

Precasting techniques

Each slab is custom made for a specific location and is given a number that enables the erection crew to place it in its correct position. Standardization is used when possible, with wall panels 16 ft. by 4 ft. by 4 in. used for the classroom wing walls, and panels 20 ft. by 4 ft. by 6 in. used in the gymnasium walls. Slabs for specific locations vary, with some being as narrow as 18 in. A right angle unit is cast for the corners of the building. Provision is made in the casting for wall openings and attachment of exterior features.

Because of the specific location and function of each unit in the overall building, they are given individual attention and cast to exact measurements. Working from the master plan, the staff at the precasting plant prepares working drawings for the individual units and their respective reinforcing curtains. The curtains, with the rods welded instead of tied, are assembled while pattern makers prepare the forms.

Forms are placed in a horizontal position on a metal surfaced bench, the curtains placed within them, with the steel plates used for attaching the slabs to the structural steel frame lying flush against the top of the bench.

The structural concrete in the panels has a mix designed by the manufacturer expressly for this project. Two separate mixes are used for the panels. A lower section (that which will face inward when erected) is made with standard gray cement. The finish (that which will face outward when erected) is composed of Calaveras White Cement and Sonora Red Quartz aggregate.

The gray cement is mixed in two sections. That which will be poured around the form and cover the curtain to form a base layer, has a 1-in. slump. The next layer, which fills the form to within ¾ in. of the top, has zero slump.

Instead of using the usual immersion type vibrator, a compressed air-driven vibrator designed especially for slab work is used. This piece of equipment compacts the concrete as well as vibrating it, thus enabling the use of a con-

crete with a very low water-cement ratio which ultimately results in a very dense concrete.

In the panels for the shop building a layer of grout, consisting of sand, cement and water, was laid on the bench prior to pouring to provide a smooth finish for the inner surface of these panels.

The lower course, containing the two sections of gray cement, is poured and vibrated, filling the form to within ¾ in. from the top. The monolithic pour is completed immediately with the white cement and colored aggregate topping.

Approximately 24 hr. after pouring, the finish surface is scoured with mechanical wire brush to expose the red aggregate and obtain the desired finish. The slabs are then tilted on the side edge to a vertical position and moved from the plant building to the curing yard.

After curing for about 20 days the finish side of the units is given a muriatic acid bath and flushed with water to clean particles of concrete from the surface of the aggregate and make them stand out in relief.

Although specifications call for 2,500-lb. concrete in 28 days, a mix designed to produce 5,000-lb. concrete in 28 days is being used. The concrete has been testing 4,000 to 5,000 lb. in seven days with the 28-day test exceeding 6,000 lb. A resident inspector makes periodical tests of the concrete as it leaves the mixers.

Trucking to the job site

The units, still in the vertical position, are transported the 210 mi. from the plant to the site on a truck equipped with a special "A"-frame, similar to those used for trucking plate glass. A 2-in. rope, inserted along the groove in the bottom of the units, acts as a cushion. Loads average 20 tons with some of the individual units weighing in excess of two tons. The total weight of the units for the building approximates 735 tons. To facilitate ease in handling the panels two rods, attached to the reinforcing curtain, protrude from the top of the panel to provide hooks for lifting. After the panel is set in place and attached the hooks are burnt off and the exposed rods are spotted with red lead.

Close observation of minute details and the same precision and exactness used in the manufacture of the precast units are required during the erection of the building. Approved detail drawings, prepared by the architect, must be followed with zero tolerance and no deviations from the plans are allowed the contractors. No short cuts are permitted even though such a step would result in a saving in time.

Foundation material at the site is good, requiring only a 2½-ft. depth of excavation for footings. Erection of steel columns on continuous concrete footings followed standard practice.

Along the major axis of the classroom wing the columns are pinned at the base; and along the minor axis they are fixed at the base, thus providing approximately equal deflection in both directions for the entire building. In the beam-to-column connections one end of the beam is designed for butt welding to the columns in the center row, with the other end designed to have clearance at the side column. The center row of columns is erected first, plumbed, and beams welded to the columns. The other end of the beams, at the outside columns, is connected with the use of an auxiliary plate. This method permits use of auxiliary plate at only one end of a beam instead of at both ends. No cross bracing was used in the structures; the frame takes the lateral load.

Before erection of the first section of the building had progressed very far, it was discovered that normal tolerances for this type of steel frame had to be eliminated. In erecting the columns for the transverse end of the classroom wing the usual procedure of aligning columns by their center line was followed. The precast units for this sidewall were designed to be attached to the column flanges. Little importance was placed upon the ¼ to 5/16-in. tolerance normally permissible in erecting steel columns.

However, as operations began on attaching the precast units, it was discovered that immediate compensation had to be taken for this tolerance to permit true alignment of the sidewall. It was then decided that when erecting subsequent columns they would be aligned from the edge of the steel.

Attaching panels to the frame

Two methods of attaching the concrete panels to the steel frame are used. In the gymnasium the steel plates at the corners of the panels are plug welded using a 1-1/16-in. hole. In the classroom wing the plates are welded to a 1-in. square lug which had been welded to the columns during fabrication. On the minor axis these lugs are welded on the face of the outer flange, and on the other axis they are attached across the edges of the two flanges of the WF-beam column. The lugs, 12 in. long, allow space for 1-in. insulation and vapor seal.

To bring the lugs to exact alignment and to compensate for extra tolerance, grinding was required on some, and others were built up with a filler strip. The lug could not be removed and another installed in its place as the state code for school buildings prohibits any cutting at connection points whatsoever.

An illustration of how the lugs are ground or built up to true alignment of the columns preparatory to receiving the panels can be seen in a case where the column was sufficiently out of line so the lug was 1/16 in. off line at one side of the column and 5/16 in. off line at the other edge. It is then necessary to grind the face of the lug to zero at both ends (remove 1/16 in. from one end and 5/16 in. from the other). In the event the dimensions are minus, then instead of grinding, the lug would be brought to true alignment by a filler strip. To get the proper penetration of weld such a lug requires an additional lug welded beneath it, thus doubling possible welding area. Five lineal inches of weld are required at connections to meet state regulations.

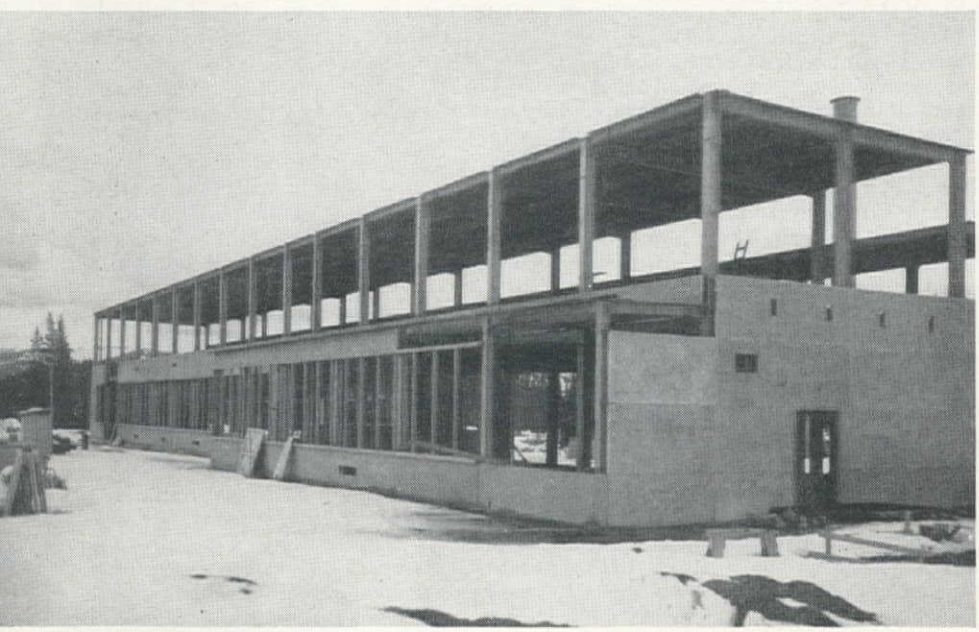
Beams and columns are joined by downhand welding. A 300-amp. welder with Airco D-78 rods is used in attaching panels. It is believed that this is the first time welding is being used to this extent in a California school building.

Erection procedures

Erection of the panels is carried out with a truck crane and a crew of three riggers, two welders and a foreman.

When erecting the panels the groove is filled with a full bed of cement mortar. This is raked out to within ¾ in. of the outer edge of the panel and an elastic pointing compound is laid on this strip to provide a mastic joint. The panel is then set on the panel already in place and welded to the column lugs. Break-

PARTIALLY-COMPLETED 2-story academic wing. Light steel frame supports the precast panels.



age due to dropping or improper handling of the panels has to date been virtually non-existent.

An 18-gage steel Robertson "Q" deck, plug welded at 12-in. centers to beams, serves as deck for both roof and second floor. A 2-in. concrete slab will be poured on the steel deck for the second floor. The flat roof deck will be covered with a 4-ply, 15-lb. felt and 1-lb. copper sheathing resulting in a 55-lb. composition roof.

Windows, specially designed for the building, project beyond the wall surface in their own steel frames. Meeting the requirements for glass in a rigid steel frame they are welded to the columns.

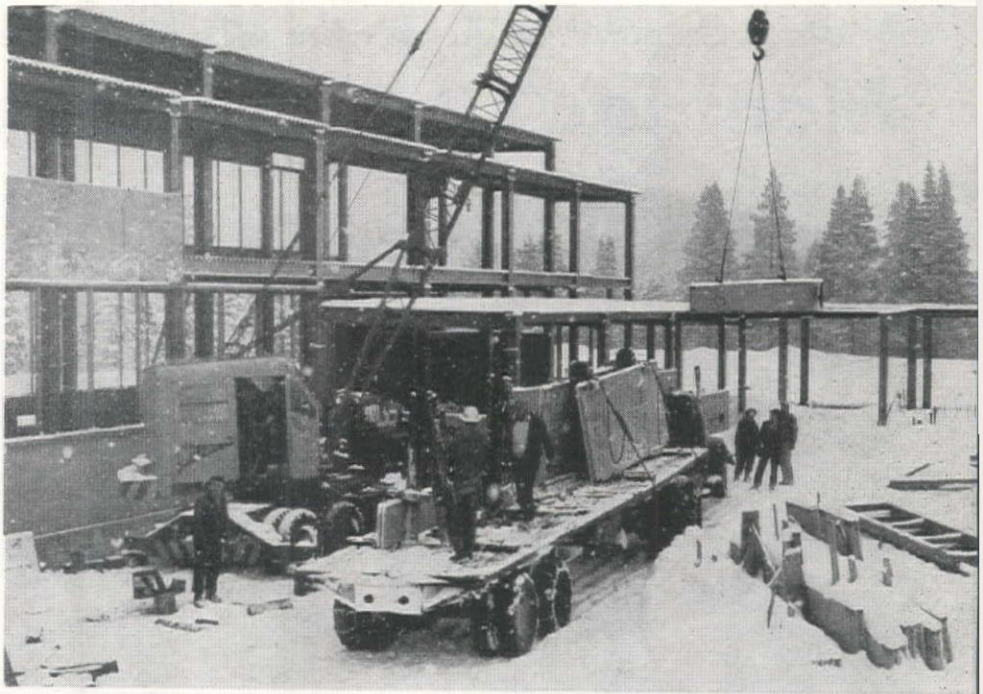
Door openings are located close to columns and the panels cantilever to the steel door frames that provide structural support as well as architectural effect. The architectural effect of the wall is carried out in the cantilevered panels by a dummy joint.

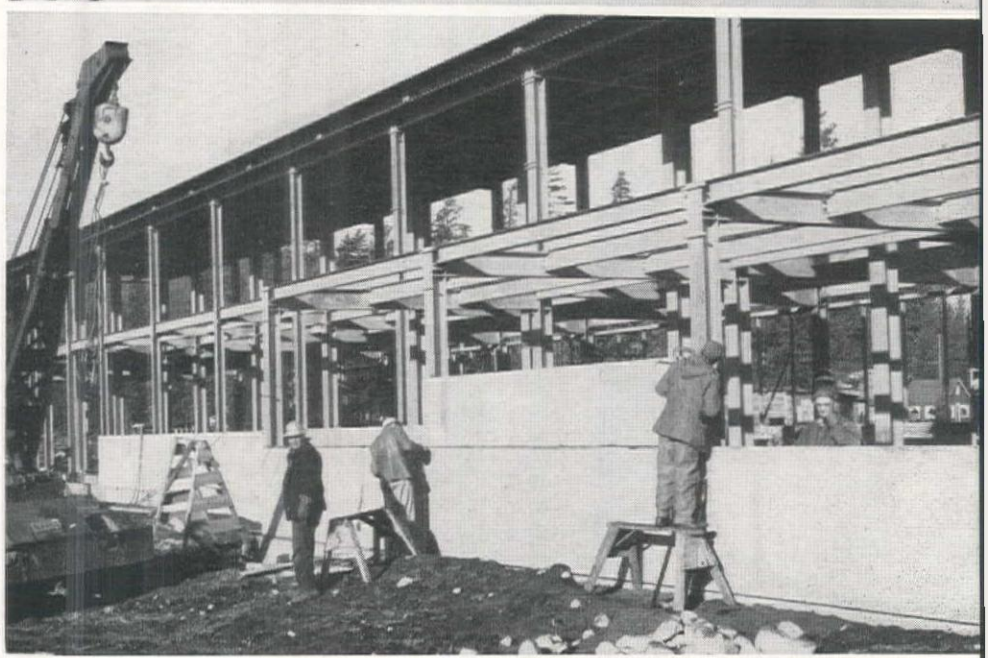
Where visible the columns are plastered and glass fibre and aluminum sheeting that acts as insulation and vapor foil is inserted in the space between the wall and columns. The walls of the gymnasium are not insulated.

In the structural design of the steel frame, the transverse load due to earthquake force was taken by bending about the principal axes of the wide-flanged beams used as columns with the columns considered as pin-ended at the base. In the longitudinal direction, seismic forces were resisted by bending of the columns about the secondary axes. In order to reduce the size of the columns and to make the deflections in both transverse and longitudinal directions equal, the column bases were designed against rotation about the secondary axes, and fixed to the reinforced concrete continuous footings in the longitudinal direction.

This procedure raised the points of contraflexture for bending about the secondary axes of the columns to approximately the mid-point between floors, thus giving moments about one-half those for similar columns hinged at the base. Welded connections of girders to columns develop full moment capacity of the girders.

The gymnasium differs from the other structures in that structural frame consists of steel rigid frame bents, spaced 16 ft. center to center and spanning 82 ft. Bents are hinged at bases of legs. Lateral loads in north-south direction are resisted by the bents, lateral loads in east-west direction are resisted by x-braces in plane of bent legs.





TOP—Unloading precast panels from truck after the 210-mi. trip from casting yard.

BOTTOM—For erection, groove in panel is filled with cement mortar, panel is positioned and steel plates attached to panel at precasting yard are welded to lugs on columns.

RAY C. MOORE, erection foreman on the job for Wilkins Drayage Co., Sacramento.

In general the contractors feel that the majority of the problems thus far encountered in the erection of the building can be eliminated in future use of this method by close adherence to plans, and that errors can be avoided by close coordination of subcontractors handling steel, precast slabs, windows, and, in general, any trade requiring holes through or attachments to the panels.

The school, being built under a $735,000 contract, will have about 50,000 sq. ft. of floor space and will consist of a 230 x 40-ft. two-story academic wing, a 90 x 90-ft. gymnasium with locker and shower wings, a 50 x 70-ft. shop building, and a 50 x 70-ft. garage and repair building.

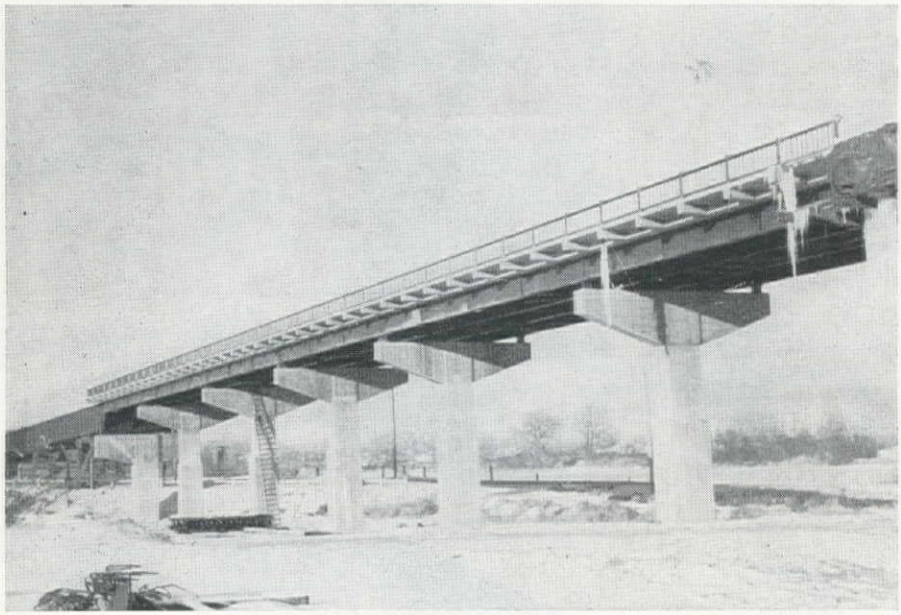
It is believed that if constructed in an area favorable to the construction of a building with cast-in-place sidewalls, the use of this method of construction would result in a saving of approximately 20%.

Personnel

Architect: Gordon Stafford, Sacramento, with E. P. Peckinpaugh, partner in charge of development of plans and specifications. Consulting structural engineer: George Goodall, Sacramento. General Contractor: Mervin Gardner Co., Reno. Precast concrete panels: P. Grassi & Co., and American Terrazzo Co., South San Francisco. Transporting and erecting panels: Wilkins Draying Co., Sacramento, with Merlyn Kruse as superintendent and Ray C. Moore as erection foreman. Fabricating and erecting steel frame: Independent Iron Works, Oakland. Resident inspector for the school board: Richard MacDonald.

Nearing Completion Across the Missouri River at Great Falls—

Montana's Longest Highway Bridge



COMPLETED UNIT of the viaduct. Plate girders in place for river bridge can be seen at left.

Contractor solves difficult cofferdam and forming problems for 2,093-ft. bridge and viaduct — Contract is largest ever awarded by Montana State Highway Commission for a bridge project

By PAUL E. POIRIER
Detailer and Bridge Inspector
Montana State Highway Commission

THE LARGEST bridge contract ever let by the Montana State Highway Commission was awarded to Anderson Construction Company in June of 1949. This $1,174,128 contract is for the construction of a 2,093-ft. bridge and viaduct in Great Falls, Montana, which will link the Tenth Ave. So. By-Pass with U. S. Highway 91. Scheduled for completion in July 1951, this structure will provide a by-pass route for through traffic as well as a direct access route for a heavy volume of truck traffic to the industrial section of Great Falls. Anderson's contract included construction of both the substructure and superstructure for a 1,008-ft. bridge over the Missouri River and a 1,085-ft. viaduct and overpass over an existing highway and the Great Northern Railway tracks.

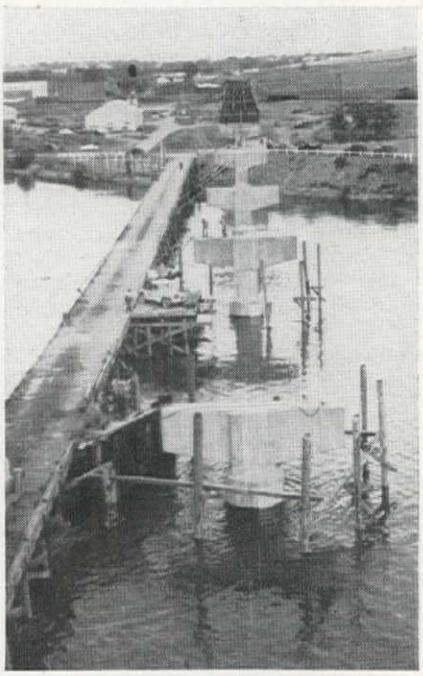
The design for this bridge, the longest highway bridge in Montana, was the work of the Bridge Section of the State Highway Commission under the direction of Howard W. Holmes, Bridge Engineer, and Albert W. Jones, Bridge Plans Engineer (now Bridge Engineer). The river bridge consists of two 3-span continuous units of 150, 185 and 150-ft. spans. The concrete deck and sidewalk is carried by two variable depth plate girders. The 836-ft. viaduct is made up of five 3-span continuous units, span lengths for each unit being 51, 64 and 51 ft. Four 36-in. WF girders with welded cover plates carry the roadway. The last 249 ft. of the structure spans four railroad tracks with five skewed spans. Designed for an H-20 S16-44 loading, the bridge and viaduct will have a 28-ft. roadway with a 3-ft. sidewalk on each side.

Probably the most unusual feature of the design is the use of the T-type piers and bents. The river piers consist of an unreinforced concrete footing supporting a circular column, 10 ft. in diameter, extending to two ft. above high water from which point a rectangular column section 6 x 7 ft., is used for the balance of the height. The cross beam is 4½ ft. wide and varying in depth from 9 ft. at face of column to 6½ ft. at the outer end. The overall height of the river piers varies from 45 ft. to 58 ft. The viaduct bents are also of the T-type, using a 4 x 6-ft. rectangular column section from top of footing to a point 16 ft. below top of bent where the column section was reduced to 3 x 5 ft. The cross beam is 2½ ft. wide and varying in depth from 7 ft. at face of column to 3 ft. at the outer end of the beam. In the design of these column sections, use was made of the method set forth in Mr. Saville's article in *Civil Engineering*, March 1940, pages 170-172, entitled "Analyzing Non-Homogeneous Sections Subject to Bending and Direct Stress."

As a result of the 39-deg. angle of skew combined with the restricted horizontal and vertical clearance, the conventional two column bents were used to support the spans over and adjacent to the Great Northern Railway Company's tracks.

The start of construction

Construction of the Tenth Avenue South Bridge and Viaduct was officially started July 25, 1949. Anderson Construction's first job was building a contractor's yard and offices on the land adjacent to the viaduct which the company already owned. During July and August the contractor constructed a concrete mixing plant, office and warehouse building, and a carpentry shop.



RIVER PIERS, varying in height from 45 to 58 ft., were built within steel sheet-pile cofferdams from an 825-ft. timber trestle.

At the same time that the contractor started building his plant facilities, work was started on a timber work bridge across the Missouri River. The 825-ft. trestle consisted of 67 five-pile bents spaced at 14-ft. centers. Stringers and timber decking were framed and assembled into 14-ft. span units on the shore and were carried out on the trestle as needed by a low-boy transport. After the work bridge had reached far enough out into the river to provide working space for driving the first two cofferdams, work was stopped on the trestle, and the first cofferdam was begun. By the time it was necessary to extend the

work trestle on across the river the extreme cold weather of January 1950 had curtailed most construction work; but this cold weather was really a help in finishing the work bridge. A three-foot layer of ice over the river enabled all materials such as piles, caps, braces and prefabricated deck sections to be spotted on the ice. An air-powered spade was used to dig holes through the ice for spotting the piles.

Cofferdam problems

For a contractor's first major bridge job the cofferdam work was surely the most challenging. Progress on the first two cofferdams was slow; but when the contractor changed his methods of bracing and driving the cofferdams, the foundation work was speeded up considerably. The five river piers required about the same size of enclosure and all were driven to approximately the same elevation. Pier footings were founded on hard sandstone about 33 ft. below mean water level. Cofferdams were 28 ft. by 36 ft. in plan or about 3 ft. outside neat footing lines.

Steel sheet-piling, M-115 Section, 45 ft. long, was driven into rock with a double-acting air hammer. The sheet-piling was braced by six sets of walers, two of 12 by 12 timbers and the four bottom walers of 14-in. WF steel beams. On the first two cofferdams the contractor used cross-strut bracing with two struts going lengthwise and three struts going crosswise. All struts and walers were bolted together. However, on the remaining three cofferdams four 45-deg. angle braces were used at each corner of the waler frame dividing the long side into three equal spans. Walers and braces were made continuous by welding all connections. This change in cofferdam bracing resulted in a big time saving due to the less restricted working space and also a saving in material. Walers and struts were assembled in place on timber piling and then lowered into position. The sheet piling was then placed around the bracing framework and driven a few feet into the fine sand bottom. The sand layer was about 10 ft. thick and overlaid a clay layer of similar thickness. Between the clay and bedrock there was a thin strata of sand and loose rock. After a couple of cycles of driving the sheets, excavating and driving the bracing framework, the stiff clay prevented the bracing framework from following the sheet piling without excessive driving.

Excavation within cofferdams

At this point in the sinking of the cofferdam, the sheet piling was driven to rock and the enclosure pumped out. Then workmen using shovels, air-powered spades and fire hoses excavated the clay underneath the walers and cross struts. The top layers of sandstone were in very thin, loose layers, so it was necessary to drive the sheets two to three feet through the top layers of rock to secure a safe seal. To pump out each cofferdam two 6-in. and two 4-in. pumps were used, but after the sheets were sealed with cinders one 4-in. pump kept the enclosure dry. A 1½-cu. yd. crawler crane with an 80-ft. boom and ¾-cu. yd. truck crane with a 70-ft. boom were used for cofferdam excavating and placing concrete for the piers.

The size of the pier footing pour (416 cu. yd.) required thorough organization and coordination of the contractor's men and equipment. Each footing pour required three continuous 8-hr. shifts. Except for the first footing pour, which was poured completely in the dry, the tremie method was used for the first half of each pour; then the water was pumped down and the remainder of the footing was poured in the dry. This combination method of pouring speeded up the rate of pour as well as eliminated the necessity of digging six sump wells through three feet of rock outside of neat footing lines, as the footings were keyed into the rock two to three feet.

All land bents, pier and end abutments were supported on steel bearing piles of 10-in., 42-lb. H-section with minimum penetration specified for each pile. These piles were driven by a double-acting air-powered air hammer (8,750 ft. lb. of energy per blow) supplied by two 500-cfm. and one 350-cfm. air compressors.

Forms designed for reuse

For all exposed surfaces of concrete, except the deck, two-inch tongue and groove matched lumber, surfaced inside, was specified. This was probably a good choice as far as the contractor was concerned. The heavy thickness of the form panels made it possible to reuse the panels as many as eight times with very little reconditioning. Forms were tight and by sanding the inside of panels, concrete surfaces were true and even with very few surface irregularities. Since finishing requirements specified that all holes left by form ties be filled and all defects repaired, the type of forms used aided materially in securing a pleasing surface with a small amount of finishing work.

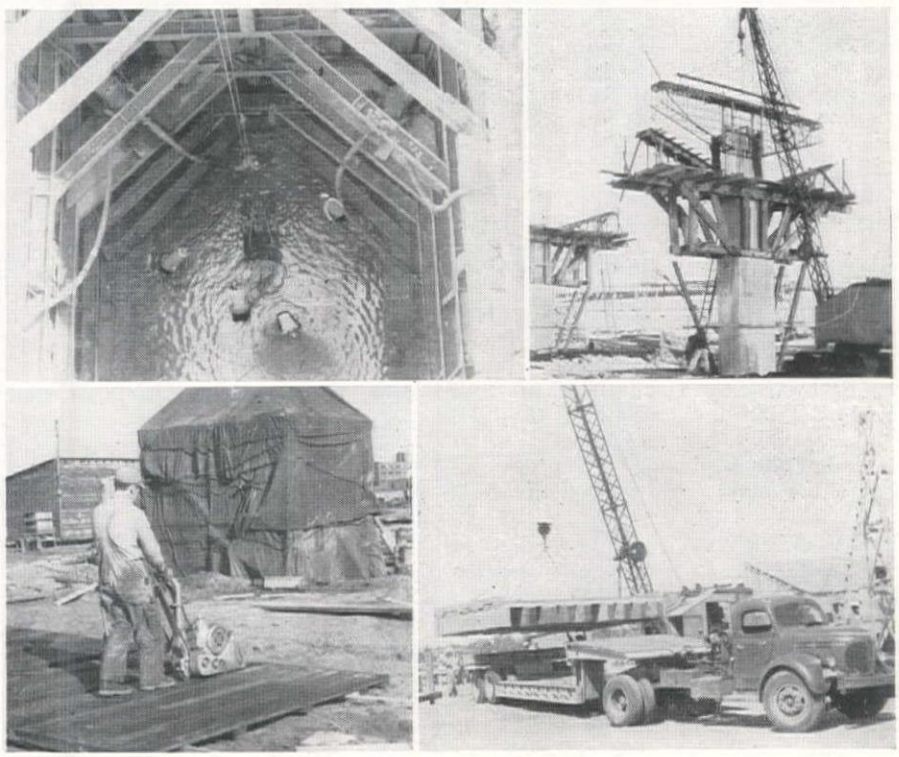
All form panels were laid out and built in the carpentry shop. Tongue and groove lumber was blind nailed to 2 by 4 back strips. Panels were sanded with floor sanders, and cracks and depressions were filled with putty, and the inside surface well soaked with oil.

Reinforcing steel was assembled and tied on the ground and placed by crane. Form panels were then assembled around the reinforcing steel cages and the tie rods were run through holes previously bored in the panels. Wales were made of double 2 by 6's and placed at right angles to the grain of the 2-in. panel lumber.

Two sets of forms were built for the viaduct bents, while one set was used for the river piers. The contractor started the work in the middle of the structure and worked both ways. The piers as well as the viaduct bents are highest near the middle of the structure and gradually become shorter towards both ends. Thus it was possible to reuse each set of forms merely by cutting off the bottoms of the lower panels.

For the concrete deck forms, a minimum of one-inch nominal thickness tongue and groove lumber was specified. The contractor elected to make flat panels of 2 by 4's and one-inch tongue and groove lumber. These panels were supported on 2 by 6 joists hung from the steel girders by wire hangers. The panels of one-inch tongue and groove

TOP LEFT—Hand excavation of loose rock in cofferdam for river pier. Note unrestricted working space due to waler arrangement. TOP RIGHT—Placing reinforcing steel cage for cross beam of viaduct bent. BOTTOM LEFT—Carpenter reconditioning column form panels with floor sander. In the background, a canvas enclosure for curing lower column section. BOTTOM RIGHT—Loading a prefabricated deck unit for the timber work trestle.



didn't hold up under repeated use as well as the 2-inch panels. Considerable reconditioning was necessary after one or two uses.

Concrete production

A central mixing plant was erected on the contractor's yard to mix all concrete used for the job. The plant is a vertical type, fully enclosed, with a one-cubic yard mixer. The three sizes of aggregates were stockpiled at one side of the plant between four timber retaining walls. An underground conveyor belt was placed under the three stock piles and enclosed by a timber tunnel. From the end of the tunnel conveyor belt, the aggregate is carried to a three-compartment storage bin by a bucket conveyor. Cement bags are unloaded directly from railroad cars to a storage house next to the plant. An elevator lifts the bags to the cement charging platform. A hot water boiler is used to supply heat through pipes to that portion of the aggregate stock piles over the tunnel and the aggregate in the overhead storage bins. Ultimate capacity of the mixing plant is 30 cu. yd. per hour. Concrete is hauled from the plant in one-yard, bottom-dump buckets on flatbed trucks. Cranes are used to lift the concrete to the point of deposit in the form.

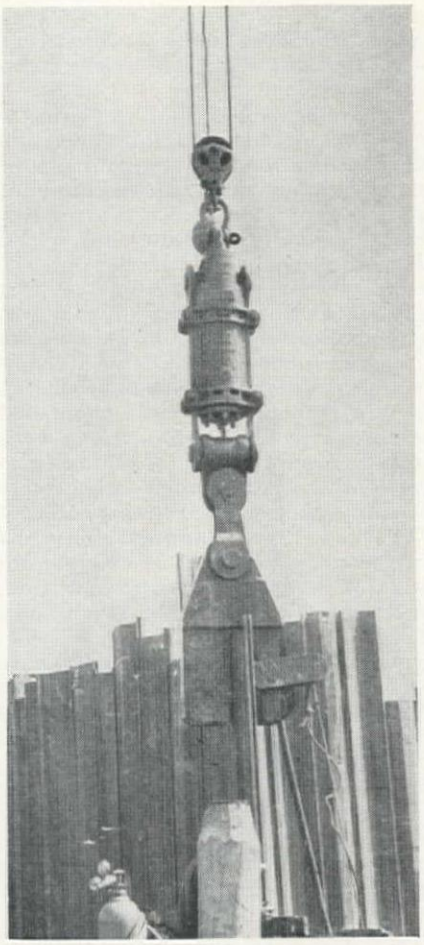
Aggregates for the concrete were obtained from the Missouri River approximately 40 mi. upstream from the bridge site. The coarse aggregate had a maximum size of 1½ in., and was separated at the ¾-in. screen. Aggregate tests were made by the Highway Department both at the bridge site and at the screening plant to insure that aggregates used for the concrete complied with the grading specifications.

A room in the concrete mixing plant was set aside for making and curing concrete test cylinders. Three cylinders are made by the Highway Department for each concrete pour. For the concrete placed to date the test breaks show that average strengths are very consistent and well above those required. The average 28-day strength of Class "A" concrete based on a 595-lb. batch is 4,800 psi., and the average 28-day strength of Class "AD" based on 470-lb. batch is 5,500 psi.

A variety of vibrating equipment was used in placing the concrete, but the air-powered type with a 2½-in. head was most generally used. For placing concrete deck slabs a 14-ft. vibrating screed, on two longitudinal screed bars, produced a uniform riding surface as well as a smooth and dense surface against the bottom forms. Concrete with a 1½-in. to 2½-in. slump was the usual although a 3-in. slump was used occasionally where placing conditions required a concrete of higher slump.

Curing concrete

Considerable concrete was placed during the winter season of 1949-1950, even though curing specifications required that the concrete be kept thoroughly saturated and at a temperature of between 60 deg. F., and 80 deg. F., for a period of seven days after placing. The contractor was able to accomplish this with hot water sprays to provide the heat and moisture to cure the concrete. Two 830,000 BTU hot water boilers mounted on skids and using water from the city water supply provided the hot water. Forms were enclosed by canvas supported by a framework of 2 x 4's. Enough space between the forms and the canvas housing was provided for stripping forms and concrete finishing. Spray bars were made of ½-in. galvanized pipe with variable sprays spaced three feet apart. In order to remove any frost and to thoroughly saturate the wood the sprays were turned on an hour prior to pouring. The day after pouring the sprays were turned off long enough to strip all vertical forms. After walers, braces, and tie rods were removed it was necessary to remove the top of the canvas housing for only a short time to lift out the form panels. Next the finishers went to work under the canvas housing to remove tie rod cones, plug these holes, and repair other minor surface irregularities. When the seven day curing period was over, the sprays were turned off and the air pockets and other minor blemishes were filled. A cement mortar consisting of one part regular cement, one part white cement, and two parts sand was rubbed on the entire surface with a rubber float; allowed to set 15 to 20 minutes, and the excess was rubbed off with a burlap sack.



PILE EXTRACTOR with gripper was especially designed by the contractor for the job.

Anderson Construction Company, with State Highway Commission approval, sublet the structural steel erection to Allied Structural Steel Company who were also the fabricators. The viaduct steel was shipped to the site in June 1950, and erection was begun on the viaduct steel almost immediately. A ¾-cu. yd. truck crane with a 70-ft. boom was used in erecting the viaduct steel. Splice plates were shop riveted to one of the two joining girders. The only falsework used in erecting the viaduct girders was a scaffold on skids to hold one end of the middle girder while sliding the final girder into place.

Erecting girders for the river bridge

After the viaduct steel was erected and riveted, a 40-ton traveler crane with an 80-ft. boom was erected on the first two girders of the river steel. These girders were placed from the highway under the first span of the river bridge by a one-yard crawler crane. Four pile tower supports were erected under each girder splice to support girders and traveler during erection. The steel girders were unloaded from the railroad siding near the concrete plant. Two heavy-duty trucks with A-frames lifted each girder clear of the flat car and a winch truck rolled the flat car from under the girder. The girders were hauled out on the work bridge by truck and trailer where the traveler crane placed them into position. The longest girder handled was in excess of 87 ft., and weighed more than 18 tons. The girders placed over the intermediate piers were 11½ ft. deep, 73½ ft. long and weighed 23 tons. Field splices for the river girders were partially riveted in the shop prior to shipping.

Personnel

In charge of the work for Anderson Construction Company are R. W. Millensifer, vice president, and William "Red" Taylor, carpenter foreman. Paul Broschinsky is in charge of steel erection and riveting for the Allied Structural Steel Company. S. D. "Dick" Larson is resident engineer for the Montana State Highway Commission.

$32,000,000 Gas Pipeline Gets Go-Ahead in Utah

THE $32,000,000 gas line from southeastern Utah to Salt Lake City was given the go-ahead signal by the Utah Public Service Commission. Utah Natural Gas Co. has a period of one year to verify its reserves and obtain financial resources.

The commission based its decision on the fact that the area needs more natural gas and that this plan will supply it efficiently. The commission had heard testimony from rival gas firms and oil and coal interests who offered other methods of meeting the need.

Boundary Butte Field, in San Juan County near the Arizona line would be the starting point of the project extending up to Salt Lake City. Fountain Green would be the start of a branch line which would extend south to the Last Chance field in Emery County. The company will have to get the necessary franchises and permits from the counties and municipalities involved.

Report of Engineering Study Sets Up Goals for—

San Francisco Bay Area Development

The need for a master plan administered by a governmental organization emphasized in report by John L. Savage and International Engineering Co., Inc. — System of dams and dikes studied as possible solution of the region's problems

RECOMMENDING the establishment of a governmental authority to coordinate the future development of the San Francisco Bay Region, a report on this subject prepared by John L. Savage and the International Engineering Co., Inc., concludes with the finding that the Reber Plan is neither functionally nor economically sound, in its entirety. The study was prepared to advise the Fact-Finding Committee of the California Assembly on "Tidelands Reclamation and Development, Related Traffic Problems and Relief of Congestion on Transbay Crossings" headed by the Hon. Richard J. Dolwig.

Background

A year ago the legislative committee arranged with John L. Savage, consulting engineer of Denver, for a study of the Reber Plan for the development of San Francisco Bay to indicate "whether this plan was, in his opinion, worthy of more detailed investigation and, if so, what such detailed investigation might cost." Mr. Savage was authorized to retain the International Engineering Co. of San Francisco to assist him.

Authority to proceed with the report was issued by Mr. Dolwig April 27, 1950. Funds were not available for field studies and the report was prepared from information available from various sources, such as the State of California, U. S. Bureau of Reclamation, Corps of Engineers and other agencies. The report was dated January 1951.

The report was signed by John L. Savage, consulting engineer, and D. J. Bleifuss, Vice President and Chief Engineer, and C. P. Dunn, President of International Engineering Co., Inc.

Statement of problem

In studying the basic problem to be considered, the report starts by pointing out that the San Francisco Bay Region has developed up to the present time in "time honored American fashion." Both public and private interests have built facilities as needs were apparent with only slight regulation by any government agency and completely without coordination.

Up to the present time, this manner of development has proved adequate, but the handling of trans-bay traffic and the approaching limit to easily available fresh water supplies have emphasized the need for a broad-gage study of the region and its problems. The development of this area in the coming years will have a definite effect on the Central Valley of California and the entire country.

Commenting on the situation as it is affected by any master plan for development, the report covers this subject in two words, "None exists."

The Reber Plan is then acknowledged as providing the only approach to a general development program for the region. It has received much publicity, but factual evidence as to the adequacy of the plan has been largely lacking, according to the report. However, because the Reber Plan represents the only existing approach to a master program, a large part of the report is devoted to its review and analysis.

The final conclusions of the report are indicated on page 89. The recommendations for setting up an authority for coordinated development are also quoted in full, on this page.

Area considered

As considered in the report, the region includes San Francisco Bay, adjoining bays, watersheds tributary to these bays, and that part of the Central Valley which is commonly called the Delta Region. Parts of nine counties are included. This region requires water for domestic use, agriculture, and industry, and in the final development of the Bay may also require fresh water for ship lockage, preservation of fishing and other miscellaneous uses.

At the present time the need for additional fresh water in most of this area is not urgent, with exception of the declining ground-water level in the agricultural areas at the southern end of

"A master plan is required . . . an organization must be formed"

"THE PROBLEM confronting the San Francisco Bay Region is extremely complex. Having been limited in our studies by both time and money, we feel that it would be presumptuous on our part to attempt to point to a specific solution, although we have mentioned several items as being worthy of further study. We therefore would instead like to recommend a method of procedure toward the determination of a solution.

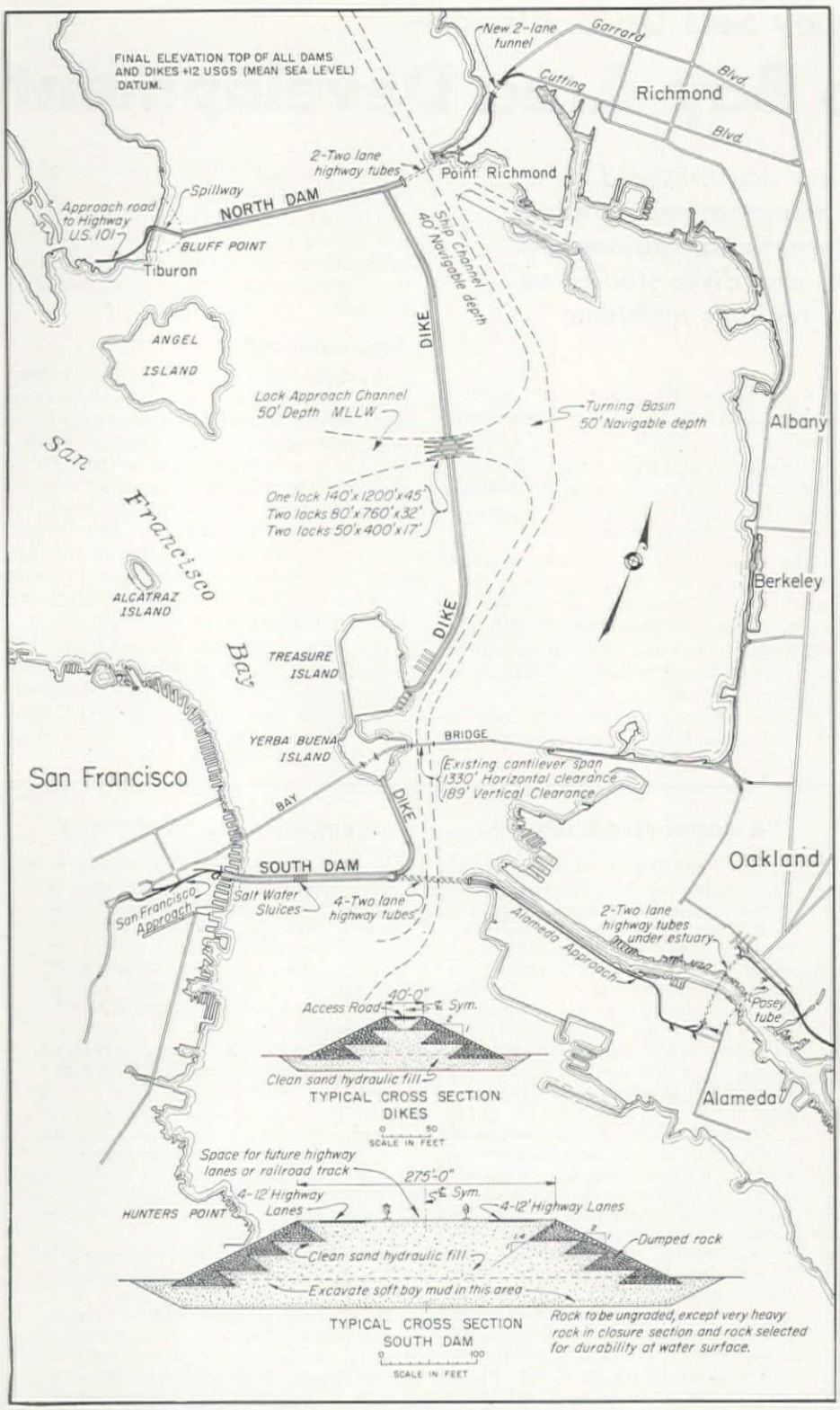
"It appears to us that development of the San Francisco Bay Region has reached a stage such that a master plan for future development is required. The master plan would have to provide for many things, trans-bay transportation, water supplies, marine facilities, industrial and residential locations, etc. While it should be a general framework, all possible latitude within the framework being allowed various political organizations and private interests, it should be definite enough so that it could be followed with confidence and orderly efficiency (without, for example, such delays as are now evident in coming to a decision on a second Bay crossing). It must be sufficiently flexible so that it can be adjusted to future requirements which we cannot now foresee. New inventions, new customs and new needs may change the commercial and social life of the Bay Region. It is only necessary to point out that if a master plan had been prepared in 1900, it would have contained no provisions for automobile traffic.

"It is here proper to say that we consider that the San Francisco Bay Region owes a debt of gratitude to Mr. John Reber, and to the sincere and earnest proponents of the plan which bears his name. We believe that they have brought home to many minds the idea that there must be a master plan, and that in so doing they have performed a great public service.

"The trans-bay traffic problem alone renders prompt action imperative.

"The master plan must benefit the community as a whole, but it cannot suit everybody; unavoidably, some individual interests will be damaged, while others will be enhanced. Thus, many features of the plan will be controversial.

"It appears to us that some sort of a legal entity or organization must be formed, to develop a master plan, keep it up to date, and to control future development in accordance with the plan, and we recommend the establishment of such an organization. It might very well take the form of a non-salaried board composed of prominent citizens with records of integrity and accomplishment, which board would act through a salaried general manager and necessary staff. The board would deal with Federal, State and Municipal governments in all matters touching upon development. It should be clothed with all requisite authority. It should be provided initially with adequate funds for carrying out a comprehensive investigation of a master plan for development of the San Francisco Bay Region. Thereafter, it should itself be able to advise on suitable appropriations and actions."



MODIFICATIONS of the Reber Plan as proposed by International Engineering Co., Inc. Key features are the "North Dam" with dikes extending to Treasure Island, locks to admit shipping both north and south, and the "South Dam," which "might be practicable as a Bay crossing."

San Francisco Bay. The increasing cost of pumping irrigation water, combined with the growing threat of saline contamination of the wells in the area is an immediate and serious water problem.

The report points out, however, that the development of the Bay Region will shortly exceed available water supplies and plans must be provided without delay to avoid future shortage. At the present time a "California Water Plan" for the entire state is being prepared by the Division of Water Resources, and this plan will indicate the general sources of water supply which the Bay Region will have available.

Present and future use of land areas is reviewed in the report in considerable detail. Based on the available information, the report tabulates the areas devoted to agriculture and the types of crops, together with amount of water required for irrigation service. The conclusion indicates that an estimated 2.0 ac. ft. of water per acre would be required, with a total of 620,000 ac. ft. annually to meet this future demand.

Population requirements are next considered, and based on 110 gal. per day per capita, a total annual requirement of 580,000 ac. ft. is the estimated need by the year 2000, when a population of 4,700,000 will occupy the region under consideration.

As to industry, the report bases the demand on the water required to serve Emeryville, which is considered a typical industrial area. Considering an estimated requirement of 4.5 ac. ft. per acre of industrial establishment, the report estimates 92,740 ac. of such area, with a requirement of 418,000 ac. ft. of water.

On the problem of salinity control the report goes into considerable detail, including the consideration of the release of upstream storage to keep the Delta Area free of salt water as well as the idea of a barrier across the Bay. The conclusion reached is that a flow of about 5,000 sec. ft. would be required at Antioch to control salinity at that point.

The traffic problem is admitted to be one requiring immediate action. But, it is also one which should be designed to fit into a master plan for the entire region. After pointing out that the existing Bay Bridge is now carrying almost 95% of its estimated capacity, the report states that the number of vehicles using the bridge is increasing at a faster rate than the automobile registration in the area. A further complication is the fact that on the east side of the Bay the population center is tending to move north, whereas on the west side the population is tending to move south down the peninsula.

Miscellaneous elements of the broad problem include rail traffic, which is not considered by the report; shipping, which the report believes will increase and must be protected; military considerations, which cannot be reviewed in detail, but are important in the interests of national defense and must receive careful consideration in any program for regional development.

Having reviewed the basic factors of the problem and arriving at conclusions as to the water requirements and other demands, the report then takes up a consideration of the Reber Plan based on these requirements.

The Reber Plan

Basic features of the Reber Plan were outlined in detail in *Western Construction*, March 1942, and will not be reviewed here. This plan is studied by the report in three distinct phases: (1) physical feasibility, (2) functional feasibility, and (3) economical feasibility.

Because several of the elements of the Reber Plan were never definitely fixed as to location, the report has made some modifications which seem to be desirable in the way of decreasing costs, increasing benefits or improving functional feasibility. The essentials of the Reber Plan were retained in the study, which resulted in the present report. The modified program of development is shown in the accompanying drawing and represents a layout studied by the

International Engineering Co. as a possible solution of the regional problems which have been outlined.

The North Barrier has been moved to a location spanning between Tiburon and Richmond, with a spillway section on the west side and subaqueous tubes to carry vehicular traffic under the ship channel near the Richmond end of the dam. This location permits construction of spillway without expensive cofferdams.

A dike extends from this North Dam to tie into existing Treasure Island and locks are provided (see illustration) in this dike to admit shipping to the inside channel extending both north and south.

The so-called South Barrier is proposed to be located from the west end of Alameda Island to a terminal at the foot of Brannan St. in San Francisco. This dam would also be provided with subaqueous tubes under the ship channel and would have a connecting dike to Yerba Buena Island. This modified location is intended to eliminate interference with many existing railroad facilities in Oakland, and also permits uninterrupted use of the existing Bay Bridge. Relocation of the ship channel from the original Reber Plan also avoids its passing through the City of Richmond.

The report then goes into considerable detail concerning the operation of the North Dam, which is the essential feature for keeping salt water from advancing up the Bay, and for passing fresh water during time of floods. The spillway problem is reviewed in detail, as well as the fish ways which would be required. The operation of the fresh water canal and ship channel to deliver fresh water from behind the North Dam to the lake formed in the southern end of San Francisco Bay is treated in detail.

Feasibility of the Plan

Having outlined a modified Reber Plan, the report then discusses its feasibility.

As to physical feasibility—could it be built?—the report indicates there is nothing connected with the structures which would show that they could not be designed and built.

Construction problems would be difficult because of magnitude of the work, but these structures would be physically feasible.

Functional feasibility—whether the program would produce the desired results—is considered complicated and difficult to answer precisely.

The report then considers the functional problems relating to railroads, highways, established tidal effects, bar at the Golden Gate, need for fresh water, evaporation losses, losses in lockage and salinity of the South Lake. On the last element, the report indicates that a long period of years might be required to render this body of water entirely fresh.

Concluding its review of functional feasibility, the report points out that the "realization of the Reber Plan would not result in any conservation of fresh water, but would forever commit the Bay Region to the use of a large quantity of water annually which could ill be spared in dry periods. Our professional military men say it would be most objectionable from the standpoint of national defense. It would disrupt the present salt producing industry, or necessitate expenditures for providing it with salt water. It would necessitate large expenditures for treatment of sewage beyond those required if sewage were to be discharged into the open Bay. It would probably destroy commercial fishing. There is considerable doubt in our minds that the South Lake could ever be rendered completely fresh; if it could, it would probably take a very long time."

On the economics of the problem, the report does not become involved in the question of how or by whom the plan would be financed. It does point out that in addition to the original cost, elements of operation, maintenance, interest and depreciation must be considered if the ratio of benefit to cost is a desirable one.

There follows detailed estimates covering costs of all of the features in the program, which conclude with a figure of $409,546,000 as the net first cost of the Reber Plan structures. Then follows cost estimates on the element of providing salt water to the existing salt industry, the additional sewage treatment works to be required, the moving of present military facilities. These elements bring total first costs of the program up to a figure of $613,546,000 with fixed annual costs of $32,679,000.

Operation and maintenance costs include the handling of the spillway, likewise pumping of fresh water, operation of sewage plants, dredging of the Golden Gate bar and mosquito control. These bring the total annual costs up to $38,259,500. Ultimately annual costs will be increased to $69,759,500 to include the cost of Central Valley storage required to make the plan function.

Balanced against these costs are benefits relating to irrigation, salinity control, elimination of marine borers and benefits to shipping, totaling $17,057,500 immediately. The development of the Bay region would ultimately bring these benefits up to a total of $32,533,000.

Balancing these financial elements, the report finds annual costs would vary from $38,259,500 initially to an ultimate figure of $69,759,500. Corresponding benefits would be $17,057,500, and ultimately $32,533,000. "The benefit-cost ratio is thus initially 0.45, and ultimately 0.47. The Reber Plan therefore would cost over twice as much as it would be worth, and is not economically feasible."

The report concludes . . .

1. The Reber Plan is physically feasible; that is, the various structures contemplated could be built.

2. The Reber Plan in its entirety is neither functionally nor economically feasible; that is, its realization would not produc the desired results, and would seriously hamper the national defense, and its costs would exceed the value of the benefits.

3. The Reber Plan in its entirety should be given no more consideration.

4. A north barrier, a ship channel, and a south barrier, as described herein as parts of the Reber Plan, taken individually, merit no further consideration.

5. Another plan involving the construction of a dam in Carquinez Straits, a 22-mile tunnel, and a south barrier, in its entirety, is not economically practical.

6. A southern barrier, much different from that contemplated in either the Reber Plan or the above-mentioned plan, might be practicable as a Bay crossing and should be further investigated.

7. The entire question of salinity protection in the Delta Region should be further investigated.

8. An additional crossing of San Francisco Bay between San Francisco at the west end and Oakland or Alameda at the east end must be constructed in the near future. As an immediate measure to provide additional capacity on the existing Bay Bridge, it appears to us that alterations to the lower deck offer attractive possibilities.

9. The San Francisco Bay Region has reached a state of development such that it is now advisable that future development be governed by a master plan. We therefore recommend that a governmental organization be created for the specific purpose of:

   a. Studying thoroughly the Bay Region.
   b. Preparing a master plan for future development of the Bay Region.
   c. Administering the master plan; that is, keeping it up to date, and controlling development in accordance therewith.

We recommend that this organization be clothed with all requisite authority, and provided initially with funds adequate for thorough and comprehensive investigation. Thereafter, the organization itself will be in a position to make all suitable recommendations to the Legislature.

Water Distribution Plan For So. Calif. Coast Area

THE COASTAL area from Laguna Beach to Corona del Mar, Calif., is tentatively scheduled to get an estimated $1,000,000 water distribution plan. The plan would involve the cooperation of the Laguna Beach County Water District and the South Coast County Water District and would start at the district reservoir at Corona del Mar.

At the present time the area is supplied with Colorado River water through Coastal Municipal Water District lines which run along the Coast Highway. Since many users are located on steep hillsides in the coastal area, pumping areas are necessary at various points to force the water up-hill.

Water pressure is not high enough and growing population indicates that demands will continue to increase. According to Judge C. C. Cravath, district chairman, the proposed plan would provide a pipeline from the 286-ft. level of the reservoir along the hillside above the coast highway with provisions made for sustaining gravity flow both from the reservoir and in distribution connections in the residential hillside area. This would substantially reduce the need for pumping and would also provide excellent supplies of pressure in case of fire in the wooded areas. Storage reservoirs are also included in the plan.

Third and Final Installment:

Lessons in Structural Safety Learned From the 1949 Northwest Earthquake

By HARLAN H. EDWARDS
Chairman, Earthquake Committee
Seattle Section, American Society
of Civil Engineers

ALTHOUGH well-constructed and thoroughly-braced wood frame residences firmly attached to substantial foundations have withstood all earthquakes in this country with little damage, the April 13 quake demonstrated again that departures from good practice pay the penalty. The unreinforced concrete foundations of one group of homes being built on fill ground in West Seattle failed utterly and miserably and showed that the earth on which a building rests is also a part of the foundation and must be firm and thoroughly consolidated.

Needs for wood frame structures

Buildings must be securely bolted and braced to their foundations. If the first floor is set on posts, on short studs or on low, dwarf walls, these supports must be strongly braced; otherwise they merely act as pivot points on which the heavy structure moves to failure. The shocks of this quake were such that only a few homes slid off their foundations.

Buildings must be diagonally braced in the frame, or by diagonally-placed solid sheathing extending from plate to plate, thoroughly nailed to all bearings. Braces are most effective if they are the continuous 1 x 4 or 1 x 6 type or larger let into the plates and studs and well spiked to each bearing. The "cut-between" type of bracing often permits building movement to take place before it comes into solid bearing, resulting in broken plaster and a racked structure. To resist torsional or twisting forces buildings should have diagonal bracing over the ceiling joists in attics, extending from corner to corner of the structure, again well spiked in place.

Throughout the area affected by this quake, a disproportionate number of schools suffered severe damage. It was said of the California schools following the Long Beach earthquake on March 10, 1933, "the cities have accumulated in the guise of schoolhouses, the most shocking collection of deathtraps that ever disgraced a metropolis. The Long Beach earthquake was nicely timed and graduated to expose the condition without exacting the penalty, at least as far as the children were concerned, but if the schools had been occupied it would have been one of the greatest catastrophes in American history. The casualties would have been numbered not in hundreds, but in thousands or tens of thousands." So might it be said also in Washington and Oregon, and in practically all other parts of the country, should a similar quake occur.

Schoolhouse architecture as developed over the years has established a pattern of design, arrangement and ornamentation which almost invariably has been followed, regardless of location. High ceilings and large rooms with many high windows create a structural shell which is unable to resist the lateral force of earth shocks unless it is very strongly braced. Ornate entrances, usually embellished with heavy and often loosely placed terra cotta, brick and stone have been first to fail and rain their death-dealing load upon the children leaving the building.

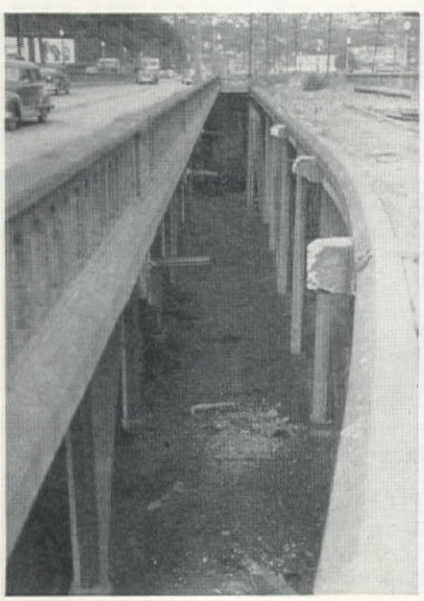
With respect to seismic forces, school buildings almost universally have been built to be weaklings. As spindly, weak-kneed, heavy-headed and overgrown specimens of purportedly good architecture many of our schools costing millions of dollars can and probably will be deathtraps for the youngsters, come a strong quake when school is in session.

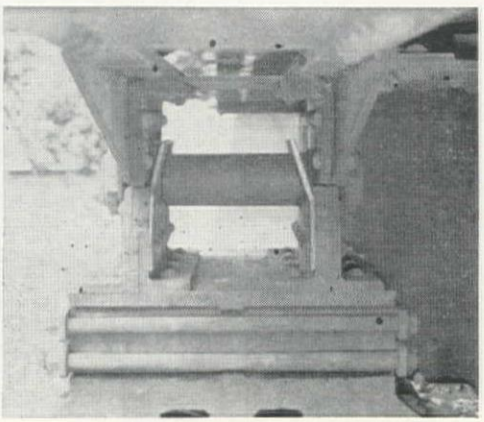
Damage to schools on April 13 was widespread but generally not spectacular. It did not approach the total destruction suffered by the schools in the Long Beach earthquake but the tell-tale fracturing and movement of wall on wall were there, mute evidence that a few aftershocks would have done the trick. Few, if any schools in Washington, however, have been strengthened since the shakeup.

Lessons in school construction

The lesson for educators and others responsible for school construction is very plain, and the results observed point up three courses of action, all of which should be worked at vigorously for safety's sake.

1. A careful inspection should be made by experienced engineers to locate potential hazards in existing buildings, and action should follow to eliminate them. Chief hazards during a mild quake are brick gable ends, parapets, cornices and chimneys, in addition to the entire structure if it is weak. At Lafayette Elementary School in Seattle,





BRIDGES damaged by the quake. Left—Horizontal reinforced concrete struts between viaduct and trestle in Spokane were destroyed by differential movement of the structures. Below—Adna bridge over Chehalis River moved perpendicular to center line of road to bend pin plates on all shoes.

A BRIEF OUTLINE of the complete report prepared by the Earthquake Committee, Seattle Section, ASCE, as it is being published in *Western Construction* is as follows:

FIRST INSTALLMENT (Feb. issue)—An on-the-spot account of the quake characteristics and damage to various types of structures as background for recommendations to be presented later; a discussion of the effects of this quake as compared to others.

SECOND INSTALLMENT (March issue)—Facts on how new structures can be built and old ones strengthened to become earthquake-resistant, based on analysis of damage by the Northwest quake.

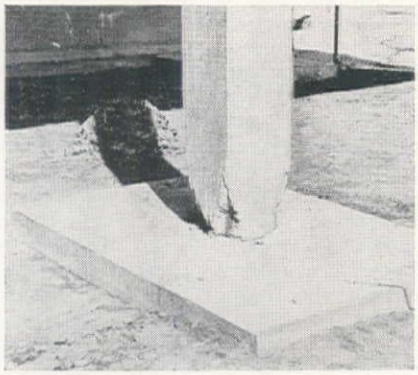
THIRD INSTALLMENT (this issue)—Recommendations for a new approach to the design of structures in areas subject to earthquake hazards; legislation required to achieve the goal of structural safety in the Northwest and elsewhere.

a typical 2-story structure of early days (now replaced) the east and north brick gable ends fell outward. The north end fell at the doorway where according to school routine pupils exit at 11:55 a. m., the time of the quake. Castle Rock School was in session and the students starting to leave for lunch when the quake occurred, sending a rain of brick from the gable end down upon them, killing one boy.

The north parapet at the Lower Columbia Junior College at Longview toppled two stories to the sidewalk entrance. Some students were inside at the time and lived through falling plaster and shattered plate glass. This was a rented building used "temporarily until some future time." Thus the town's worst damaged building was used, though not designed, for school purposes.

From cornices at Central Elementary in Seattle and at similar schools in many other cities assorted sizes and numbers of bricks and stones catapulted down. Only gross disregard of the history of earthquakes permits beauty and symmetry to transcend safety.

Chimneys are the telltales of mother earth's movements. A quiet antic both-

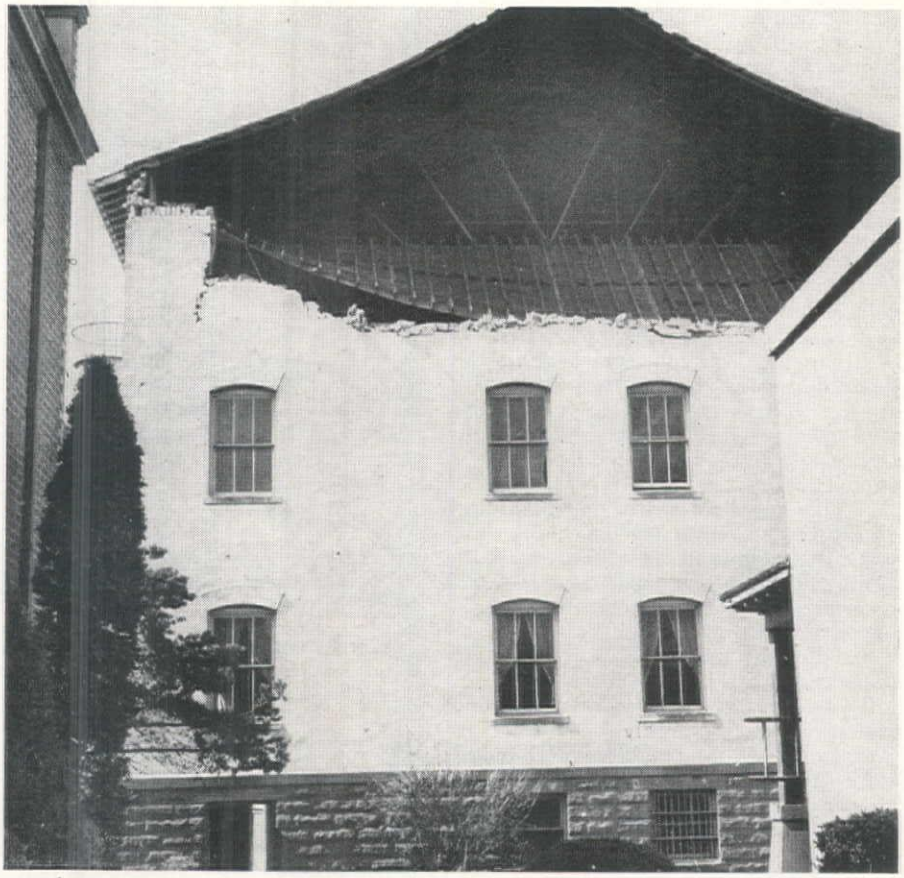


CONNECTIONS between structures must be rigid enough that both structures move as a unit or be separated so they move independently. Above, damaged base of an unbraced column.

ers few well-built stacks but down they come in a violent vibration, laid out flat across the playgrounds, dropped down through roofs into toilets and classrooms, all spelling death to the children below them.

Gingerbread versus safety

The most dangerous spot during a mild quake is just outside the entrance, the place where gingerbread architecture reaps its casualties. But other places can be dangerous, too, for a jolt of greater force or longer duration tends to "bring down the house." At Puyallup High School it has been told how the unanchored ceiling and roof beams over the stage slipped off their supporting masonry walls and dropped to the stage of the auditorium. At the Rainier Elementary School in Oregon a classroom of hollow tile construction split away from the main portion of the building and only conjecture can fix the added temblors needed to throw classroom, contents and all into the yard three



TYPICAL of pre-1900 buildings, this tall thin wall and unanchored gable were easily knocked out by flexing of wood structure. Crack to left shows side wall about to fail.

stories below. In Castle Rock, Wash., the elementary pupils vacated a 3-story frame building and double-sessioned in the Junior High School, judged by experienced engineers to be more hazardous than the elementary school.

2. Continuing instruction and drill should be given concerning pupil conduct during earthquakes and other emergencies.

3. Adequate safeguards should insure the structural integrity of each new school. At best, heavy masonry units on top are dangerous. Modern architecture needs no such ornamentation, but bond beams alone in masonry walls are inadequate. In addition a complete lateral bracing system is required, designed by a structural engineer or architect experienced in seismic matters. The building and all its parts must be constructed and interconnected so that neither lives nor dollars will be placed in jeopardy.

Existing structures can be examined, tested, and analyzed to determine their performance in an earthquake, and means of strengthening can be designed by engineers trained in this specialty. If cracks or distortions in walls, or other indications of damage appear, it is advisable to have and it should legally be the owner's responsibility to obtain such a checkup, and to follow the recommendations made.

The owner, engineer, architect, contractor and public official all have definite legal responsibilities to see that the design, construction and maintenance of structures will make and keep them free from hazard to the public. These responsibilities have been defined and enforced by the courts time and again, sending to prison those found to be at fault such as was done with the contractor and building inspector following the Pasadena, Calif., grandstand disaster in 1925 in which 9 spectators of the Tournament of Roses were killed. These responsibilities should be reiterated in codes, and to establish them, the several parties involved should be required to certify in writing prior to final approval of the structure by the building department that the work has been done in accord with the plans, specifications and building codes.

Conclusions

Study of the effect of the earthquake of April 13, 1949, together with the experiences of other localities, supports the following conclusions:

1. The entire Pacific Northwest west of the Rocky Mountains, and particularly the area west of the Cascade Mountains, is a seismic area subject to strong motion earthquakes.

2. To minimize loss of life and property, all structures used by humans should be designed and built to provide reasonable resistance to seismic forces.

3. The design and construction of all structures, including those built by local, state and federal bodies, should be in accordance with the requirements of an adequate, modern building code.

4. Adequately designed structures of steel, reinforced concrete, reinforced masonry and wood can be earthquake resistant.

5. Adjoining structures or adjoining parts of the same structure are subject

to differential movements and hence to damage through dynamic contact, tension or torsion unless they are adequately anchored, braced, or sufficiently separated.

6. Inadequately anchored unit masonry partitions, filler walls, and veneers of the several kinds are vulnerable to damage or destruction by an earthquake and if only slightly damaged or weakened by one quake, they may be a serious potential hazard during a subsequent relatively mild quake.

7. Chimneys, parapet walls, cornices or other members cantilevered from the general structural mass are particularly subject to damage by seismic movement and where used should be especially designed and be securely anchored to their supports.

8. Due to their stiffness or rigidity, elevator shaft walls are especially subject to damage and are capable of damaging adjacent elements. They should be designed to resist horizontal forces proportional to their rigidity.

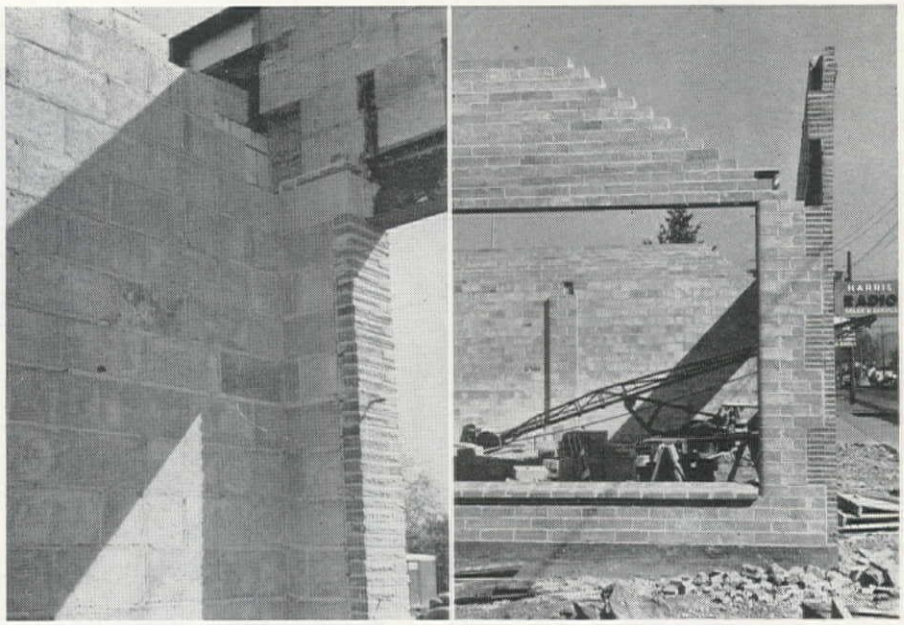
9. Due to relatively high rigidities in planes where relatively little other rigidity occurs, walls of stair wells and stairway slabs themselves are particularly subject to damage in an earthquake. Careful analysis should be given these elements to provide correspondingly resistant strength, and where the conditions are too highly indeterminate, slip joints should be provided.

10. Soil conditions and the strength of foundations are vital elements affecting the ability of structures to resist earthquakes. On soft ground it is essential to tie footings together securely either by strong, stiff struts or by a continuous slab.

11. Water tanks supported by buildings are not only subject to the hazards of other cantilever members but have the added hazards of dynamic movement of the liquid in conjunction with the seismic forces, which can severely stress the building. Especial analysis should be made of tanks, tank structures, and the building members surrounding and supporting them.

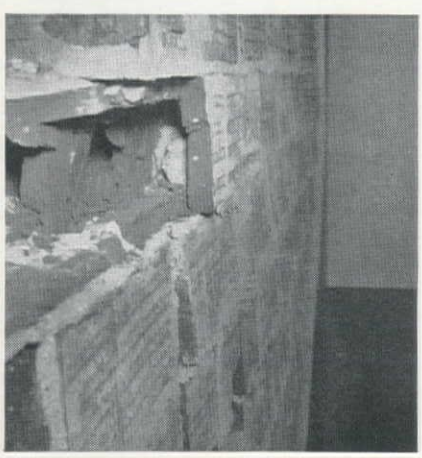
12. Suspended piping is subject to sidesway and endsway. In strong earthquakes this sway may cause the rupture of fittings such as on fire sprinkler lines, gas, refrigeration and heating lines, with serious consequences. All such piping should be secured by supports from each side additional to vertical suspenders with due allowance for expansion and contraction of the system. Similar restraint should be given to heavy ventilation fans, air and water tanks and similar equipment in a building.

13. Subsidence of filled ground due to the vibratory action of earthquakes can cause breakage of water, sewer and other lines serving a building supported on piles or having deep foundations, and can damage lines extending from hard ground into such unstable soil. Such breakage hazards can be reduced by using flexible joints and by using pipe that is capable of withstanding the differential motion.



STREET FRONTS and parapets must have strong support. Building under construction above was entirely inadequate. At left, note light I-beam bearing on thin veneer with concrete block above for back-up only. At right, note thin support for the front wall, giving no lateral stability.

SUPERFICIAL damage was costly in high structures which flexed markedly. Interior partitions lost their plaster and fractured. Note vertically bowed condition of this interior wall.



Recommendations

On the basis of the foregoing findings and observations, the following recommendations are made:

1. That useless, superficial and dangerous ornamentation be deleted from plans or removed from the structure.

2. That the basic design be such that rigid resisting units are provided where needed, so that differential movement of various masses can be properly provided for and that torsional movement can be resisted or eliminated.

3. That ultimate economy be considered in addition to safety. In the architectural and structural design, if advantageous, conventional heavy materials should be discarded for modern lightweights, particularly in the upper portions of the building.

4. That the seismic design sections of the 1949 and succeeding editions of the Pacific Coast Uniform Building Code be adopted by all governing bodies and that a state organization be created to secure compliance in all areas not under the jurisdiction of city or county building departments.

5. That the minimum seismic design factor in the above-mentioned code be determined for any area by the zone of earthquake probability established by the Coast and Geodetic Survey.

6. That, due to the public hazards disclosed, legislation be enacted requiring potential earthquake hazards to be abated within a specified maximum time.

7. That legislation be enacted requiring owners of structures used by the public or located along public ways to bear responsibility for damage to the property of others and for injury or loss of life occasioned by their structures or parts of them due to seismic disturbance.

In conclusion

Seismic shocks have been of common occurrence in the Pacific Northwest in recent years (155 have occurred in the Pacific Northwest states since 1841, and 30 in the last 10 years) and therefore they should no longer be considered as "Acts of God."

It is obvious that buildings have been built so they can be shaken down in an earthquake, and equally obvious that they **can** be built so they will hold together under similar circumstances. Resourceful engineering in the specialized field of seismic design of structures and the cooperative interest of and intelligent understanding by capable architects will result in earthquake resistant structures often at little, if any, additional cost.

Guided by the modern seismic design section of the Pacific Coast Uniform Building Code, some owners are making their structures more safe to use and less costly to maintain. It is hoped that many more will learn the lessons taught by earthquakes and do likewise. Probably 5,000 persons in the Pacific Northwest are living today and property damage of $100 million was spared solely because the quake of April 13, 1949 did not last a little longer. **Next time we may not be so lucky!**

—The End

Current Contract Policies Of the Corps of Engineers

Cost-plus-a-fixed-fee, negotiated lump sum or unit price contracts? The Chief of Engineers, speaking before the national AGC convention, tells contractors what principles will determine the type of contracts to be used during the vastly expanded military construction program

THE FULL SCOPE of the military construction program cannot yet be forecast accurately. Currently, the work authorized through the fiscal year 1951—and for which funds have been made available for both Army and Air Force construction—totals $2,400,000,000. And, in the words of Major General Lewis A. Pick, Chief of Engineers, speaking before the 32nd Annual Convention of the Associated General Contractors, the magnitude of the program makes it highly imperative that the letting of contracts be accomplished efficiently, effectively and to the best interests of government.

Authority still decentralized

Pick emphasized the point that authority is being decentralized under the emergency military program in the same manner in which authority is decentralized through divisions and districts of the Corps of Engineers during large peace-time civil works programs. Consequently, a directive was issued last December 28th to the appropriate members of the Corps of Engineers' organization, delegating to them certain authorities they previously did not have.

In line with this directive, Division and District Engineers, and the Assistant Chief of Engineers for Military Construction, now have authority to approve the award of negotiated contracts for construction up to $15,000,000 in value. In addition, Division and District Engineers were given authority to approve awards of architect-engineer contracts up to $500,000. For all contracts —within their approval authority—Division and District Engineers are authorized to select their contractors without reference to the Office of the Chief of Engineers.

What type of contract?

In carrying out the authority invested in them under the directive, Division and District Engineers have been instructed to observe the following principles in determining the type of contracts to be used:

1. When plans and specifications are complete enough to permit lump sum bidding, they will decide whether to negotiate or advertise on the basis of the time element involved.

2. Where the work can be defined by partial plans and specifications that are not sufficiently complete to permit formal advertising, negotiated lump sum or unit price contracts will be used—if practical—in lieu of cost-plus-a-fixed-fee contracts.

3. Cost-plus-a-fixed-fee contracts will be used when the completion date is such that planning and building must be started at the same time.

4. When the project is located offshore, in areas where construction experience is lacking, or otherwise of such a nature that it makes it impracticable to estimate costs, the cost-plus-a-fixed-fee type of contract will be used.

5. Any contract to be negotiated on a fixed-price basis will generally be accomplished by soliciting proposals from such qualified contractors as may be deemed necessary to insure effective competition, consistent with meeting the required completion date.

6. If letter orders will serve to expedite the completion of a contract let by negotiation, the letter orders will be issued in the first instance.

7. All types of contracts will contain adequate requirements for maintaining sufficient plant, personnel, extra shifts and overtime to insure completion within the specified time limits.

Selecting contractors

The following principles will govern the selection of contractors when the element of competition is necessarily lacking:

1. The contractors must be fully capable of accomplishing the required design or construction work.

MAJ. GEN. LEWIS A. PICK, Chief of Engineers. Currently, military construction authorized to proceed under his direction during fiscal year 1951 totals $2,700,000,000.

2. The contractor should be located in the general geographical area in which the work is to be performed. The guiding principle set for the Division and District Engineers in determining the size of the geographical area is to make it large enough to provide a reasonable choice of contractors capable of handling the project. Unusually large or complicated projects thus generally will require consideration of firms within a large geographical area.

3. Everything possible will be done to avoid overloading one firm. In this line, it continues to be the Corps of Engineers' policy to utilize the smaller contractors where appropriate. The smaller contractors of an area can—and should—contribute substantially to the program.

When cost-plus-a-fixed-fee?

At the present time, the Chief of Engineers must determine when a cost-plus-fixed-fee contract is required. This applies to all types of contracts—construction, procurement, and architect-engineer. There are certain circumstances when such a contract must be used. For example, if the completion date is such that building and planning must be started at the same time, there is no answer other than a cost-plus-fixed-fee contract. The Ordnance rehabilitation program is an example.

In his talk before the assembled AGC members, Pick also attempted to clarify current Corps of Engineers' policy pertaining to the system of priorities and allocations instituted under the Defense Production Act of 1950. The following discussion, although not following the exact wording used by the Chief of Engineers in his talk, reviews Pick's remarks concerning the current status of the Defense Order system and its effect on contractors' operations.

Clarifying the "DO" system

The "DO" (Defense Order) is becoming increasingly essential to the conduct of the contractor's business. The Chief of Engineers has received two definite authorities regarding the use of defense order ratings to military construction of both the Army and Air Force. This authority in turn has been re-delegated to the various district offices of the Corps of Engineers. They in turn give to the contractors the right to apply a defense order rating to the materials and supplies necessary to complete a specific contract. At present, "Defense Order No. 22" is being utilized for military construction. (The number "22" is a category rather than a relative priority number.) This defense order is applicable to construction materials, as set forth in the NPA regulations. Construction priority covers almost any building material, except the mineral aggregates which go into the concrete.

To date, the present priority system has been effective in obtaining necessary materials. Whether the over-all effect will later necessitate certain changes, it cannot be said. However, for the most part, suppliers of material have been cooperative in supplying necessary items on time. The majority of the rela-

tively few delays that have occurred in securing materials have been due primarily to the failure of the contractor to place his order early enough—or to set a reasonable schedule for their delivery.

In the field of contract and construction equipment, there has been some difficulty. Defense Order No. 22 is not extendable to contractors for the purchase of equipment for their own plant. However, the Office of the Chief of Engineers is endeavoring to obtain authority to apply a very small amount of priority ceilings to the procurement by contractors of construction equipment. In this line, it is anticipated that 1% of the total value of Corps of Engineers' contracts will secure relief for the contractor when some specific item of the contractor's construction equipment is preventing the completion of the work.

Avoiding hardships on contractors

A system of priorities and allocations must necessarily work added hardships on contractors. Yet, there are certain points that can perhaps be modified. For example, the "Time Extensions" paragraph of the "Delays-Damage" clause in construction contracts. Inevitably, the operation of the priorities and allocation system will make uncertain the dates on which contractors can expect delivery of materials necessary to the completion of a project. These delays will be caused by no fault or negligence by the contractor or supplier. Consequently, the Chief of Engineers has asked permission of higher authority to amend the Time Extensions paragraph. Under the amendment, such delays would be considered as caused by "acts of Government" and therefore excusable as such. It is hoped that this amendment, if executed, by bringing relief to contractors, will be evidenced in substantially lower bids.

Information from district offices

Western offices of the District Engineers have within the past month released information in an attempt to further clarify Corps of Engineers' contracting policy as outlined above. The following, as an example, is a release from the Office of the District Engineer, Seattle District, dated March 1, 1951.

"Competitive bidding for all military construction work to be accomplished by the Seattle District, Corps of Engineers will continue to be the district policy where there is ample opportunity for preparing plans and specifications in sufficient detail to permit contractors to make accurate estimates. Only in those cases where construction is ordered completed at such an early date as to prevent advance, detailed engineering work or other special circumstances, will this office resort to a negotiated contract.

"While the National Defense Program calls for an extensive military construction program in the Northwest, the Corps of Engineers has not relaxed its traditional stand of having private contractors do the work on a fixed price basis, competitive or negotiated. Use of the cost-plus-a-fixed-fee contract will not be considered unless that is the only possible way of initiating construction, and this is only considered possible in very limited and extreme instances.

"Some questions have been asked as to the effect of Executive Order 10210 on the Seattle District construction program. No instructions have been received on that order, and it is not anticipated that the present policy will be altered except in the event of drastic changes in the international or economic situations.

Limiting number of bidders

"It may become necessary to limit the number of bidders or to solicit bids only from selected contractors of specific abilities, experience, or organization for certain work. The reasons for such limitations or selections will be in the savings in time that can be achieved, need for localizing work efforts of available firms, or the specialized nature of the proposed construction. Even in these cases, every consideration will be given to the inclusion of the greatest possible number of contractors available and able for the work.

"It is assumed that the construction industry will cooperate, as in the past, by making fair and reasonable bids on what may be short notice; by avoiding the over-loading of subcontractors and suppliers; and by its full support of the selected bid or award procedure."

Corps of Engineers' Northwest Bid Schedule

THIRTY-EIGHT major civil works jobs having a total estimated cost of more than $100,000,000 are slated for bid opening by the four district offices of the Corps of Engineers in the North Pacific Division during the remainder of the present fiscal year, according to announcement by Brig. General O. E. Walsh, Division Engineer, in Portland.

The Portland District has scheduled 13 major invitations for advertisement and bid opening during the remainder of the fiscal period which ends July 1. The Walla Walla District will advertise and open bids on 17 jobs, all but one in connection with McNary Dam. Seven invitations are scheduled for advertising and bid opening in the Seattle District, with only one civil works job of major importance being scheduled for bid call and opening by the Alaska District.

Both Seattle and Alaska Districts have a heavy workload of military construction, some of it under way or advertised, but much of it still in the design stage, in addition to civil works, General Walsh said.

Contracts to be let range in estimated cost from $100,000 to more than $60,000,000. Largest by far is the third step or completion contract for McNary Dam. It consists of constructing the powerhouse substructure for 12 generating units, powerhouse superstructure for 14 units, remainder of the spillway dam, Oregon shore fishways, Oregon and Washington shore abutment embankments and raising upstream sill in navigation lock. This feature of work was advertised in February and bids will be opened by the Walla Walla District Engineer April 5.

Other McNary contracts costing upwards of a million dollars for which bid calls are pending include: Intake gates, 14 units and two station service units (supply contract), bids to be opened April 10; spillway gates (supply contract), bids due June 20; grading Union Pacific and Northern Pacific railroads and Washington state highway, and constructing highway bridge, bids due July 24; constructing Pasco levees, bids due July 24.

From Portland . . .

Largest project for which bids will be called in the Portland District is the main contract for construction of Big Cliff Dam and powerhouse. The opening date of bids on this dam, three miles downstream from Detroit Dam, is June 29. The work is estimated to cost more than $4,000,000. Other Portland District contracts to be let costing over a million dollars include: manufacture and delivery of three turbines and governors (supply contract) for Lookout Point Dam, bids due July 6; manufacture and delivery of three generators, another supply contract in connection with Lookout Point with the same bid date; and construction of the powerhouse superstructure at Detroit Dam June 29.

From Seattle . . .

Two contracts in connection with Albeni Falls Dam in Idaho top the list of projects for which bids will be considered by the Seattle District. Figures were opened March 1 for construction of the spillway structures, powerhouse, cofferdam, and removal of spillway cofferdams and other appurtenant work at Albeni Falls, aggregating well over $3,000,000. Bids are scheduled for opening April 13 for supplying generators for the project, also in the three-million dollar bracket. Other large contracts include works to prevent erosion of Point Chehalis and south jetty at Grays Harbor and Chehalis River, for which bids are due June 7, and supplying tainter gates for Chief Joseph Dam, with bids to be opened June 12.

The lone civil works job costing over $100,000 scheduled by the Alaska District is for construction of dikes, channel rectification, and the raising of a bridge in Skagway.

All of the major projects are listed, together with bid dates and approximate costs, in a pamphlet prepared by the North Pacific Division office of the Corps of Engineers.

TIMBER tree nurseries are adding nearly 20,000,000 seedlings this year to the growing stock of Washington and Oregon forests. A survey just completed by American Forest Products Industries, Inc., shows eight major "tree factories" in the two states are turning out that many little trees this season to help nature restock idle timberlands for future crops. Last year the same nurseries—six in Washington and two in Oregon—distributed 16,237,500 trees.

Solving Trenching Troubles In Arizona Desert Sand

Dry sand, powdery and unworkable, made normal trenching operations impossible — After several alternative methods had been tried and discarded, a simple but ingenious solution was hit upon

RESIDENTS of Maricopa and Pima counties, Arizona, in the area just north and east of Tucson, will soon have a modern vitrified clay pipe sewer system—with little thought to the trenching troubles encountered during its construction.

The Arizona desert's rain-free climate proved a decided handicap to Mark Cockrill Contracting Co., Phoenix, which was awarded the contract to install over 26,000 ft. of clay pipe in the $1,250,000 sewerage program. Once the topsoil was removed in trenching, workmen encountered sand as fine as powdery dust.

Walls of the upper soil strata, Cockrill found, could easily be held in place with shoring planks and steel trenching jacks. But the sand below flowed into each new excavation like liquid. It undermined the solid soil formations above, making dangerous cave-ins inevitable. It leaked through every gap in the sheeting, spilling out and piling up faster than the diesel-powered trenchers could remove it.

"Headache" conferences

A hasty conference was called among Cockrill Co. engineers and the engineering firm of Hedman, Ferguson and Coloro, who had prepared plans and specifications for the sanitary sewer system. Representatives of the Pima County sewer district were also present. They decided, where possible, to widen the trench with a diesel-powered dragline.

A ¾-cu. yd. bucket was hitched to the dragline, "wallowing out" a V-shaped trench to required depth. The method proved workable in areas where trench widths did not have to be restricted.

But where narrow trenches became necessary, Buckeye ladder-type trenching machines were put to work. Side cutters widened the 26-in. trench an extra 12 inches. When the powdered sand was reached, steel piling was driven below the grade established for the clay pipe bed. Bulldozers then refilled the trench, and the trencher moved in to re-excavate, with its side cutters removed to allow the "stinger" to operate between the pilings.

The operator was successful in piloting his machine along the delicate course, but this method, too, failed. The sand was too fine, and would not stay in the buckets. As each bucketfull was lifted, the sand flowed away in streams.

It was decided that the sand would probably prove workable if enough water could be added to give it consistency. Tanker trucks were put in operation, hauling water from a distant source to pour onto the sand immediately in front of the trencher.

This pre-puddling solved the problem on a temporary basis, but proved too costly to carry out in the project's entirety.

Near the solution

A third attempt to moisten the sand was found effective for a short distance. A nearby rancher was persuaded to let the engineers pump water from his artesian well through the open trench. It flowed along, moistening the sand as the trencher progressed, and the damp sand clung readily to the buckets. But as the trench lengthened, the stream dwindled to a trickle. Sand in the open trench blotted it up.

Another engineering conference finally solved the problem and permitted the clay pipe to be laid without further incident.

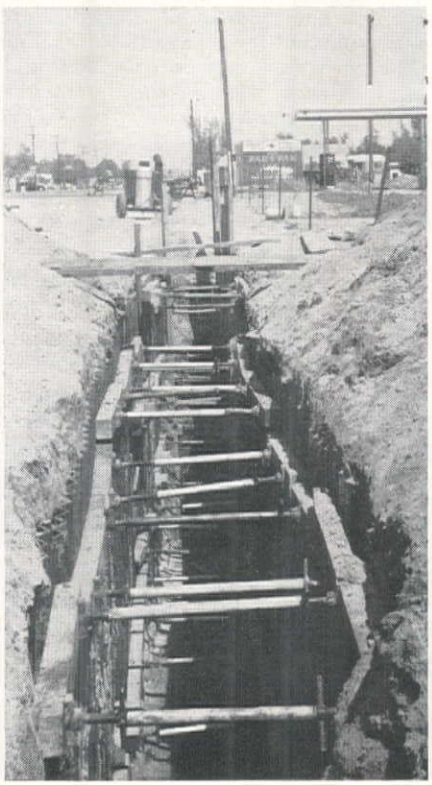
Workmen abandoned the trenching project and began to lay clay pipe in the partially-completed trench. They constructed a manhole at the beginning of the first section and laid pipe to the point where the trench had been abandoned.

Water was then pumped through the completed line, moistening the sand so trenching could continue.

As the trencher moved ahead, pipelaying crews worked close behind it. Water was pumped through the line at intervals, keeping the sand ahead moist and workable. The vitrified clay pipeline, installed to carry sewage, was found effective as a carrier of the water needed to complete the project.

Sizes of the clay pipe varied from 8 to 21 inches.

Sewage from the system will be directed to a new treatment plant, to be owned by the City of Tucson. The Sanitary District building the trunk line has a 10-year contract with the City of Tucson to use a portion of the capacity of the $1,000,000 treatment plant now being constructed.



CORRUGATED steel sheeting was driven below invert grade and supported by trench jacks as one attempt to stop the running sand. But this method was too costly for the entire project.

TOP—Where trench widths were not restricted, a dragline could wallow out a V-shaped trench to the required depth.

BOTTOM—When the problem was finally solved, trenching and installation of the clay sewer pipe proceeded simultaneously with no further delay.

HOW IT WAS DONE . . .

Concrete Buggy Competition Spurs Placing of Building Floor Slab

THE SETTING at Sacramento for a competitive demonstration by two manufacturers of concrete handling equipment. Another overall view of operation is on this month's front cover.

IN A COMPETITIVE demonstration staged by two manufacturers of concrete handling equipment, two men riding motor driven concrete carts replaced 10 men pushing the conventional "Georga Buggies" during the pouring of a portion of the basement floor slab for the 180,000-sq. ft. annex to the Public Works Building in Sacramento.

Scooting back and forth on an elevated runway the speedy concrete carts kept well ahead of an eight-man rough finishing crew throughout the short shift day, and on several occasions had to stop and wait for the crew to catch up.

The competitive demonstration was held for the benefit of Ray LaBrae, superintendent for Haas and Rothschild, San Francisco, contractor for the building. The carts used in the demonstration were the products of the Gar-Bro Manufacturing Co., and Whiteman Manufacturing Co., both of Los Angeles.

The runway for the carts was set up in the shape of a large "T" with the base at the edge of the excavation and the wings spreading out parallel with the line of pour. As the pouring progressed the top of the "T" was moved back to provide for another line of pour.

The runway was constructed of 5-ft. square panels of 1 x 6-in. lumber with 2 x 4-in. cross pieces, and set on short saw horses that held the runway approximately 18 in. above the grade of the excavation. The horses were constructed from 4 x 4-in. cross pieces with 2 x 4-in. legs attached on an angle and braced with a short piece of 1 x 4-in. material nailed close under the main piece.

In some instances a single leg of 4 x 4-in. material was used but proved unsatisfactory as legs were inclined to sink, causing dips to appear in the runway. The panels of the runway were stabilized with a 1-ft. piece of 1 x 1-in. material nailed on each side of the runway where the panels met.

Two men were used to remove the panels as the pouring progressed, thus keeping the end of the runway at the exact location where the concrete was being poured.

Concrete of 4-in. slump was delivered to the hopper on the job by transit-mix trucks.

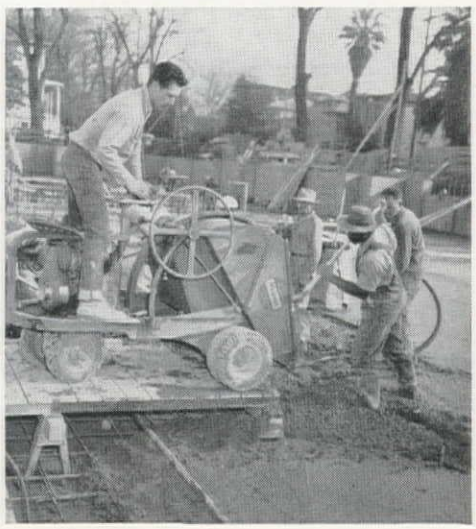
The carts would load from a double spout on this hopper at the edge of the excavation, turn and speed down the runway to where the rough finishing crew was working.

Due to the 4-in. slump in the concrete one man with a shovel was stationed at the dump spot to assist the slow moving mud out of the cart's hopper. The vibrator operator went to work on the con-

CART LOADS from hopper at edge of excavation. Wide platform provides waiting and turning area.

LOADED CART speeds down runway. Empty cart, at left, yields right of way and waits on siding.

CART DUMPS concrete from end of runway. Sections of runway were removed as the pour progressed.



crete as it dumped from the cart and worked side to side over the area covered by the dumped load.

Due to the use of the "T" runway a siding, consisting of two panels, was used on the stem of the "T" (see illustration) to permit an unloaded cart to pull out of the way of a loaded one enroute to the dump location. At the hopper five panels provided a platform where one could wait while one was being filled and also to give additional turning space.

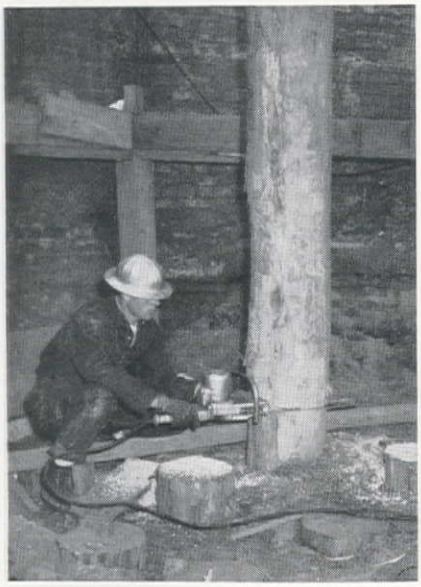
Representatives of the manufacturers staging the demonstration stated that for best results with the carts a circular route, from pick-up to dump and return, should be used instead of having the carts double back over the "T."

During the short shift 125 cu. yd. of concrete was poured, a production rate, according to the manufacturers' representatives, that is very low.

Electric Driven Chain Saw Speeds Pile Topping

TOPPING PILES after they were driven to the required bearing was a relatively easy job on the Ben C. Gerwick operation at the site of the new Cahill Building in San Francisco.

Instead of two men laboriously pulling on each end of a cross-cut saw to slowly cut off the piles at grade, one



ELECTRIC chain saw enables one man to top pile at a cutting rate of 1 in. per second.

man, equipped with an electrically driven chain saw, quickly and neatly topped the piles in a few seconds. Keeping well abreast of the driving operation the saw operator had ample time to perform other duties in connection with the pile driving operation.

The saw, a product of the Homelite Corporation, has a chain with saw teeth that travels at the speed of 1,200 ft. per min., which enables it to cut through piles at the rate of 1 in. per sec. Thus the actual cutting of a 14-in. pile was accomplished in roughly 14 seconds. A slightly longer period was required on piles cut to exact grade. It was no difficult task for the workman to carry the 27-lb. saw from pile to pile.

In addition to topping the piles at grade the chain saw also showed its advantage over a cross-cut when used to cut a pile that was splitting while being driven. One of the piles had split to about three feet from the top. The saw was called for and the operator, standing on the base of the driving rig, held the saw at shoulder height and quickly cut the pile off, about a foot below the lowest extremity of the split. The protective steel pile was replaced and driving was resumed. The entire operation took less than 25 seconds. As the pile was longer than needed the required bearing was reached with the shortened length.

Electricity for the saw was supplied by a lightweight gasoline-powered Homelite generator that produced 230-volt, 180-cycle 3-phase alternating current or 110-volt direct current. The plant, weighing 125 lb., could be easily moved about the job by two men. A 100-ft. cord enabled the saw to cover an area approximating 30,000 sq. ft. The generator, well protected against water that often is present in such excavations, also offered power to operate floodlights for night work and other electrical tools.

Driving Pressure Maintained Under Hard Conditions by Auxiliary Boiler

USE of an auxiliary boiler was required to maintain proper working pressure under hard driving conditions during a recent San Francisco pile driving operation of Ben C. Gerwick, Inc.

The Gerwick organization had contracted to drive 700 timber piles for the foundation of the new 185 x 124-ft. reinforced concrete Cahill building in downtown San Francisco. The piles, averaging between 35 and 40 ft. in length, were driven to an 8-blow-per-inch or approximately 70-ton bearing.

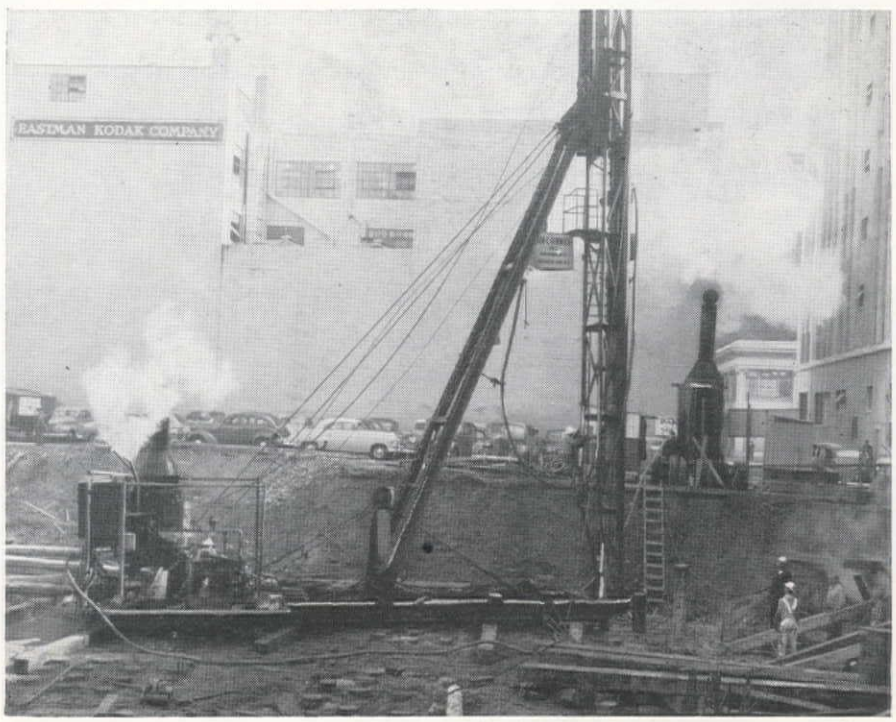
Due to hard driving conditions the portable steam-driven pile driver equipped with a No. 1 Vulcan Hammer could not sufficiently recover pressure between piles. When the timber pile was driven about one-half of the way pressure would decrease from 120 psi., needed to drive the piles to the required bearing, to 80 psi.

Rather than exchange the rig for a larger one that could maintain the proper pressure or recover sufficiently between piles, a portable boiler mounted on rubber tires was installed on the bank of the excavation and steam piped from it to the driving rig.

The auxiliary boiler, connected to the main rig by a flexible hose, supplied 125-psi. pressure, enabling proper pressure to be maintained at the hammer. Driving averaged 30 piles per day.

Due to the fact that the pile driver used is the largest that can be mounted on tires and made portable under the California law, the Gerwick organization believes that use of it and the auxiliary was less expensive in the long run than bringing in a large rig in sections and erecting it for the project and dismantling it when the job was completed. The only additional personnel required was the fireman for the auxiliary boiler. William M. Goss was superintendent of the operation with Bill Ferraris filling the post of pile driving foreman.

TO MEET hard driving conditions Ben C. Gerwick Inc., moved the auxiliary boiler shown at right to the edge of the excavation and piped steam to help pile driving rig maintain adequate pressure.



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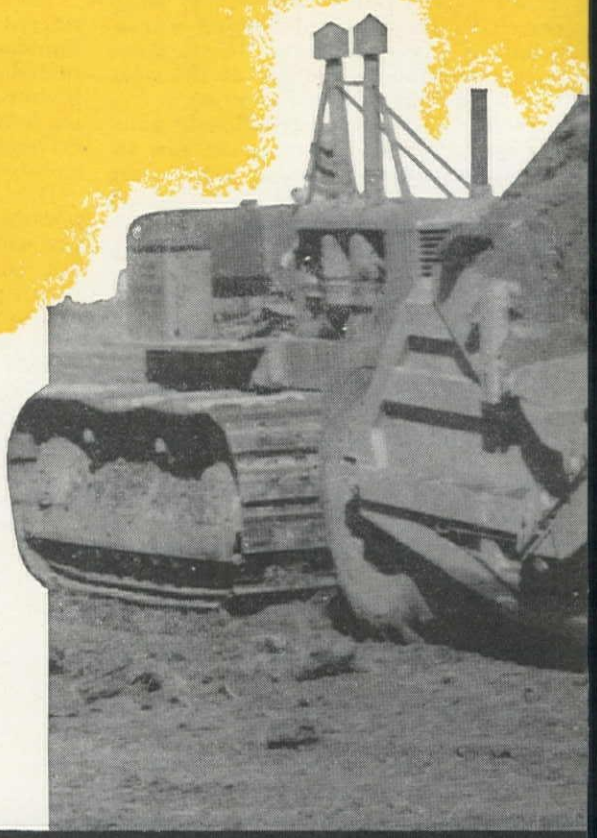
DEWEY SPENCER, of the Spencer Construction Co., Carrollton, Texas, bought his first two TS-300 Motor Scrapers in 1948, and 6 months later added a third unit to his fleet. In three years, the two oldest units have had *only one major* overhaul, and the newest machine has had *no overhaul* to date. These TS-300's have been used on 6 big jobs and have moved an estimated 1,500,000 yards of material.



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ESTIMATOR for Williams and Burrows worked out comparative costs on type of scaffoldings based on the firm's experience while constructing these apartment buildings in San Francisco.

Costs Compared for Wood and Metal Scaffolding on Low Building Jobs

METAL SCAFFOLDING long ago took over the field in high building construction, but wood scaffolding has continued to predominate in home and low building construction on the theory that it is more economical.

Chief Estimator George Meyer of Williams and Burrows, Burlingame, Calif., a firm that has used Safway steel scaffolding for both large and small construction for the past two years, comes up with some cost comparison figures that put considerable dent in this theory.

Originally, the contractors rented the scaffolding from the Beatty Safway Scaffold Company. Then, a year ago, they bought a substantial amount of the standard frame scaffold and, according to Meyer, "the scaffolding paid for itself in the first two jobs."

A Williams and Burrows apartment development now under construction in the Kirkham Heights district of San Francisco is a case at point. There are eleven two- and three-story buildings in the development, covering an area of 75,000 sq. ft. Meyer estimates the comparative cost of the use of their own Safway steel scaffolding vs. a similar amount of wood scaffolding as follows:

	Steel	Wood
Cost of material	$13,000	$6,500
Labor cost of erection and dismantling	817	2,500
Transportation of material	100	.....
	$13,917	$9,000
Salvage value of material	12,900	3,200
Total cost of use of material on job	**$ 1,017**	**$5,800**

According to these figures, savings on the job through the use of steel scaffold amounts to $4,783. Three such jobs would more than pay the original investment in the steel scaffold and from there on out this substantial amount can be counted as net savings.

The Beatty Company, which sells, rents or rents-and-constructs the Safway steel scaffolding, gives a figure of $4,000 as the cost of renting and constructing scaffolding equal to the amount of construction figured above . . . still a substantial saving.

"My estimate of labor costs for erection of wood scaffolding is average for construction of this size," says Meyer. "Actually, because of the steeply sloping terrain on this site, costs of wooden scaffolding would be considerably higher. Upright members would have to be cut individually to size, whereas the steel scaffolding members can be adjusted to any height in a matter of seconds with adjusting screws.

"There is no trick to the erection of the steel scaffolding. Our men got the hang of it quickly and after the first job were putting it up in one-fourth the time that would have been required for wood. The prefabricated end frames of this particular product speed erection about 25% over other types of metal scaffolding.

"We have no accurate check, but we think it is safe to say that the steel scaffolding also speeds the work of carpenters, masons, painters—all the craftsmen who use the scaffolding. The increased safety of the pre-tested steel is an important psychological factor, and the strength of the steel members allows more height between platform levels, thus providing more comfortable working conditions."

Heliarc Spot-Welding Solves Problem of Pipe Protection

HELIARC spot-welding solved the problem of how to tack caps on the ends of pipe to protect those ends during shipment. An order for 10,000 tons of 12¾-in. diameter pipe was received by Kaiser Steel Corporation, Fontana, Calif. The company for whom the pipe was fabricated furnished a cap with a 1-in. lip to be put on each end of the pipe at the mill for protection in handling and shipping. Although original specifications called for a tack-weld, this proved to be impractical, as good tack-welds could not be made consistently between a 0.040-in. cap and a 0.250-in. wall pipe.

The Heliarc HW-8 spot-welding torch, marketed by Linde Air Products Company, a Division of Union Carbide and Carbon Corporation, was recommended for this job. A special clamping device was designed to press the cap tight to the pipe where the three spot welds were made so as to eliminate any difficulties due to caps not fitting the pipe closely enough for a metal-to-metal contact.

SPECIAL CAP for protection in shipment being spot-welded to length of 12¾-in. pipe at Kaiser Steel Corp., Fontana, Calif.

Use of a single spot-welding torch kept up with an eight hour a day mill production and also caught up with a backlog of 2,000 lengths of pipe in stock at the time the HW-8 torch was introduced. Rejects due to bad spot welds were kept to a minimum.

A huge engineering project is now underway in Australia, which will eventually employ about 15,000 men, cost about $448,000,000 and roughly double the nation's power and irrigation storages. The total project, which might take 25 years to complete, is known as the Snowy Mountains Hydroelectric scheme and will include the construction of dams, tunnels and power houses. The Australian government proposes very shortly to call for bids on parts of the projects, and some are expected to come from the United States.

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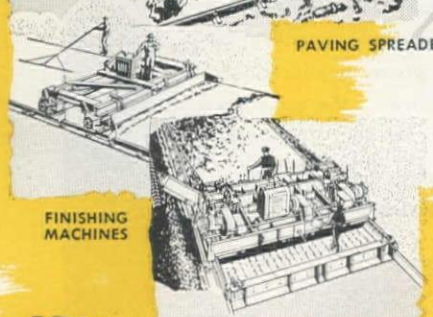
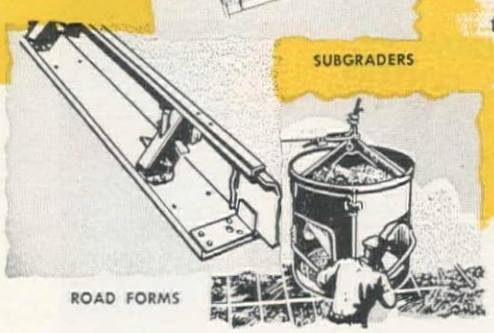


FINISHING MACHINES



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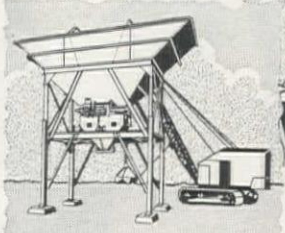

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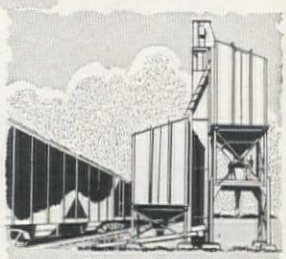

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CONSTRUCTION DESIGN CHART

By
JAMES R. GRIFFITH
Dean of Engineering
University of Portland
Portland, Ore.

CXXX... Flexural Stress in Iron Pipe

WHEN SUPPORTING iron pipe by hangers or brackets, the maximum spacing of the supports is controlled by one of two factors:

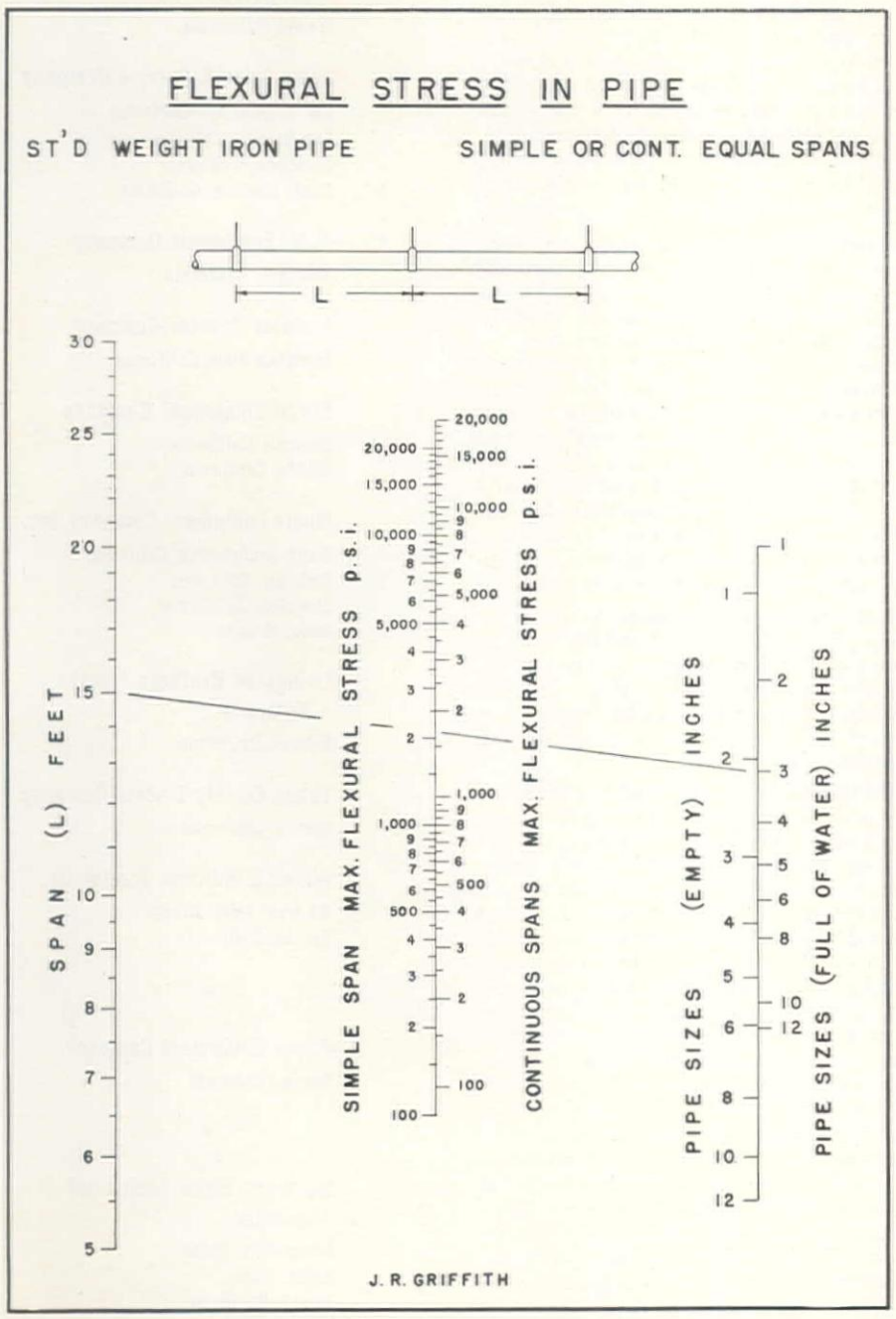
(1) Flexural stress
(2) Deflection.

Although deflection is more often the controlling factor, discussion of that subject will be deferred until the September 1951 issue.

The accompanying chart has been designed to give the maximum flexural stress in standard weight iron pipe. It is applicable for either simple spans or equal continuous spans; it may also be used for empty pipes or when full of water. A solution line has been drawn on the chart for the assumed conditions:

3-in. pipe, full of water.
15-ft. span.

The central scale indicates that for a simple span, a maximum flexural stress of 2,100 psi. will be developed. The corresponding scale likewise indicates that for continuous equal spans of 15 ft., the maximum flexural stress will be 1,700 psi.



In order to check the above values, we have:

From standard tables

3-in. standard weight iron pipe
Outside diameter = 3.5 in.
Moment of inertia = 3.017 in.^{4}
Section Modulus = 1.725 in.^{3}
Weight of pipe alone = 7.62 lb. per ft.
Weight of water contents = 3.06
Total weight per ft. = 10.68 lb.

Bending moments

$$\text{Simple span, } M = \frac{w L^2}{8}$$

$$= \frac{10.68 \times 15^2 \times 12}{8} = 3{,}600 \text{ in. lbs.}$$

$$\text{Contin. spans, } M = \frac{w L^2}{10}$$

$$= \frac{8 \times 3{,}600}{10} = 2{,}880 \text{ in. lbs.}$$

Maximum flexural stress

$$\text{Simple span, } f = \frac{M}{S} = \frac{3{,}600}{1.725}$$

$$= 2{,}100 \text{ psi.}$$

$$\text{Contin. spans, } f = \frac{M}{S} = \frac{2{,}880}{1.725}$$

$$= 1{,}670 \text{ psi.}$$

The chart indicates that for normal pipe spans, the flexural stresses are low. As a consequence, the graduations on the stress scales of the accompanying chart are more for a rough check. As previously indicated, the subject of deflections will be discussed in a later chart.

Quick Removal of Sunken Hospital Ship Ordered

THE San Francisco, California branch of the U. S. Army Corps of Engineers has been requested to find the most practical method of removing the wreckage of the U. S. Navy hospital ship "Benevolence" from waters near the Golden Gate entrance to San Francisco Harbor. The vessel, which sank in a collision with a freighter last August, is a menace to navigation and of no use as salvage. Washington has asked that the investigation be made and that preliminary negotiations with contractors, on securing flotation for towing the wreck to deep water for sinking, or depositing it in a hole to be dug by government plant and labor be instituted.

AGC National Convention Considers Problems Due to Defense Emergency

Shortages of materials and construction equipment promise to be the contractor's biggest headaches

PLANNING how the construction industry can best serve the nation during the emergency was the principal business of the 32nd annual convention of The Associated General Contractors of America (at the Hotel Statler, Boston, Mass., Feb. 26-March 1). More than 1,000 representatives of the 5,800 member construction firms of AGC heard addresses from speakers in industry, education and government, discussed among themselves the problems they are encountering, and made recommendations for such action as will enable the industry to execute its work more effectively.

Keynoting the convention on the opening day was the speech by retiring president Walter L. Couse of Detroit. He warned the construction industry not to accept new work without first making sure of the availability of all materials required for the job, and the timing of their delivery. Couse said shortages which developed last year in spite of a big increase in the manufacture of construction materials and equipment, and a larger supply of all basic new materials, minerals, lumber and cements, have been severely aggravated this year by the tremendous defense program. The AGC head said the migration of workers and the denuding of some areas of construction work would be due to the nature of the defense construction program. He did not elaborate on this point.

Probably the most important speech from the point of view of the individual contractor's day-to-day operations was presented on the second day of the convention when Ralph K. Stiles, president of the Construction Industry Manufacturers Association, carefully analyzed the outlook for construction equipment. Stiles revealed that the Association had recently completed an exhaustive survey of the industry's requirements equipment-wise to be used by the National Production Authority in determining what is needed for the construction industry's overall program.

He listed the findings of this "SOS call" as follows:

Motor Graders—Average production per year of all sizes, 8,000. Estimated military requirements, 6,000 this year, and about 3,500 to 4,000 per year afterward. The number available for civilian needs should be sizable but far under the level of 1950.

Loaders—Availability for essential construction as seen at the present time should be fairly reasonable in 1951.

Rollers and Compactors—Principal problem is that of securing steel and other scarce materials used in producing the finished product. All manufacturers have more civilian orders on their books for machines than they can possibly secure material to build. Reasonable to assume that these manufacturers could supply military needs with 50% of their capacity, leaving 50% for civilian use.

Tractors—Current heavy demand for crawler tractors by civilian users will continue. Expected recognition by the government of the essentiality of tractors will allow manufacturers to produce at capacity, making available to civilians well over half the industry's output of crawler tractors.

Scrapers—Overall supply problem aggravated by the inability of manufacturers to secure raw materials, such as plate and structural stock. Small proportion of scrapers available for civilian requirements will be directed to those operations related to defense program such as iron ore, copper, bauxite, etc. Production capacity not the basic problem; more units could be produced if more materials could be made available.

Power Cranes and Shovels—Assuming ever-increasing amounts of materials and components and making allowance for known and estimated military requirements and export shipments, domestic users other than government agencies will have available between 4,000 and 5,000 units from ⅜ to 2½-cu. yd. capacity including rubber-tired equipment during 1951 and 1952, compared with between 5,500 and 6,000 units last year. In sizes larger than 2½-cu. yd. capacity, it is expected that production will reach approximately 30% to 50% above the output for last year.

Bituminous Equipment—Will be in short supply because of armed services purchases and shortage of steel and all components. For some time the contractor will have to have his equipment before he can commit himself to any defense job.

Off-highway Trucks and Trailers—Industry has capacity to handle three times the maximum volume attained during World War II. Number available for industry and civil construction after military requirements are met should represent a volume comparable to normal years provided maximum manufacturing facilities can be utilized, with sufficient materials and component parts made available for such utilization.

Grant Bloodgood, chief construction engineer of the Bureau of Reclamation, told a luncheon meeting audience of heavy construction and railroad contractors that government reclamation projects for 1950 hit an all-time high but a probable 25% curtailment in reclamation construction was in store. Bloodgood said he believed that power development would hold top place in the

Continued on page 107

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MAINTENANCE—*theme of 4th Annual*

JUNE HIGHWAYS ISSUE

of WESTERN CONSTRUCTION

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AGC Convention

. . . Continued from page 104

1952 program of the USBR, but that material shortages, priority demands, manpower limitations and rising prices will continue to delay completion of projects and increase their cost.

Problems and policies of the Corps of Engineers in handling the tremendous military construction program necessitated by the defense emergency were reviewed by Major General Lewis A. Pick, Chief of Engineers. His remarks are reviewed in more detail on page 93 of this issue.

Glenway W. Maxon, president of the Maxon Construction Co., Dayton, Ohio, was installed as new president of National AGC at the close of the convention. He succeeds Walter L. Couse. The new vice president, slated to be president in 1952, is a Westerner, Arthur S. Horner, highway and heavy construction contractor and president of Horner Construction Co., Denver, Colo.

ARTHUR S. HORNER, Denver contractor, is new vice president of National AGC and slated to be president in 1952.

Newly-elected directors for the three AGC Western districts to serve a period of three years are as follows:

District 1—Montana: Dan J. Mooney (Building), Cahill-Mooney Construction Co., Butte; **Washington:** James W. Cawdrey (Building), Cawdrey & Vemo, Seattle; **Oregon:** Ray H. Northcutt (Heavy & R.R.), Guy F. Atkinson Co., Portland; J. R. Wininger (Highway), Warren Northwest Inc., Portland; **Alaska:** R. H. Stock (Heavy & R.R.), Stock & Grove Inc., Anchorage.

District 2—California: J. A. Thompson (Highway), J. A. Thompson and Son, Inglewood; **Nevada:** E. J. Maupin, Jr. (Highway), Dodge Construction Inc., Fallon.

District 3—Wyoming: Homer A. Scott (Highway), Peter Kiewit Sons' Co., Sheridan; **New Mexico:** Charles H. Lembke (Building), Lembke Construction Co., Albuquerque.

NEWS OF WESTERN CONSTRUCTION APRIL, 1951

Construction Speeded at Dugway Proving Grounds

THE PRESENT emergency has speeded construction plans at the Dugway Proving Grounds in Utah. The entire military project, under direction of Corps of Engineers' Salt Lake City office, is now expected to total about $27,000,000. In addition to the $12,000,000 bid mark already reached on the various construction projects an additional $5,000,000 will be advertised on April 23. Total employment on the project should be about 3,500.

Davis Dam Reservoir Fills, Power Plant in Operation

THE COLORADO RIVER below Hoover Dam will become a full-fledged reservoir around the middle of May when Lake Mohave above Davis Dam backs up to the Hoover power plant tailrace in Black Canyon. The reservoir, which started forming a little more than a year ago, is expected to reach an elevation of 643 ft. above sea level May 15. At this elevation the lake will extend 67 mi. upstream to Hoover Dam and will contain approximately 1,700,000 ac. ft. After the 643-ft. elevation has been reached, it is anticipated that only small fluctuations in the reservoir's level will occur during the following several months.

Water began backing up in Lake Mohave in January 1950 when concrete stop logs shut off the spillway openings at Davis Dam through which the water had been diverted since July 1948. The stop-logging operation, referred to as the second stage diversion, raised the water about 46 ft. at the dam. At this level the water flowed through radial gate outlets, one on each side of the spillway, and back into the river below the dam. The reservoir remained at an elevation approximating 570 ft. throughout the spring and summer of 1950 while the concrete crests of the spillway were completed. Filling of the reservoir has been most rapid since last September.

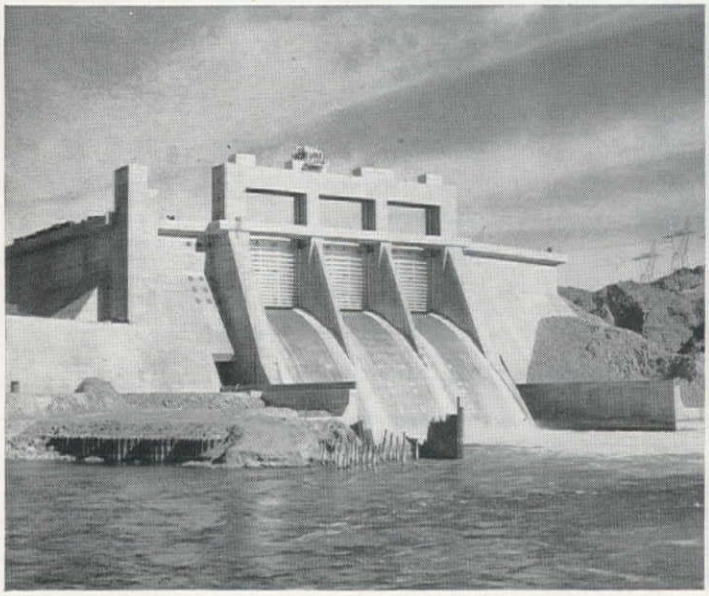
Water is now flowing over the completed Davis Dam spillway and is also being released through the first of the Davis power plant's five 45,000-kw. hydroelectric generating units. The spillway gates will be closed this spring when sufficient generating units have been installed to permit utilizing the full water release for generation of electrical energy. From then on it is expected that all of the water released from Lake Mohave will be flowing through the power plant turbines, all of which are scheduled to be in operation by summer.

The Davis Dam project, including the dam embankment, spillway, and power plant structures and some 1,500 miles of transmission lines, will be substantially completed this year, according to E. A. Moritz, Regional Director for the Bureau of Reclamation.

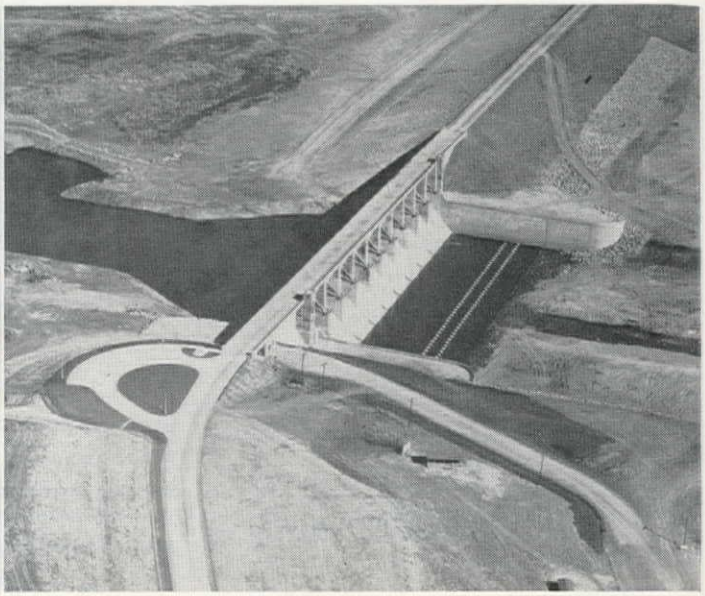
$1,000,000 Access Road Planned to Utah Uranium

ATOMIC Energy Commission uranium developments in southwestern Utah have prompted approval of a $1,000,000 access road construction plan by the Utah State Road Commission following an over-all preliminary survey by the Bureau of Public Roads. A new network of roads near uranium deposits would facilitate the trucking-out of the valuable ore. The commission agreed to furnish about 10% of the funds while the federal government will provide the rest. Included in the project is the construction of 14 mi. of road near Blanding and Mexican Hat on Utah Route 47. A 220-ft. bridge span and improvement of the present roads in the area are covered in the plan. Emery, Garfield and Wayne counties are the target for the second phase of the construction. Ten miles of new road, improvement to access roads,

DAVIS DAM RESERVOIR FILLS—Water is now flowing over the recently-completed spillway at Davis Dam on the Colorado River and the reservoir will soon be filled and backed up its full 67-mi. length upstream to Hoover Dam (see item above). Five generators are going on the line to produce about a billion kilowatt-hours of energy annually. Utah Construction Co. was prime contractor for the Bureau of Reclamation structure.



HULAH DAM COMPLETE—After inspection of Hulah Dam on the Caney River near Bartlesville, Okla., the Corps of Engineers has accepted it as essentially completed from Mittry Brothers Construction Co., Los Angeles. The $6,500,000 dam is rolled-earthfill type, 4,728 ft. long and 97 ft. above stream bed. Ten 40-ft. wide gates control spillway discharges. The project is a unit of a reservoir system for the Arkansas River Basin.



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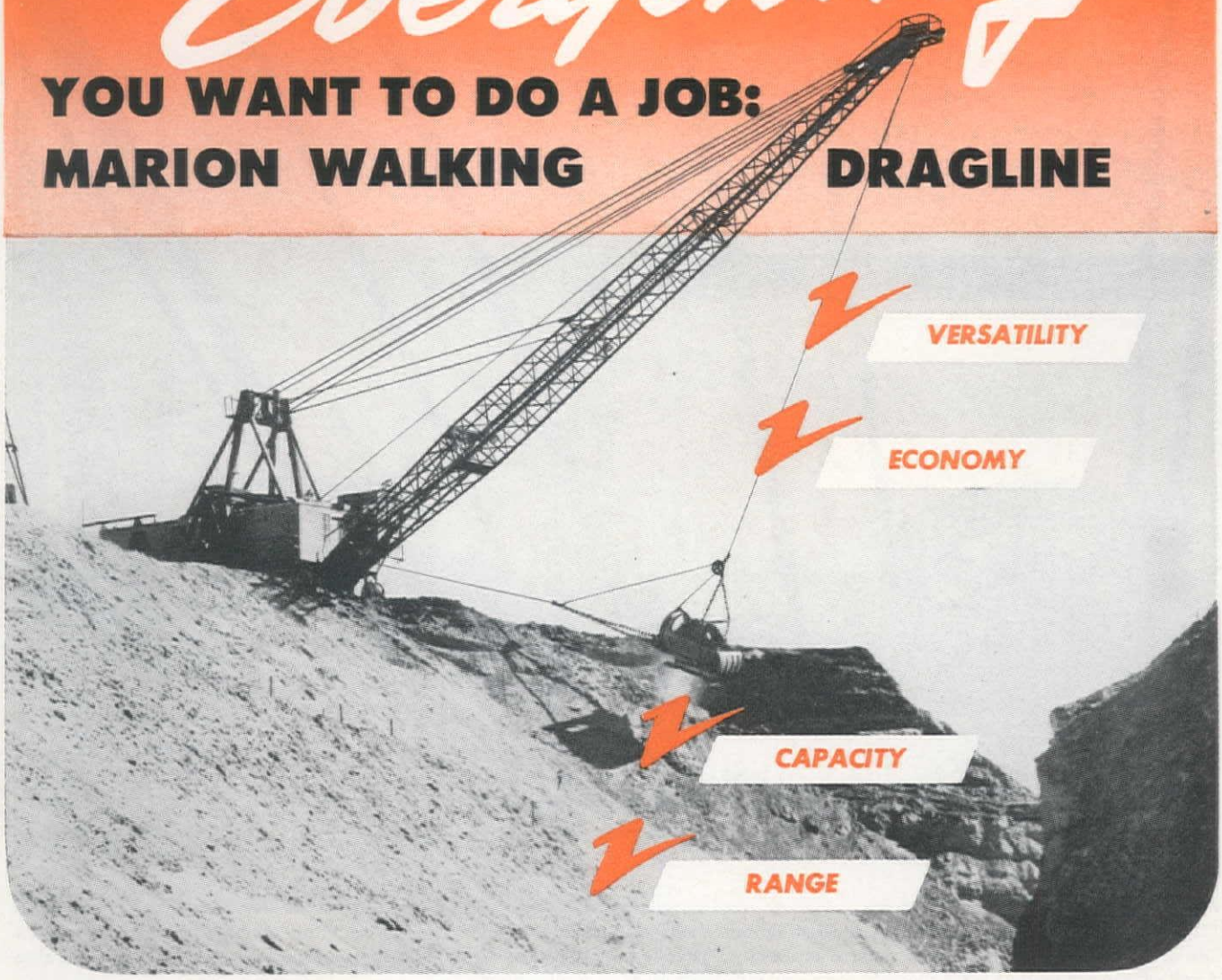

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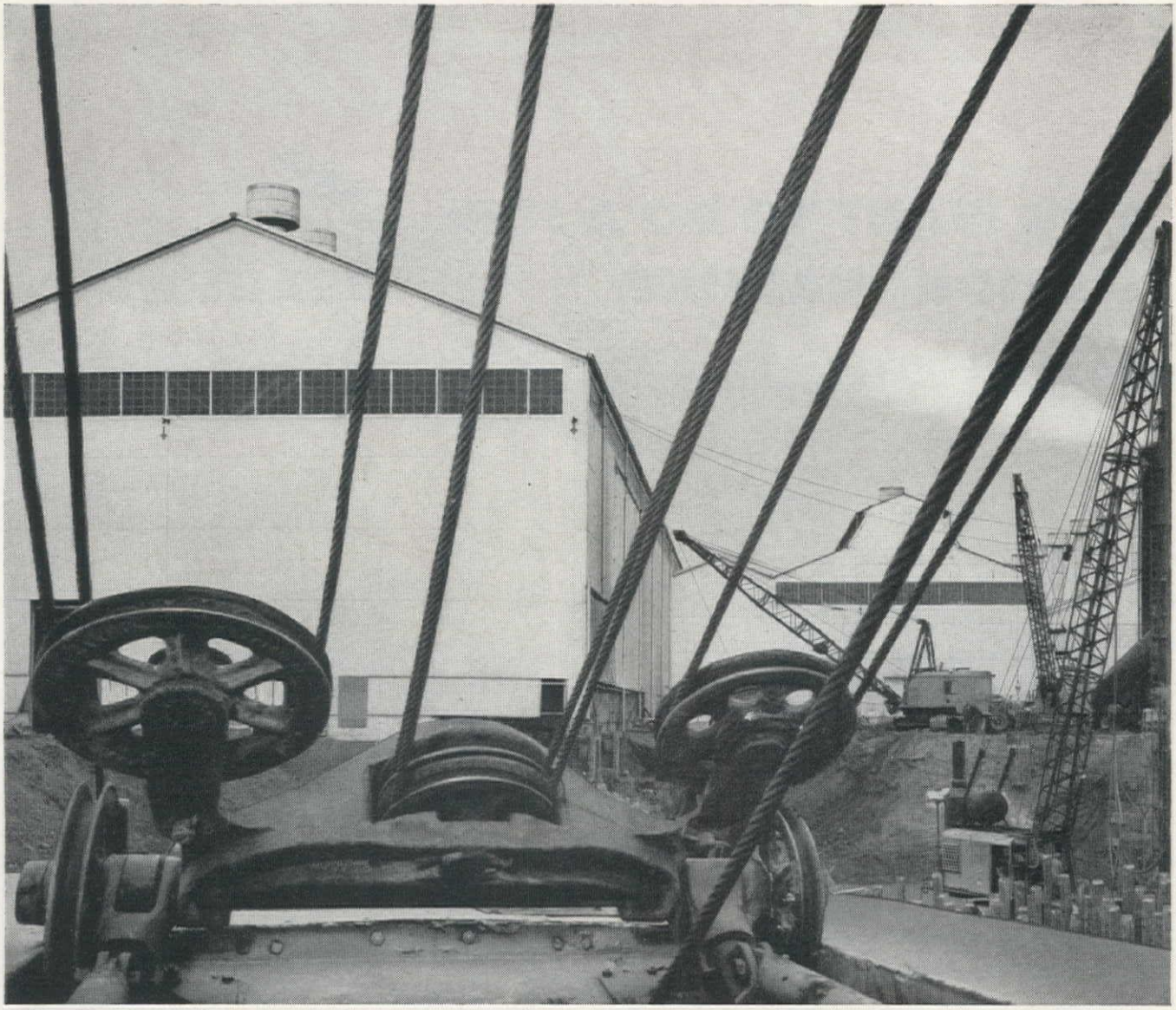

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and a 150-ft. bridge and drainage project are to be undertaken.

Last stages of the construction will be in the area west of Blanding on Utah Route 95. Application of spot surfacing is necessary in this area along with new construction totaling about 30 mi.

Lone Bid Received for Ross Dam Power Plant

ONE BID was received for the construction of the Ross Dam power plant. Guy F. Atkinson Co., Seattle, Wash., in association with A. Teichert & Son, Inc., Bressi & Bevanda Constructors and Charles L. Harney, Inc., submitted the bid of approximately $14,500,000. The offer was referred to the Seattle Board of Public Works for consideration.

The project includes the construction of a reinforced-concrete and steel frame power house, 307 ft. long by 76 ft. wide and 64 ft. high, below the dam on the left bank of the Diablo Reservoir. Plate-steel penstock liners and spillway gates must be installed, powerhouse appurtenant works must be constructed and alterations are necessary on a power tunnel already in existence.

Ultimately four 100,000-kva. hydroelectric generators will be in operation. Three of these are already in order and should be installed and operating in 1953. The fourth generator will be added at a later date.

Difficult Work Complete at Keyhole Dam in Wyoming

WORK on the Bureau of Reclamation's Keyhole Dam on the Belle Fourche River near Moorcroft, Wyo., is more than one-third completed, according to K. F. Vernon, director of the Bureau's Region 6. The contracting firm, Knisley-Moore Company of Douglas, Wyo., working under terms of a $1,667,724.50 contract awarded June 8, 1950, has continued with operations at the dam throughout the winter and now expects to complete construction of the 3,420-ft. long earthfill dam by next December 15, beating the original completion date by almost eight months.

The dam, which will be about 118 ft. high above the original stream bed, is being constructed to provide supplemental irrigation water for the existing Belle Fourche Reclamation Project in western South Dakota and to provide for the control of floods and silt. The reservoir formed by the dam will have a storage capacity of 340,000 ac. ft.

F. E. Goehring, Bureau construction engineer in charge of the work on Keyhole Dam, reported that the "most difficult and troublesome work" on the dam has been completed and that work remaining is of a "more or less routine nature and should progress without incident."

Goehring said that the contractor has completed excavation for the 653-ft. long diversion and outlet tunnel and the gate chamber and access shaft. Drilling of the tunnel required the removal of 3,863 cu. yd. of sandstone rock by tunneling methods. The contractor has stripped undesirable materials from the area to be occupied by the dam and has excavated the cut-off trench.

The excavation and backfilling of the cutoff trench in the river bottom was termed by Goehring as the "most important and perhaps the most difficult phase of the contractor's work." In order to reach bedrock for the foundation of the dam, the contractor excavated to a depth of about 56 ft. below the normal bottom of the river channel. Before selected materials, which serve as a cutoff to prevent water percolation through the dam structure, could be backfilled into the trench, the entire surface of the excavated area had to be cleaned of all unsatisfactory materials.

Excavation of the cut-off trench to bedrock required the removal of 146,780 cu. yd. of material. An additional 13,380 cu. yd. of earth was removed for the concrete spillway section, which will be on the right wing dike section of the dam. The contractor stripped 83,180 cu. yd. of undesirable earth from those areas from which he will obtain selected earthen material for construction of the dam.

The contractor has placed 138,000 cu. yd. of material in the dam so far, which is about 11% of the total amount of earth material that will be required for the dam's construction.

Work is advancing steadily and is about 75% completed on the lining of the diversion and outlet tunnel as of early in March.

WORK ROLLING FOR 5-MILE LONG EARTH DAM ON THE RIO GRANDE

CONSTRUCTION started in January on the $50,000,000 Falcon Dam project 75 mi. south of Laredo, Texas. First yardage of a total 30,000,000 cu. yd. required for the 26,294-ft. long rolled-earthfill dam is being placed under a $7,801,064 contract awarded to a joint venture of seven contractors with C. F. Lytle Co. as sponsor and Philip Royer as general superintendent. In the view above, two of five International TD-24's used to pull 40,000-lb. tamping rollers are shown at work on the eastern half of the dam on the American side of the Rio Grande. The big irrigation and hydroelectric project is a cooperative enterprise of the United States and Mexico. Completion is scheduled for 1953.

Corps of Engineers' Largest Contract

BIDS for one of the largest contracts ever awarded by the Corps of Engineers, the completion of McNary Dam construction, are being opened April 12. It is anticipated that some $60,000,000 will be involved and this contract will bring the dam completion date to early in 1954.

Early in March a pre-bid conference was held to fully acquaint interested contractors with the tremendous problems involved in the final stages of construction on the huge project. Charles J. Monahan, geologist of the Walla Walla district, told approximately 100 contractors representatives assembled, that approximately 100,000,000 cu. yd. of fill will be necessary to complete the earth work and the abutment of the dam. Tremendous amounts of concrete and aggregate are necessary to complete the spillway, and human considerations such as housing problems for workers were brought before the McNary Dam contractors group.

Questions were answered by a battery of district personnel who are thoroughly familiar with the tightness of the schedule involved in order to put power on the line by two units with 70,000 kw. each at the end of 1953.

Application for Bridge Across North S. F. Bay

APPLICATION has been made to the Department of the Army by the State of California for permission to construct a bridge across the northerly part of San Francisco Bay between Castro Point at Richmond, Calif., and Point San Quentin on the Marin County shore about 2¾ mi. southeasterly of San Rafael, Calif.

Following approximately the same route now plied by the Richmond-San Rafael ferry, the portion of the bridge over the main channel near the center of the bay would be a cantilever truss, with horizontal clearances of 1,000 ft. for the central span and 480 ft. for the adjoining side spans, measured at right angles to the channel. The minimum vertical clearances above mean high water would be 185 ft. for the central span, decreasing to 168 ft. for the adjoining side spans.

This application supersedes a previous application for approval of plans of a bridge to have been located between Point San Pablo, the Marin Island and the Marin County shore.

Road Builders' Clinic at Washington State College

THE AMERICAN Road Builders' Association, Student Chapter of Washington State College, with the help and cooperation of the Institute of Technology and the Asphalt Institute, will hold its "Second Annual Road Builders Clinic" April 12 and 13 in Pullman, Wash. Theme of the Clinic this year is "The Use of Bituminous Materials in Connection with the Design and Construction of Mining and Logging Roads, Streets and Highways." A number of excellent speakers have been secured among whom are prominent members of the Asphalt Institute such as Duane Gagle, Research Engineer of Phillips Oil Co. of Bartlettsville, Okla., and J. C. Dalton, Asphalt Engineer for Shell Oil Co. of Portland, Ore. Four schools: University of Washington, Oregon State College, University of Idaho, and The State College of Washington, will be represented at the Clinic.

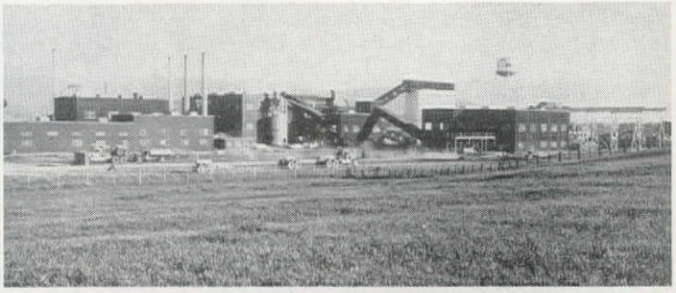
Libby Dam Project Approved at Hearing

CONSTRUCTION of Libby Dam on the Kootenai River in the Northwest gained the unanimous approval of witnesses before the International Joint Commission (composed of representatives from the U. S. and Canada).

Testimony was given by experts in dam construction from government and private experience. Actually the site of the proposed dam is at Jennings, Mont., up the river from Libby. It is over 100 mi. upstream from the International line at Porthill, Ida.

All witnesses concurred that the pool level be 2,459 ft. above sea level, backing water up about 40 mi. into Canadian territory.

MASONITE OPENS BIG NEW HARDBOARD PLANT AT UKIAH, CALIFORNIA



A SPRAWLING plant occupying 10 buildings on a 116-acre site has been completed by Masonite Corp. at Ukiah in the logging country of Northern California for the manufacture of the firm's diversified line of pressed wood products. Largest building in view at top is the main factory, 1,018 ft. long and 280 ft. wide. Directors making their first visit to the plant, bottom. Redwood and fir logs are trucked to the plant over a 35-mi. private road designed to withstand gross loads exceeding 200,000 pounds (see *Western Construction*, June 1950, page 79).

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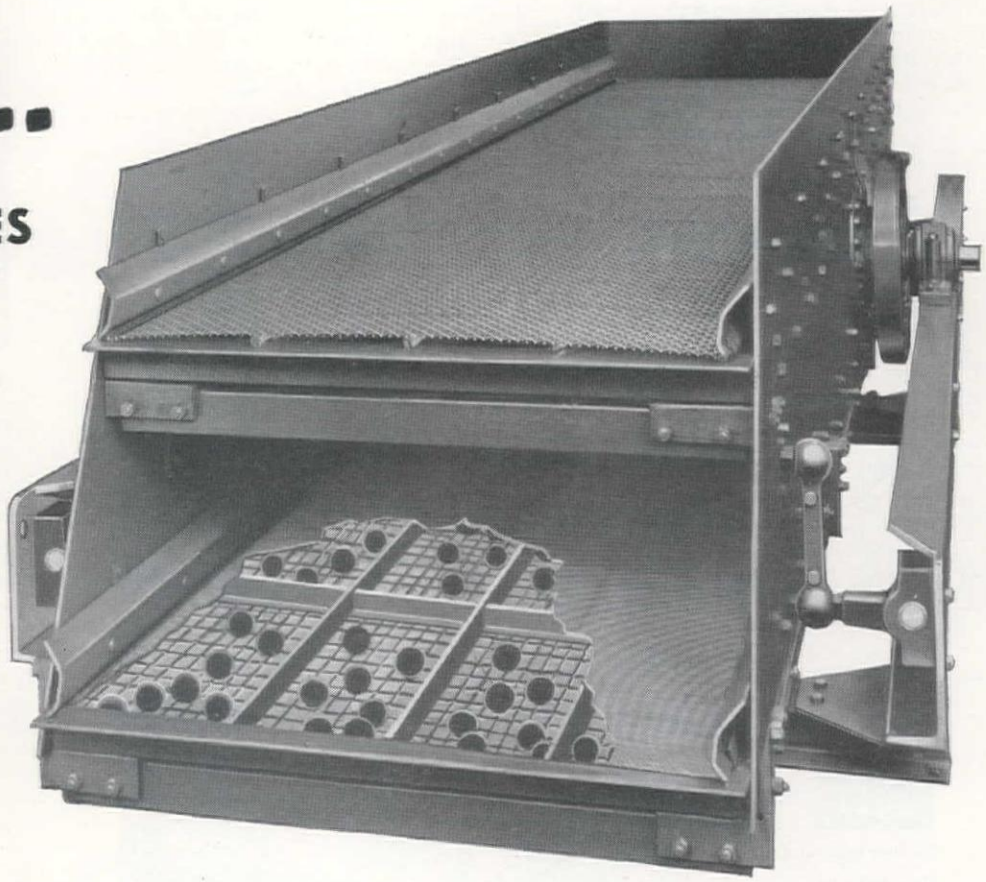

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NEWS IN BRIEF

New Cableway Speeds Pine Flat Job

NEWLY-INSTALLED construction equipment is helping to speed construction of Pine Flat Dam on the Kings River in California. The $24,000,000 concrete dam, when complete, will be 440 ft. high, contain 2,500,000 cu. yd. of concrete. About 80,000 cu. yd. of concrete is already in place.

Unlike last year's weather trouble, the project has withstood the current rains and the installation of a high-speed cableway is making it possible to double the amount of concrete poured during each shift. At present the structure has risen 40 ft. above the river channel.

Construction is now on a day-and-night basis during a 5½-day week. Nearly 600 men are at work on the project.

Bond Issue Approved for Highways

THE STATE Legislature of Washington approved a $65,000,000 highway bond issue and sent it on its way to Governor Langlie for signature. After an hour of debate the measure passed 27 to 17 in the senate. Its provisions would mean $49,000,000 for improvements on U. S. 99 and $16,000,000 for work on highway for Snoqualmie pass, Columbia Basin roads and the Pasco-Kennewick bridge project. A proposal to make Agate Pass bridge toll free went along with the measure.

BLASTING BASALT—Excavating approach channel and headworks at O'Sullivan Dam on the Columbia Basin Project in Washington, Scheumann and Johnson uses 9 by 9-ft. hole pattern, drilling ninety 20-ft. holes per round to blast through basalt. Unsprung holes are loaded straight with 1,750 lb. of 49% dynamite supplied by Pacific Powder Co. Fragmentation is excellent with virtually no overbreak.

New Mexico Wants License Board

A STATE construction codes board has been proposed in the New Mexico State senate. The measure was introduced by Senator James Brewster (D-Las Cruces) as a possible solution to the criticism aimed at the contractors, plumbers and electricians licensing boards now in existence.

Los Angeles Sewer Bond Issue

BOND ISSUES totaling $35,500,000 go to Los Angeles, Calif., voters at the May 29 municipal elections. One bond is for a $21,000,000 sewer program, while the other would support a $14,500,000 airport expansion program. Great expansion in the Los Angeles area makes the sewer project necessary, according to the Board of Public Works, and the war emergency coupled with civil aviation increases make airport expansion advisable.

Alaska Thaws Liquefy Highways

THE GREAT spring thaw brings many problems to Alaskan highways, since the surfacing, no matter how strong, has a good deal of its base in a semiliquid state. To combat this condition the Alaska Road Commission last year instituted a system of controlled traffic on the highways, which proved very successful. This year the same efforts will be made to limit travel on highways where heavy loads would bring damag-

ing cracks and sags. The commission again hopes to enlist the aid of press and radio facilities and trucking firms in Alaska and the Northwest so that Alaska's ever increasing network of roads can be kept in good condition for travel and industry.

Concrete Lining for Arizona Tunnel

PLANS for completion of the Queen Creek tunnel on the Superior-Miami highway in Arizona are being prepared. Because of the hazards of falling stones to fast-moving automobiles the 1,200-ft. tunnel, recently holed through, will require concrete lining. Bids will be called for this part of the construction soon along with bids for paving and installing interior lighting.

Oregon Plans Highway Budget

THE OREGON State House Ways and Means Committee approved an expanded budget for the state highway commission for 1951-53. The $78,032,750 budget will mean that 150 additional engineers can be hired by the State to carry out the proposed highway program.

BIG PAYLOAD FOR READY-MIX—New White 3000 trucks, owned by Graham Brothers, haul ready-mix concrete for foundations of the world's largest suburban store, the May Shopping Center at Lakewood Park in Southern California. Design of the trucks permits greater weight on front axle so that 6¼-cu. yd. mixers can be carried legally in California. The new type transit-mix trucks feature dual-drive rear axles and power steering.

USBR Plans Bid Calls

BID CALLS have been issued for several important Bureau of Reclamation projects. Calls went out for bids on the Gila Project near Wellton, Ariz., for construction of about 12 mi. of the concrete-lined Wellton canal, 300 cfs. capacity and excavation of 838,000 cu. yd. common for canal.

Bids on constructing about 12.5 mi. of unlined Rocky Coulee Drain wasteway on the East Low canal lateral system of the Columbia Basin Project near Moses Lake, Wash., were invited. Construction of timber bridges, road crossings, drainage inlets and drop structures, plus the excavation of 202,000 cu. yd. are included in the project.

The Willow Creek Dam and pump

canal near Granby, Colo., part of the Colorado-Big Thompson project, will involve construction of a 105-ft. earthfill dam and a 1,050-ft. long earthfill structure for diversion of Willow Creek water to Granby reservoir. The pump canal consists of 4,800 ft. of 400 cfs. capacity unlined. Further calls went out on the project for construction of a pumping plant and switch yard. The plant requires construction of a 15-ft., 600-ft. long, earth forebay dam, a pumping plant building to house 2 pumping units, and one 8.5-ft. diameter, 2,100-ft. long, concrete discharge line.

A spillway stilling basin for the Davis Dam project on the Colorado River 30 mi. west of Kingman, Ariz., is another project for which bid advertisements were to be issued. Excavation of the outlet channel, construction of sidewalk, repair of existing concrete spillway structures, bituminous surfacing of roads and improvement of Colorado River channel below power plant afterbay are part of the project.

Bid calls for dike and channel improvements on the Klamath project near Tulelake, Calif., were issued. Work includes the enlargement and improvement of 5.3 mi. of Lower Lost River channel, construction of adjacent embankments and relocation of 1,500 ft. of adjacent lateral and drains.

Further information can be obtained from the Office of the Chief Engineer, Bureau of Reclamation, Denver, Colo., or from regional offices of the USBR.

Steel Institute Scholarships

TO ENCOURAGE future engineers to enter the fabricated structural steel industry, the American Institute of Steel Construction is awarding 10 scholarships of $1,000 each in American colleges and technical schools during 1951. Last year, in a national competition, 10 high school graduates received the first scholarships offered under the Institute's new educational program.

The objective of the Institute's scholarship plan, according to L. Abbett Post, executive vice-president, is to train engineers and administrators for the industry, although recipients of the scholarships are under no obligation to continue in the industry after graduation.

To be eligible for a scholarship a candidate must be proposed by the executive head of a member company of the Institute. A candidate need not be an employee, or the dependent of an employee, of the sponsoring company. Scholarships are available only to students who pursue the full course in civil engineering offered at any one of 125 colleges located throughout the country.

GIANT PIECE OF PLUMBING is actually a pressure relief valve discharge liner for generating unit A-4 now being installed by the Bureau of Reclamation in the power plant at Hoover Dam. Manufactured by Allis-Chalmers Co., the liner weighs 65,000 lb., stands 26 ft. high and is 14 ft. in diameter. Too bulky for shipment in one piece, the liner arrived in sections which were being welded together when this photo was taken.

Ephrata New USBR Headquarters

THE COLUMBIA River District headquarters for the Bureau of Reclamation moves from Coulee Dam to Ephrata, Wash., on April 14. District Manager H. A. Parker is in charge of the move. The new headquarters are being prepared by Walter W. Harfst Co., Inc., Seattle, Wash., under a $482,408 contract.

The new location will mean a savings in tires, gas, etc., which otherwise would be required for numerous round trips from Coulee Dam to the now more active irrigation area developments around Ephrata. The office at Coulee Dam was set up 16 years ago, on March 22, 1935.

ENGINEERS ON THE MOVE

M. L. Zirul is now district engineer at Kelowna, B. C., for the water branch of the British Columbia Lands Department. He succeeds **A. G. Hatton,** who recently retired.

* * *

E. G. Johnson is the new chief highway engineer for the State of Utah. The new chief engineer, formerly a bid estimator for the Utah Construction Co., in San Francisco, Calif., is a native of Michigan and a graduate of Michigan State College. In the early 1930's he was employed by the Marquette County, Michigan, road commission as a construction engineer. He later became resident engineer on the Chicago subway system, as an employee of the Public Works Administration. He served as chief construction engineer for Bates and Rogers Co., Chicago, on the Alcan highway. Johnson succeeds **W. L. Anderson,** who becomes assistant chief engineer in charge of bridges and design.

* * *

L. C. Cole, formerly with A. Teichert & Son on the Los Angeles, Calif., river channel project, is now working as chief field engineer for Winston Bros. Company, Monrovia, Calif., on a $40,000,000 naval project at Camden, Arkansas.

* * *

Henry G. Porak resigns as city engineer of Olympia, Wash. While in service

Top USBR Men in Charge of Southwest Power Program

THE BUREAU of Reclamation has headquartered some of its finest technical personnel in Phoenix, Arizona, to direct the construction, operation, and maintenance of the 1,500-mi. integrated Hoover Dam-Davis Dam-Parker Dam power transmission system which it is completing at a cost of approximately $45,500,000.

Phoenix will be the "nerve center" from which the transmission of hydroelectric power generated at Hoover Dam for the states of Arizona and Nevada and power generated at Davis and Parker Dams will be directed to areas in Arizona, southern Nevada, and southeastern California. A dispatching center and buildings to house operation and maintenance staffs are being constructed 5 mi. west of Phoenix on a 40-ac. plot to the east of the Central Arizona Light and Power Company's steam plant and the Bureau of Reclamation's Phoenix substation. The dispatching center, directing the flow of approximately three billion kilowatt hours of electric energy annually over the transmission system, will be in operation this fall.

USBR's power construction, operation, and maintenance program in Arizona is supervised by S. A. McWilliams, Parker Dam Power Project Engineer, who came to Arizona in 1917 on the Yuma Project. He left the Reclamation Service in October 1922 for a job with a private construction firm in California. With the private firm McWilliams worked on the Hollywood subway in Los Angeles and on estimates in the Oakland area for the East Bay Public Utilities. He also built bridges and other structures in the Los Angeles area. McWilliams returned to the Bureau in 1933 as a member of the Chief Engineer's staff in Denver and transferred to Parker Dam as Field Engineer in 1934. When Parker Dam was completed in 1938, he went to Elephant Butte to supervise construction of the power plant there. He spent a short time on the Minidoka project in Idaho, then returned to Parker Dam as Construction Engineer. His title since has been changed to Project Engineer. The Parker Dam power project staff moved to Phoenix 2 years ago.

On McWlliams' right hand is Erick Alfred Benson, Assistant Project Engineer, and a native of Montana. Benson started his career with the Anaconda Copper Company in 1927. In 1936 he joined the U. S. Engineers' staff at Fort Peck Dam, in Montana. He accepted his first Reclamation job at Parker Dam in 1939 as Electrical Engineer in charge of installations in the Parker power plant. Subsequently he was promoted to Superintendent of Power and then to his present position.

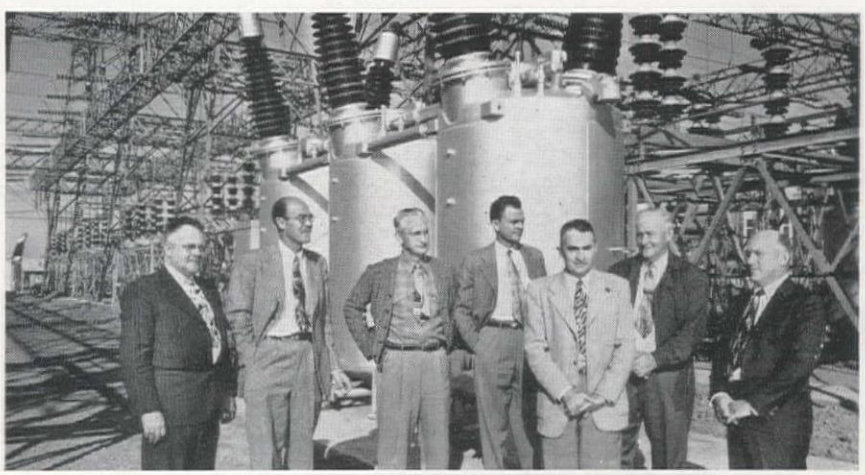
Howard L. Fink sits at McWilliams' left hand as Office Engineer. A graduate of the University of Arizona, he joined the Reclamation staff at Bartlett Dam in 1937 and in 1939 transferred to Parker Dam. A series of promotions landed him in the Office Engineer's position.

William W. Gage, Field Engineer, is a product of Oregon and Arizona and a graduate of Colorado State College (A&M). Following graduation he entered on duty at Parker Dam in June 1934, and four year later went to Shasta Dam, at Redding, California. In 1944 he returned to the Parker Dam power project where he has played a major part in the construction of transmission facilities throughout Arizona. Assisting him is Walter E. Sims, Resident Engineer. Sims joined the Bureau in 1935 on the Colorado River Basin investigations staff at Denver. In 1937 he changed to the Colorado-Big Thompson project and later worked on the Rio Grande project. He transferred to the Parker project in 1941, working in the Phoenix and Yuma offices. In September 1943 he went to the Kennett division of the Central Valley project in California and returned to the Phoenix office of the Parker project in June 1944.

Otto K. Mangum, Superintendent of Transmission Lines and Substations, has grown up with Arizona's water and power programs. He was with the Arizona Edison Company from March 1933 to September 1935 at Gila Bend and then was Engineer for the Gila Water Commission at Safford until October 1941. He joined the Reclamation investigations staff at Holbrook in October 1941, transferred the following July to the Parker Dam power project office in Phoenix, and since has worked up to his present position.

William M. Doak came to the Parker staff last November as Superintendent of Power System Operations. He is well known in Arizona, southern Nevada, and California through his past connections with private, State and Federal power activities in the Southwest area. He started his career in 1926 with the Southern California Edison Company.

THESE are the Bureau of Reclamation officials in charge of construction, operation and maintenance of the 1,500-mi. integrated Hoover Dam-Davis Dam-Parker Dam power transmission system. Left to right: *William M. Doak, Otto K. Mangum, William W. Gage, Howard L. Fink, Walter E. Sims, S. A. McWilliams* and *Erick A. Benson.* They are shown at the Phoenix substation, one of major distribution centers for Colorado River power.



with the city Porak supervised contract letting and engineering for the sewage disposal system, a $1,500,000 project. He had also worked as an engineer for the city of Tacoma, Wash., and in the highway department of the State. He will be succeeded by **Charles H. Williams,** former city engineer who has been in private business.

* * *

James K. Carr, manager of the Sacramento Valley, Calif., district of the Bureau of Reclamation since 1945, goes to Washington, D. C., to work with the Bureau's Branch of Operation and Maintenance. Carr did outstanding work in the development of vital water projects in California. His district included Keswick Dam and Powerplant, Shasta Dam and Powerplant, and many irrigation projects.

* * *

George S. Patterson, executive of the John L. Hudson Company, coast to coast constructors of prefabricated grain storage bins is the "Flying Businessman of the Month," named by the Ryan Aeronautical Company. Patterson won the award through his work as project manager flying daily to supervise the 54 building jobs his company has in progress around Grand Island, Neb.

More Officers of Western Associations for 1951

DeWitt C. Griffin, Seattle, Wash., is the new vice president for the Western area of the National Society of Professional Engineers. He is a graduate of the University of Washington and a member of the firm of DeWitt C. Griffin and Associates, Seattle consulting engineers. He has held local offices in the NSPE and is active in many civic groups.

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I. J. Matthews of Casper, Wyo., North Platte district manager for the Bureau of Reclamation, is the new president of the Wyoming Engineers Society. He succeeds **O. P. Reed** of Cheyenne.

* * *

James R. Howell, James R. Howell & Co., is the new president of the Colorado Building Chapter of the AGC. **Gerald H. Phipps** is vice president, **David A. Olson,** secretary, **Nicholas R. Petry,** treasurer, and **W. S. Hibberd** is secretary-manager.

* * *

Kenneth Storment is the president of the Associated Engineers of Spokane, Wash., for 1951. **Ivan A. Shirk** is the first vice president and **Wilbur L. King** is secretary-treasurer.

* * *

Gordon H. Brodrick, consulting engineer, is the new president of the Wyoming section, ASCE. Vice president is **Harold P. Eisenhuth,** assistant to the president is **Joseph S. Bailey, N. D. Morgan, Jr.,** is again secretary-treasurer with **Glenn B. Mullens** as his assistant.

* * *

Cleve H. Milligan, School of Engineering, Utah State Agricultural College, is the newly-elected president of the Intermountain section, ASCE. **Robert E. Simpson** is first vice president, **Le Roi C. Chadwick,** 2nd vice president, and **Clyde D. Gessel** is secretary-treasurer.

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Samuel DeMoss is the new president of the Seattle section of the ASCE. **Cecil C. Arnold** is the vice president; **James H. Reid,** the treasurer, and **Wilson F. Bow** is the secretary.

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The Montana section of the American Society of Civil Engineers has **William J. Wenzel** as president, **Reginald T. Hurdle,** vice president, Billings branch; **Earle O. Parsons,** vice president, Helena branch; **Emil F. Gehri,** vice president, Hungry Horse branch, and **Thomas R. Smith,** vice president, North Central branch. **George J. Hoge** is the secretary-treasurer. Branch presidents are as follows: **Oliver C. Reedy,** Billings; **Albert W. Greiner,** Helena; **Allen J. Johannesen,** Hungry Horse; and **Thomas R. Smith,** North Central branch.

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P. F. Glendening, Civil Aeronautics Administration, is the new president of the Arizona section of the ASCE. **J. A. Rau** is vice president, **H. C. Schwalen,** 2nd vice president, **A. J. Medford,** secretary-treasurer. Former president **John Girand** is now a director.

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William A. Hill, Washington Water Power Co., is the new president of the Spokane section, ASCE. Vice president is **Emmett B. Moore,** 2nd vice president, **Robert E. Tobin,** and **John P. Esvelt** is secretary-treasurer.

* * *

Guy H. Taylor is the president of the Oregon section of ASCE. **Thomas Smithson** is vice president, **H. Loren Thompson** is 2nd vice president, **Norman W. Haner** is the secretary, and **David J. Lewis** is treasurer.

Brodrick *DeMoss* *Wenzel* *Milligan* *Glendening* *Hill*

AWARDS OF MERIT for outstanding service in the Bureau of Public Roads have been presented to the four men pictured above. *W. H. Lynch* (seated) was given the exceptional service award of a gold button. He has 37 years' service with Public Roads, with 22 years in charge of Federal highway work in the Northwest. Recognition for original research in bridge design was accorded *R. B. McMinn* (standing, center). *G. S. Vincent* (right) received his citation for research at the University of Washington on aerodynamics of suspension bridges, especially as related to the new Tacoma Narrows Bridge. *J. B. Reher* (left) received his award primarily for outstanding work in locating the Alaska highway during the last war.

* * *

Tom Davis, U. S. Bureau of Public Roads district engineer in the State of Oregon, retires after 34 years of continuous service with the Bureau. He was in charge of all federal highway activities in the State. **Clifford G. Polk** succeeds Davis. A graduate of Oregon State College, Polk has had 31 years' service with the Bureau in the Pacific Northwest.

Davis *Polk*

CALENDAR OF MEETINGS

April 12-13—American Road Builders' Association, Student Chapter of Washington State College, Second Annual Road Builders' Clinic, at Pullman, Wash.

April 26-28—Pacific Northwest Conference of the American Society of Civil Engineers. Oregon section, ASCE, host. Conferences, technical meetings, field trip to Detroit Dam project. Dinner meeting with Gail Hathaway, National President, present.

April 28—Arizona Section, American Society of Civil Engineers, Annual Spring Meeting, at Pioneer Hotel, Tucson.

May 3-5—California Sections of American Society of Civil Engineers, annual joint conference, at Ahwahnee in Yosemite National Park, Calif.

June 13-15—American Society of Civil Engineers, Summer Convention, at Louisville, Kentucky.

Concrete Experts Discuss Practical Field Problems

Reducing protection needed for concrete placed in sub-freezing weather by use of air entrainment, earthquake-resistant concrete construction and the problem of "false set" were subjects at the 47th Annual Convention of the American Concrete Institute, held in San Francisco

CONCLUDING with a session in which experts answered questions on practical field problems, the American Concrete Institute held its first meeting on the Pacific Coast in San Francisco, Feb. 20-22. This was the 47th Annual Convention of the organization, which represents all interests concerned with use of concrete. The only other meeting of the A.C.I. held in the West was in Denver. Registration at the San Francisco meeting totaled well over 500.

Session on earthquakes

Recognizing a Western problem in concrete design and construction, the program included a session with three papers on this subject. Professor Martel of the California Institute of Technology analyzed the effects of earthquakes on existing buildings and a paper was presented by Charles S. Whitney, consulting engineer of New York, outlining a comprehensive analysis of design to resist earthquake stress.

A practical report on specific structures designed to provide earthquake resistance was contained in a paper by John J. Gould, consulting engineer of San Francisco. His paper reviewed the design of a group of 13-story apartment buildings at Parkmerced in San Francisco. The X-shaped apartments have flat-slab floors with wide flat beams over corridors. Exterior walls are of the bearing-wall type without columns. Many interior partitions commonly built of plaster or other materials are of reinforced concrete to resist vertical as well as horizontal loads.

"All of these provisions resulted in extremely economical structures," Mr. Gould said. Because of the structural system chosen, he estimated that the extra cost of the earthquake resistance was only 1 to 2 per cent of the total cost as compared with otherwise sound minimum construction.

Major economies were realized, he continued, through the elimination of plaster ceilings. The concrete gave an extremely pleasing finish. The structures were adapted for mass production and mass building methods—speed, simplicity of formwork, ease of placing and maintaining reinforcement, and speed and ease of placing concrete.

"A prime advantage of the interior bearing wall system is that the lateral bracing of the building is increased at no extra cost. A secondary advantage is that there are no breaks around columns in the rooms, thus giving more usable floor area." He went on to say that the interior bearing walls provide greater rigidity against vertical load deflections and greater safety to the occupants in case of earthquake or even atomic blast.

Stewart Mitchell of the Bridge Department of California Division of Highways discussed the current work of the organization in the design and construction of a prestressed concrete pedestrian bridge. Design features of this unique structure were described in detail in *Western Construction*, Dec. 1950, and current construction operations are reviewed elsewhere in this issue.

Effects of air entrainment

Tests were reported in a paper presented by three engineers of the Bureau of Reclamation (J. J. Shideler, H. W. Brewer, Wilbur Chamberlin) indicating that the use of air entrainment reduces the protection required for concrete placed in sub-freezing temperatures. Laboratory studies would seem to indicate that a revision can be made in the usual specifications for winter concreting. Providing that 1% of calcium chloride and 4% entrained air are included in the mix, the period of protection can be reduced from a normal 14 days to 6 days. The effect of this reduction in time would make it possible to eliminate many of the usual precautions including arrangements for the application of heat during the curing period. The heat of hydration of the cement in the concrete might be adequate to maintain the required temperature over the shorter period of time if some insulation were provided in the forms. Lewis Tuthill reviewed some of the practical applications of this development in his discussion of the paper.

The problem of "false set"

The aggravating problem of "false set" in concrete was discussed by R. F. Blanks of the Bureau of Reclamation, who stated that the cause has been definitely established as an element in the manufacturing process. He stated there were several ways to overcome false set. Holding down the grinding temperature through the use of cool clinker and water-sprays on the mills has been a very successful method, he disclosed. Whenever proper precautions to cool the mills have been taken, false set has disappeared. It is generally agreed, the author declared, that the usual cause of premature stiffening is unstable gypsum (plaster set). The most common cause of unstable gypsum in cement is high grinding mill temperatures.

Another possible approach, Mr. Blanks said, is to use stable calcium sulfate, either natural anhydrite or gypsum which has been calcined to form insoluble anhydrite. Limited tests have shown that low alumina cements may be regulated with these materials.

In some cases the addition of an admixture at the mixer has relieved false set in cement. Mechanically, stiffening can sometimes be overcome by prolonged mixing, or by remixing. This "doctoring" is not as desirable as a change in the manufacturing conditions responsible for false set.

A paper by H. H. Roberts, chief engineer for Consolidated Builders, Inc., described in detail the plant which is being used to cool cement and aggregate at Detroit Dam. This subject was reviewed in detail in *Western Construction*, Oct. 1950.

Advances in the development of precast concrete units for building construction were reviewed in a series of papers, including one by A. G. Streblow, president of Basalt Rock Co., Napa, Calif. He described in detail the operations of his company in producing structural units with standard concrete casting machines.

The method of tilt-up construction using precast concrete units which has been so extensively used in Southern California was described in a paper by F. Thomas Collins, consulting engineer of San Gabriel, Calif.

A session on field problems

The concluding session was planned by the local committee as an effort to enable practical construction men to have their field problems answered by the authorities from all over the country who attended the convention.

Many of the questions asked related to the small, but annoying problems encountered in the field where the concrete did not behave as planned by the designer and left the field engineer or contractor open to complaint and criticism by the owner. In spite of elaborate discussions and explanations by experts, it was obvious that a gap still remains between the technical approach to concrete as a material of construction and its actual use in the field. This is particularly true on smaller structures where control is difficult and the concrete is placed in relatively thin sections, such as in building construction. In answer to questions on this point the experts were inclined to fall back upon the usual recommendations that the water-cement ratio be kept as low as possible and that great care be exercised in handling the concrete and in workmanship on the job.

The new president of the American Concrete Institute elected at the San Francisco meeting is Harry F. Thompson, manager of Redi-Mix Concrete Division, Material Service Corp., Chicago. He succeeds Frank H. Jackson, principal engineer of tests, Bureau of Public Roads, Washington, D. C.

The local committee in charge of arrangements functioned under the general direction of Harmer E. Davis, Director of Institute of Transportation and Traffic Engineering, University of California, Berkeley, Calif. Financial arrangements which enabled the local committee to entertain those attending the convention at a banquet and a boat trip on the Bay were under the direction of a committee consisting of A. G. Streblow, J. E. Jellick and M. McIntyre.

DEATHS

Al V. Perkinson, 77, died in Los Angeles, Calif. During his career as a contractor he once enlarged the Rose Bowl, Pasadena, Calif., stadium, and constructed several motion picture theaters for the Fox West Coast Theater chain.

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Louis N. Royar, 80, retired engineer for the Southern California Edison Co., died in Los Angeles, Calif.

* * *

Lawrence C. Nappe, 36, president of the Nappe Construction Co., Burbank, Calif., and **Harry Kauffman,** 42, president of the Boulder Construction Co., Canoga Park, Calif., were killed instantly in a private plane, which crashed while attempting to land at Metropolitan Airport in Los Angeles, Calif.

* * *

David Graham, 71, retired building contractor, died February 17 in Los Angeles, Calif.

* * *

Charles G. Grosvenor, 62, chief construction engineer for the New Mexico State Highway Department, died of a heart attack February 22, at his home. He was in charge of all new road construction in the State at the time of his death. Grosvenor had long been associated with highway departments in the Southwest.

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William Henry Humes, 67, retired building contractor originally from St. Louis, Mo., mysteriously plunged 100 ft. to his death from Pacific Palisades at Santa Monica, Calif.

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Chemisch Saderup, 63, building contractor, died February 23 in Venice, Calif. Originally from Salt Lake City, Utah, Saderup moved to the Los Angeles, Calif., area about 30 years ago.

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James B. Mullins, 74, Salt Lake County, Utah, commissioner from 1934 to 1942 in charge of the county road department, died March 3 in Temple City, Calif. In Salt Lake City, Mullins was a member of many civic organizations.

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Thomas B. McCarthy, 63, building contractor, died at his home in Garvey, Calif., February 28.

* * *

John W. Tindall, 92, retired city engineer, died February 27 in Los Angeles, Calif.

* * *

William Albert Freeman, 75, a civil engineer, died March 2 of a heart ailment in Salt Lake City, Utah. He had worked for the Union Pacific Railroad in Omaha, Neb., and later in Salt Lake. He later was a civil engineer for Gibbons and Reed Co., and served as an inspector

for the Salt Lake City engineering department.

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John H. Hansen, 86, contractor, died February 22 in Spokane, Wash. He constructed many buildings in the mining section of Idaho before coming to Spokane.

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Dan Wells Wood, 64, a structural engineer of Florence, Colo., died February 27. He was a member of the Colorado Society of Engineers. At the time of his death the well known engineer was the chief engineer for the Industrial Constructors, Denver, Colo.

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Marinus W. Van Seters, 66, building contractor, died March 3 in his Salt Lake City, Utah, home. During his carrer he had constructed many private homes and public buildings in the area. He was very active in church and civic affairs.

* * *

Albert White, 78, builder and contractor, died in his Salt Lake City, Utah, home after a long illness. He built many churches and public buildings during his long career.

* * *

Delph E. Carpenter, prominent attorney on Colorado water rights, died February 27 in Greeley, Colo. He began his water rights cases in 1922, and was called "the father of the Colorado River compacts" by Governor Dan Thornton. He was an honorary member of the Colorado Society of Engineers.

* * *

Basil C. Gilbert, 50, was instantly killed March 10 while working on the Chief Joseph Dam project near Bridgeport, Wash. He was directing an earthmoving operation when a huge boulder fell off a truck and struck him.

* * *

Gordon Burr, 86, well-known retired Colorado contractor, died March 7 after an illness of two weeks. For six years the early settler was county commissioner for Kit Carson county and he built the county court house.

* * *

O. S. Warden, 85, publisher of the Great Falls, Mont., Tribune, died March 12 at his home. He was very active in the development of Montana's natural resources and was a past president of the National Reclamation Association, a member of the water conservation board, past president of the National Association of State Highway Officials and a member for ten years of the highway commission.

* * *

William C. Finke, 81, retired contractor and builder, died in Seattle, Wash.

* * *

Samuel D. Hendricks, 50, former Bureau of Mines and Park Service engineer, died March 3 in Santa Fe, N. M. He had been chief highway engineer for Region No. 3 of Park Service with headquarters in Santa Fe.

SUPERVISING THE JOBS

H. E. Buckert is the general superintendent for Morrison-Knudsen Company, Inc., Los Angeles, Calif., on the construction of the multi-million dollar Cabinet Gorge project near Sandpoint, Idaho. Other men who will work on the project are: **Jim Raferty,** carpenter superintendent; **T. Bailey Lee,** excavation superintendent; **L. O. Wilson,** electrical superintendent; **Fred Reif,** field engineer; **L. P. Williams,** purchasing agent, and **J. R. Berry,** job administrator.

* * *

W. D. Hale is the job superintendent for Mountain States Construction Co. and Statewide Plumbing Co., Pocatello, Ida., on construction of sewer lines at Nampa, Ida. **W. S. Christensen, Walter Gay, William McDermott,** and **Kenneth Balis** are foremen on the $374,094 project.

* * *

Paul C. Guinn is project manager and **Charles Hagerman** is project engineer on construction of the 5840 Tunnel, Bingham, Utah. **Roy Anderson** and **Hap Tollman** are tunnel assistants. The tunnel is being built for the Kennecott Copper Corp. by the Utah Construction Co., Ogden, Utah.

* * *

In Tulare County, Calif., the grading and surfacing and construction of five bridges one mile south of Goshen by Griffith Co. is being supervised by **H. S. Massen.**

* * *

Sid Milligan is the superintendent for Fisher Contracting Co., Phoenix, Ariz., on the highway job at Little Hell's Canyon on Route 89 near Prescott, Ariz.

* * *

C. A. McMahon is the general superintendent and **Robert H. Kirkman,** the project manager, for City Garage, Inc., Los Angeles, Calif., on construction of the $5,000,000 underground garage project at Pershing Square, Los Angeles.

* * *

Clayton Hoon is the general superintendent and **Bogue Ford** is his assistant on the 230-ft. rock-filled dam project on the Bear River, Calif. **Bert Sandberg** is the project engineer and **Charles Guhne** is the office manager on the Pacific Gas & Electric Co. project being built by the Utah Construction Co., Ogden, Utah. The project is scheduled for completion in September 1953.

* * *

The $2,871,212 construction of highway and separation structures on 4.2 mi. of the Eastshore Freeway at Oakland, Calif., is being supervised by **Karl Poss. Lloyd Erickson** is the carpenter superintendent and **Gordon Johnson,** the grade superintendent for Fredrickson & Watson and M. & K. Corporation (joint venturers) on the State of California project. **R. M. Vail** is the quantity engineer. The scheduled completion date is May 1952.

* * *

George Storm is the job superintendent on construction of a reinforced concrete and steel frame public works building annex in Sacramento, Calif. **A. A. Murdock** is general foreman and **Dick Eldridge** is concrete foreman for Haas and Rothschild, San Francisco, Calif., contractor on the $1,508,000 project.

* * *

Dick Lindgren is the superintendent for 5 miles of grading and surfacing on a Montana highway project. **Tom Grady** is project manager and **Joe Howell** is master mechanic for Kiely Construction Co., Butte, Montana.

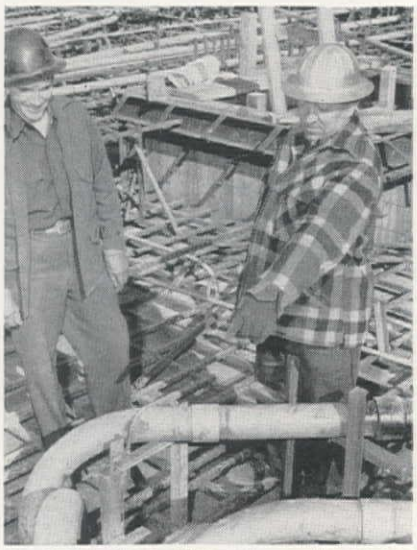
* * *

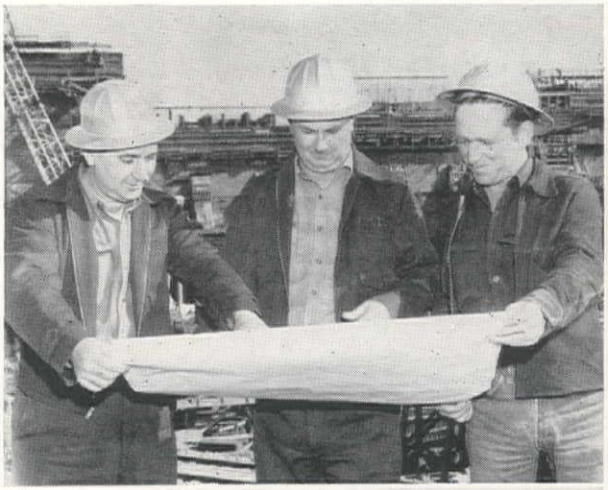
O. H. Tucker is the job superintendent for the initial rock excavation and

Continued on page 129

Here Are the Men Who Have Brought McNary Dam Halfway to Completion

Taming the civilized world's wildest river at the toughest location ever tackled, McNary Dam Contractors (Atkinson-Jones-Ostrander) has brought this $270,000,000 Columbia River dam to 50% of completion. These men are doing the job under the general direction of John Morton, project manager.

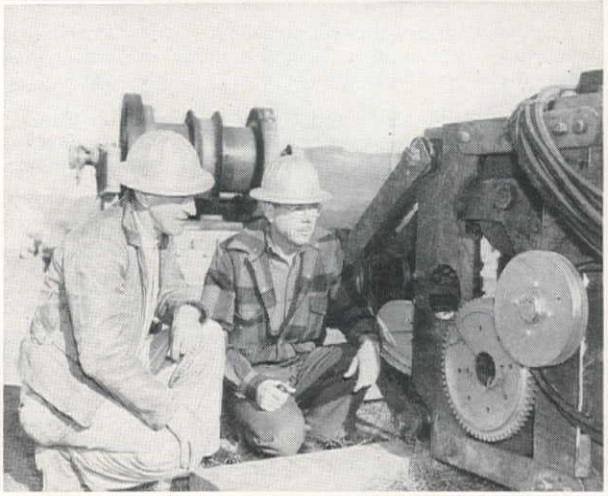




Left to right:

Norton M. Stone, shift superintendent, *William D. (Bill) Rives*, assistant general superintendent, and *Walter E. (Curly) Tate*, assistant concrete superintendent, go over the latest plan change.

Henry K. (Hank) Hoover and *Ernest Brown*, electrical superintendents, look over some conduit work.



Charles P. Mason, ironworker superintendent, and *Vern Glascock*, project engineer, inspect a new type slack carrier developed for the cableway.

Lewis L. (Lew) Sheddy, assistant concrete superintendent, *Walter B. (Walt) Hill*, excavation superintendent, and *Albert G. (Al) Chaussee*, assistant chief engineer, take time out to "bull" a bit.

Edwin L. (Ed) Hoggins, personnel manager-paymaster, *Charles F. (Chuck) Ewing*, business manager, and *David H. (Dave) Olson*, office manager, look over the company's books.

Samuel A. Reynolds, reinforcing steel walker, receives some directions from *Elmer L. Skinner*, reinforcing steel superintendent.

Albert P. (Bert) Louis, master mechanic, *Clifford T. (Cliff) Maddox*, assistant chief storekeeper, *John L. Zeimer*, assistant purchasing agent, and *Leo Stewart*, assistant master mechanic, consult about some equipment parts.

All photos by VAL.

CONTRACTS

A Summary of Bids and Awards For Major Projects in the West

★★

Alaska

$4,659,401—**Boen-Sealand Construction Co.,** 3647 Stoneway, Seattle—Awarded contract for construction of housing units at Eielson and Ladd air force bases; by Corps of Engineers.

$142,650—**Earl L. Butcher,** Fairbanks—Low bid for Weeks Field sewer project at Fairbanks; by Alaska Board of Public Works.

$1,333,378—**Carson Construction Co.,** Seattle—Low bid for construction of the territorial office building in Juneau, to be five stories high; by Alaska Public Works Commission.

$1,236,205—**C. F. Lytle** and **Green Construction Co.,** Box 206, Sioux City, Iowa (joint venturers)—Low bid for construction of a section of the Seward-Anchorage highway consisting of 17 mi. grading, etc.; by Bureau of Public Roads.

$1,936,628—**Manson Construction & Engineering Co.,** Seattle; **Osberg Construction Co.,** Seattle, and **Halvorson Contractors** (joint venturers)—Low bid for construction work on the Seward-Anchorage highway; by Bureau of Public Roads.

$131,368—**Munter Construction Co.,** Seattle—Award for 4 I-beam bridges to be constructed on section C of the Richardson highway; by Alaska Road Commission.

$1,423,401—**Valle-Sommers Construction Co.,** Seattle—Low bid for construction of unit I of an ordnance vehicle repair shop at Fort Richardson; by Corps of Engineers.

Arizona

$173,850—**Johnnie Iben,** 1109 W. Palm Lane, Phoenix—Low bid for highway construction from Congress Junction south on State Route 71 for 5.4 mi. to be graded, drained; by State Highway Department.

$328,737—**Phoenix-Tempe Stone Co.,** West Broadway, Phoenix—Awarded contract for construction work on Topock-Kingman highway, beginning at Yucca and extending to a point about 20 mi. south of Kingman, including the construction of 2 bridges and grading and draining; by State Highway Department.

$119,848—**H. L. Royden,** 2211 W. Jackson St., Phoenix—Low bid for work on gravel way approaches on section of the Topock-Kingman highway south of Kingman; by State Highway Department.

California

$2,159,376—**P. & J. Artukovitch,** 13305 S. San Pedro St., Los Angeles—Low bid for piping on the Silver Lake outlet line in Los Angeles; by Department of Water and Power.

$2,824,001—**M. H. Golden Construction Co.,** 3485 Noell St., San Diego—Low bid for San Diego Naval Laboratory construction; by Department of the Navy.

$522,638—**Foster & McHarg,** P. O. Box 244, Riverside—Low bid for construction of levees at Feather River and Honcut Creek; by Corps of Engineers.

$205,444—**Mercer Fraser Co.** and **Mercer Fraser Gas Co.,** Second and Commercial Sts., Eureka—Low bid for highway construction in Del Norte County; by State Division of Highways.

$106,084—**Ben C. Gerwick,** 112 Market St., San Francisco—Low bid for bulkhead and wharf construction at the Port of Oakland; by Oakland Board of Port Commissioners.

$630,697—**Granite Construction Co.,** Box 900, Watsonville—Low bid for highway improvements in Santa Barbara County; by State Division of Highways.

$3,389,651—**Guy F. Atkinson Co.,** P. O. Box 259, Long Beach—Low bid for construction of 3 bridges and approaches and alter-

ations to existing bridge on the Colorado Freeway in Pasadena; by State Division of Highways.

$967,350—**Cox Bros. Construction Co.,** Stanton—Low bid for grading and paving work in Oceanside, Calif., San Diego County, and some box girder separation structures to be constructed; by State Division of Highways.

$1,221,640—**Griffith Company,** 1060 S. Broadway, Los Angeles—Low bid for grading and surfacing work on about 3.8 mi. of highway in San Diego County and reinforced concrete bridge construction; by State Division of Highways.

$2,476,981—**Haddock Engineers, Ltd.,** 1616 Greenward Ave., Montebello—Low bid for construction of test range facilities at the Naval Ordnance Test Station, Inyokern; by Department of the Navy.

$2,194,482—**M. H. Hasler Construction Co.** and **D. & H. Construction Co.,** P. O. Box 387, Santa Ana—Low bid for construction of an auxiliary dam in Sacramento County for the Folsom reservoir project; by Corps of Engineers.

$2,360,185—**Peter Kiewit Sons' Co.,** 345 Kieways Ave., Arcadia—Low bid for improvements on the Los Angeles River; by Corps of Engineers.

$348,320—**R. V. Lloyd,** Coachella—Low bid for earthwork and pipeline on the Boulder Canyon Project, Coachella Valley Distribution System, California, Arizona and Nevada; by Bureau of Reclamation.

$121,740—**Lord & Bishop,** Sacramento—Low bid for widening the existing bridge at H St. with timber, reinforced concrete and structural steel; by State Division of Highways.

$273,822—**Charles MacCloskey Co.,** 112 Market St., San Francisco—Low bid for construction of a reinforced concrete and structural steel bridge across the San Gabriel River at Beverly Blvd., Los Angeles; by State Division of Highways.

$130,922—**Fred McKinley,** 14503 S. Garfield Ave., Paramount—Low bid for construction of a reinforced concrete bridge and about 4.3 mi. of highway to be graded and paved in San Luis

Obispo County east of State Route 137; by State Division of Highways.

$6,659,001—**Robert McKee Co.,** 4700 San Fernando Rd., Los Angeles—Low bid for the construction of a receiving hospital and health center to be 8 stories high in Los Angeles; by City Board of Public Works.

$4,500,000 approx.—**Morrison-Knudsen Co., Inc.,** 411 W. 5th St., Los Angeles—Contract negotiated for parking apron and other facilities to be constructed at Travis air force base; by U. S. Army.

$763,128—**C. K. Moseman** and **Lew Jones Construction Co.** (joint venturers) 1535 S. 10th St., San Jose—Low bid for sewage pumping station construction, force main and sewage treatment plant in San Mateo; by Menlo Park Sanitary District.

$342,735—**H. Earl Parker,** 12th & F Sts., Marysville—Contract for abutment excavation and core drilling in Sacramento County on the Folsom Reservoir project; by Corps of Engineers.

$7,000,000 approx.—**Swinerton & Walberg,** 225 Bush St., San Francisco—Contract for large 2-story body building factory for Chrysler Corporation in San Leandro; by Chrysler Corporation.

$407,528—**A. Teichert & Son, Inc.,** 1846 37th St., Sacramento—Low bid for first section levee construction on the Georgiana Slough; by Corps of Engineers.

$617,723—**United Concrete Pipe Corp.,** P. O. Box 425, Baldwin Park—Low bid for highway construction about 5.6 mi. in length, to be graded and paved in Merced and Stanislaus Counties; by State Division of Highways.

$1,396,953—**United Concrete Pipe Corp.** and **Ralph A. Bell,** Baldwin Park—Low bid for grading and paving about 1.5 mi. of Santa Ana Freeway; by State Division of Highways.

$876,858—**Walsh Construction Co.,** 785 Market St., San Francisco—Low bid for sewer construction in Santa Rosa, Sonoma County; by City of Santa Rosa.

$361,140—**Webb & White,** Los Angeles—Low bid for work on the Harbor Freeway project in Los Angeles; a reinforced box girder bridge to be constructed and paving and grading connecting roads; by State Division of Highways.

$1,799,501—**Williams & Burrows,** Burlingame—Low bid for construction of a school in San Mateo County; by Sequoia Union High School District.

$938,105—**Wonderly Construction Co.,** 2694 Lime Ave., Long Beach—Contract for sewage plant construction and related work at Bakersfield; by City of Bakersfield.

$723,510—**Clyde W. Wood & Sons,** North Hollywood—Low bid for work on the Lauro Dam project, north of Santa Barbara; by Bureau of Reclamation.

$390,740—**E. L. Yeager Co.,** Riverside—Low bid for grading and surfacing about 11.7 mi. between Riverside Drive and State Route 19; an existing bridge to be widened; by State Division of Highways.

Idaho

$3,009,751—**Baldwin-Lima-Hamilton Corp.,** Philadelphia, Pa.—Low bid for the hydraulic turbines at Albeni Falls Dam, Priest River; by U. S. Engineers.

$3,839,149—**Donovan-James Construction Co.,** Seattle, Wash.—Low bid for foundation and spillway dam on second phase construction of Albeni Falls Dam, Priest River; by Corps of Engineers.

$40,000,000 approx.—**Morrison-Knudsen Co., Inc.,** 319 Broadway, Boise—Award for construction of Cabinet Gorge Dam and power plant in Northern Idaho; by Washington Water Power Co.

$200,000—**John E. Thomas,** Moscow—Awarded contract for housing construction at Cabinet Gorge Dam site in northern Idaho; by Washington Water Power Co.

Montana

$1,792,782—**Grafe, Shirley, Lane Co.,** Los Angeles, Calif.—Low bid for completion of construction at Hungry Horse Dam project; by Bureau of Reclamation.

$851,622—**J. & J. Construction Co.,** 1801 Petroleum Bldg., Oklahoma City, Okla.—Low bid for construction of a 115-kv. transmission line, Glendive-Williston, Fort Peck project; by Bureau of Reclamation.

New Mexico

$270,901—**Jack Adams,** P. O. Box 58, Santa Fe—Low bid for access road construction for the Atomic Energy Commission's Los Alamos project; by Bureau of Public Roads.

$8,000,000 approx.—**Beck-Utah-Hopkins Co.,** Albuquerque—Award for construction of 700-unit Wherry housing project at Kirtland Air Force Base; by Corps of Engineers.

$213,005—**O. D. Cowart,** Albuquerque—Low bid for construction of 7.86 mi. of Highway 10, Mansano-Mountainair Road in Torrance County; by State Highway Department.

$139,008—**Floyd Haake,** Santa Fe—Award for construction of 3.31 mi. of highway, Tesque-Chupadero, Santa Fe County; by State Highway Department.

$1,895,001—**Mex-Tex Construction Co.,** Roswell (8-firm venture)—Low bid for construction and improvement work on Walker Air Force Base; by Corps of Engineers.

Utah

$292,498—**W. W. Clyde & Co.,** Springville—Low bid for the construction of 2 concrete bridges and a section of highway; by State Road Commission.

$317,150—**Reynolds Construction Co.,** Springville—Low bid for work on the Low-Knolls project, about 8.7 mi. in length; by State Road Commission.

Oregon

$240,931—**Durbin Bros.,** Eugene—Low bid for construction work on section of the Oregon Coast Highway south of Agate Beach; by State Highway Commission.

$449,520—**General Electric Co.,** Schenectady, N. Y.—Low bid for supplying station service control boards, main control board

on the McNary Dam project, in Washington and Oregon; by Corps of Engineers.

$136,500—**Hamilton & Thomas,** Box 726, Eugene—Low bid for construction of an overcrossing at Goshen in Lane County; by State Highway Commission.

$661,192—**Kuckenberg Construction Co.,** 11104 N. Holman St., Portland—Low bid for embankment and grading work in Wasco and Hood River Counties on the Hood River-Mosier section of the Columbia River Highway; by State Highway Commission.

$493,913—**McNutt Bros.,** 351¼ E. Broadway, Eugene—Low bid for construction work on the Pacific Highway, Judkins Point-Goshen unit, near Eugene; by State Highway Commission.

$434,500—**Rogers Construction Co.** and **Babler Bros.,** Portland—Low bid for highway construction in Hood River County; by State Highway Commission.

Washington

$314,474—**Anderson Bridge Co.,** 4130 S. Adams, Tacoma—Low bid for bridge project in Lewis County, the Skookumchuck River bridge near Centralia; by State Highway Department.

$14,690,000 approx.—**Guy F. Atkinson Co.** (4-firm venture)—Low bid for the construction of Ross Dam on the Skagit River; by Seattle Board of Public Works.

$894,340—**Electric Construction Co.,** Tacoma—Low bid for construction of a 100-mi. 230-kv. transmission line from Big Eddy near The Dalles to substation east of Yakima; by Bonneville Power Administration.

$350,000 approx.—**Morrison-Knudsen Co., Inc.,** Boise, Idaho—Low bid for rehabilitation of magnesium plant at Mead, near Spokane.

$1,690,901—**S. S. Mullen, Inc.,** Seattle and **Donald M. Drake Co., Inc.** (joint venturers)—Award for the construction of buildings and related work at the Yakima firing range; by Corps of Engineers.

$309,251—**Pacific Electric Manufacturing Co.,** San Francisco, Calif.—Low bid for providing oil circuit breakers; by Bonneville Power Administration.

$622,840—**Pacific Sand & Gravel Co.,** Centralia—Low bid for the extension of north-south runway at McChord air force base; by Corps of Engineers.

$138,144—**Charles A. Power,** Box 11220, Spokane—Award for the construction of a railway bridge on Loon Lake undercrossing; by State Highway Department.

$2,646,500—**Sound Construction & Engineering Co.,** Seattle—Low bid for construction of various buildings and utilities at North Richland, U. S. Army project; by Corps of Engineers.

$674,820—**Smith & White,** Pier 65, Seattle—Contract for construction of a transmission line, Douglas, Okanogan and Grant counties, part of the Grand Coulee project; by Bonneville Power Administration.

$1,547,320—**Smith & White,** Seattle—Low bid for construction of transmission line in Seattle area; by Seattle Board of Public Works.

$116,403—**C. V. Wilder,** 2006 State St., Bellingham—Contract for bridge and approach system construction in Whatcom County; by State Highway Department.

Wyoming

$105,001—**Asbell Bros. Construction Co.,** Riverton—Low bid on Schedule I for the clearing of about 2,500 ac. of land for reservoir site on Missouri River Basin project; by Bureau of Reclamation.

$842,140—**J. & J. Construction Co.,** 1801 Petroleum Bldg., Oklahoma City, Okla.—Low bid on transmission line construction for the Lovell area; by Bureau of Reclamation.

$103,562—**Sharrock & Pursel,** Casper—Low bid on Unit I, membrane lining and related work for the Riverton project; by Bureau of Reclamation.

$111,712—**Trans-Electric Co.,** Louisville, Ky.—Low bid for the installation of overhead ground wires on the Seminoe-Cheyenne 115-kv. transmission line, Kendrick project; by Bureau of Reclamation.

SUPERVISING THE JOBS

. . . Continued from page 122

construction of cofferdams for Albeni Falls Dam near Priest River, Idaho. Macco Corporation, Paramount, Calif., is contractor on the $519,500 job.

Supervising the construction of a $526,300 bridge in Walnut Grove, Calif., is **Dick Haggerty.** Lord and Bishop, Sacramento, Calif., contractors, have **Charlie McPhee** as structure superintendent and **Harold Dooty** as pile driving superintendent. The bridge, which is expected to be finished by Jan. 1952, is a project of Sacramento County.

Cox Brothers Construction Co. has **Robert Werfoot** as the job superintendent on the $155,960 highway project near Newport, Calif. **Dick Hubbard** is the foreman on the job.

Construction on U. S. Highway 66 in McKinley County, N. M., is being supervised by **C. W. Holford. Joseph Brock** and **Clifford Earsley** are also working on the project for Henry Thygesen & Co., Albuquerque, N. M.

Guy M. Elder, Jr., is the job superintendent on construction of a 10,000,000-gal. reservoir at the north side filter plant in Denver, Colo. **E. E. Duckworth** is the general superintendent for Guy M. Elder Construction Co. of Denver on the $415,319 Denver Water Board project.

The $2,000,000 medical building being constructed in Los Angeles, Calif., by T-S Construction Engineers, Inc., Ford J. Twaits, Inc., & Morrison-Knudsen Co., Inc., has **Harry A. Arnburg** as job superintendent.

The Falcon Dam project near Laredo, Tex., is being managed by **Phil Royer** and his assistant, **Art Church. Fred Kinney** is the purchasing agent for the seven companies which compose the Falcon Dam Constructors, Rio Grande City, Tex.

Lee Keifh is the superintendent and **Harold Parlee** and **Ed Trimble** are the foremen on the Edison elementary school building project in Long Beach, Calif. Royse & Hight, Los Angeles, Calif., is the contractor.

The new city hall project in Ventura, Calif., is being supervised by **Ralph Taplett** for the George MacLeod Construction Co. of Ventura.

M. S. Morris is the job superintendent for Bechtel Corporation, Los Angeles, Calif., on the construction of an electrical sub-station at Norwalk, Calif. **J. M. Reimers** is general superintendent and **Tony Martinelli** is field engineer on the $4,400,000 project.

Colorado Turnpike

. . . Continued from page 69

Valley Highway, a project which probably will cost $20,000,000, is now under construction to provide a four-lane freeway through Denver from north to south.

Use of the turnpike will reduce the distance between Denver and Boulder by 8 miles when the connection is made to the Valley Highway.

Travel time between the two cities is expected to be cut to half the present average of about an hour.

Studies have indicated that the turnpike will generate approximately 30% more travel between the two cities than at present, and during the life of the bond issue the highway is expected to return to motorists an estimated $37,400 in direct benefits, more than five times the cost of its construction and maintenance over the same period. Revenues from the toll road are expected to be approximately $266,000 the first year, increasing to $400,000 in 1980.

Since the stepping up of the defense effort the Department was somewhat concerned about structural and reinforcing steel, but now has obtained a priority from the National Production Authority, and no difficulty is anticipated in obtaining necessary materials.

The turnpike, by offering superior speed of travel, safety and freedom from congestion, is expected to be of definite benefit to the defense effort because of the fact that the Bureau of Standards is constructing a laboratory in Boulder to conduct research into radio propagation waves.

Denver is over-crowded and an acute housing shortage exists, thus forcing workers in defense plants to reside at a considerable distance from their work. At least 300 have been forced to commute between Denver and Boulder daily for this reason.

In the event of an emergency, the turnpike would provide a rapid exit route from Denver. The accident rate on the existing highway is high and is increasing with the traffic volume, 20% of which is composed of heavily-loaded trucks, many filled with coal from the mines which are scattered throughout the region.

Reluctance for toll roads

The Colorado Highway Department entered into the toll road proposition reluctantly. It was well understood that improvements must be made to the existing highway to the limit of our ability, even after the turnpike is in operation. But, facing a serious transportation problem, and wholly without funds to solve it on even the basis of minimum requirements, it was felt the toll road offered the only alternative.

It has been a long battle but, we believe, well worth while. The Department does not contemplate additional toll roads in this state nor is it an advocate of this method of highway financing.

It is firmly convinced, however, that when the turnpike is completed, late this fall, it will in every way prove itself to be all that has been expected.

Big Creek 4

. . . Continued from page 74

heating in the field. Shop fabricated pipe sections were stress relieved in an oven at the shop.

Powerhouse features

The basic design of the powerhouse was controlled by a need for economy and by the necessity of providing for a flood level almost 40 ft. above the normal river water. For this reason, no opening exists in the building below the level of the main entrance, which is 8 ft. above the maximum recorded flood level.

In cooperation with the Operating group, the designers made a special effort to reduce the size of the powerhouse as much as possible. The gross volume of the powerhouse amounted to 7.4 cu. ft. per kilowatt of installed capacity compared to approximately 15 cu. ft. for other power plants of similar capacity. The powerhouse is a reinforced concrete building 135 ft. long and 82 ft. wide and houses two turbo-generators with a total nameplate capacity of 84,000 kw. The two turbines are of the Francis type and manufactured by the Pelton Water Wheel Company. One of the generators is being manufactured by Allis-Chalmers and the other by General Electric.

Foundation excavation was begun on December 6, 1949 and completed in March 1950. Concrete placing was started immediately and proceeded at a rapid rate to reduce the possibility of damage from spring runoff in the San Joaquin River. A 2-cu. yd. Johnson batch plant with a 1-cu. yd. mixer furnished all concrete for the powerhouse end of the project. Two methods of transporting concrete to the point of placement were devised. A special dump compartment of 1-cu. yd. capacity was constructed in two 3-cu. yd. dump trucks. Concrete was hauled from the mixer in these trucks to either a Pumpcrete machine or was discharged into a Gar-Bro laydown-type bucket and placed with a crane. To date 13,000 cu. yd. of concrete have been placed out of an estimated total of 15,000 cu. yd.

Installation of the first turbine started in December 1950 and the second in February 1951. The first unit is scheduled to go on the line in June of 1951 and the second unit late in July, 1951. The Allis-Chalmers generator is being stacked and wound in the field. The stator of the General Electric machine will come shop stacked and wound in three sections.

Electrical equipment and controls on the powerhouse are arranged for semi-automatic operation with but one operator on duty at a time. In addition to the 11-kv. auxiliary supply of energy from other plants, a 350-kw. house generator is provided in the powerhouse. The main transformers are located on the deck behind the plant and step up the 11,000-volt generated voltage to 220,000 volts for transmission to Los Angeles and to other system load centers.

Simultaneously with the work on the project, the construction of two 220-kv., ACSR, steel tower, transmission lines is under way by the Stone & Webster Engineering Corporation in collaboration with the Company's engineering staff.

The main transmission line to the south extends from Powerhouse No. 4 to a switching center at the Magunden Substation near Bakersfield.

A short tie line is also being constructed from Powerhouse No. 4 to the existing up-river No. 3 plant.

Cast-in-place, reinforced concrete, pile type footings were usel to support the steel towers. The conductor was 605,000 C. M. aluminum core steel reinforced.

Footings were excavated by tractor and truck-mounted augers. Undercutting of the bottom one foot of the excavation was accomplished by using a retractable blade on the bit. This method effected a considerable saving in using reduced footing diameters with adequate loading factors.

In most cases the steel towers were pre-assembled at the site and placed with a gin-pole.

W. L. Chadwick is Vice President in charge of Engineering and Construction for the Southern California Edison Company; R. W. Spencer is manager of the engineering department and P. B. Peecook, assistant manager. During the construction of the project Mr. Peecook was resident construction engineer for the company.

For the contractors, John Kiely was project sponsor; C. E. Pehl, manager of engineering; H. L. Leventon, construction manager on the dam and tunnels, and K. O. Taylor, general superintendent on the powerhouse and miscellaneous work.

NEWS of DISTRIBUTORS AND FACTORY BRANCHES

Nelson Stud Welding Division of *Morton Gregory Corporation* announces the expansion of its technical service staff on the West Coast and the establishment of a direct factory branch warehouse at 440 Peralta Ave., San Leandro, Calif. VERNE W. BENDER is the Western States regional manager for the firm.

☆ ☆ ☆

Ferguson

J. E. FERGUSON, assistant Western division parts manager for *Caterpillar Tractor Co.* since December, 1949, becomes Western division parts manager with headquarters at San Leandro, Calif. Ferguson, a graduate of Bradley University, joined Caterpillar in 1946 as an order interpreter in the parts department. He soon became a supervisor, then assistant parts manager in the central division before coming West. W. L. ANDERSON, formerly eastern division assistant parts manager, succeeds Ferguson as assistant parts manager in the Western division.

☆ ☆ ☆

F. O. MARION succeeds the late WALTER G. STROMQUIST as sales manager for *Masonite Corporation*, Chicago, Ill. He will direct all sales activities, including advertising and sales promotion. The 38-year-old executive joined the corporation in 1936 as a dealer salesman.

☆ ☆ ☆

Equipment Sales Company, 720 South 19th Ave., Phoenix, Ariz., is now distributor for the Cleco division of the *Reed Roller Bit Company*, Houston, Tex. In addition to handling the full line of Cleco Pneumatic Tools, the company will maintain complete stocks of Cleco parts and accessories.

☆ ☆ ☆

B. E. DAVID will be district manager for *Arcos Corporation's* new West Coast office and warehouse in Los Angeles, Calif. The firm produces a large line of welding electrodes.

☆ ☆ ☆

Associated Equipment Distributors, composed of manufacturers and distributors of construction equipment, proposes a nation-wide survey of construction machinery and trained personnel to determine "the nature and ownership" of available construction equipment, and the location of trained operators. The purpose of the survey would be to make the information available to Civil Defense authorities on all governmental levels in the hope of dismissing the necessity of governmental agencies purchasing large quantities of construction machinery at a time when economy should be stressed. The association believes that stockpiles of idle equipment, vitally needed for military and domestic construction, would result from government defense agency purchases.

☆ ☆ ☆

Le Roi-Rix Company, 6403 E. Slauson Ave., Los Angeles, Calif., becomes distributor in Southern California and Southern Nevada for the *Mandt Manufacturing Co.*, Columbus, Ohio, manufacturer of hydraulic swing loaders, cranes and excavators.

☆ ☆ ☆

The expansion and increased importance of Western heavy industry was greatly emphasized by a joint announcement by the *Mack Manufacturing Corporation* and the *Wooldridge Manufacturing Company* of Sunnyvale, Calif. Wooldridge will partially produce and fully assemble Mack off-highway vehicles in their main Sunnyvale plant. The vehicles, which operate off the public highways, will be specially designed to fit the needs of Western contractors, miners and loggers. Almost immediately,

SHAKING on the agreement signed between Mack Manufacturing Corp. and Wooldridge Manufacturing Co. (see accompanying item) are, left to right: *H. W. Dodge*, executive vice-president of Mack; *Pierce J. Fleming*, manager of Mack's off-highway sales division, and *H. Gusman*, president of Wooldridge.

one million dollars will be added to the payroll of the Sunnyvale plant, and plans are being rushed for the construction of a $250,000 modern assembly plant. The joint activity brings together the experiences and skills of two firms noted for the manufacture of heavy rubber-tired equipment, but Wooldridge will continue their usual operations and procedures in connection with Terra Cobras and other contracting and earth moving equipment produced by them. The announcement also specifies that Wooldridge will act as exclusive distributor for Mack's off-highway equipment in the Western States.

☆ ☆ ☆

Western Industrial Supply Company, 905 G St., Sacramento, Calif., is now a dealer for *Allis-Chalmers* motors and controls in northern counties of California. The supply company is managed by WILLIAM H. KEYSER.

☆ ☆ ☆

West Coast Engine and Equipment Company, distributors of *General Motors* diesel engines to the construction, industrial, marine and petroleum fields in Northern California, increase their sales and service facilities by moving into their newly completed building at 1077 Eastshore Highway, Albany, Calif. Floor space will be in-

West Coast Engine and Equipment Company's new building opening in April at Albany, Calif.

creased to over 15,000 sq. ft., and their new facilities will include glassed-in display room, enlarged parts department and assembly areas, overhaul bays, injector room and ample heavy equipment cleaning areas. Future expansion is guaranteed by 30,000 sq. ft. of additional ground space available for building.

☆ ☆ ☆

PETER P. BABIN comes to the San Francisco, Calif., branch office of the pump division, *Byron Jackson Co.*, Los Angeles, Calif. Babin's title will be sales engineer.

☆ ☆ ☆

Cornils

THOMAS CORNILS is now chief engineer for the Pacific Northwestern division of the *Link-Belt Company* with headquarters at Seattle, Wash. Cornils joined the company in 1928 as an engineering draftsman, and later worked in engineering sales, specializing on the needs of the pulp and paper mills, sawmills and fish canneries of the Seattle area.

☆ ☆ ☆

At the *Republic Supply Company of California's* sales convention in Los Angeles, Calif., the objective was to improve service to customers by increasing the salesmen's technical knowledge of their products. Tours were conducted through the Taylor Forge and Pipe Works and the

Continued on page 134

EXPERIENCE

CRAFTSMANSHIP

INTEGRITY

Structural Steel

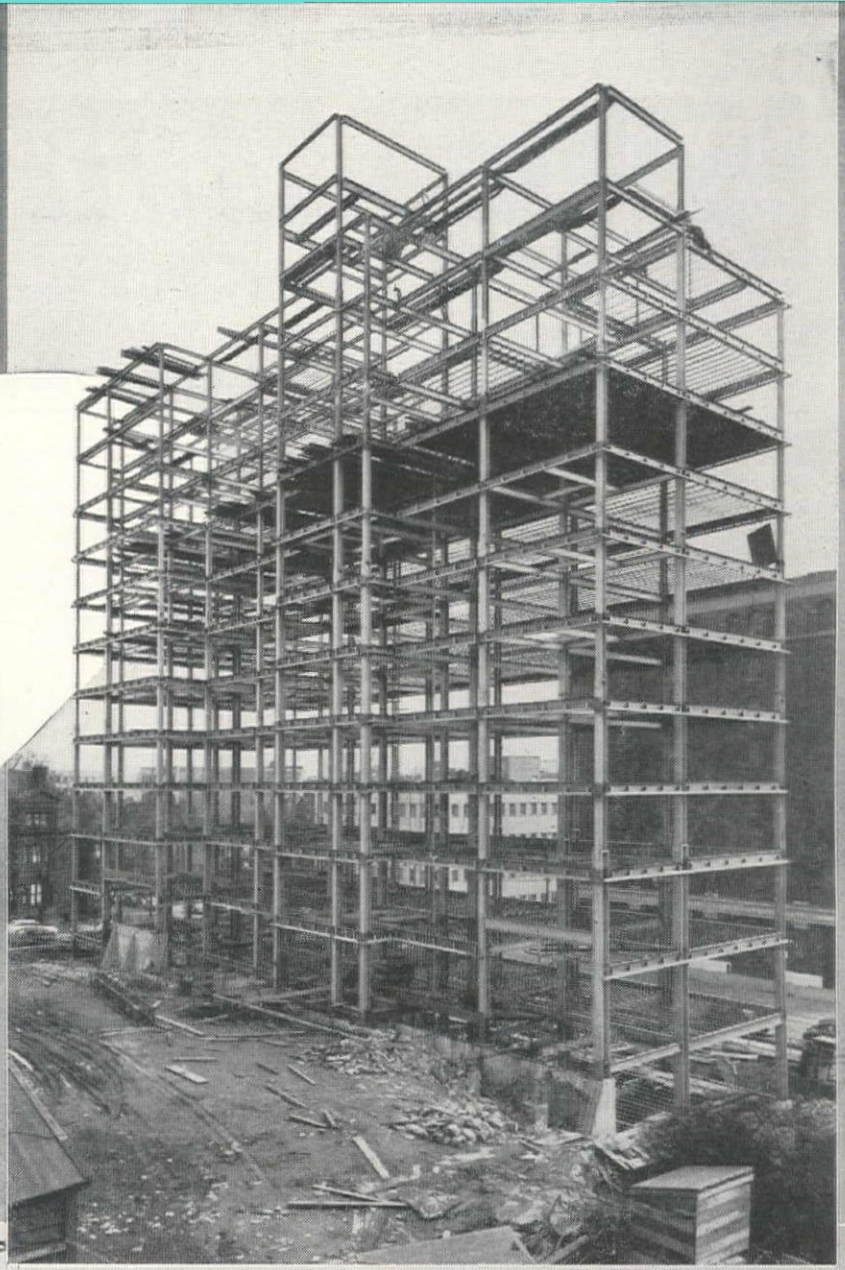
FABRICATION

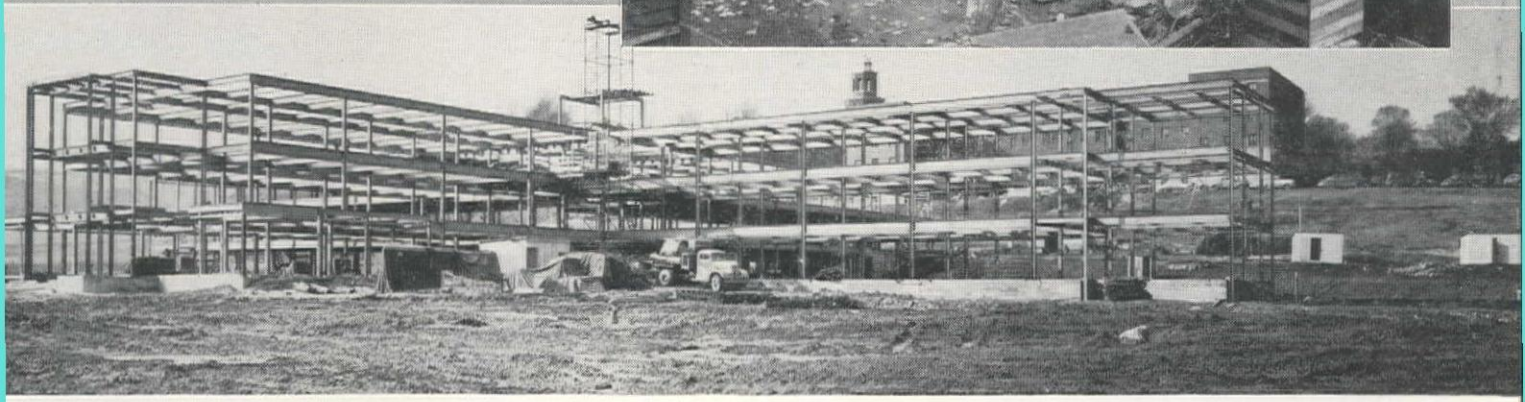
AND

ERECTION

BY

PITTSBURGH •DES MOINES





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NEW YORK (7), . . Room 919, 270 Broadway
CHICAGO (3), 1224 First National Bank Bldg.
DES MOINES (8), ... 921 Tuttle Street
DALLAS (1), . . . 1225 Praetorian Building
SEATTLE . . . . . 928 Lane Street
SANTA CLARA, CAL. . . 627 Alviso Road

NEWS of DISTRIBUTORS AND FACTORY BRANCHES

Continued from page 132

Kaiser Steel Mills at Fontana, Calif., for a first-hand look at the weld products distributed by the company. The discussions were in small groups for better results. Finally, in a general session, the entire force was addressed by company president JOHN J. PIKE and general sales manager ROY W. JOHNSON.

☆ ☆ ☆

Hercules Powder Company announces that its San Francisco, Calif., offices are now in the Standard Oil Bldg., 225 Bush Street. The offices handle sales of Hercules products in the Bay area.

☆ ☆ ☆

THOMAS A. HOPKINS, engine sales representative for *Caterpillar Tractor Co.'s* Western sales division since early 1949, is promoted to district representative with headquarters at Seattle, Wash. He will work with Caterpillar distributors and dealers in Washington, Alaska and British Columbia.

☆ ☆ ☆

J. F. BELES is the new district sales manager for the *Thew Shovel Co.*, Lorain, Ohio, in the entire Pacific Coast territory with offices in San Francisco, Calif. He formerly lived in Portland, Ore., and headed the Northwest area only. Beles replaces J. M. McLAIN who has been transferred to New York as district sales manager.

Beles

Lineweaver

Sales promotion director is the title HUGH M. LINEWEAVER acquires when he joins the *Forest Fiber Products Company*, Forest Grove, Ore. He will be responsible for coordinating sales promotion activities.

☆ ☆ ☆

Marion Power Shovel Company, Marion, Ohio, announces the appointment of *Ingenieria Mecanica y Electrica S. A.* as the Mexican distributor for its excavating and material handling equipment.

☆ ☆ ☆

Vibro-Plus Products, Inc., 54-11 Queens Blvd., Woodside, L. I., N. Y., announces the appointment in the Pacific States territory of *P. L. Crooks Co.*, Portland, Ore., *Air-Mack Equipment Co.*, Seattle, Wash., and *Le Roi-Rix Machinery Co.*, Los An-

Continued on page 136

UNIT BID PRICES

Selected Bid Abstracts for Typical Western Projects

Water Supply . . .

Furnishing and Installing Reinforced Concrete Pipe, etc., for Outlet Line

California—Los Angeles County—Department of Water and Power—United Concrete Pipe Corp., Baldwin Park, Calif., with a bid of $2,172,424, was low bidder for Alternate A of the construction of Silver Lake Outlet line. P. & J. Artukovich, Inc., with a bid of $2,162,681, was sole bidder on Alternate B for the same project. Unit bids were as follows:

Alternate A

(1) United Concrete Pipe Corp. $2,172,424
(2) Artukovich Bros., Inc. 2,346,336
(3) American Pipe and Concrete Co 2,365,400

Alternate B

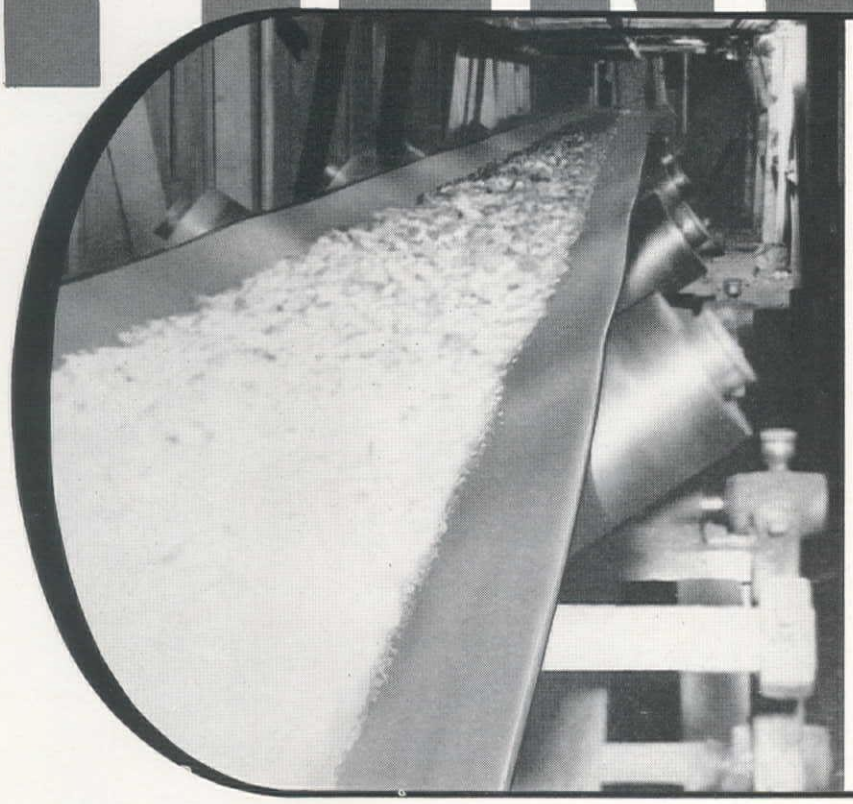
(1) P. & J. Artukovich, Inc. $2,162,681

		Alternate A			Alternate B	
		(1)	(2)	(3)	Units Same Item	(1)
115,300	cu. yd. trench excav., unclassified	4.00	2.50	3.90	100,750	3.73
79,890	cu. yd. trench backfill	.50	1.00	1.95	72,100	.70
5,485	ton rock refill	3.50	3.50	3.50	4,550	2.00
	Furn. and install 66-in. I.D. reinf. conc. cyl. pipe					
617	lin. ft. A. Class 70	36.40	45.00	40.35	—	—
430	lin. ft. B. Class 75	36.80	45.50	40.65	—	—
681	lin. ft. C. Class 80	37.40	46.00	41.05	—	—
1,186	lin. ft. D. Class 90	39.20	47.50	42.55	—	—
2,065	lin. ft. E. Class 95	40.20	48.00	43.40	—	—
521	lin. ft. F. Class 100	41.30	49.00	44.15	—	—
459	lin. ft. G. Class 105	42.40	49.50	44.85	—	—
	Furn. and install 60-in. I.D. reinf. conc. cyl. pipe					
320	lin. ft. A. Class 90	36.20	42.00	37.30	—	—
1,216	lin. ft. B. Class 105	38.60	44.00	39.35	—	—
1,540	lin. ft. C. Class 110	39.60	45.00	40.00	—	—
2,020	lin. ft. D. Class 120	41.30	46.00	41.20	—	—
1,019	lin. ft. E. Class 125	42.20	47.00	41.85	—	—
1,102	lin. ft. F. Class 130	43.10	47.50	42.30	—	—
1,583	lin. ft. G. Class 135	43.90	48.25	43.40	—	—
252	lin. ft. H. Class 140	44.80	49.75	43.80	—	—
2,329	lin. ft. I. Class 145	45.70	50.00	44.20	—	—
4,864	lin. ft. J. Class 150	46.60	50.50	44.95	—	—
4,604	lin. ft. K. Class 155	47.50	51.25	45.60	—	—
875	lin. ft. L. Class 160	48.30	52.00	45.70	—	—
551	lin. ft. furn. and install 67-in. I.D.x⅜-in. W.S. pipe, no lining, no coating	36.00	60.00	44.50	6,507	33.50
4,003	lin. ft. furn. and install 61-in. I.D.x⅜-in. W.S. pipe, no lining, no coating	33.50	59.25	41.10	25,727	31.50
50	lin. ft. furn. and install 30-in. I.D.x⅜-in. W.S. pipe, ¼-in. cem. mort. lining, ⅜-in. cem. mort. coating, C.T.E. undercoat	30.00	48.00	36.00	50	30.00
55	lin. ft. furn and install 24-in. O.D.x⅜-in. W.S. pipe, ¼-in. cem. mort. lining, ⅜-in. cem. mort. coating, C.T.E. undercoat	28.00	47.00	32.50	55	28.00
125	lin. ft. furn. and install 20-in. O.D.x⅜-in. W.S. pipe, ¼-in. cem. mort. lining, ⅜-in. cem. mort. coating, C.T.E. undercoat	25.00	40.00	28.80	125	22.00
71,100	sq. ft. furn. and apply ½-in. thick spun cem. mort. pipe lining	.28	.30	.30	526,000	.30
71,600	sq. ft. furn. and apply 1-in. thick reinf. cem. mort. pipe coating	.33	.35	.35	547,700	.35
71,200	sq. ft. furn. and apply coal tar enamel undercoat	.27	.27	.28	547,700	.26
	Additional circum. pipe-joint field welds					
32	per joint A. 66-in. I.D. reinf. conc. cyl. pipe, ¼-in. welds	110.00	75.00	150.00	—	—
59	per joint B. 60-in. I.D. reinf. conc. cyl. pipe, ¼-in. welds	90.00	70.00	75.00	—	—
7	per joint C. 67-in. I.D. W.S. pipe, ⅜-in. welds	60.00	65.00	45.00	7	120.00
20	per joint D. 61-in. I.D. W.S. pipe, ⅜-in. welds	60.00	60.00	42.00	20	105.00
	Furn. and install W.S. reducers and enlargers, cem. mort. lined and coated, C.T.E. undercoat					
1	ea. A. 66-in. x 36-in. reducer	$1,000	800.00	950.00	1	$1,100
5	ea. B. 60-in. x 36-in. reducer	$1,000	700.00	850.00	5	$1,000
1	ea. C. 66-in. x 60-in. reducer	600.00	450.00	525.00	1	$1,400
1	ea. D. 36-in. x 66-in. enlarger	$1,700	$1,500	$1,625	1	$1,100
5	ea. E. 36-in. x 60-in. enlarger	$1,400	$1,300	$1,380	5	$1,000
1	ea. F. 24-in. x 30-in. enlarger	600.00	550.00	620.00	1	600.00
1	ea. G. 24-in. x 20-in. enlarger	700.00	450.00	510.00	1	500.00
	Outlets on trunk line					
1	ea. A. 48-in. x 36-in.—90°, flange, blind flange	$1,400	$1,300	$1,430	1	$1,200
1	ea. B. 30-in.—45° with dished head	800.00	700.00	750.00	1	500.00
1	ea. C. 36-in. x 24-in.—90° with flange	900.00	750.00	735.00	7	750.00
1	ea. D. 36-in. x 24-in.—90° with blind flange	$1,000	900.00	870.00	1	900.00
1	ea. E. 36-in.—90° with dished head	700.00	600.00	605.00	1	700.00
2	ea. F. 30-in.—90° with dished head	600.00	550.00	560.00	2	$1,250
1	ea. G. 24-in.—45° with flange (10-ft. W.S.P.)	900.00	850.00	890.00	1	750.00
1	ea. H. 20-in.—61° with flange	700.00	600.00	600.00	1	450.00
1	ea. I. 20-in.—61°—9-ft. W.S.P., with flange	900.00	800.00	785.00	1	600.00
1	ea. J. 20-in.—90°—5 ft. W.S.P., with flange	800.00	700.00	700.00	1	700.00
1	ea. K. 20-in.—90° flange, blind flange	900.00	800.00	790.00	1	700.00
1	ea. L. 20-in.—74° with flange	700.00	600.00	600.00	1	550.00
1	ea. M. 20-in.—90° flange, blind flange	700.00	650.00	645.00	1	750.00

(Continued on next page)

Industrial rubber products especially built for LONG SERVICE

PIONEER



this Pioneer conveyor belt has worked a 144 hour week for 22 years

144 hours a week—that's 24 hours a day for six days. Yes, it would take 66 years to carry the same load on a regular 8-hour schedule. That is the record of an engineered conveyor belt supplied by PIONEER RUBBER MILLS to a Pope and Talbot sawmill in 1928. "Old reliable" has never caused a shutdown, and is still in good condition delivering wood chips from the mill.

Unusual? Not at all—the *right* belt was specified for the *right* job. At PIONEER, sound engineering advice goes hand-in-hand with *sixty-three* years of experience in building *long-lived* industrial rubber goods. PIONEER RUBBER MILLS or its distributors will give you expert recommendation—and industrial rubber goods built especially for *long service.*

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DISTRIBUTORS:

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PORTLAND • EUGENE.....Munnell & Sherill, Inc.
KLAMATH FALLS.....Klamath Machinery Co.
SPOKANE • BOISE • POCATELLO....Intermountain Equipment Co.
SALT LAKE CITY.....National Equipment Co.
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NEWS of DISTRIBUTORS AND FACTORY BRANCHES

Continued from page 134

geles, Calif., as distributors with exclusive sales rights in their areas. These companies will handle the Vibro-Plus line of vibrating equipment including the gasoline, electric and pneumatic powered internal Rollgear vibrators, Topdog external vibrators, the type MRJ-6 vibratory soil compactors as well as other vibratory units. Vibro-Plus still has some open territories about which inquiries are welcomed.

☆ ☆ ☆

The Bay Equipment Co., Richmond, Calif., is now the Northern California distributors for *Worthington Pump & Machinery Co.; Ransome Machinery Co.; Pettibone-Mulliken Corp.; Universal Engineering Co.*, and *Haiss Mfg. Co.*, according to RAY SMITH, company president. Smith also announces that they will serve as distributors for *Manitowoc Engineering Works* in the states of Oregon, Washington and Nevada, in addition to Northern California. CHARLES ROBINSON joins the sales staff of Bay Equipment Co. He will have the San Francisco and Marin County, Calif., territory.

NEWS of MANUFACTURERS

Consolidated Machinery & Supply Co., Ltd., expands its manufacturing facilities at 2031 Santa Fe Ave., Los Angeles, Calif., by adding over 18,000 sq. ft. of floor space. An entire new building houses the final assembly line for Consolidated's Comet industrial woodworking saws, metal cutting saws and home workshop tools.

☆ ☆ ☆

JAMES P. CUMMINS is the new president of the *Centriline Corporation*, New York City, N. Y. Western representative for the firm is *American Pipe and Construction Co.*, South Gate, Calif.

☆ ☆ ☆

The annual business meeting of the *Water and Sewage Works Manufacturers Association* will be held on May 2, 1951 in Miami, Florida. Featured speaker of the WSWMA luncheon at the Columbus Hotel will be FRANK LOVEJOY, marketing and sales executive of the Socony Vacuum Oil Company.

☆ ☆ ☆

After 46 years of continuous service, HAROLD R. MANSFIELD, president of *Pioneer Rubber Mills*, is retiring. He joined Pioneer Rubber Mills in 1905, when the company was operating both factory and offices in San Francisco, Calif. He first worked in the factory shipping department, and advanced through sales and produc-

Continued on page 138

UNIT BID PRICES . . . CONTINUED

1 ea.	N. 16-in.—90° flange, blind flange	400.00	400.00	300.00	1	500.00
2 ea.	O. 12-in.—90° flange, blind flange	300.00	300.00	225.00	2	700.00
	Outlets on regulator lines					
1 ea.	A. 24-in.—90°	400.00	400.00	360.00	1	700.00
1 ea.	B. 24-in.—90° flange, blind flange	600.00	600.00	525.00	1	$1,100
	Install valves and couplings					
3 ea.	A. 36-in. cone	700.00	500.00	330.00	3	300.00
3 ea.	B. 36-in. gate	700.00	450.00	435.00	3	200.00
2 ea.	C. 24-in. gate	200.00	400.00	270.00	2	150.00
4 ea.	D. 20-in. gate	150.00	400.00	225.00	4	100.00
1 ea.	E. 20-in. gate	130.00	350.00	225.00	1	100.00
2 ea.	F. 12-in. gate	100.00	200.00	150.00	2	30.00
27 ea.	18-in. manholes	400.00	400.00	350.00	27	500.00
25 ea.	8-in. passholes	200.00	300.00	150.00	25	250.00
	Air release and vacuum valve assemblies					
20 ea.	A. 2-in. A.R.V.	400.00	275.00	345.00	20	125.00
6 ea.	B. 4-in. V.V. and A.A.R.	350.00	350.00	450.00	6	150.00
2 ea.	C. 4-in. V.V.	300.00	350.00	435.00	2	150.00
1 ea.	D. 6-in. V.V. and A.A.R.	350.00	495.00	600.00	1	220.00
2 ea.	E. 6-in. V.V.	300.00	495.00	585.00	2	220.00
	Blowoffs					
6 ea.	A. 8-in.	850.00	$1,150	$1,750	6	250.00
6 ea.	B. 12-in.	$1,250	$1,350	$2,175	6	400.00
3 ea.	Vaults for 36-in. cone valves	$1,700	$2,700	$3,165	3	$1,200
	Steel standpipes for gate valves					
3 ea.	A. 36-in. gate	750.00	800.00	840.00	3	800.00
2 ea.	B. 24-in. gate	600.00	750.00	840.00	2	600.00
4 ea.	C. 20-in. gate	450.00	720.00	840.00	4	550.00
12 ea.	manhole vaults	700.00	750.00	730.00	12	300.00
8,470 per. ft.	streetcar rails, remove, deliver and unload	1.00	.50	1.00	8,470	1.75
	Temporary bulkheads: F, and I, and remove					
2 ea.	A. 67-in.	400.00	600.00	285.00	14	250.00
10 ea.	B. 61-in.	400.00	350.00	265.00	58	200.00
2 ea.	butt straps 6-in. x ⅜-in. x 61¼-in.	150.00	200.00	100.00	2	250.00
129 cu. yd.	concrete for walls, pipe encasements and substructure supports, Cl. 2000. furn. and place	50.00	50.00	45.00	103	30.00
450 cu. yd.	concrete for anchor blocks and cradles, Class 1500, furn. and place	30.00	25.00	30.00	403	20.00
2,488 lb.	reinforcement steel, furn. and place	.20	.15	.15	2,488	.18
20 per ft.	concrete curb, reconstruct	4.00	2.00	4.00	20	5.00
1,200 sq. ft.	sidewalk, reconstruct	.30	.30	.35	1,200	.50
2 ea.	catch basin No. 37, construct	300.00	300.00	315.00	2	300.00
85 per ft.	15-in. conc. storm drain pipe, reconstruct	6.00	5.00	8.00	85	8.00
215 ea.	6-in. house connection sewers, reconstruct	55.00	150.00	50.00	215	30.00
23 ea.	6-in. house connection sewers, remodel	60.00	250.00	80.00	23	15.00
1 ea.	sewer offset manhole, remodel	350.00	200.00	345.00	1	300.00
1 ea.	8-in. sewer and drop "S" manhole, const. and remodel	600.00	600.00	900.00	1	350.00
	Removing existing water mains					
850 per ft.	A. 20-in. cast iron pipe	.50	1.00	3.00	850	1.00
1,267 per ft.	B. 30-in. cast iron pipe	.50	1.00	3.75	1,267	1.10
	Removing existing water mains					
850 per ft.	A. 20-in. cast iron pipe, comp. sections	2.50	2.00	3.75	850	1.50
1,267 per ft.	B. 30-in. cast iron pipe, comp. sections	3.00	2.00	4.50	1,267	1.60
9 ea.	trees, remove and dispose	150.00	100.00	110.00	9	50.00
2 ea.	electrolysis test points, furn. and install	200.00	180.00	150.00	2	400.00
4 ea.	61-in. W.S. bulkhead, remove	200.00	100.00	55.00	4	50.00
4,850 per ton	vibrated sand backfill for substructure support, furnish and place	2.50	4.50	3.10	4,850	3.50
2,415 per ton	temporary resurfacing, furn. and place	5.00	10.00	10.00	2,232	6.00
1 ea.	A.S.M.E. standard dished head, 61-in. x ⅜-in. furnish and install	200.00	300.00	150.00	1	300.00
	Jacked casing					
297 per ft.	A. 72-in. I.D., furnish and install	75.00	75.00	110.00	529	73.00
232 per ft.	B. 84-in. I.D., furnish and install	80.00	80.00	125.00	—	—
	Contractor's total, Items 1 to 49 incl. credit allowance for dept. pipe					
850 per ft.	A. 20-in. cast iron pipe	1.00	.50	1.30		1.00
1,267 per ft.	B. 30-in. cast iron pipe	1.50	.50	2.15		1.10

Bridge and Grade Separation . . .

Four Steel I-Beam Bridges on Richardson Highway

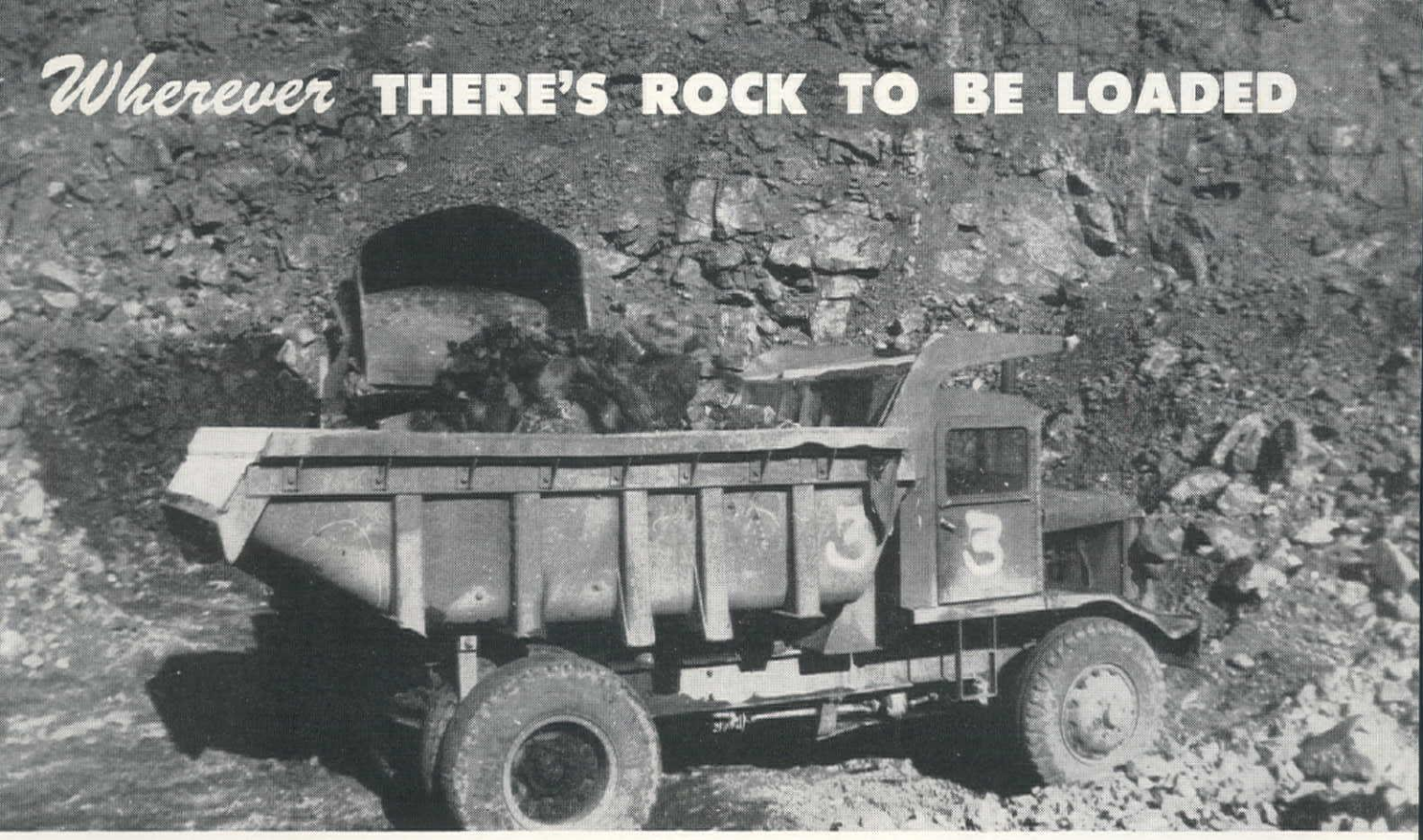
Alaska—Fairbanks district—Alaska Road Commission—Munter Construction Co., Inc., Seattle, Wash., with a bid of $131,366.75 was low bidder for construction of 4 I-beam bridges located on Richardson Highway, Section C. Unit bids were as follows:

(1) Munter Construction Co., Inc.....$131,366.75
(2) J. J. Badraun Co. 141,942.00
(3) M. P. Butler 153,587.78
(4) Lytle & Green Co. $170,361.70
(5) McClain Construction Co., Inc..... 246,988.83

		(1)	(2)	(3)	(4)	(5)
	Darling Creek Bridge					
90 cu. yd.	foundation excav.	10.00	5.00	5.00	15.00	10.00
120 cu. yd.	fill for tie-rod support	10.00	5.00	4.50	7.00	7.20
70.6 cu. yd.	Class A concrete	165.00	195.00	200.00	225.00	350.25
67,690 lb.	structl. steel, furn. fabri. and erect.	.31	.35	.39	.43	.57
12,010 lb.	reinf. steel (intermed. grade), furn. and installed	.21	.22	.22	.30	.64
280 lin. ft.	steel piling (10 BP 42) furn. and driven	8.00	10.00	11.50	11.00	16.38
360 lin. ft.	steel piling (12 BP 53) furn. and driven	9.50	10.00	13.50	13.00	23.19
450 lb.	hardware, furn. and installed	1.60	2.00	1 60	1.75	1.39
4.874 M. ft.	B.M. creosoted lumber, furn. and installed	500.00	400.00	460.00	475.00	648.20
	Bear Creek Bridge					
30 cu. yd.	foundation excav.	10.00	5 00	5.00	15.00	10.00
225 cu. yd.	fill for tie-rod support	10.00	5.00	4.50	7.00	7.20
52.8 cu. yd.	Class A concrete	165.00	195.00	200.00	225.00	350.25

(Continued on next page)

Wherever THERE'S ROCK TO BE LOADED



Eimco RockerShovels have been known as good rock loading machines ever since the first machine was produced. Now over 6,000 of these installations operate in rock everyday — they're the equipment used when the going gets rough.

The 104, shown here, is loading rock with its 1¼ yard* bucket at the rate of 4 to 5 yards per minute. It's a heavy-duty, fast, dependable machine, saving contractors and rock handling companies money on every job.

Write for information on this versatile rock loading machine.

*Larger buckets for lighter materials.

A304

EIMCO

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

EXECUTIVE OFFICES AND FACTORIES — SALT LAKE CITY 10, UTAH, U. S. A.

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AGENTS IN ALL PRINCIPAL CITIES THROUGHOUT THE WORLD

NEWS of MANUFACTURERS

Continued from page 136

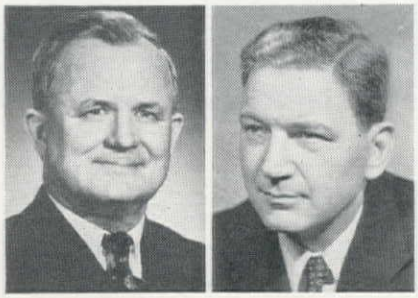
tion to the position of vice president in charge of production in 1920. He was top production man at the Pittsburg, Calif., plant for many years, became executive vice president in 1935, and began his term of office as president in 1946. Mansfield is succeeded by W. S. TOWNE.

☆ ☆ ☆

J. J. NOLAN, JR., *Central Foundry Company*, Newark, N. J., is re-elected president of the *Cast Iron Soil Pipe Institute*, which represents 27 major manufacturers of cast iron soil pipe and fittings.

☆ ☆ ☆

W. A. ROBERTS is the new president of *Allis-Chalmers Mfg. Co.*, Milwaukee, Wis., succeeding the late WALTER GEIST. W. C. JOHNSON, formerly executive vice-presi-



Roberts ***Johnson***

dent in charge of the general machinery division, now becomes executive vice president for the entire company, and R. S. STEVENSON is now vice president in charge of the tractor division.

☆ ☆ ☆

M. B. GARBER, director of sales for *The Thew Shovel Co.*, Lorain, Ohio, is now on-call as a consultant to the Machinery Division of the *National Production Authority*, Washington, D. C. Garber will continue his present duties with Thew but will be available as an on-call advisor to NPA on matters pertaining to the requirement, use and production of construction machinery. He was on loan to the government in World War II to serve as director of the Construction Machinery Division of the War Production Board.

☆ ☆ ☆

Calaveras Cement Company, San Andreas, Calif., announces that increased government demands for cement make it necessary to institute an allocation system of non-government shipments immediately. H. C. MAGINN, company vice president, said that every effort would be made toward a "fair and equitable" disbursement of cement after the needs of government were satisfied.

☆ ☆ ☆

The *Concrete Products Association of Washington* moves its offices from 416 Arctic Bldg., to 328 Third Avenue West, in Seattle, Wash.

UNIT BID PRICES . . . CONTINUED

35,410 lb. struct. steel, furn., fabr. and erect.	.31	.35	.39	.43	.57
8,702 lb. reinf. steel (intermed. grade), furn. and installed	.21	.22	.22	.30	.64
880 lin. ft. steel piling (10 BP 42), furn. and driven	8.00	10.00	11.50	11.00	16.38
565 lb. hardware, furn. and installed	1.60	2.00	1.60	1.75	1.39
5.648 M. ft. B.M. creosoted lumber, furn. and installed	500.00	400.00	460.00	475.00	648.20
30-ft. x 24 I-Beam Bridge Located at Mile 230.4					
35 cu. yd. foundation excav.	10.00	5.00	5.00	15.00	10.00
110 cu. yd. fill for tie-rod support	10.00	5.00	4.50	7.00	7.20
35.2 cu. yd. Class A concrete	165.00	195.00	200.00	225.00	350.25
16,470 lb. struct. steel, furn., fab., and erect.	.31	.35	.39	.43	.57
5,060 lb. reinf. steel (intermed. grade), furn. and installed	.21	.22	.22	.30	.64
300 lin. ft. steel piling (10 BP 42), furn. and driven	8.00	10.00	11.50	11.00	16.38
200 lin. ft. steel piling (8 BP 36), furn. and driven	7.50	10.00	11.00	10.00	23.36
350 lb. hardware, furn. and installed	1.60	2.00	1.60	1.75	1.39
3.592 M. ft. B.M. creosoted lumber, furn. and installed	500.00	400.00	460.00	475.00	648.20
30-ft. x 24-ft. I-Beam Bridge Located at Mile 236.8					
80 cu. yd. foundation excav.	10.00	5.00	5.00	15.00	10.00
420 cu. yd. fill for tie-rod support	10.00	5.00	4.50	7.00	7.20
39.6 cu. yd. Class A concrete	165.00	195.00	200.00	225.00	350.25
23,160 lb. struct. steel, furn., fabr. and erect.	.31	.35	.39	.43	.57
5,893 lb. reinf. steel (intermed. grade), furn. and installed	.21	.22	.22	.30	.64
880 lin. ft. steel piling (10 BP 42), furn. and driven	8.00	10.00	11.50	11.00	16.38
578 lb. hardware, furn. and installed	1.60	2.00	1.60	1.75	1.39
5.724 M. ft. B.M. creosoted lumber, furn. and installed	500.00	400.00	460.00	475.00	648.20

Concrete and Steel Bridge Over Coos River

Oregon—Coos County—Oregon State Highway Department—Tom Lillebo, Reedsport, Oregon, with a bid of $553,789.00 was low before the Oregon State Highway Department for construction of a concrete and steel bridge over Coos River on the Coos River Secondary highway. Unit bids were as follows:

(1) Tom Lillebo $553,789.00
(2) Gilpin Construction Co. $670,053.00

	(1)	(2)
Lump sum, shoring, cribbing, etc.	$79,000	$100,000
1,500 cu. yd. struct. excav.	7.00	5.00
20 cu. yd. struct. excav. below elevations shown	15.00	10.00
8,800 lin. ft. furn. foundation piling	.56	.61
322 only drive piles	23.00	40.00
540 cu. yd. seal concrete	38.00	50.00
1,810 cu. yd. Class "A" concrete	63.00	88.00
340,000 lbs. metal reinforcement	.105	.125
325,000 lb. struct. carbon steel	.262	.2575
390,000 lb. struct. low alloy steel	.262	.2925
1,850 sq. ft. filled steel grid decking	3.50	6.25
Lump sum, machinery	$42,700	$60,000
Lump sum, electrical equipment	$44,900	$46,000

Steel and Concrete Bridge, Precast Concrete Piling

Washington—Lewis County—Department of Highways—Bennett Campbell, Inc., Seattle, Wash., with a bid of $87,201.20, was low for construction of the Salzer Creek Bridge on primary state highway No. 1, a federal aid project, No. FI-001-2(5). Unit bids were as follows:

(1) Bennett Campbell, Inc. $87,201.20
(2) Anderson Bridge Construction Co. 92,131.00
(3) Mac Rae Bros. 94,807.00
(4) S. S. Mullen, Inc. 95,872.00
(5) Lockyear & White, Inc. 97,576.50
(6) General Construction Company 98,382.00
— N. Fiorito Co. $100,150.00
— J. A. Troxell 102,415.00
— M. P. Butler 102,496.00
— Donald M. Drake 104,393.00
— Terpening & Sons 108,563.00
— Roy T. Earley Co. 124,778.00

	(1)	(2)	(3)	(4)	(5)	(6)
550 cu. yd. common excav., incl. haul	1.10	1.00	1.00	1.00	.90	1.00
3,020 cu. yd. channel change excav., incl. haul	.86	.75	.60	1.20	.70	1.00
BRIDGES						
525 cu. yd. conc. Class A in place	59.20	60.00	64.00	65.00	66.50	75.00
572 lin. ft. reinf. conc. bridge railing in place	8.00	8.00	8.00	8.00	9.00	6.00
107,000 lb. steel reinf. bars in place	.11	.10	.125	.115	.115	.115
5,900 lb. struct. carbon steel in place	.37	.40	.38	.40	.40	.50
6,200 lin. ft. furn. precast conc. piling	4.25	5.00	3.75	4.70	4.50	3.75
96 only driving precast conc. piles	60.00	80.00	112.00	72.00	102.00	125.00
3 only furn. and driv. precast conc. test piles	760.00	500.00	$1,550	760.00	850.00	500.00

Reinforced Concrete Box Girder Overcrossing

California—Los Angeles County—Division of Highways—Fredericksen & Kasler, Sacramento, Calif., with a bid of $320,942.58, was low before the Division of Highways for construciton of a reinforced concrete box girder bridge for an overcrossing to be constructed on the Hollywood Freeway. Unit bids were as follows:

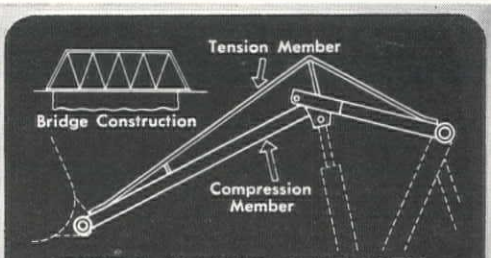
(1) Fredericksen and Kasler $320,942.58
(2) J. E. Haddock, Ltd. 327,072.35
(3) Charles MacClosky 331,643.50
(4) Bongiovanni Construction Co. 331,743.05
(5) Webb & White $344,028.90
(6) George W. Peterson and Jack W. Baker 377,368.00

	(1)	(2)	(3)	(4)	(5)	(6)
1,300 cu. yd. removing concrete	3.50	4.80	3.50	3.15	5.00	5.20
40 cu. yd. remove. pav't by burning	12.70	15.00	15.00	14.00	15.00	15.00
Lump sum, clearing and grubbing	$4,600	$4,000	$6,000	$4,500	$4,000	$10,000
36,000 cu. yd. roadway excav.	.47	.59	.58	.56	.50	.80
3,520 cu. yd. struct. excav. (bridge)	1.65	2.20	2.00	1.00	2.00	2.50
5,290 cu. yd. struct. backfill (bridge)	1.80	1.60	1.80	2.40	2.00	2.40
3,500 ton imported base material	2.10	2.15	2.20	2.15	2.00	2.50
Lump sum, dev. wat. supp. and furn. wat. equip.	350.00	$1,300	200.00	500.00	$1,000	$1,000
200 M. gal. applying water	1.45	1.75	2.50	2.00	2.00	2.50
Lump sum, finishing roadway	600.00	250.00	500.00	500.00	500.00	$3,500
800 ton mineral aggregate (P.M.S.)	4.15	5.85	3.75	3.90	4.50	4.00
45 ton paving asphalt (P.M.S.)	21.50	5.85	20.00	19.00	20.00	20.00
1,144 ton asphalt concrete	4.97	5.70	4.75	4.95	5.50	5.50
86 cu. yd. Class "B" P.C.C. (base)	21.00	16.50	25.00	20.00	22.00	28.00
3,230 cu. yd. Class "A" P.C.C. (struct.)	43.80	45.00	45.00	47.80	45.78	50.00
480 lin. ft. rubber waterstops	2.55	2.00	3.00	2.50	2.50	2.50
19,300 lb. miscl. iron and steel	.35	.33	.35	.30	.35	.35
230 cu. yd. Cl. "A" P.C.C. (curbs, gutters, sdwlks.)	27.00	34.00	30.00	30.00	33.00	40.00
580,300 lb. bar reinforcing steel	.10	.095	.095	.025	.105	.10
70 lin. ft. laminated timber guardrail	2.90	4.00	7.00	3.00	3.50	4.50
950 lin. ft. temp. timber curb and railing	3.20	3.50	3.00	2.50	3.50	2.50

(Continued on next page)

Operators Agree...

There's MORE PAY TIME with a LULL Shoveloader



EXTRA LIFTING STRENGTH

Lull Shoveloaders are equipped with lifting arms of rugged bridge-like construction. They are designed to give maximum lifting strength without bulkiness and to eliminate twisting or swaying even under maximum loads.

LONG FORWARD REACH

Note how the Long Forward Reach of the Lull Shoveloader lets you get in close, handles big loads with ease, and permits minimum maneuvering.

MORE PAY MINUTES as fast hydraulic action and finger-tip control of both lifting arm and bucket saves time in positioning for each operation.

MORE PAY HOURS as longer higher reach ahead of radiator permits faster loading or piling . . . saves hours of maneuvering time.

MORE YEAR 'ROUND PAY TIME . . . digging . . . lifting . . . loading . . . transporting . . . scraping or bulldozing, A wide variety of interchangeable attachments make the Lull Shoveloaders the most versatile equipment you can own to give you *more pay time* with lower costs every day of the year.

Write for PAY TIME FACTS on all of the eight Shoveloader models, each value-packed with exclusive Lull features.

MAIL THIS COUPON TODAY!

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Designers and Builders of
The Largest Line of Allied Equipment
for Industrial Wheel Type Tractors

SHOVELOADERS ● UNIVERSAL LOADERS ● FLUID-DRIVEN SWEEPERS ● LULLDOZERS ● SHOULDER MAINTAINERS

UNIT BID PRICES . . . CONTINUED

120 lin. ft. portable timber barricades	4.40	2.25	3.00	3.00	3.50	4.50
600 lin. ft. chain link fence	2.25	2.40	2.20	2.50	3.00	2.50
484 lin. ft. steel railing	7.40	7.40	7.00	7.50	8.00	7.50
150 lin. ft. 15-in. reinf. conc. pipe (std. str.)	7.80	6.00	13.00	5.45	13.30	7.00
250 lin. ft. 18-in. reinf. conc. pipe (extr. str.)	7.80	6.00	14.00	6.40	13.50	7.50
50 lin. ft. 21-in. reinf. conc. pipe (std. str.)	10.60	10.70	14.00	7.95	15.00	11.00
110 lin. ft. 24-in. reinf. conc. pipe (std. str.)	11.50	10.70	15.00	9.65	15.50	13.00
32 lin. ft. 27-in. reinf. conc. pipe (std. str.)	12 30	12.50	16.00	10.60	16.50	17.00
15 cu. yd. Class "C" P.C.C. (pipe reinf.)	19.00	18.00	20.00	31.80	20.00	28.00
2 ea. reinf. conc. box. sections (storm drain)	550.00	275.00	600.00	350.00	660.00	650.00
2 ea. catch basins No. 37-B (storm drain)	350.00	260.00	300.00	275.00	330.00	425.00
2 ea. catch basins No. 38 (storm drain)	305.00	265.00	200.00	300.00	220.00	425.00
1 ea. catch basin No. 39 (storm drain)	400.00	525.00	400.00	300.00	385.00	425.00
2 ea. catch basins No. 40 (storm drain)	770.00	$1,150	900.00	500.00	935.00	800.00
1 ea. spec. outlet chamber (storm drain)	750.00	350.00	800.00	400.00	825.00	850.00
3 ea. manholes "EZ" (storm drain)	400.00	480.00	300.00	292.00	330.00	500.00
1 ea. remodel. exist. manhole (storm drain)	130.00	150.00	200.00	106.00	165.00	650.00
124 lin. ft. 6-in. clay sewer pipe (std. str.)	6.30	4.20	6.00	2.75	6.00	4.50
520 lin. ft. 8-in. clay sewer pipe (extra str.)	7.85	4.50	7.00	5.40	7.00	7.00
700 lin. ft. 12-in. clay sewer pipe (extra str.)	8.12	6.00	9.00	6.25	9.50	8.50
5 ea. manholes (sanitary sewer)	330.00	280.00	400.00	212.00	400.00	350.00
1 ea. drop manhole (sanitary sewer)	450.00	450.00	500.00	329.00	550.00	500.00
13 ea. house connection caps	23.00	15.00	30.00	10.60	25.00	25.00
Lump sum, electrical equipment	$8,900	$9,000	$8,700	$9,314	$10,000	$9,000
Lump sum, engineer's office	$2,400	$2,700	$1,500	$2,500	$2,500	$2,500

Three-Span Steel I-Beam Bridge

Wyoming—Lincoln County—Wyoming Highway Department—George M. Carruth & Son, Evanston, Wyo., with a bid of $45,055.85, was low bidder for construction of an I-beam bridge consisting of three continuous spans over the Mansfork River and miscellaneous work on the Hamsford Road in Lincoln County. Unit bids were as follows:

(1) George M. Carruth & Son.....$45,055.85
(2) Etlin E. Peterson 45,991.55
(3) Woodward Construction Co.....$59,208.25

	(1)	(2)	(3)
5,000 cu. yd. excavation	.60	.60	.60
200 cu. yd. mi. haul	.25	.25	.30
20 hr. bulldozer operation	18.00	8.00	11.00
10 hr. patrol operation	18.00	8.00	10.00
69,180 lb. structural steel	.18	.175	.25
33,970 lb. reinforcing steel	.14	.14	.20
265.8 cu. yd. Class B concrete	53.00	55.00	65.00
240 cu. yd. dry excav. for bridges	3.00	4.00	4.00
260 cu. yd. wet excav. for bridges	12.00	12.00	25.00
60 hr. mechanical tamping	6.00	6.00	10.00
327.5 lin. ft. metal plate guardrail	3.50	3.50	3.50
90 cu. yd. Class 1 riprap	8.00	12.00	10 00
50 cu. yd. structure excav.	2.00	3.00	2.00
80 cu. yd. special backfill	1.50	2.00	2.50
Lump sum, removing existing structs.	$2,000	$1,500	$1,000
Lump sum, detour bridge	$1,000	$2,000	$2,500
400 lin. ft. std. R-W fence	.20	.25	.25
4 ea. end panels	10.00	12.00	15.00
8 ea. brace panels	8.00	12.00	12.00
1 ea. prov. and maint. field test. lab. bldg.	700.00	500.00	300.00

Reinforced Concrete Bridge on Concrete Pile Bents

California—Riverside County—Division of Highways—F. Fredenburg, Temple City, Calif., with a bid of $69,425 was low before the Division of Highways for construction of a reinforced concrete bridge on concrete pile bents across the Coachella Valley storm drain near Thermal. Unit bids were as follows:

(1) F. Fredenburg $69,425
(2) E. G. Perham 69,879
(3) Tumbler Co. 70,708
(4) E. L. Yeager Co. 73,026
(5) Andersen Co. 75,854
(6) C. B. Tuttle Co. 76,496
(7) Griffith Co. $77,935
— Fredericksen & Kasler 80,607
— E. H. Thomas Co. 80,925
— Penn Construction Co. 81,785
— Norman I. Fadel 93,606

	(1)	(2)	(3)	(4)	(5)	(6)
25 cu. yd. structure excavation	4.00	5.00	5.00	3.00	3.00	4.00
600 cu. yd. Class "A" P.C.C.	42.00	46.00	44.50	48.00	52.00	50.00
2,400 lin. ft. furn. concrete piling	3.35	2.50	3.90	3.85	3.70	4.00
75 ea. driving piles	95.00	90.00	89.00	75.00	100.00	140.00
156,000 lb. bar reinforcing steel	.10	.11	.10	.105	.10	.10
2 ea. clearance markers	10.00	20.00	25.00	10.00	10.00	10.00
19,000 lb. miscellaneous steel	.30	.20	.26	.25	.27	.20
764 lin. ft. steel railing	10.00	11.00	9.50	10.65	9.75	9.00

Irrigation . . .

Furnishing and Installing Radial Gates and Hoists

Arizona—Yuma County—Bureau of Reclamation—Western Contracting Corporation, Los Banos, Calif., with a bid of $59,900, was the sole bidder before the Bureau of Reclamation for furnishing and installing radial gates and gate hoists for Wellton-Mohawk canal, Gila project, Ariz. Unit bids were as follows:

Lump sum, **Wellton-Mohawk Turnout, Station 1+16.05**..... $23,900
Furnishing and installing two (2) 12-ft. 0-in. by 15-ft. 3-in. radial gates and two (2) 10,000-lb. capacity, motor-operated radial-gate hoists including 4 pin bearings, 4 side seals, 2 bottom seals, 10-ft. 0-in. long, 4 corner seals, motor starters, electric wiring and conduit, and 2 each per hoist of part 12, in lieu of the quantities shown on the drawings and not including part 13; complete in accordance with specifications.

Lump sum, **Wasteway No. 1, Station 99+23.5**..... $17,800
Furnishing and installing two (2) 10-ft. 0-in. by 5-ft. 0-in. top-seal radial gate hoists including pin bearings and seals, and 4 each of parts 25 and 26, in lieu of quantities shown on the drawing, and not including parts 22 and 23; complete in accordance with specifications.

Lump sum, **Dome Turnout, Station 556+60.00 and Wellton Turnout, Station 948+29.5**..... $18,200
Furnishing and installing one (1) 10-ft. 8-in. by 6-ft. 6-in. top-seal radial gate, one (1) 12-ft. 8-in. by 6-ft. 6-in. top-seal radial gate, and two (2) float-operated radial-gate hoists, including seals and pin bearings and 4 of part 25, in lieu of quantities shown on the drawing, and not including parts 21 and 23; complete in accordance with specifications.

HAULING 5,000 TONS A DAY—

and they throw in the shovel!

MINING coal near surface level is big business with the Badgett Stripping Corporation of Madisonville, Kentucky. And when it comes to shunting about their giant equipment, or transporting an output of 5,000 tons a day—they turn to GMC Diesel power *to save time and money.*

First the coal is stripped by large shovels or draglines which load it into bottom dump-haulers of 20-ton capacity. Then a shuttle of 14 dumpers, powered by GM 6-71 Diesels, maintains a constant flow of coal between shovel and washer—which is often miles away.

From time to time the giant shovels must be moved to new locations. That's where Badgett calls on GMC Model HDCWX 988, shown above giving a lift to a shovel with a mammoth appetite—*one that can scoop up five tons of coal at a single bite.*

Little wonder the Badgett people agree with Scotty McGaw, GMC dealer in Madisonville who sold them the equipment: "*These Diesels can haul bigger loads, haul them faster, and save you 56% on fuel costs alone—enough to pay for the new equipment in the first 300,000 miles!*"

Better check with your GMC dealer. Get the facts on these new 2-cycle Diesels—the modern power plants that give you *twice as many power strokes* per revolution as conventional 4-cycle types. You can't beat 'em for performance!

GMC Truck & Coach Division of General Motors

GMC

GASOLINE & DIESEL TRUCKS

½ TO 20 TONS

Your key to greater hauling profits

GM GENERAL MOTORS

Waterway Improvement . . .

Footings and Pile Work for Anchorage at San Diego

California—San Diego County—City of San Diego—Guy F. Atkinson Co., Long Beach., Calif., was low before the City purchasing agent of San Diego for construction of tuna boat anchorage piers at the foot of Grape St. the Embarcadero, San Diego. Unit bids were as follows:

(1) Guy F. Atkinson Co.
(2) Johnson-Western Constructors
(3) M. H. Golden Construction Co.

	(1)	(2)	(3)
Item No. 1. For the construction and completion of Tuna Boat Anchorage Pier No. 2, including the guniting of the required untreated wood piling, as per Plans and Specifications, excepting the furnishing and driving of untreated wood piles and the creosoted fender piles, for the lump sum price of:	$68,323	$63,800	$68,357
Item No. 2. For the construction and completion of Tuna Boat Anchorage Piers No. 1 and No. 2, including the guniting of the required untreated wood piling, as per Plans and Specifications, excepting the furnishing and driving of untreated wood piles and the creosoted fender piles, for the lump sum price of:	$129,169	$128,800	$135,000
Item No. 3. For the construction and completion of Tuna Boat Anchorage Piers No. 1 and No. 3, including the guniting of the required untreated wood piling, as per Plans and Specifications, excepting the furnishing and driving of untreated wood piles and the creosoted fender piles, for the lump sum price of:	$129,169	$128,600	$136,000
Item No. 4. For the construction and completion of Tuna Boat Anchorage Piers No. 1 and No. 2, and No. 3, including the guniting of the required untreated wood piling, as per Plans and Specifications, excepting the furnishing and driving of untreated wood piles and the creosoted fender piles, for the lump sum price of:	$187,598	$189,900	$203,000
Item No. 5. For the furnishing of untreated Douglas Fir piling and the driving of gunited Douglas Fir piling, as per Plans and Specifications, based on the following estimated lineal footage; namely: Pier No. 1.....8,710 Lineal Feet Pier No. 2.....8,120 Lineal Feet Pier No. 3.....8,845 Lineal Feet complete and in place at the unit price per lineal foot of:	1.45 ft.	1.80 ft.	1.68 ft.
Item No. 6. For the furnishing and driving of creosoted Douglas Fir piling, as per Plans and Specifications, based on the following estimated lineal footage; namely: Pier No. 1.....3,860 Lineal Feet Pier No. 2.....3,910 Lineal Feet Pier No. 3.....3,924 Lineal Feet complete and in place at the unit price per lineal foot of:	2.00 ft.	2.33 ft.	2.53 ft.
Item No. 7. For the furnishing and placing of an additional estimated five (5) cubic yards of concrete in each pier footing over and above the amount called for in the Plans or in the Specifications at the unit price per cubic yard in place, including necessary excavation:	50.00 cu. yd.	50.00 cu. yd.	50.00 cu. yd.
Item No. 8. For the furnishing and placing of an estimated 150 pounds of reinforcing bar steel in each of the pier footings, if required, at the unit price per pound in place:	.12 lb.	.12 lb.	.11 lb.

Sewerage . . .

Sewage Disposal System at Monterey, Calif.

California—Monterey County—City of Monterey—Stolte, Inc., Oakland, Calif. and Fred J. Early, Jr., San Francisco, Calif., with a bid of $864,140.60, was awarded a contract by the City of Monterey for the construction of Units 1 and 2 of a sewage disposal system. Other bidders and unit bids were as follows:

(1) Stolte, Inc.
(2) Barrett & Hilp and DeLuca & Son, Contractors
(3) McGuire & Hester
(4) P. and J. Artukovich
(5) R. A. Wattson Company
(6) F. S. Rolandi, Jr., Inc.
(7) Wonderly Construction Company
(8) Theodore R. Gregory

UNIT I

INTERCEPTING SEWER LINES	(1)	(2)	(3)	(4)	(5)
2,055 lin. ft. 15-in. double str., rubber-gasketed joint, vitrified clay pipe sewer in Camino Aguajito, betw. Fremont St. and El Estero pumping plant jct. manhole, as specified and shown on the plans, at	$18,186	$13,871	$23,324	$22,605	$36,370
185 lin. ft. 10-in. std. str., rubber-gasketed joint, vitrified clay pipe sewer in Camino Aguajito from Del Monte Blvd. diversion manhole, to El Estero pumping plant jct. manhole, as specified and shown on the plans, at	$1,008	758.50	$1,193	$1,295	$1,850
8 only std. manholes in Camino Aguajito, complete with cast-iron frame and cover as specified and shown on the plans, at per manhole	$2,160	$1,640	$1,920	$3,200	$2,138
1 only junction manhole in Camino Aguajito, complete, at lump sum	504.00	405.00	470.00	550.00	500.00
1 only diversion manhole in Del Monte Blvd., complete, at lump sum	525.00	260.00	300.00	500.00	275.00
1 only metal pipe jacket for sewer line crossing of Del Monte Blvd., in Camino Aguajito, at lump sum	$2,355	$1,460	$1,800	$2,700	$2,400
200 cu. yd. quarry waste rock trench stabilization, as shown on the plans and as directed at	$1,160	$1,400	760.00	600.00	$1,000
345 lin. ft. 8-in. std. str., rubber-gasketed joint, vitrified clay pipe sewer in Del Monte Blvd., betw. Myers St. and Virgin Ave., as specified and shown on the plans, at	$2,121	$2,760	$2,242	$2,070	$6,555

(Continued on next page)

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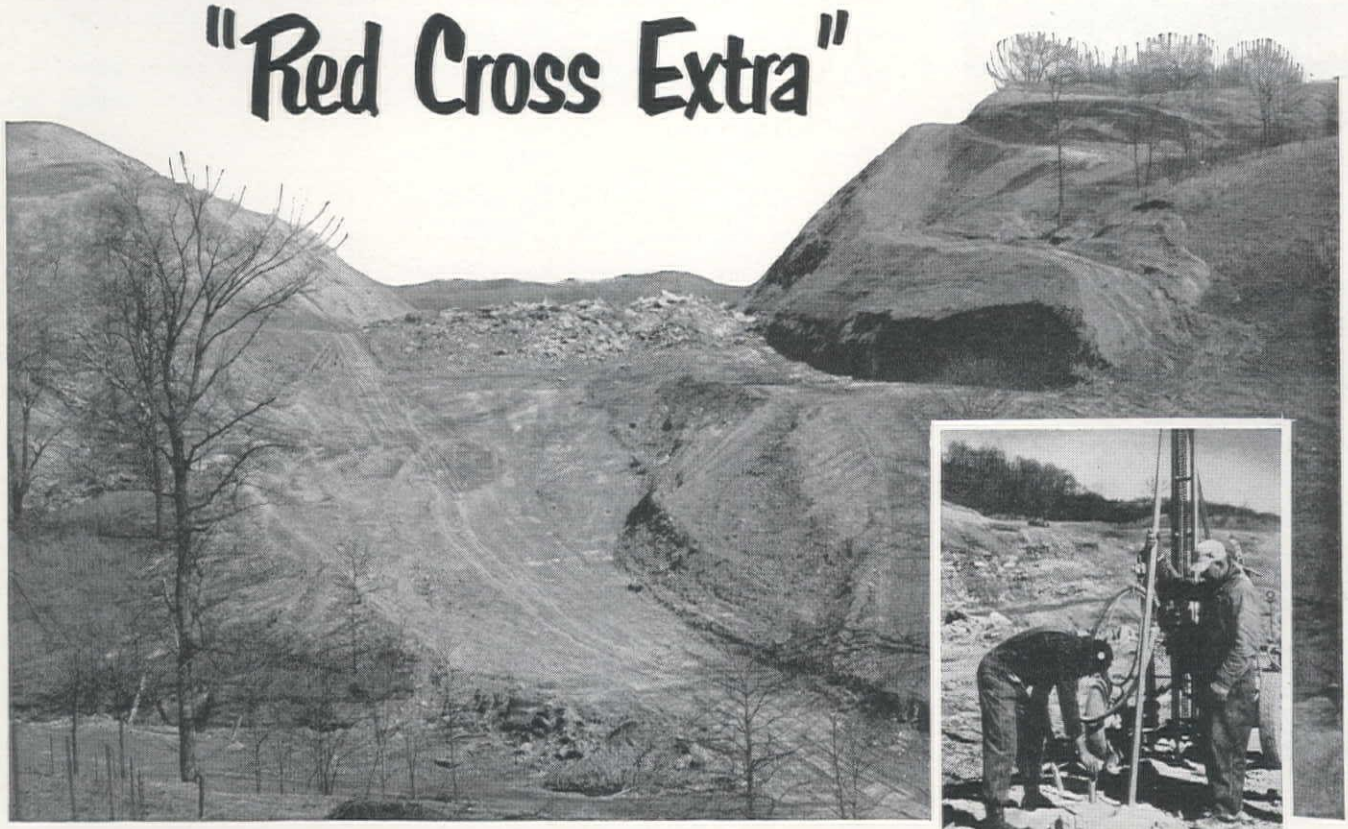

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UNIT BID PRICES . . . CONTINUED

2,940 lin. ft. 15-in. dbl. str., rubber-gasketed joint, vitrified clay pipe sewer in Del Monte Blvd. betw. English Ave. and Palo Verde Ave., incl. jct. with Del Monte pumping plant, as specified and shown on the plans, at	$29,988	$31,752	$38,220	$32,340	$64,533
12 only std. manholes in Del Monte and Palo Verde Aves., complete with cast-iron frame and cover, as specified and shown on the plans, at	$3,660	$3,060	$3,240	$4,800	$3,900
300 cu. yd. quarry waste rock trench stabilization, as shown on the plans and as directed, at	$1,740	$2,100	$1,140	900.00	$1,500
FORCE MAINS					
3,740 lin. ft. 24-in. diam., No. 7 U. S. gauge, cement-lined, Somastic-coated, welded steel pipe force main, complete in place with all appurtenances, from a jct. with the Reeside pumping plant to a junction with the reinf. conc. pipe force main 75 ft. easterly of the So. Pac. R.R. crossing at Scott St., as shown on the plans and specified, at	$84,898	$78,540	$110,330	$56,100	$91,630
7,285 lin. ft. 24-in. diam., rubber-gasketed joint, centrifugally-spun, reinf. conc. pipe force main, complete in place with all appurtenances, from a jct. with the welded steel pipe force main of Bid Item No. 12, to a jct. with the jct. manhole of the sewage treatment works, as shown on the plans and specified, at	$104,904	$85,963	$122,023	$145,700	$131,130
740 lin. ft. 14-in. diam., No. 10 U. S. gauge, cement-lined, Somastic-coated, welded steel pipe force main, complete in place with all appurtenances, from a jct. with the El Estero pumping plant to a jct. with the 24-in. reinf. conc. force main of Bid Item 13, opposite Park Ave., as shown on the plans and specified, at	$9,250	$8,880	$11,100	$9,620	$10,730
735 lin. ft. 14-in. diam., No. 10 U. S. gauge, cement-lined, Somastic-coated, welded steel pipe force main, complete in place, from a jct. with the Del Monte pumping plant to a junction with the force main of Bid Item 13, as shown on the plans and specified, at	$9,077	$8,379	$10,473	$9,555	$10,657
650 lin. ft. 8-in. diam., No. 10 U. S. gauge, cement-lined, Somastic-coated, welded steel pipe force main, complete in place, from a jct. with the Myers St. pumping plant to a jct. with the intercepting sewer manhole in Del Monte Blvd., at English Ave., as shown on the plans and specified, at	$5,460	$5,005	$6,500	$5,200	$7,280
1 only metal pipe jacket for 24-in. force main crossing of S.P. R.R. rt/way opposite Scott St., as shown on the plans and specified, at	$2,205	$1,880	$1,450	$2,610	$2,120
1 only metal pipe jacket for 14-in. force main combined crossing of Del Monte Blvd. and S.P. R.R. rt/way at Park Ave., as shown on the plans and specified at	$6,175	$3,400	$4,400	$6,880	$5,600
1 only metal pipe jacket for 14-in. force main combined crossing of Del Monte Blvd. and S.P. R.R. rt/way opposite entrance to treatment works roadway, as shown on the plans and specified, at	393.00	$4,500	$3,750	$7,650	$5,900
2,055 lin. ft. 15-in. No. 14 gauge asbestos-bonded corrugated iron pipe sewer, with watertight band couplers, as specified, in lieu of the 15-in. V.C. pipe sewer of Base Bid Item No. 1, at	$21,577	$16,748	$26,098	$20,550	—
185 lin. ft. 10-in. No. 16 gauge asbestos-bonded corrugated iron pipe sewer, with watertight band couplers, as specified, in lieu of the 10-in. V.C. pipe sewer of Base Bid Item No. 2, at	$1,239	980.50	$1,387	$1,110	—
345 lin. ft. 8-in. No. 16 gauge asbestos-bonded corrugated iron pipe sewer, with watertight band couplers, as specified, in lieu of the 8-in. V.C. pipe sewer of Base Bid Item No. 8, at	$2,587	$3,208	$2,725	$1,725	—
2,940 lin. ft. 15-in. No. 14 gauge asbestos-bonded corrugated iron pipe sewer, with watertight band couplers, as specified, in lieu of the 15-in. V.C. pipe sewer of Base Bid Item No. 9, at	$36,015	$36,015	$43,512	$29,400	—
3,740 lin. ft. 24-in. diam., No. 7 U. S. gauge, cement-lined, double-wrapped, welded steel pipe force main, complete in place with all appurtenances as specified, in lieu of the Somastic-coated force main of Base Bid Item No. 12, at	$60,962	$64,141	$95,370	$52,360	—
3,740 lin. ft. 24-in. diam. cement-lined cast-iron pipe force main, complete in place with all appurtenances, as specified, in lieu of the welded steel pipe force main of Base Bid Item No. 12, at	$75,361	$82,280	$108,460	—	$84,150
7,285 lin. ft. 24-in. diam. cement-lined cast-iron pipe force main, complete in place with all appurtenances, as specified, in lieu of the reinforced conc. pipe force main of Base Bid Item No. 13, at	$148,249	$139,507	$156,627	—	—
740 lin. ft. 14-in. diam. cement-lined cast-iron pipe force main, complete in place with all appurtenances, as specified, in lieu of the welded steel pipe force main of Base Bid Item No. 14, at	$8,547	$8,251	$10,064	—	$9,620
735 lin. ft. 14-in. diam. cement-lined cast-iron pipe force main, complete in place with all appurtenances, as specified, in lieu of the welded steel pipe force main of Base Bid Item No. 15, at	$8,415	$7,901	$9,481	—	$9,555
650 lin. ft. 8-in. diam. cement-lined cast-iron pipe force main, complete in place with all appurtenances, as specified, in lieu of the welded steel pipe force main of Base Bid Item No. 16, at	$4,485	$4,225	$5,297	—	$6,305
UNIT II					
1 only Reeside Avenue pumping plant, complete and in satisfactory operating condition, as shown on the plans and as specified, for the lump sum of	$77,760	$70,000	$72,817	$69,161	$72,450
1 only El Estero pumping plant, complete and in satisfactory operating condition, as shown on the plans and as specified, for the lump sum of	$37,320	$33,000	$43,751	$31,473	$43,620
1 only Del Monte pumping plant, complete and in satisfactory operating condition, as shown on the plans and as specified, for the lump sum of	$35,550	$32,800	$44,150	$31,642	$41,600
1 only Myers St. lift station, complete and in satisfactory operating condition, as shown on the plans and as specified, for the lump sum of	$14,520	$8,000	$15,897	$12,245	$12,200
1 only Sewage treatment works, complete and in satisfactory operating condition, including access roadway					

(Continued on next page)

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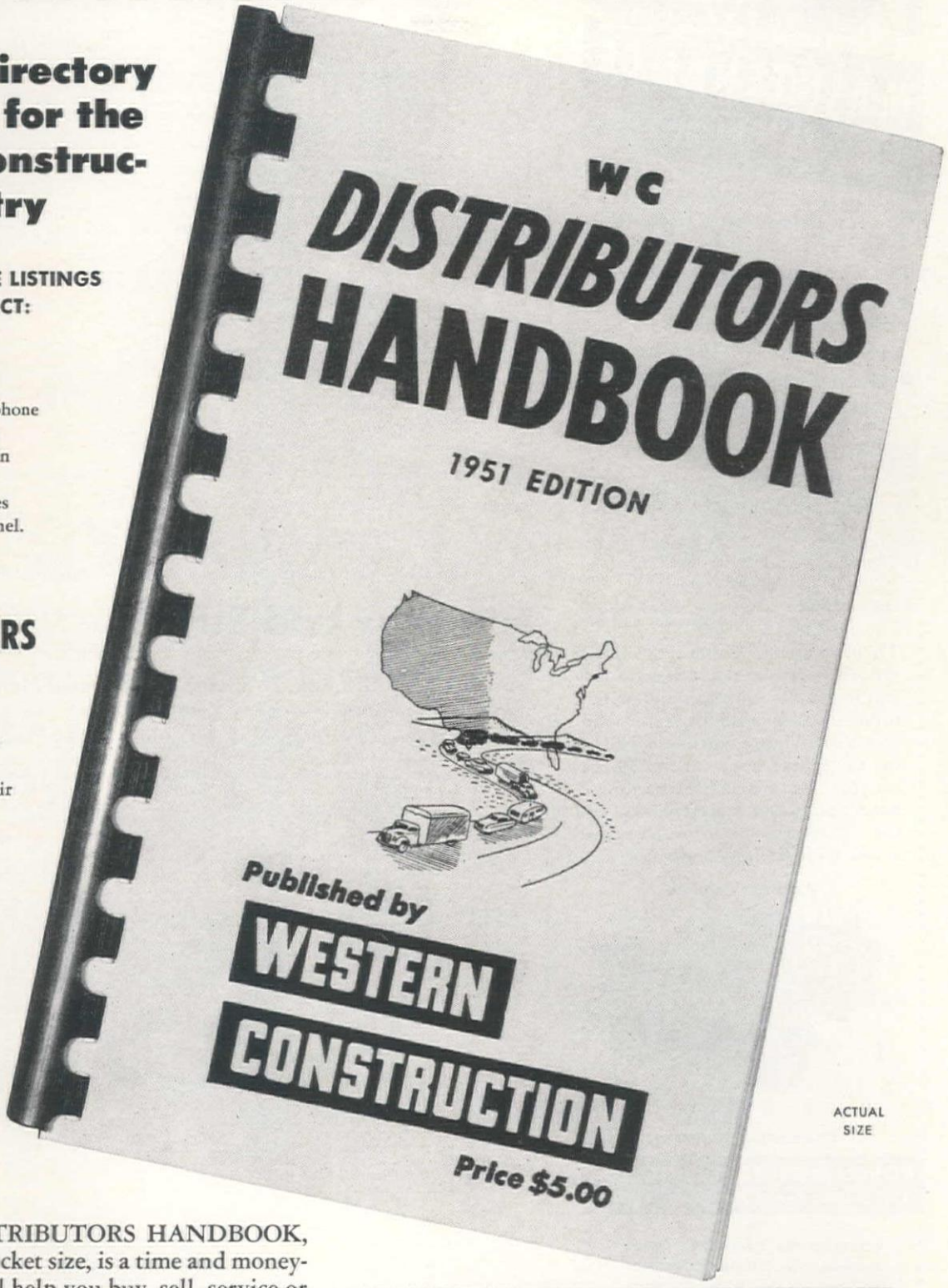

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UNIT BID PRICES . . . CONTINUED

and all site work, together with force main junction box and connections with plant effluent line, as shown on the plans and as specified, for the lump sum of	$355,970	$358,900	$377,391	$354,734	$403,600
580 lin. ft. 30-in. std. reinf. conc. pipe plant effluent line from junction with A-B corr. iron pipe plant outlet and bypass lines, to and including surge manhole, as shown on the plans and specified, at	$11,878	$7,540	$9,280	$8,874	$9,280
125 lin. ft. 24-in. rubber-gasketed joint, centrifugally-spun, reinforced concrete pipe outfall line, from a jct. with the surge manhole at Sta. 0 + 20 to Sta. 1 + 45, as shown on the plans and specified, at	$2,633	$1,750	$2,250	$1,875	$2,250
1,035 lin. ft. 24-in. genuine wrought iron pipe Bay Outfall line from Sta. 1 + 45 to Sta. 11 + 80 in Monterey Bay, complete in place, as shown on the plans and specified, at	$49,887	$49,680	$60,030	$62,265	$50,197
1 only Bay Outfall outlet structure, complete in place, as shown on the plans and specified, at	$3,768	$2,100	$4,983	$2,583	$5,000
18 only Bay Outfall pipe line anchorage units, complete in place, as shown on the plans and specified, at	$6,951	$3,600	$11,700	$5,274	$9,000
SEWAGE PUMPING AND TREATMENT WORKS ALTERNATES					
1,035 lin. ft. 24-in. American concrete cylinder pipe Bay Outfall line from Sta. 1 + 45 to Sta. 11 + 80 in Monterey Bay, complete in place, as shown on the plans and specified, in lieu of the 24-in. genuine wrought iron pipe Bay Outfall line of Base Bid Item No. 8, at	$63,818	—	$82,800	—	—
1,035 lin. ft. 24-in. Somastic-coated and cement-lined welded steel pipe Bay Outfall line from Sta. 1 + 45 to Sta. 11 + 80 in Monterey Bay, complete in place, as shown on the plans and specified, in lieu of the 24-in. genuine wrought iron pipe Bay Outfall line of Base Bid Item No. 8, at	$43,894	$44,505	$93,150	$51,129	$48,645
1 only for the omission of the Myers St. lift station of Base Bid Item No. 4, deduct from the total Base Bid price for Project Unit 2, the lump sum of	$13,025	$8,000	$14,330	$10,918	$12,200
1 only for the omission of the floating-cover gas-holder only, of the secondary sludge digestion tank of the sewage treatment works, deduct from the total Base Bid price for Project Unit 2, the lump sum of	$18,031	$18,000	$19,200	$20,145	$16,200

Highway and Street . . .

Heavy Grading, Drainage and Selected Material Surfacing

Wyoming—Natrona County—Wyoming Highway Department—Forgey Construction Co., Casper, Wyo., with a bid of $340,702.40 was low bidder for grading, draining, selected material surfacing and miscellaneous work on 6.032 miles of the Midwest-Casper road in Natrona County. Unit bids were as follows:

(1) Forgey Construction Co. $340,702.40
(2) Platte Valley Construction Co. 340,891.56
(3) Peter Kiewit Sons' Co. 359,207.20
(4) J. H. & N. M. Monaghan 360,146.00
(5) Taggart Construction Co. $367,349.50
(6) Read Construction Co. 375,432.60
— S. Birch & Sons Co. 381,203.60
— Stanley H. Arkwright 405,373.60

	(1)	(2)	(3)	(4)	(5)	(6)
615,000 cu. yd. excavation	.19	.21	.217	.23	.24	.25
499,800 ton mi. haul of surfacing matl.	.07	.08	.10	.075	.085	.075
126,000 ton selected matl. surfacing (Type 1)	.28	.30	.30	.28	.28	.34
1,240,000 cu. yd. sta. overhaul	.01	.01	.01	.01	.01	.01
45,000 cu. yd. mi. haul	.25	.12	.15	.14	.15	.15
2,250 hr. sheepsfoot roller operation	9.00	8.50	8.00	9.00	10.00	10.00
430 hr. pneumatic tired roller operation	6.00	6.00	5.00	7.00	6.00	7.00
8,600 M. gal. watering	1.75	1.50	1.00	1.50	2.00	2.00
100 cu. yd. Class 1 riprap	17.00	11.00	12.00	15.00	10 00	13.00
15 cu. yd. grouted riprap	25.00	16.00	20.00	25.00	15.00	21.00
560 hr. mechanical tamping	6.00	6.00	8.00	6.50	8.00	7.00
800 cu. yd. excav. for pipe culverts	2.50	2.50	1.50	3.00	2.00	2.50
40 cu. yd. struct. excav.	2.00	2.00	2.50	10.00	3.00	3.00
4,840 cu. yd. special backfill	2.00	2.50	2.00	2.25	2.00	1.60
2,052 lin. ft. 18-in. std. R.C.P.	5.00	4.05	6.00	5 00	4.00	4.50
492 lin. ft. 24-in. std. R.C.P.	7.00	6.13	7.00	5.75	6.00	6.80
92 lin. ft. 30-in. std. R.C.P.	9.00	8.40	11.00	10.00	8.00	9.00
268 lin. ft. 36-in. std. R.C.P.	12.50	12.00	14.00	13.00	12.00	12.00
100 lin. ft. 42-in. std. R.C.P.	16.00	15.75	17.00	16.50	15.00	16.00
252 lin. ft. 47-in. std. R.C.P.	20.00	19.50	21.00	21.00	19.00	20.00
392 lin. ft. 60-in. std. R.C.P.	30.00	28.90	32.00	33.00	27.00	29.00
140 lin. ft. 18-in extra str. R.C.P.	5.15	4.50	6.00	5.25	4.00	4.70
5,344 lin. ft. 10-in. std. split R.C.P.	4.10	2.75	3.50	3.40	3.00	3.00
1,052 lin. ft. 12-in. std. split R.C.P.	4.40	3.10	3.60	3.70	4.50	3.40
456 lin. ft. 18-in. std. split R.C.P.	6.20	4.85	5.00	5.50	6.00	5.20
96 lin. ft. 24-in. std. split R.C.P.	8.00	7.10	6.75	8 00	8.00	7.00
95 lin. ft. 84-in. std. split R.C.P.	50.00	45.00	36.00	42.00	39.00	37.00
1,900 lin. ft. standard R-W fence	.20	.16	.18	.20	.20	.20
3 ea. brace panels	15.00	10.00	12.00	15.00	8.00	10.50
3 ea. end panels	20.00	13.00	14.00	20.00	10.00	13.00
45 ea. R-W markers	10.00	10.00	9.00	10.00	8.00	7.00
1 ea. R. C. project marker	20.00	35.00	25.00	50.00	40 00	30.00
175 lin. ft. metal plate guard fence—Type B	3.00	4.00	4.00	5.00	2.50	3.50
6.6 cu. yd. Class B concrete	80.00	100.00	85.00	70.00	75.00	90.00
440 lb. reinforcing steel	.15	.15	.15	.25	.15	.20
Lump sum, removing existing structures	500.00	$1,000	750.00	$1,500	400.00	150.20
1 ea. prov. and maint. field test. lab. bldg.	400.00	500.00	450.00	500.00	700.00	400.00

Portland Cement Concrete on Cement-Treated Subgrade

California—Los Angeles County—Division of Highways—J. E. Haddock, Ltd., Long Beach, Calif., was low before the Division of Highways with a bid of $1,769,134, for construction of a state highway on Ramona Freeway between Helen Drive and Hellman Avenue, about 1.5 miles in length to be graded and paved with Portland Cement Concrete course on cement treated subgrade and with plant mix surfacing on imported base material; and four bridges to be constructed; to provide a six lane divided highway with frontage roads. Unit bids were as follows:

(1) J. E. Haddock, Ltd. $1,769,134.00
(2) United Concrete Pipe Corp. & Ralph Bell 1,879,725.10
(3) Griffith Co. $1,903,571.00
(4) Guy F. Atkinson Co. 1,923,206.00

(Continued on next page)

	(1)	(2)	(3)	(4)
4,600 cu. yd. removing concrete	4.00	2.00	4.40	3.00
3,000 cu. yd. broken conc. channel lining	4.20	2.00	4.20	3.00
Lump sum, clearing and grubbing	$15,000	$20,000	$9,400	$5,535
408,730 cu. yd. roadway excav.	.36	.42	.50	.50
7,300 cu. yd. struct. excav. (bridges)	1.80	1.50	1.40	1.60
9,930 cu. yd. struct. backfill (bridges)	1.50	1.65	1.90	1.50
52,870 cu. yd. struct. excav.	1.70	1.35	1.80	1.50
5,500 cu. yd. ditch and channel excav.	.70	.60	.85	1.00
60,000 sq. yd. compacting orig. ground	.03	.04	.04	.05
13,000,000 sta. yd. overhaul	.001	.003	.0015	.003
82,500 ton I. B. M.	1.00	1.15	1.30	1.25
3,800 ton imp. pervious matl.	1.70	1.15	1.90	2.00
40,000 sq. yd. preparing slopes (eros. control)	.075	.11	.11	.15
94,000 sq. yd. cultivating (preparatory landscape)	.03	.11	.06	.08
Lump sum, dev. water supply and furn. water equipment	$10,000	$15,000	$5,000	$8,000
12,000 M. gal. applying water	1.00	1.40	1.50	1.50
Lump sum, finishing roadway	$1,000	$2,000	$3,000	$3,000
68,000 sq. yd. mix. and compact. (C.T.S.)	.17	.17	.20	.24
3,200 bbl. Portland cement (C.T.S.)	3.25	4.00	3.75	3.60
72 ton liquid asph., SC-2 (pr. ct.)	24.00	25.00	23.00	50.00
108 ton asph. emuls. (pt. bdr., sl. ct. and cur. sl.)	45.00	35.00	40.00	50.00
14,000 ton min. aggr. (P.M.S.)	4.25	3.90	3.45	3.50
730 ton pav. asph. (P.M.S.)	4.25	19.00	18.00	18.00
325 lin. ft. raised traffic bars	.90	1.00	1.00	1.00
200 ton sand (sl. ct.)	4.00	4.00	3.40	5.00
5,200 sq. ft. P.M.S. ditch lining	.20	.15	.23	.20
15,200 cu. yd. P.C.C. (pavement)	11.00	13.50	11.70	12.00
13,500 ea. pavement tie-bolt assemblies	.55	.45	.60	.60
9,680 cu. yd. Class "A" P.C.C. (struct.)	40.00	43.55	40.00	42.00
860 lin. ft. rubber waterstops	2.00	2.00	1.90	2.50
1,136,000 lb. bar reinf. steel	.095	.09	.10	.10
350 sq. yd. mesh reinforcement	.65	1.00	.70	.60
3,100 sq. ft. pneumatically applied mortar	.57	.60	.45	.60
69,120 lb. miscl. iron and steel	.29	.30	.30	.35
687,000 lb. struct. steel (Floral Park and Freemont Ave. br.)	.163	.17	.175	.16
105,000 lb. struct. steel (Warwick Road bridge)	.32	.17	.33	.32
Lump sum, clean. and paint. struct. steel	$9,500	$11,000	$10,000	$10,000
4,600 cu. yd. P.C.C. (curb, gutters and sidewalks)	24.00	24.00	25.50	24.00
1,870 lin. ft. steel rail	7.20	7.00	8.00	7.00
Lump sum, metal railing (Warwick Road bridge)	$9,500	$10,000	$10,000	$10,000
350 lin. ft. pipe handrailing	6.40	7.00	7.00	7.00
200 lin. ft. metal stair treads	2.00	2.00	2.00	3.00
800 sq. yd. protective covering	1.00	.50	.85	3.00
810 sq. yd. membrane waterproofing	2.75	2.70	2.80	3.00
20 ea. culv. markers and guide posts	6.00	5.00	5.00	4.00
27,000 lin. ft. chain link fence	2.00	1.75	1.85	1.75
13 ea. walk gates (chain link fence)	85.00	70.00	75.00	75.00
4,160 lin. ft. 15-in. R.C.P.	3.50	3.50	3.10	4.00
2,700 lin. ft. 18-in. R.C.P.	4.30	4.00	3.85	5.00
800 lin. ft. 21-in. R.C.P.	5.00	5.00	4.60	6.00
320 lin. ft. 24-in. R.C.P.	6.00	6.00	5.50	7.00
730 lin. ft. 30-in. R.C.P.	7.70	7.25	7.00	8.00
210 lin. ft. 36-in. R.C.P.	9.70	9.50	9.00	10.00
2,330 lin. ft. 42-in. R.C.P.	12.30	12.00	11.50	14.00
580 lin. ft. 48-in. R.C.P.	14.60	14.50	14.00	16.00
140 lin. ft. 60-in. R.C.P.	20.00	20.00	20.00	24.00
1,190 lin. ft. 66-in. R.C.P.	22.50	23.00	21.00	25.00
620 lin. ft. 72-in. R.C.P.	26.30	27.00	24.00	28.00
25 cu. yd. Class "C" P.C.C. (pipe reinf.)	18.00	25.00	17.00	20.00
1,200 lin. ft. 4-in. cast iron pipe	3.25	3.00	6.00	2.00
1,450 lin. ft. 8-in. cast iron pipe	7.00	6.00	6.50	4.00
172 lin. ft. 6-in. P.M.P. (16 ga.)	2.50	1.25	2.00	2.00
280 lin. ft. salv. exist. pipe culv.	1.75	2.00	2.00	4.00
160 lin. ft. relaying salv. 36-in. R.C.P.	2.00	1.50	2.00	3.00
120 lin. ft. relaying salv. 60-in. R.C.P.	4.00	3.00	2.50	5.00
100 lin. ft. pipe shaft manholes	13.00	15.00	15.00	20.00
17 ea. adjust. manholes to grade	20.00	25.00	25.00	25.00
370 lin. ft. metal plate guard rail	2.60	2.75	3.40	3.00
3,850 lin. ft. 8-in. vitrified clay pipe (std. str.)	3.00	3.25	3.70	3.00
1,350 lin. ft. 8-in. vitrified clay pipe (extra str.)	4.70	3.50	6.90	3.00
23 ea. brick manholes	250.00	300.00	240.00	400.00
3 ea. drop manholes	400.00	350.00	350.00	400.00
5 ea. flushing manholes	300.00	400.00	300.00	400.00
Lump sum, drainage pump. equip.	$6,200	$10,000	$7,000	$8,000
Lump sum, electrical equip.	$2,000	$2,500	$2,000	$2,000
Lump sum, lighting equip.	$9,400	$10,000	$10,000	$10,000

Grading, Drainage and Cinder Topping

Oregon—Union County—Oregon State Highway Department—Leonard & Slate & E. C. Hall Co., Portland, Ore., with a bid of $850,863.50, was low before the Oregon State Highway Department for grading and other work for six miles in Union County on the east unit of the LaGrande to Ladd Canyon section of the relocated Old Oregon Trail. Unit bids were as follows:

(1)	Leonard & Slate, Oregon Ltd., and E. C. Hall Co.	$850,863.50	
(2)	Kuckenberg Construction Co.	851,037.50	
(3)	Goodfellow Bros.	853,155.00	
(4)	M. L. & C. R. O'Neil	898,756.50	
(5)	J. N. & M. J. Conley	929,837.50	
(6)	Rogers Construction Co. & Babler Bros., Inc.	$ 934,125.00	
—	McNutt Bros.	936,597.00	
—	Natt McDougal Co.	949,929.50	
—	White Bros. Co.	996,652.00	
—	Gibbons & Reed Co.	1,122,781.00	

	(1)	(2)	(3)	(4)	(5)	(6)
Lump sum, clearing and grubbing	$16,000	$25,000	$17,900	$65,300	$30,000	$30,000
920 cu. yd. trench excav., unclassified	3.00	5.00	2.00	5.00	3.75	3.00
83,000 cu. yd. special borrow excav., unclassified	.34	.50	.25	.35	.33	.30
653,000 cu. yd. general excav., unclassified	.68	.53	.73	.675	.80	.80
1,870,000 yd. sta. short overhaul	.015	.015	.01	.02	.01	.01
40,400 cu. yd. sta. long overhaul	.50	.50	.40	.50	.35	.50
106,800 yd. mi. truck haul on special borrow	.25	.30	.15	.17	.15	.15
6.41 mi. finishing roadbed and slopes	600.00	$1,000	500.00	800.00	500.00	$1,000
9,000 lin. ft. rounding cutbanks	.20	.25	.20	.20	.15	.20
3,900 cu. yd. placing topsoil	.95	1.00	.30	.70	.70	1.00
110 acres preparing soil and seeding	100.00	200.00	30.00	65.00	60.00	100.00
3,500 lb. nitrogen fertilizer	.40	.05	.50	.40	.30	.50
330 lin. ft. 18-in. concrete pipe	4.50	4.25	3.00	4.25	3.50	4.00
490 lin. ft. 24-in. concrete pipe	5.00	6.25	6.00	5.50	5.50	6.00
750 lin. ft. 72-in. sectional plate culverts	42.00	50.00	46.00	40.00	42.50	50.00
190 lin. ft. 1-in. galvanized water pipe	1.00	1.00	1.50	1.50	1.00	1.00
110 lin. ft. 2-in. galvanized water pipe	1.25	1.25	2.00	3.00	1.50	2.00
1,110 cu. yd. Class "A" concrete	55.00	60.00	50.00	58.00	55.00	50.00
206,500 lb. metal reinforcement	.12	.12	.11	.12	.125	.11
146,000 cu. yd. selected cinder topping	.30	.40	.22	.27	.30	.30
1,450,000 yd. mi. hauling cinder topping	.06	.08	.08	.065	.075	.07
4,300 M. gal. sprinkling	2.50	2.50	2.00	1.75	1.70	2.00

NEW EQUIPMENT

MORE COMPLETE INFORMATION about any of the new equipment or products briefly described on the following pages may be obtained at no charge. Send your request to Equipment Service, Western Construction, 609 Mission St., San Francisco 5, Calif. For quicker service, designate items by number.

★★

401

Two new sizes added to twin-helix earth augers

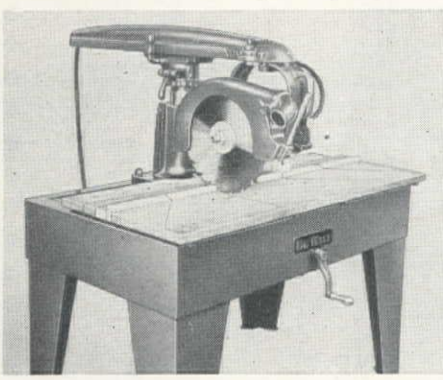
Features claimed: One of the new twin-helix earth augers is for 10 in., and the other for 12 in., actual hole diameters. The complete Pengo line now consists of 11 auger sizes for hole diameters from 10 in. to 36 in. They will fit Highway, Williams and Trackson earth boring machines, and adapters to make the augurs interchangeable on these and other makes of machines are available.

Manufacturer: Peterson Engineering Co., 460 Kifer Rd., Santa Clara, Calif.

402

Radial arm saw permits 40% greater depth of cut

Features claimed: The Model R-2 has the low dead-rise motor which makes it possible to get a depth of cut about 40% greater than that possible with conventional direct-drive motors. Reduced interference of the bottom of the motors permits this radial arm saw to be brought closer to the material being cut. The arm of the Model R-2 rides smoothly on eight grease-



packed, double-row bearings. Locating latches permit the rapid location of the cutting tool in any of the many cutting positions possible.

Manufacturer: DeWalt Inc., Dept. P-157, Lancaster, Pa.

403

Pneumatic impact wrench has simplified mechanism

Features claimed: Incorporating a completely different and simplified impact mechanism, this pneumatic-type impact wrench can be used for both driving and removing nuts, studs and screws in all types of assembly and sub-assembly. Model M950 is rated for a ⅜-in. bolt size capacity on most work. By the use of a new type air inlet control valve, this one size of the tool may be used for many different sizes of work. There are two impacting parts, and the unit does not contain any springs or gears. Impacting takes place only when the nut begins to tighten. The reverse valve is readily accessible to the operator's thumb. The wrench weighs about 5¼ lb., operates

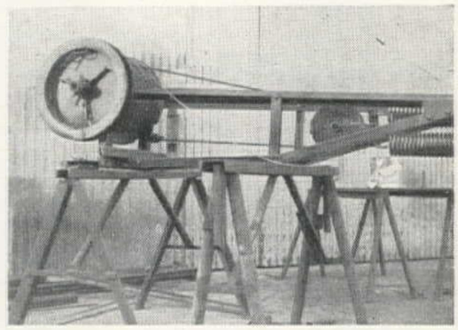
on air pressure of from 80 to 100 psi., and consumes 16 to 17 cfm. under load.

Manufacturer: Master Pneumatic Tool Company, Inc., Cleveland, Ohio.

404

New tagline increases capacity of cranes

Features claimed: The new Calomatic Taglines provide a constant tension on your tagline with a maximum of 20% increase or decrease. They steady the bucket, provide trouble-free performance, improve operation and increase the capacity of cranes. They are manufactured in five sizes for your present equipment. Reels ranging



from 14 to 30 in. in diameter deliver approximately 75 to 400 lb. pull with a range of from 65 to 96 ft.

Manufacturer: Calomatic Equipment Corp., 4546 E. Washington Blvd., Los Angeles, Calif.

405

Bedrock, overburden information using new seismic equipment

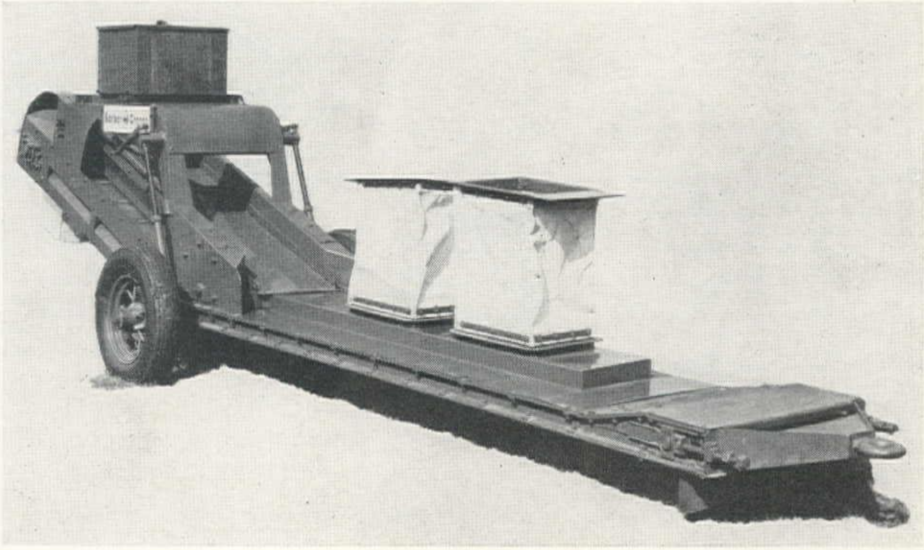
Features claimed: Refraction seismic equipment, long used in the petroleum industry, is now newly designed for application in the engineering, construction and mining industries and a contract survey service employing the equipment is available. The primary application of the seismic apparatus is in measuring the depth to bedrock where this information is needed in the exploration program preceding construction. The exploration is based on the detailed measurement of travel times of

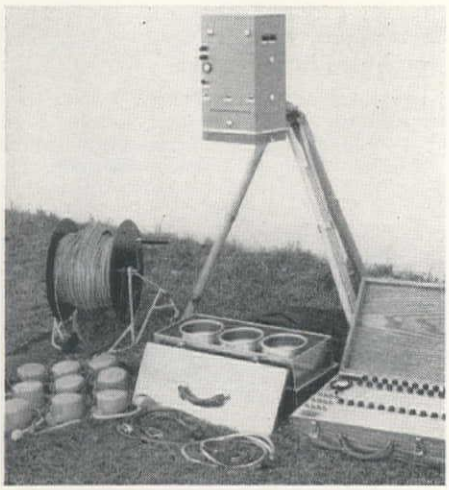
406

Portable conveyors adapted for dry cement handling

Features claimed: The Model 358 car Unloader has been fitted with complete metal covers for the under-car section as well as the up-run. Collapsible canvas spouts with metal stiffeners can be drawn up between the cross ties, (the Unloader should be operated in a shallow pit beneath the rails) and attached to the hoppers of the cement car. The discharge end of the Unloader is equipped with metal, all-enclosed concentrating spout to direct the discharge into the conveyor hopper and to minimize dust.

Manufacturer: Barber-Greene Co., Aurora, Ill.





shock waves through the various near surface strata. The equipment is small, rugged and lightweight.

Manufacturer: Fisher Research Laboratory, Inc., Palo Alto, Calif.

407

Easy-pour tilter eliminates spillage

Features claimed: This tilter is scientifically designed to aid in pouring liquid from cans into small containers and eliminating accidents resulting from spilling, splashing, etc. The cradle is made of steel, fits any standard 5-gal. can. All members

are riveted or welded to insure a strong and durable device. Tilter can also be used for mixing ingredients.

Manufacturer: General Scientific Equipment Co., 2700 W. Huntingdon St., Philadelphia, Pa.

408

Improved refuse loader with 9 or 12-cu. yd. capacity

Features claimed: Models available in capacities of 9 cubic yards and 12 cubic yards offer increased load capacities by virtue of the new body design and increased packing ability. Both sizes are for installation on truck chassis of 84-in. cab-to-axle dimension. Bucket size has also been increased and the rubbish packing panel now holds the load in packed position, but during loading is released as the bucket passes a pair of trip levers. The panel then snaps back instantly, allowing the bucket to discharge its load into the body. Maintenance

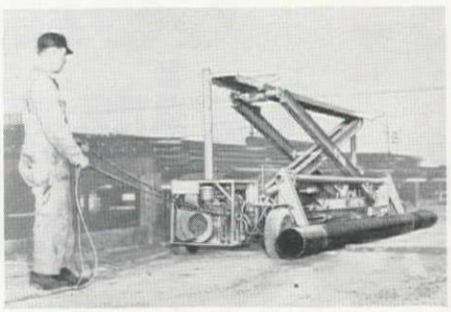
is simplified since all operations of loading, packing and dumping the Paxall refuse loader are powered by one double-acting hydraulic cylinder.

Manufacturer: Gar Wood Industries, Inc., St. Paul Division, 2207 University Ave., Minneapolis, Minn.

409

Lifting device loads pipe on truck in 17 seconds

Features claimed. The Straight Lift pipe loader picks up one or several joints of pipe, places the load on a truck or gondola, then returns to position for another lift in just 17 seconds. The number of joints per load varies with the size of the pipe. Power-driven and hydraulically controlled, the unit is self-propelled but also designed to be towed. The operator can stand at a safe distance up to 25 ft. while operating the machine. Maximum load of 4,000 lbs. to any height up to 11½ ft.

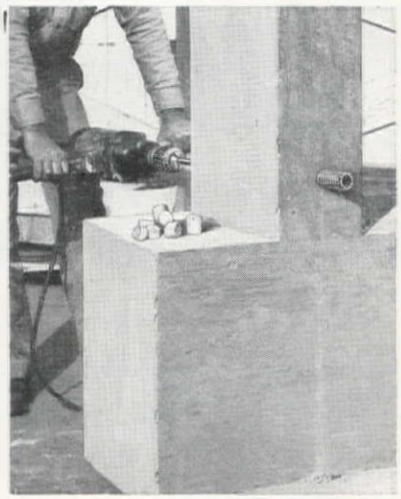


Manufacturer: Republic Supply Company of California, 1753 Workman, Los Angeles, Calif.

410

Extra-length drills for holes in concrete

Features claimed: Termite Rotary Masonry drills in special lengths of 12, 18, 24 and 36 in. are recommended for drilling a large number of holes in concrete and are available in extra lengths in diameters



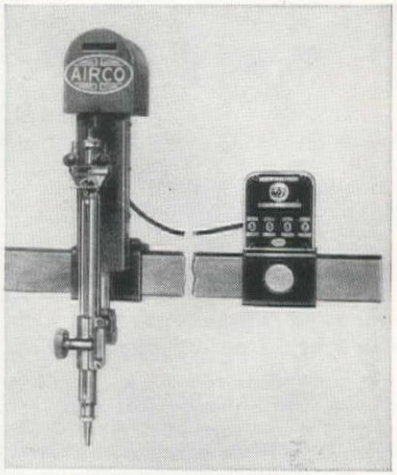
of ¼, ⅜, ½, ⅝ and ¾ in. They are approximately 50% worm. The Core Termites, which have a hollow construction and are used for drilling large-diameter holes, are available in extra length sizes in diameters from ⅞ in. to 5 in. To make the special length Core Termites, the standard head is used, with extra-length shanks. Both devices have the scientifically designed worm which withdraws the pulverized residue from the hole.

Manufacturer: Concrete Termite Drill Company, 2084 Foothill Blvd., Pasadena, Calif.

411

Motorized torch holder controls cutting torches

Features claimed: Remote control raising and lowering of cutting torches mounted on oxyacetylene cutting machines is the purpose of this new motorized torch holder. Designed for mounting on the 3-in.



square torch bar of an Airco Oxygraph or Travograph, this device raises or lowers the cutting torch through 5 in. of travel. The remote control switch box, mounted on the torch bar at the operator's control station, provides a switch to actuate each of four torches individually and a master

switch for simultaneous control of all four torches. One control box is added for each four torches used.

Manufacturer: Air Reduction Pacific Company, 60 E. 42nd St., New York, N. Y.

412

3 to 5-ton maintenance roller is instantly portable

Features claimed: Without ballast, the Ferguson roller weighs 3 tons and will trail at normal truck speeds on its own wheels, which are raised and lowered by power-

driven hydraulic pump at the touch of a finger. Towing end of the roller is also raised instantly for attachment to the truck by power-driven hydraulic cylinder. With the water ballast, the roller becomes a full 5 tons. Forward and reverse movement is controlled by a single lever, with two speeds in each direction. It will operate alongside any standard curb without removing transportation wheels, which can be raised 12 in. above the bottom of the roller. Minus easily removable wheels, the roller can operate within 4 in. of a fence or wall.

Manufacturer: Shovel Supply Company, P. O. Box 1369, Dallas, Tex.

413

Proximity warning device for crane and shovel mounting

Features claimed: The Electro-Alarm pays automatic attention to power-line proximity while the operator concentrates on his load It provides dependable protection when rigs are operated at night, or when blinding sunlight restricts the operator's vision. The device has manually adjustable proximity control, allows complete protection with shovel in any position on excavators. Special features are obtainable for use on mobile cranes, pile drivers, construction towers, and scaffolds.

Manufacturer: Electro-Alarm Co., Fresno, Calif.

414

New anti-rust paints join maintenance coating line

Features claimed: Known as Rustrem Chromate Special, these new paints are available in clear, black and aluminum. They possess all of the penetrating and sealing qualities of the standard Rustrem, and they also contain liberal quantities of chromate pigment which in itself is an efficient rust inhibitive. It is reputed to stand up longer under extreme conditions of temperature and moisture, can be applied right over rust without wire brushing or scraping and is suitable for both interior and exterior use. The Chromate Special is avail-

able in quart, gallon, 5-gallon cans and 55-gallon drums.

Manufacturer: Speco, Inc., 7308 Associate Ave., Cleveland, Ohio.

415
Electric power saw aids carpenters, house-builders

Features claimed: Model 700 Builders Special power saw, described as "the first one-hand operated saw," for all cutting on house-building jobs, weighs 10 lb., and its 6⅜-in. blade cuts to 2-1/16-in. depth. Base adjustments are 3/16 to 2-1/16 in. at 90 deg., and 0 to 1⅞ in. at 45 deg. No-load speed is 5,500 rpm. Model 800 offers faster cutting and versatile usefulness for heavier jobs in home building. It weighs 14 lb., with an 8-in. blade; cuts 2⅝ in. on a square cut, and saws through 2-3/16 in. lumber at 45 deg. Base adjustments are 1 in. to 2⅝ in. at 90 deg., and 0 to 2-3/16 in. at 45 deg. No-load speed is 4,600 rpm.

Manufacturer: Cummins Portable Tools, 4740 N. Ravenswood Ave., Chicago, Ill.

416
Submersible pump features simplified installation

Features claimed: This self-priming deep well pump is installed below water level by added pipe lengths to the depth of the water. No jets, rods or shafts are required. It is water-cooled, water-lubricated and is designed to deliver high capacities at settings in excess of 70 ft., with well diameters of 4 in. and larger. The entire effort of the pump is concentrated toward raising water through the service line. No suction line is required.

Manufacturer: Fairbanks, Morse & Co., 600 Michigan Ave., Chicago, Ill.

417
Materials handling scoop is the largest yet

Features claimed: Five cubic yards is the level capacity of the Super-Scoopmobile, claimed as the largest material handling scoop of its kind in the construction industry. The machine, which weighs over 18 tons, has a heavy duty four speed forward and reverse transmission, powered by a 4 to 1 planetary drive axle from a 250-hp. diesel engine. The track tilt has hydraulic control and the carriage can be operated with the track in any position. The Super-Scoopmobile can be used for elevating and pouring concrete, loading and shoveling

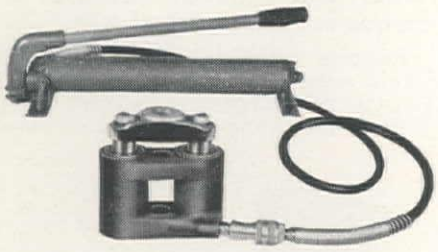
dirt and bulk materials, lifting heavy equipment and other heavy duty lifting and transporting operations.

Manufacturer: Mixermobile Manufacturers, 8027 N. E. Killingsworth, Portland, Ore.

418

Hydraulic puller offers speed and compactness

Features claimed: Weighing less than 10 lb. and developing 15 tons of power, the Power-Twin has a center hole which makes it quickly and conveniently adaptable to



all Owatonna Tool Company pulling systems now in use. The center hole and twin cylinders also make it possible to get at jobs formerly inaccessible with a hydraulic ram. The Power-Twin is only 5¼ in. high, works in any position, works faster, easier and safer than a screw-operated puller.

Manufacturer: Owatonna Tool Company, Owatonna, Minn.

419

Trench hoe now equipped with gooseneck boom

Features claimed: The addition of the gooseneck boom to the P & H Model 150 is designed to make possible greater digging depths, maximum ruggedness and better over-all performance. The machine

is adaptable for use as a shovel, dragline, clamshell or crane. A two-part hoist line gives greater speed, and a low gear transmission provides a greater amount of available power for the toughest kind of digging. A special hoe stick linkage provides a chopping action.

Manufacturer: Harnischfeger Corporation, Small Excavator Div., Milwaukee, Wis.

420

Combination overhead and front-end tractor loader

Features claimed: Designed especially for civilian defense bomb shelter tunnels and protective construction is the new Underground Lodover, manufactured for International Harvester tractors. It is a combination over-head and front-end tractor loader, loads overhead in a 14-ft. shaft. No-turn overhead operation doubles track life on rock and reduces wear at 19 points in the crawler assembly. Equipped with the special 1¼-cu. yd. heavy duty rock bucket, the loader can dig its own sloping ramp in and out of the tunnel or shaft. It has all hydraulic operation, handles easily and reduces wear and tear on the tractor.

Manufacturer: Service Supply Corporation, Philadelphia, Pa.

421

New lubricant maintains grader blade turning parts

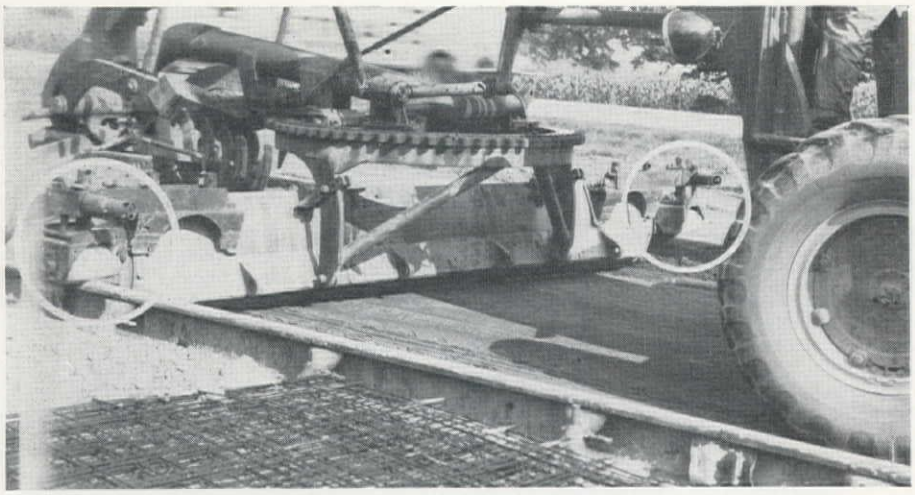
Features claimed: This sludge-free lubricant, ideal for motor grader blade turning mechanisms, is also recommended for all outside lubricating needs. It will adhere to metal, will not mix with water and it permits all turning mechanisms to operate easily with minimum wear. It is also adaptable to track plow chafing plates as a factor in eliminating friction.

Manufacturer: Norgahn Company, Wausau, Wis.

422

Controlled impact action featured in new breaker

Features claimed: "Controlled impact action" is an exclusive operating principle of this heavy duty impact breaker which controls the breaking operation and directs the flow of material through the machine to produce a highly uniform gradation cubical aggregate. High ratio of reduction, low horsepower per ton of finished aggregate, easy access to all parts, and large volume



423
Roadgrader gauge offers efficient finegrading

Features claimed: Finegrade can be prepared faster and more economically because of the flexibility, speed and accuracy of this Roadgrader gauge. With the overrun cut to a minimum, one cubic yard of concrete covers more ground. The device is attached to the moldboard of a standard roadgrader.

Manufacturer: Roadgrader Gauge Corporation, Wilmington, Del.

production with minimum plant investment are other features. The impact master consists of an outer plate steel housing forming a breaking chamber over two rotor hammer members which are mounted in its base. It is designed for use in open or closed circuits for producing aggregates for road building and concrete construction. The machine has a capacity of 250 tons per hour of minus 2½ in. for average limestone, and in many types of rock capacities of 125 tons of minus 1 in. are possible.

Manufacturer: Pettibone-Mulliken Corporation, 4700 West Division Street, Chicago, Ill.

424
New Dodge trucks are practical and powerful

Features claimed: Increased power, new styling, better brakes, improved steering for easier handling, more driver comfort and newly designed shock absorbers are among the more than 50 new features in the B-3 series of Dodge trucks. Higher governor settings, redesigned fuel pumps, hotter spark plugs with improved moisture-proofing, larger-capacity generators, a new high-torque starting motor, plus more efficient cooling systems are engine improvements for power and economy.

Manufacturer: Dodge Division, Chrysler Corp., Detroit, Mich.

425
Wheel tractor loader features torque converter drive

Features claimed: The single stage torque converter drive furnishes a smooth, constant flow of power to the drive wheels. There is practically no spinning of wheels

while loading, and crowding action is definitely improved. Loading in higher gear is possible, operation is easier and there is less wear and tear on clutches and other parts. Most gear-shifting is eliminated by a new clutch type transmission. One is for forward speeds and the other for reverse with only one clutch engaging at a time. The model is mounted on rubber tires, has a ¾-cu.yd., hydraulically-controlled bucket and weighs 10,650 lb.

Manufacturer: Tractomotive Corporation, Deerfield, Ill.

426
Contractors saw with new radial arm control

Features claimed: The most important change in the design of the Comet Clipper contractors saw is the new control for raising and lowering the radial arm column. The control is now located at the front of

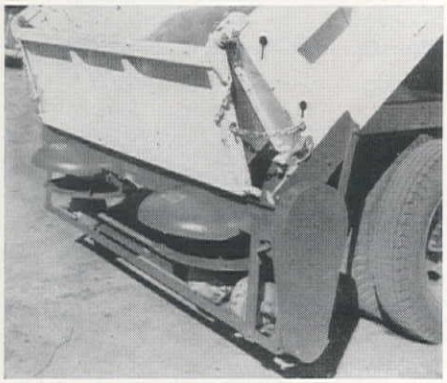
the machine just below the work table and folds compactly out of the operator's way. Further changes include a compact grouping of all saw controls so that they are located at the front right of the saw motor, improved heavy oiled felt wipers enclosed in each end of the bearing housing protect the retractable arm bearing from dust and dirt, and a redesigning of the blade guard and sawdust chute.

Manufacturer: Consolidated Machinery & Supply Co., Los Angeles, Calif.

427

Fast hydraulic spreader fits all dump trucks

Features claimed: One man can operate this new all purpose Hydro-spreader de-



signed for ice control, seal coating, and lime spreading. Controlled speed, density and direction offer efficiency and economy. Speed is controlled from the cab; density and direction are controlled by simple adjustment of the openings at the agitator. It is not necessary to remove the spreader to dump loads. No wheel sprockets or exposed drive chains are used.

Manufacturer: Central Engineering Co., Inc., 4429 W. State St., Milwaukee, Wis.

428

Oil filter cartridges for Wisconsin air-cooled engines

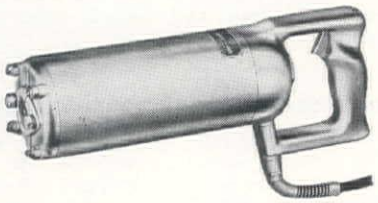
Features claimed: This filter is designed to match the lubrication system of the V-type 4-cylinder Wisconsin air-cooled engines. It adds extra horsepower hours of dependable service to life of the engine by keeping the oil free from dirt, filings, and sludge.

Manufacturer: Wisconsin Motor Corporation, 1910 S. 53rd, Milwaukee, Wis.

429

Portable electric hammer has simplified design

Features claimed: This portable electric hammer has only one working part, and it incorporates a specially designed power



unit consisting of two alternately energized magnetic coils, eliminating gears, cranks and connecting rods. Striking 3,600 blows a minute, the Skil electric hammer will handle the toughest jobs—drilling and channeling in concrete; vibrating concrete forms; chipping, scaling and cleaning of many materials. An exclusive, patented, contour grip handle makes the tool easy to hold and operate during long use.

Manufacturer: Skilsaw, Inc., 5033 Elston Ave., Chicago 30, Ill.

430

Tractor-shovel has speed, power, durability

Features claimed: A rugged addition to the Payloader line, this tractor-shovel has a 1¼-cu. yd. bucket and is available with 60-hp. gasoline or diesel power. The en-

gine is in the rear over the drive wheels for tractive effort and capacity, and the operator is located up where he has a clear view in all directions. It has a powerful bucket crowd and automatic tip-back to prevent spillage. Hydraulic power control of bucket-dump and bucket-close and four speeds in each direction are included.

Manufacturer: Frank G. Hough Co., 707 Seventh Street, Libertyville, Ill.

NEW LITERATURE

YOU MAY OBTAIN any of the publications reviewed below. Send your request to Western Construction, 609 Mission St., San Francisco 5, Calif. The literature is free, unless otherwise indicated. Please designate the desired items by number.

★★★★★★★★★★★★★★★★★★★★★★★★★★

431

Highway construction

International Harvester Co., 180 N. Michigan St., Chicago, Ill., has released an 8-page folder on construction of roads and highways. "For More Profitable Road Building" has pictures and stories on construction jobs large and small, and the use of International equipment on road and highway construction.

432

Elevating grader uses

The varied uses and special features of the Domor Elevating Grader for stripping, casting, loading, terracing, roadbuilding and widening, and ditching, are discussed in a four-page folder issued by the **Ulrich Products Corp.**, of Roanoke, Ill.

433

Reducing maintenance costs

An 8-page folder on road maintenance entitled "Make Maintenance Dollars Give More Mileage," has been published by **International Harvester**, 180 N. Michigan St., Chicago, Ill. It tells, in pictorial fashion, how International crawler and wheel tractors are helping to maintain the city, county, and state roads throughout the country.

434

Power units

International Harvester Co., Chicago, Ill., has a new mailing folder available entitled "A Change to International Power Makes Dollars and Sense." The colorful folder describes many industrial applications for the International line of engines and power units.

435

Plywood reference booklet

"Architectural grade Weldwood plywood" is the title of a booklet newly published by the **United States Plywood Corporation**, New York, N. Y. Photographs and line drawings keynote this reference brochure, which is designed to explain plywood and veneer cuts, types of veneer matching, how to make corners, joints, curved panels and counterfront layouts. Architectural specifications are also included. Two detailed charts reveal the availability of various woods and the characteristics, origin and length range of thirty-six veneers.

436

Condensed piping dimensions card

Searching through catalog pages and tables for dimensions on welding fittings and flanges is now obsolete. **Taylor Forge & Pipe Works**, Chicago, Ill., is issuing an 8½ x 11-in. card, which contains all the information in condensed form. One side shows the wall thickness and the essential dimensions for all types of fittings for every nominal pipe size from ½ in. through 30 in. The other side of the card gives the essential dimensions and bolting data for all types of flanges, in all weights, for nominal pipe sizes from ½ in. through 24 in. The colorful card is varnished on both sides for durability.

437

Corrosion control coatings

Control of corrosion on exteriors of steel, concrete, brick, formed block and plywood structures is the topic discussed in a new illustrated booklet offered by **Casey & Case Coating Company**, Maywood, Calif. Specific properties are given, a chemical resistance chart is included, as well as valuable information concerning application. Photographs and charts are included.

438

"Pointers on Penta"

Industrial users of wood will be interested in a new fact guide on "penta" pressure treated wood, being distributed by the Dow Chemical Company, Midland, Mich. Technical information is given for the industrial user to better adapt the various "penta" treatments to meet his requirements.

439

Crane and roller catalogs

A 16-page catalog on the Hystaway excavator-crane, and a 6-page brochure on the grid roller, **Hyster Company**, Portland, Ore., products, are now available. The Hystaway catalog, profusely illustrated, contains mounting procedure data and complete specifications and dimensional information. Optional equipment and attach-

ments available are also listed. The literature on the Grid Roller introduces the newest piece of equipment in the Hyster line and shows practical applications on highway salvage jobs throughout the country.

440

GM diesel division digest

The complete line of Series 71 2-cycle diesel engines for application in the industrial, petroleum and marine fields are featured in a 33-page book containing pictures, charts, and an outline of **General Motors Detroit Diesel Division** (Detroit, Mich.) service facilities.

441

Economical retaining walls

In a 16-page booklet entitled "Armco Bin-Type Retaining Walls" the installation procedure, strength plus flexibility features and illustrated case histories of economical embankment stabilization are shown. Technical data on selection of design, and the units required for various types of sections as well as sketches showing typical applications are also included in the booklet offered by **Armco Drainage & Metal Products, Inc.**, Middletown, Ohio.

442

Scoop on scaffolding

"Trouble Saver" sectional tubular steel scaffolding is discussed in detail in a 12-page bulletin issued by **The Patent Scaffolding Co., Inc.**, Long Island, N. Y. Forty-eight photographs and line drawings give detailed information on erection and dismantling of basic units, building up complete assemblies, available frames and components and a wide variety of actual applications of special nature. The selection of pictures illustrates applications ranging from rolling scaffolds and other small assemblies to large and elaborate erections covering entire buildings.

443

Insulation "how-to-do-it"

The **Zonolite Company**, Chicago, Ill., is issuing a 12-page illustrated booklet explaining the proper application of all forms of the company's vermiculite for use by architects, engineers, contractors and building supply dealers. Design data, methods, and specifications outlined in the publication are the result of laboratory research and field tests made under service conditions.

444

Concrete admixture for strength

Dehydratine No. 80 for use in concrete and cement mortar is graphically explained in a new 8-page booklet issued by **A. C. Horn Company, Inc.**, Long Island, N. Y. The booklet describes the features of the product which make for accelerated set, increased early strength, higher ultimate strength and improved workability. Applications on various types of projects are discussed along with proportional directions for use.

445

Diesel data

Construction and operation features of the Nordberg four-cycle, one cylinder and recently introduced two-cylinder, vertical, mechanical injection, Type 4FS diesel engine are contained in a new two-color, 6-page bulletin released by **Nordberg Manufacturing Company**, Milwaukee, Wis. The engines are offered as complete, self-contained, ready to operate electric generating sets, pumping units and with clutch or stub-

shaft power takeoff for direct connection or belt drive. The bulletin illustrates these various engine applications and gives kilowatt ratings and pumping capacities for the different models.

446

100th issue of Thew-Lorain News

Distributors for the **Thew Shovel Co.**, Lorain, Ohio, will mail owners and prospects the 100th issue of the "Thew-Lorain News," company house-organ. When started in 1929, the News was a 4-page magazine with a circulation of 12,000. Currently, the magazine runs from 8 to 12 pages and circulates over 100,000 copies. Over 5,000 pictures of Lorain power shovels and cranes have been used in the magazine up through this March-April 1951 issue. Improved techniques and helpful suggestions are always included in the publication.

447

Better, safer roads urged

Caterpillar Tractor Co., Peoria, Ill., is offering a booklet entitled "Stop Murder," which stresses the importance of better roads for safer driving. The booklet is a compilation of Caterpillar magazine advertisements. Seven pages in four colors and a cover in black and white compose the booklet which is being offered to interested agencies and organizations.

448

Color film on DeWalt machines

A color film on the applications of the latest line of DeWalt "400" machines and their versatility, is available for showing through DeWalt representatives located throughout the country. The first of six demonstration films proposed for release this year, the five minute motion picture shows the "400" as a power feed: rip saw, single-head shaper, single-head moulder, rabbeting machine, tongue and grooving machine, bevel-rip machine and ploughing machine. Industrial plants, schools, lumber yards, home builders, etc., are invited to seek further information from **DeWalt Inc.**, Lancaster, Pa.

449

Impact breaker bulletin

An 8-page bulletin which fully describes the new "Controlled Impact Action" of the PMCO heavy duty impact breaker is now available. Diagrams of the operation and method and photographs of the machine in action along with the machine's specifications are included in the booklet. General construction features are explained and discussed in the booklet, issued by the **Pettibone-Mulliken Corp.**, Chicago, Ill.

450

Stud welding aids described

Detailed specifications and performance characteristics of two Nelwelder power units specifically designed to improve and extend the advantages of stud welding are described in a new 4-page bulletin issued by the **Nelson Stud Welding Division** of **Morton Gregory Corp.**, Lorain, Ohio.

451

Sealer for bituminous pavements

The advantages of Super Seal, a coal tar compound which seals the influences of weather, solvents, salts, anti-freezes, acids, etc., out of pavement and makes it more

Space is sold as advertisers' inches. All advertisements in this section are ⅛ 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.

smooth and lasting, are discussed in literature issued by the **Troyer Driveway Service**, Buffalo, N. Y. Engineers, contractors and blacktop producers should have this explanation.

452

Oil burner line described

Complete listings and illustrations of **Ray Oil Burner Co.'s** products appear in a new condensed 16-page catalog in color issued by the San Francisco, Calif., firm. In addition, the booklet features a selector chart, plus listing of specifications and capacities, and operation and control of each unit is described.

453

Euclid power equipment

Two 16-page booklets are offered by the **Euclid Road Machinery Company**, Cleveland, Ohio, describing the Cummins and General Motors powered Euclid equipment. These list by model number the various diesel engines and the Euclid equipment in which they are available. Specifications for Euclid rear-dump and bottom-dump hauling units, scrapers and loaders are included along with lists of engine dealers and Euclid distributors in the United States and Canada.

454

Hydraulic pullers and jacks

Labor saving applications of hydraulic pullers and jacks are discussed in a new 8-page bulletin, Hydraulic 51, issued by **Templeton, Kenly and Co.**, Chicago, Ill. Simplex hydraulic pumps and remote-controlled rams are introduced in the booklet with illustrations showing how these units simplify rigging requirements and improve safety in numerous pulling, pushing and lifting operations, by means of "center-hole" tubular ram construction.

455

"Caterpillar hydraulic controls"

This booklet released by **Caterpillar Tractor Co.**, Peoria, Ill., explains in detail how three models of hydraulic controls fit the various models of Caterpillar track-type tractors. Arrangements needed to adapt the versatile No. 44 Hydraulic Control to either the D2, D4 or D6 tractors are itemized in tabular form. Complete specifications for all three controls are included and several job application pictures indicate the many and varied types of jobs to which these controls are suited.

456

Plaster-mortar mixers compared

A simple method of comparing construction features, dimensions and capacities of various types and sizes of plaster-mortar mixers is discussed in a new catalog offered by the **Kwik-Mix Company**, Port Washington, Wis. Printed in attractive colors, the new bulletin contains photographs depicting exclusive Kwik-Mix features along with schematic drawings listing the detailed dimensions of each machine. A complete description of the recently introduced tilting plaster-mortar mixer is also included.

457

Eye safety stressed

Eye hazardous occupations and the recommended eye protection for specific industrial eye hazards are discussed in a revised issue of "AO Eye Safety Guide," released by the **American Optical Company**, Southbridge, Mass. The completely illustrated guide is a reference chart in that it contains a careful summary of recommendations made by the Safety Engineering Service bureau of AO for jobs that are dangerous to eyes throughout industry.

458

Aluminum bridge railings

Reynolds Metals Company, Louisville, Ky., offers an outstanding manual on aluminum for bridge railings . . . a relatively new field for aluminum in which practically no other technical information is available. Engineers and architects will find the answers to many engineering questions regarding the use of aluminum for this service as well as typical designs to show the possibilities in this field. This 50-page, 8¼ by 11-in. loose-leaf manual will be sent without charge to engineers requesting it on their letterhead. Address Customers' Service Dept., Reynolds Metals Company, 2500 South Third St., Louisville, Ky.

459

Foundation structure information

Casey & Case Foundation Company, with plants in Los Angeles and Berkeley, Calif., have issued an unusual 24-page brochure on drilled and poured foundation structures, which should be of interest to structural engineers, contractors and construction companies. Types and applications of foundation structures, pressure grouting, drainage, de-watering, shoring and sub-surface soil exploration are illustrated and described in case history fashion. Included are valuable tables prepared for the assistance of engineers in estimating drilled and poured foundation piling and caissons. Tables on volume of different diameter caisson bells in relation to various size shafts are included. The booklet is furnished free to engineers, engineering organizations, contractors and construction companies who submit requests on their letterheads.

460

Straddle truck versatility

Photographs and diagrams of straddle trucks in action highlight the 16-page booklet released by **Hyster Company**, Portland, Ore. The design, construction and performance of the devices are discussed and specifications are included for the 18,000-lb. and 30,000-lb. capacity models.

461

Tunnel mixer details

The models, features and attachments and specifications for the Dual Drum Tunnel Mixers are described in detail in an 8-page booklet issued by **Worthington Pump and Machinery Corporation**, Harrison, N. J. Photographs of the mixers in action along with close-ups of the various important parts accompany the description in the bulletin.

462

Concrete forming devices

Uni-Forms and the Uni-Form system of Wall Form Construction are described in a new catalog issued by the **Universal Form Clamp Co.**, Chicago, Ill. The descriptive catalog covers the use of Uni-Forms in many types of concrete forming.

463

Diesels for aggregate production

Thirty-one different illustrations of Cummins Diesels producing crushed stone, agricultural lime, sand and gravel, are displayed in the eight-page leaflet just released by **Cummins Engine Company, Inc.**, Columbus, Indiana. The photographs show actual case histories of hauling, loading, crushing and pulverizing, and sand and gravel dredging.

INDEX TO ADVERTISERS
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