WESTERN CONSTRUCTION

FEATURED THIS ISSUE

MARCH 1951

IMPROVE YOUR COMPRESSOR PERFORMANCE

...by using the TEXACO air compressor oils designed for YOUR operating conditions

TEXACO ROCK DRILL LUBRICANTS EP are "extreme pressure" lubricants designed to give full protection against wear, to guard against rust, and to prolong drill life. Use them and you'll drill *more footage at lower cost.*

Different air compressor operating conditions give rise to different operating problems—each of which calls for a special type of oil. By using the proper Texaco air compressor oil, you can overcome *your* difficulty, assure efficient compressor operation, reduce wear and maintenance costs. For example—

1. TO OVERCOME RUST, use Texaco rust-inhibited air compressor oils. They keep compressors and systems rust-free whether running or idle.

2. TO OVERCOME CARBON AND GUM, use Texaco heavy-duty air compressor oils. They have special detergent properties and are highly oxidation-resistant—will keep compressors clean under extreme operating conditions.

3. TO OVERCOME "WET CYLINDER" WEAR, use Texaco compounded air compressor oils. They resist the washing effect of moisture of condensation.

4. TO OVERCOME "NORMAL" OPERATING DIFFICULTIES, use Texaco straight mineral air compressor oils. They assure clean operation and reduce wear.

Your Texaco Lubrication Engineer will gladly help you select the right oils to assure you the most efficient compressor operation. Contact him through 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

TUNE IN . . . TEXACO presents MILTON BERLE on television every Tuesday night. METROPOLITAN OPERA radio broadcasts every Saturday afternoon.

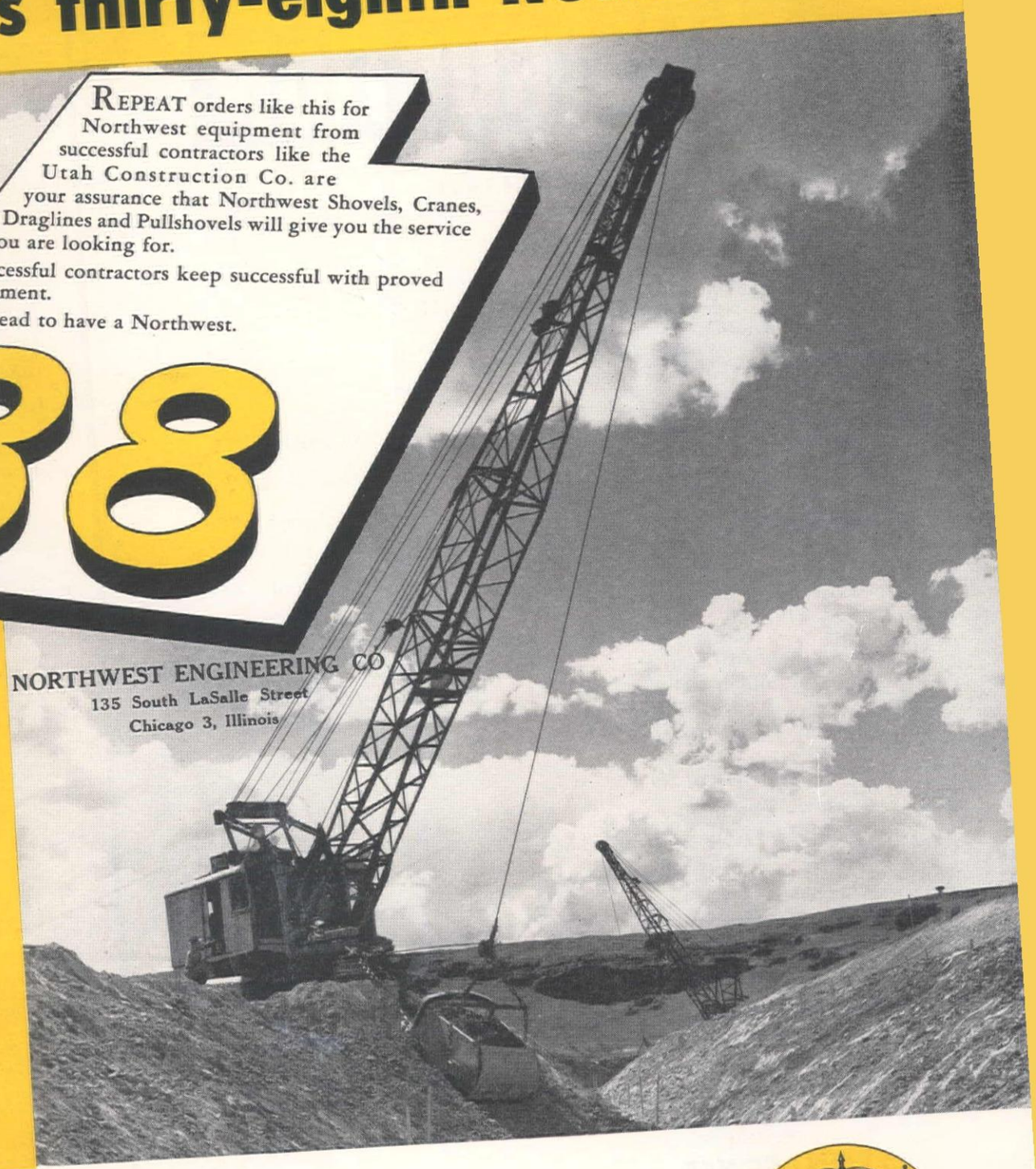
UTAH *Construction Co.* buys its thirty-eighth NORTHWEST

REPEAT orders like this for Northwest equipment from successful contractors like the Utah Construction Co. are your assurance that Northwest Shovels, Cranes, Draglines and Pullshovels will give you the service you are looking for.

Successful contractors keep successful with proved equipment.

Plan ahead to have a Northwest.

38



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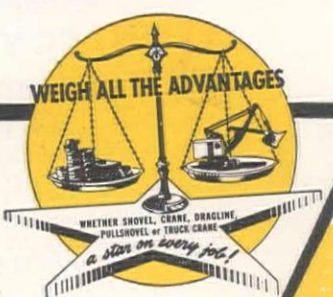

WESTERN CONSTRUCTION

Volume 26 **MARCH 1951** Number 3

ARTICLES

DEPARTMENTS

FRONT COVER

ON THE SNAKE RIVER in one of the country's deepest canyons, the L. L. Jeffries Co. of Richmond, Calif., is completing three diamond drill holes to determine depth to bedrock for the Bureau of Reclamation's Hells Canyon Dam. The big dam, not yet authorized for construction, would be a concrete arch-gravity structure 742 ft. high. Third largest in the world, it would contain about 6,200,000 cu. yd. of concrete. Each abutment would touch the base of a mountain range in a different state—the Seven Devils of Idaho and the Wallowas in Oregon. Entire cost of the multiple-purpose project would be about $333,000,000. *Photo courtesy Bureau of Reclamation*

The Construction and Civil Engineering Publication of the West

★

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B.F. Goodrich

The tire that should lose but doesn't

WHEN water, sharp rocks and rubber start fighting—it's usually the tire that has the handicap. The water acts as a lubricant, causing the tires to spin — while the sharp rocks cut at the slipping rubber.

But the BFG Rock tires shown above are an example of how B. F. Goodrich builds tires to lick tough problems.

To resist cutting, these tires have a special, tough tread—compounded for rock service. To resist slippage, the heavy cleats on the shoulders are non-directional . . . they dig in for a non-slip bite, in forward or reverse. To give real shock protection to the cord body, these and other B. F. Goodrich off-the-road tires have a patented *nylon shock shield* (double in larger sizes).

Found only in BFG tires, the shock shield is made of two nylon cord breakers. This is vulcanized between the tread and cord body to protect the life of the tire against the shocks of hard service.

The Wallowa County Road Department office in Enterprise, Oregon, operators of the equipment shown above, have this to report: "The B. F. Goodrich tires have given longer and better all-around service than any other brand we have used." In other words, the tire that's hard to cut is the tire that cuts costs.

Whatever job your off-the-road equipment must perform, there's a special BFG tread built to help you do it better. In addition, you get the exclusive protection of the nylon shock shield at no extra cost.

So see your B. F. Goodrich dealer. And specify BFG tires for your new equipment. Enjoy the longer life and lower operating costs offered you by *The B. F. Goodrich Company, Akron, Ohio.*

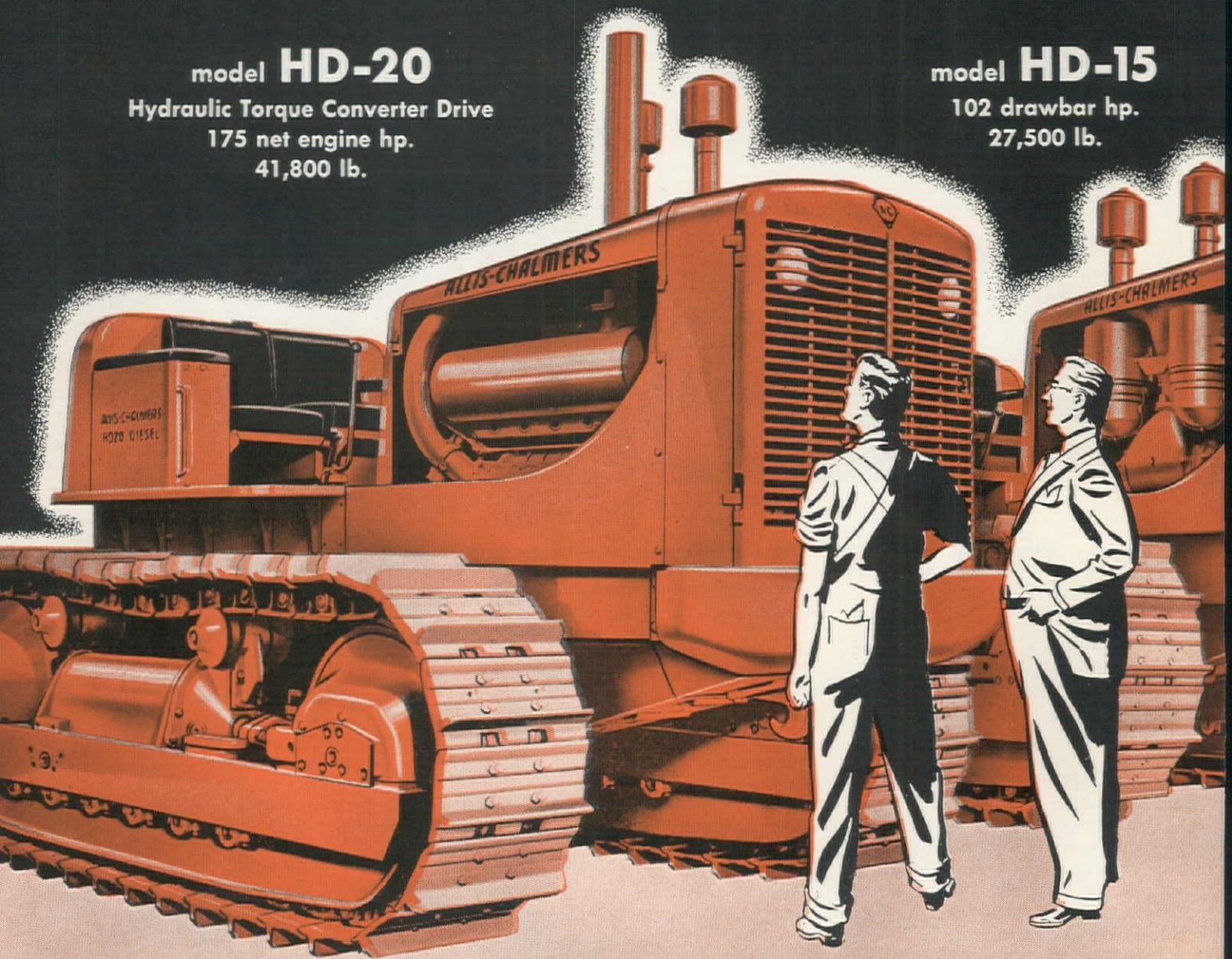
RESEARCH KEEPS
B.F.Goodrich
FIRST IN RUBBER

ALLIS-CHALMERS
Sets New Standards

. . . THE NEWEST, FINEST

model **HD-20**
Hydraulic Torque Converter Drive
175 net engine hp.
41,800 lb.

model **HD-15**
102 drawbar hp.
27,500 lb.



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See these tractors perform. They're built for YOUR job!

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for Lasting Durability
for Simplified Servicing
for Ease of Operation

TRACTOR LINE ON EARTH

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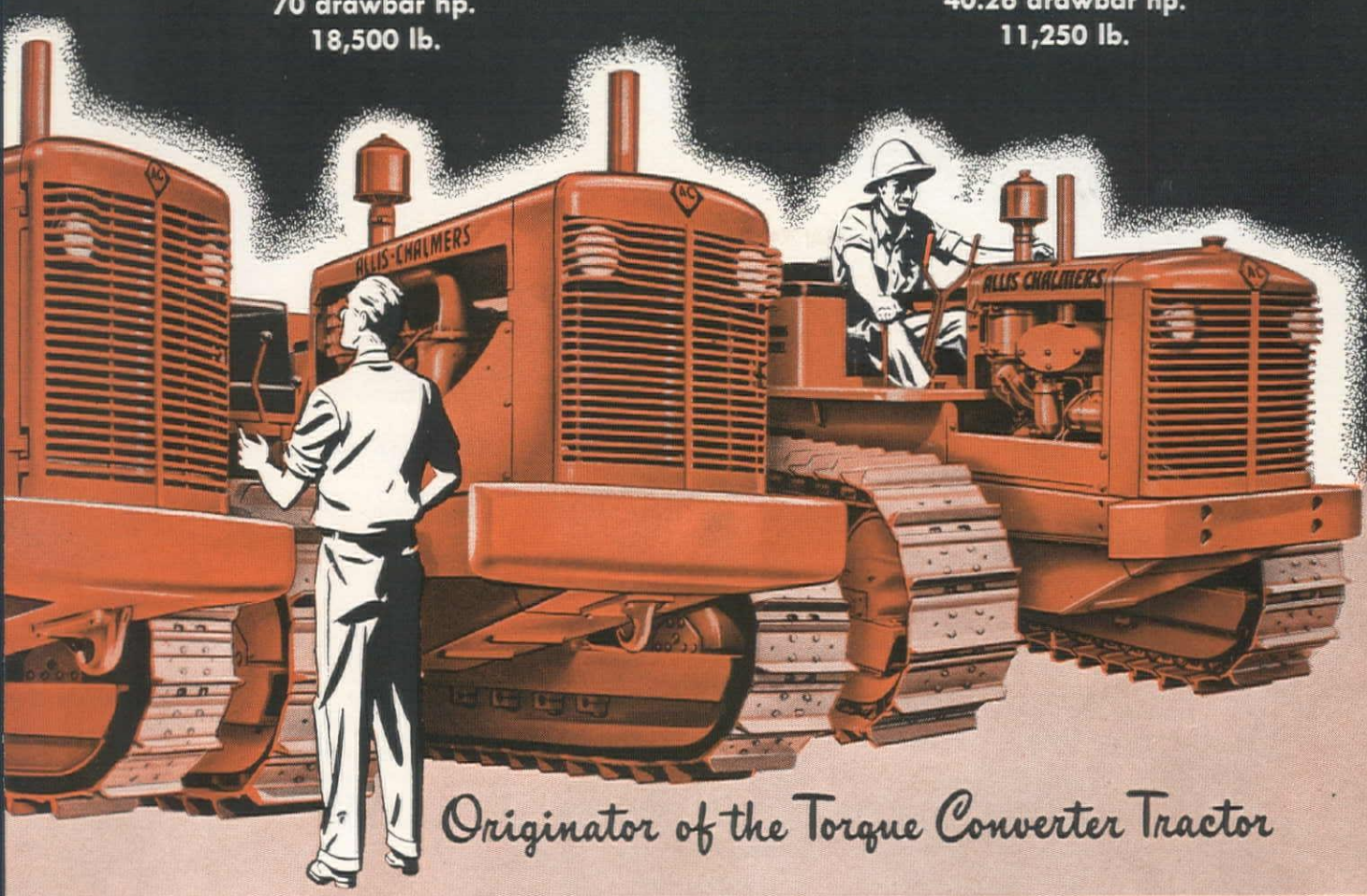
70 drawbar hp.
18,500 lb.

model **HD-5**
40.26 drawbar hp.
11,250 lb.



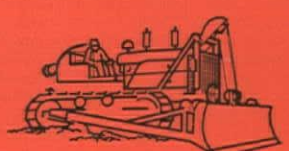
Originator of the Torque Converter Tractor

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 Co.; **The Dalles**—Dielschneider Equip. Oreg. Ltd.; **La Grande**—Oregon Tractor Company; **Medford**—Tractor Sales and Service, Inc.; **Klamath Falls**—West Hitchcock Corp.; **Portland**—Wood Tractor Company. **UTAH: Salt Lake City**—Cate Equipment Co., Inc. **WASHINGTON: Seattle, Tacoma and Wenatchee**—A. H. Cox & Company; **Walla Walla**—Northern Harris; **Spokane**—American Machine Company. **WYOMING: Casper**—Studer Tractor & Equipment Co.

PULLING A 17-YARD SCRAPER, the TD-24 moves more paydirt in a faster time cycle to keep Highum and Wondra ahead of the contract time clause on Minnesota State Aid Road Number 9, near Clinton Falls, Minnesota.

IT'S "THE CHAMP"—the big red International TD-24—and here's what R. E. Highum says about it: "The easy quick-starting engine gets our equipment working sooner each day. Over a period of time that means a lot more profit for us. Economy in fuel, lubrication, and repairs is good. International parts delivery and service are tops."



Clean, quick shave for the face of Minnesota

How one contractor closes the work-gap with the TD-24

Up in the land of ten thousand lakes, the International TD-24 is doing a job of moving paydirt that would make any contractor sit up and take notice.

Highum and Wondra, Blooming Prairie, Minnesota, on a state road improvement contract, are a hundred percent for International—and here's why:

The TD-24 on the job rolled up 1,500 hours its first year with no downtime and not a cent for repairs.

Quick, all-weather starting—with International's exclusive push-button, gasoline-conversion starting system—gets equipment working sooner each day—doubly important where the snow flies early and stays late.

TD-24 hauls a bigger payload with a shorter time cycle—does more work with more speed.

Synchromesh transmission—you shift "on-the-go."

Planet Power steering with finger-tip control for pivot turns, feathered turns, turns with power on both tracks.

Reserve engine torque control—gives more lugging ability and increased drawbar pull for overloads.

Power—TD-24 delivers 148 maximum horsepower at the drawbar.

Ask the superintendents and the "skinners" on any TD-24 job. Ask to take the controls yourself. Then let your International Industrial Distributor show you what's in the TD-24 for you. You'll be a TD-24 man from then on in.

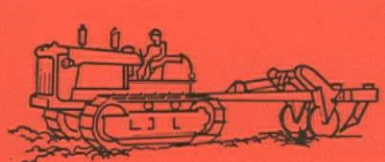
INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILLINOIS

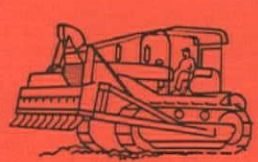
INTERNATIONAL CRAWLERS MAKE SNOW TRAPS—deep snow ditches to keep the highway from drifting over in winter. A TD-9 and two TD-18's are on this job. One TD-18 has 4,500 hours in three years, the other has 9,600 hours in four years!

INTERNATIONAL HARVESTER

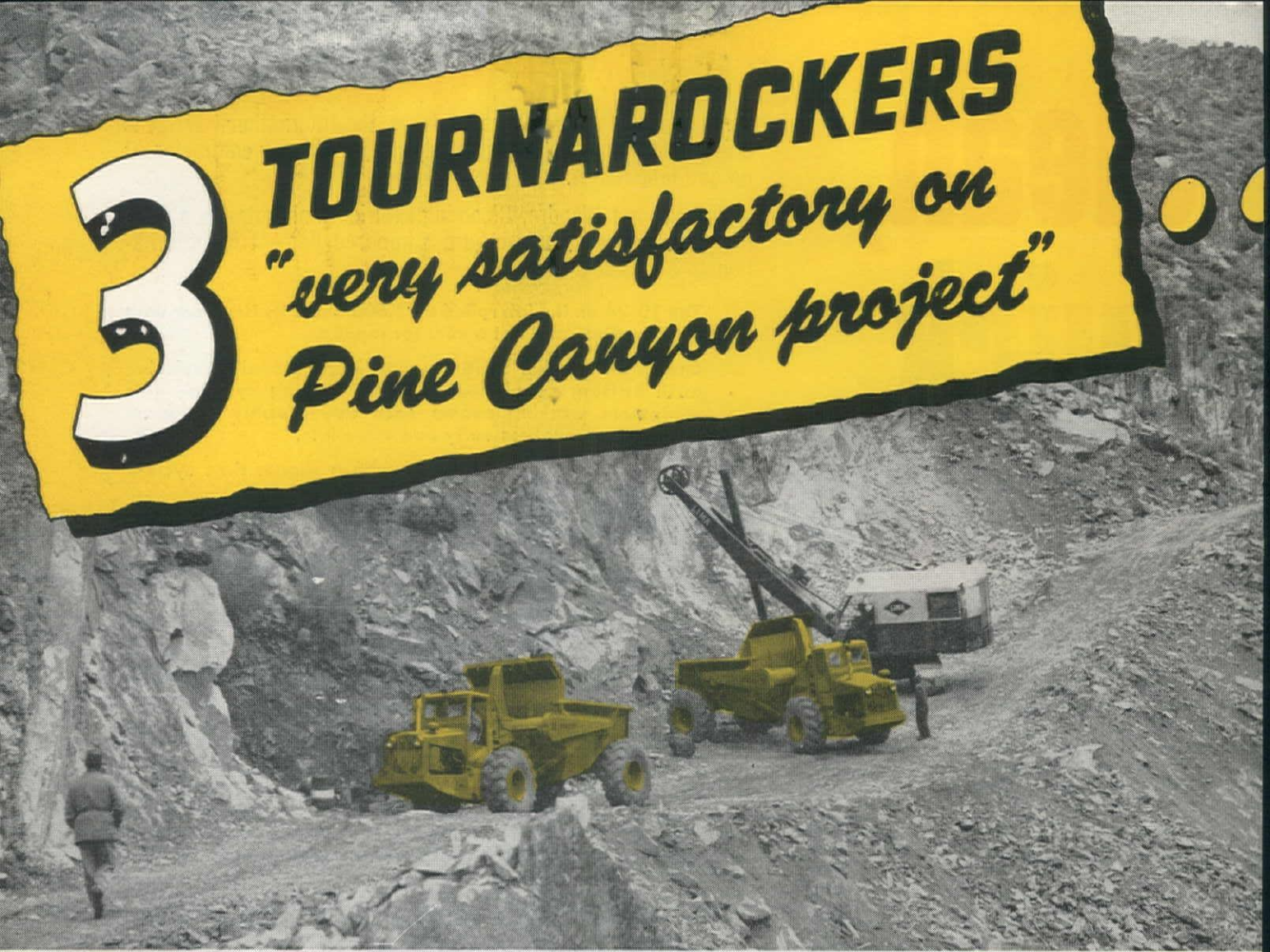
INTERNATIONAL

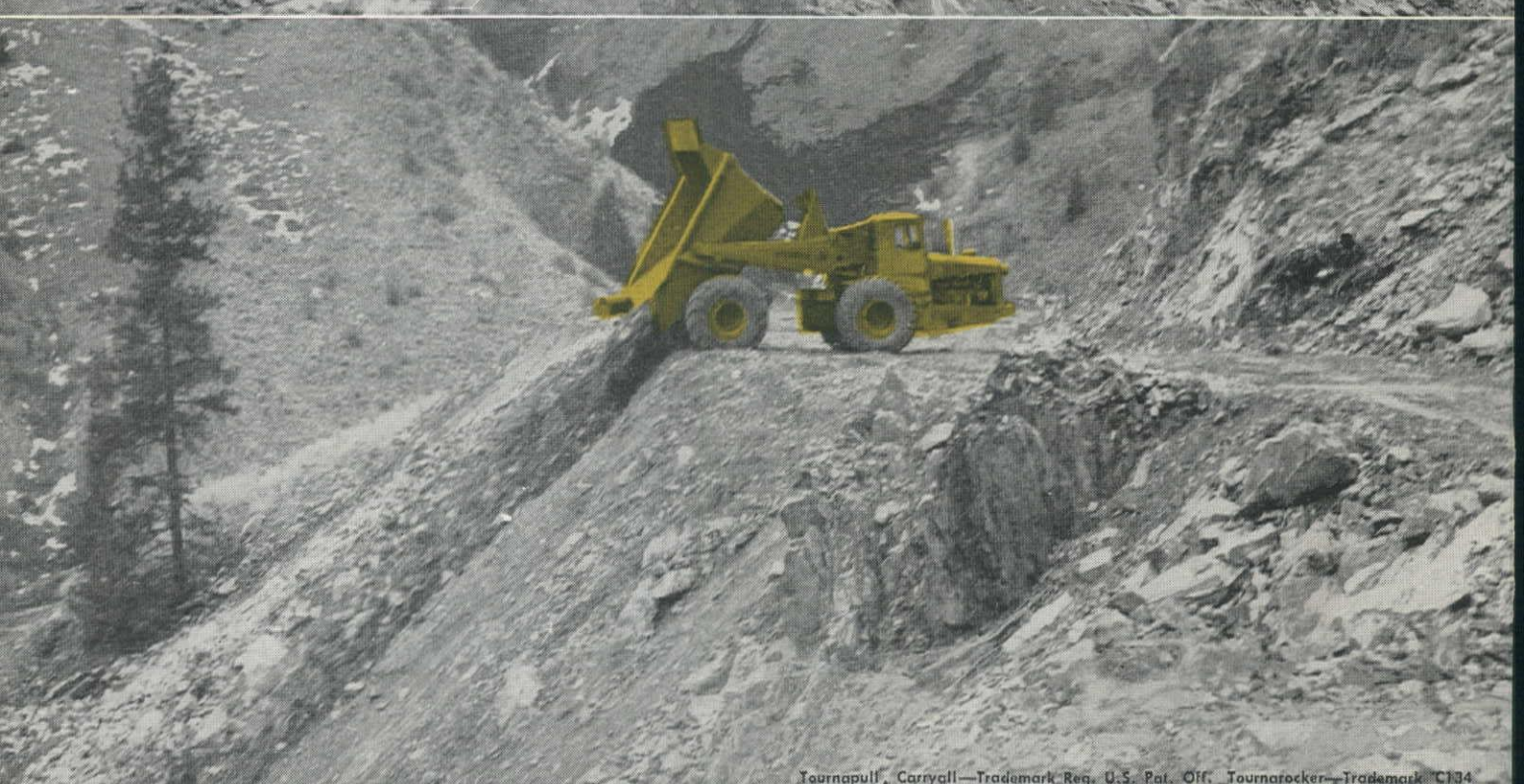
POWER THAT PAYS





3 TOURNAROCKERS "very satisfactory on Pine Canyon project"





Tournapull, Carryall—Trademark Reg. U.S. Pat. Off. Tournarocker—Trademark C134

Arizona — Phoenix
ARIZONA EQUIPMENT SALES, INC.

California — Los Angeles, Bakersfield
CROOK COMPANY

Idaho — Pocatello
J. K. WHEELER MACHINERY CO

California — Sacramento
CAPITOL TRACTOR & EQUIP. CO.

Colorado — Denver
COLORADO BUILDERS' SUPPLY CO.

Montana — Helena, Billings
MONTANA POWDER & EQUIP. CO.

GOODFELLOW Brothers, Inc.,

tackled one of the northwest's toughest highway jobs . . . relocating 4.4 miles of U. S. 2 along steep sidewalls of rocky Pine Canyon, near Wenatchee, Washington. With over 600,000 yards of shovel rock to be carved out of the cliff face, some of the material is side-cast . . . much of it has to be hauled and dumped along the mountainside trail to widen narrow sections. Goodfellow Brothers, Inc., assigned the most difficult hauling to 3 LeTourneau 16-ton, rear-dump Tournarockers . . . and according to James B. Goodfellow "They are working out *very* satisfactorily".

Here are contractor's own figures

Loading under a 2-yard rock shovel, the Tournarockers carry 9 to 11 bank yards each trip. On one 2800-foot, one-way haul, actual job records show that Tournarockers easily handle shovel production of 1000 yds. every 8-hour shift. This rate of production, day in, day out, helps keep the job on schedule in spite of the rough haul roads, steep grades, and confined hauling conditions at altitudes of 2000 feet.

13′ 9″ turn radius speeds handling

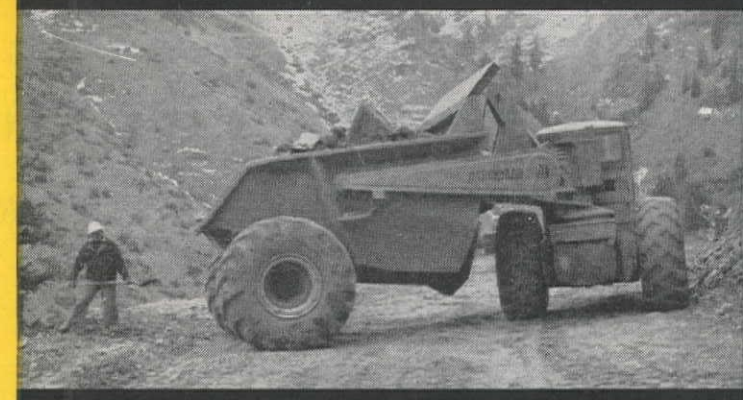
Short, 90° turns, and positive electric steer by push-button control, permit easy turning and spotting anywhere along the narrow trail for load and dump position. Oversize, disc-type air brakes on all 4 wheels (4176 sq. in. total braking surface) give operators complete safety throughout the hauling cycle. Positive holding action of 4-wheel brakes . . . plus front-wheel drive on 186 h.p. Tournapull prime mover . . . let the Tournarockers dump safely out over the edge of mountainside fills. Simple electric hoist raises body to vertical position . . . streamlined bowl clears loads instantly.

Important savings for you

These same revolutionary Tournarocker advantages that are helping Goodfellow Brothers, Inc., lick steep slopes and rough going on the Pine Canyon project offer new low-hauling costs for your jobs, too. Ask your LeTourneau Distributor about this 16-ton, rear-dump Tournarocker. He can also give you complete information on 9-ton and 35-ton Tournarockers . . . and will show you money-saving interchangeability with Carryall Scrapers, bottom-dump hoppers, cranes, flat-beds and other auxiliary hauled units. Your investment dollar provides steady year-round earnings with interchangeable auxiliary units at approximately 25% of the cost of the original unit. Write or call NOW!

Big target . . . Operator on Goodfellow Brothers' 2-yard shovel has large target with Tournarocker's 12' 5" x 8' top opening . . . speeds shovel swings, has less spillage.

Rock body . . . Here's a typical load of big-chunk rock carried by Tournarockers along Pine Canyon's slopes. 186 h.p. for 16-ton capacity licks the toughest hauling conditions.



90° turns with positive power steer . . . Short 13' 9" turning radius is an important advantage where operators have to turn and dump their loads along these narrow trails.

Front-wheel drive . . . Means you can keep the drivewheels of the prime mover on firm ground. Front or rear wheel air brakes can be set independently.

Nevada — Reno
SIERRA MACHINERY COMPANY

New Mexico — Albuquerque
ONTRACTORS EQUIP. & SUPPLY CO.

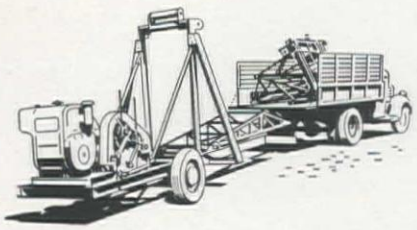
Oregon — Portland, Eugene
LOGGERS & CONTRACTORS MACHY. CO., INC.

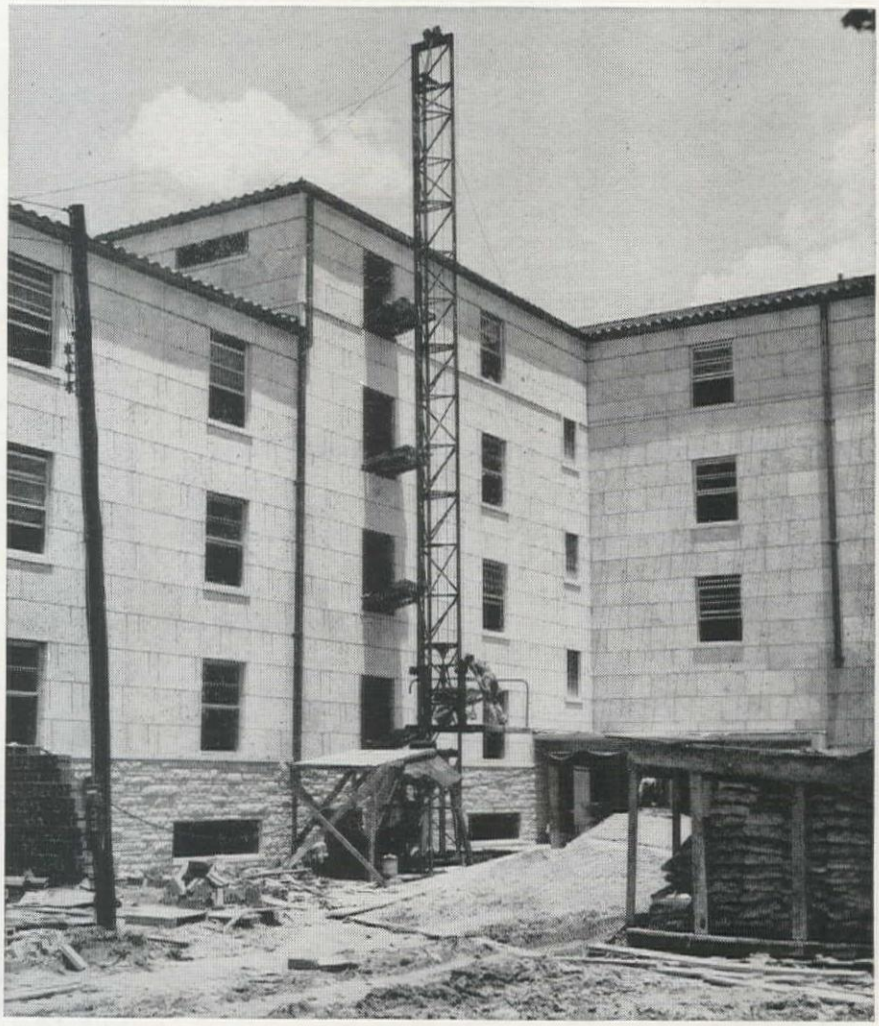
Utah — Salt Lake City
J. K. WHEELER MACHINERY CO.

Washington — Spokane
MODERN MACHINERY CO., INC.

Wyoming — Casper
COLORADO BUILDERS' SUPPLY CO.

One truck moves it





THERE are three ways to move an American Portable Material Elevator. You can dismantle it and *carry* it on one truck. You can take the tower apart and *tow* the base, on rubber-tired transport wheels. Or you can leave the tower up, and *skid* the complete elevator from spot to spot on the job. All you ever need is one truck.

Pin connections—not bolts—fasten the tower to the base, and the platform to the tower carriage. This makes quick work of dismantling, or of change-over from platform to self-dumping ½ yard concrete bucket.

The American PME stands 47′ without guying; up to 97′, guyed, by adding 10′ sections. Capacity 2500 lbs. Lifting speed 90′ a minute. Talk to your American Hoist distributor about renting or buying.

Modernize...economize...with

American Hoist
& Derrick Company
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St. Paul 1, Minnesota

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CITY_____ STATE_____

ROCK RATED!

FOR HEAVY GOING

P&H *Magnetorque**

SLICKEST SWING YOU'VE EVER KNOWN!

It's everything you've wanted for more profitable rock handling . . . It's the P&H 955-A (2½ yd. shovel) . . . newer . . . better . . . proving it where the going is heaviest. Here's why:

P&H MAGNETORQUE ELECTRIC SWING. The smoothest, slickest swing you've ever known . . . yours for the full life of your machine. Old style swing frictions are *out* . . . all their troubles, adjustment and replacement costs.

SMOOTHER OPERATION means less strain on machine and operator. **GREATER STABILITY** gives you increased digging ability. **ALL-WELDED** for maximum strength.

Ask to see the one working nearest you. It's the 2½ yd. version of the famous 1055 (3½ yd.).

P&H **EXCAVATORS**

4490 W. National Ave.
Milwaukee 14, Wisconsin

HARNISCHFEGER CORPORATION

*T. M. of Harnischfeger Corporation for electro-magnetic type clutch.

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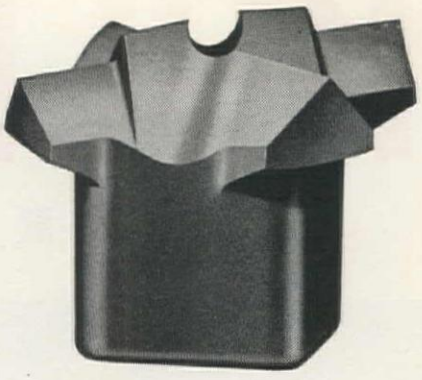
MULTI-USE. Gives lowest cost per foot of hole when full increments of drill steel can be drilled and when control and reconditioning of bits are correct.

CARBIDE INSERT. For drilling extremely hard and abrasive ground, small holes, extra deep holes. Holes go down faster, bit reconditioning is simplified.



ONE-USE "SPIRALOCK". To use where reconditioning is not feasible. Gives lowest unit cost. "Spiralock" union holds bit on dependably, permits easy removal.

ONLY THE TIMKEN COMPANY OFFERS:

1. *All 3 rock bit types...*

2. *A complete Rock Bit Engineering Service*

No matter which type of removable rock bit is best for your particular job, you can get it from the Timken Company! For *only* the Timken Company *makes all three rock bit types*—multi-use, carbide insert, and one-use "Spiralock". And *only* the Timken Company can offer you the world's largest field engineering organization devoted exclusively to rock bit problems.

Our Rock Bit Engineers have more than 18 years of field and laboratory experience behind them, and with all three rock bit types to choose from, they'll help you make an unbiased selection of the *one* best bit for your job.

Whether you're looking for lowest bit cost, lowest cost per foot drilled, greatest possible drilling speed, or any other desired advantage, call on us to get the kind of bit performance you're after. For information and help, contact The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN

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your best bet for the best bit
...for every job

FREE BOOKLET! *Packed with helpful information. Shows full line of bits with detailed descriptions. Write The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".*

427,360 PAY YARDS in just 51 days

Months ahead of schedule, the main fill of Farmington Dam was completed—substantially lessening damage from historic 1950 winter floods which poured through much of the fertile San Joaquin Valley. Key factor in early completion was the *consistent production* of six Wooldridge Terra Cobras—the kind of *consistent production* which spells "PROFITS" on any earthmoving job. Rugged dependability and extreme simplicity of maintenance again paid off with minimum down-time. Accurate job statistics proved a 94.7% efficiency record for the Cobras. Thus, each machine made the most of its fast full-loading, quick dumping, and high speed hauling characteristics. Protect your next contract with the assured *consistent production* of Wooldridge Terra Cobras—proved for long or short hauls.

EQUIPMENT—6 WOOLDRIDGE TERRA COBRAS
PROJECT—Farmington Dam, California
LENGTH OF ONE-WAY HAUL—1500 to 8000 ft.—average 3000 ft.
TYPE OF WORK—Excavation and placing fill for dam embankment
MATERIAL—Hard clay
AVERAGE LOAD—14.7 cu. yds. weighed at 41,250 lbs. (over 2806 lbs. per cu. yd.)
TYPICAL PERFORMANCE—11 loads per hour on 3000 ft. 1-way haul

WOOLDRIDGE MANUFACTURING COMPANY
Sunnyvale, Calif. 5345 N. Winthrop Ave., Chicago 40, Ill.

WOOLDRIDGE

Terra Cobra  Terra Cobra Wagon  Power Control Units  Scrapers  Rippers  Bulldozers 

KOEHRING

WEST COAST SALES DIVISION IN STOCKTON, CALIFORNIA

Provides local, time-saving sales, parts, service facilities for Koehring, Parsons and Kwik-Mix equipment in Northern California and Nevada . . . Leo J. Lamley in charge of sales!

ALL of Northern California and Nevada now receive prompt factory attention on Koehring, Parsons and Kwik-Mix construction equipment through the Koehring Company West Coast Sales Division in Stockton, California.

Leo J. Lamley, formerly Koehring West Coast district representative, is in charge of sales at Stockton for all products produced by the Koehring, Parsons and Kwik-Mix companies. Complete stock of parts available locally, as well as time-saving shop and field service facilities from Stockton, assure prompt, expert attention to your equipment requirements.

Phone 4-4681 any time we can be of service to you.

Harold Buckler, West Coast district representative for C. S. Johnson Company, Koehring subsidiary, also headquarters at the West Coast Sales Division office in Stockton. Kemp Yorke, Johnson district representative serving Southern California, is located in Los Angeles.

KOEHRING HEAVY DUTY

KOEHRING • PARSONS • KWIK-MIX

Sales, Service, Parts

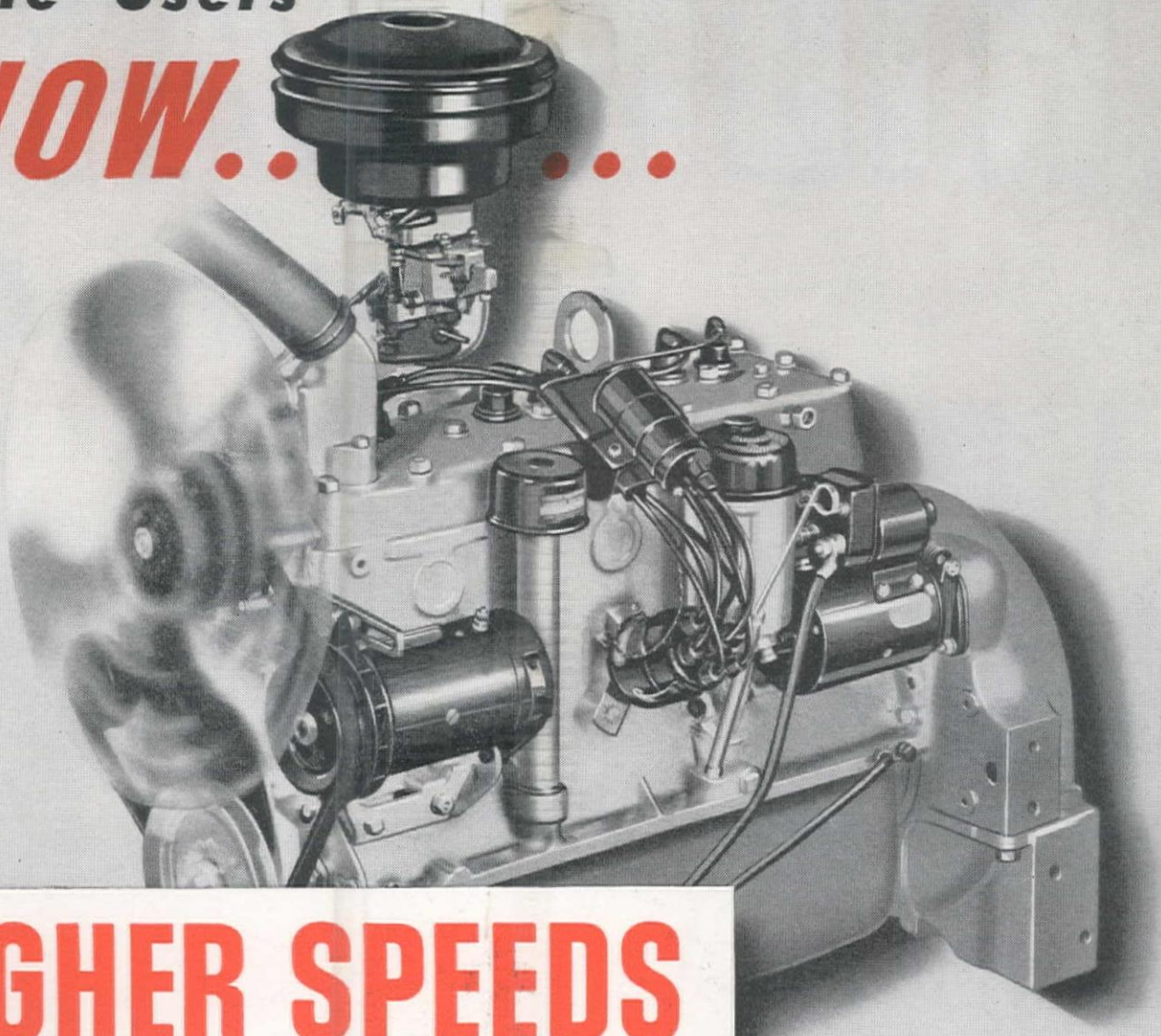
Koehring Subsidiaries: JOHNSON • PARSONS • KWIK-MIX

Koehring West Coast Sales Division Stockton, California

K185

Now Industrial Engine Users

KNOW.....



Chrysler Industrial 7—one of eight basic models.

HIGHER SPEEDS

MEAN BETTER PERFORMANCE AND LOWER COSTS!

For years, operators of gasoline powered industrial equipment, and the engineers who design it, have known that higher speed engines deliver better performance.

Now Chrysler has proved that you can have all the advantages of higher speed—and *lower costs, too.*

Continuous Chrysler research in higher alloy steels and famed Chrysler engineering have produced an industrial engine that runs faster and lasts longer. An engine that *costs less to buy and less to operate!*

A letter of inquiry will bring an engineer to your desk, well qualified to discuss application to your equipment. Address

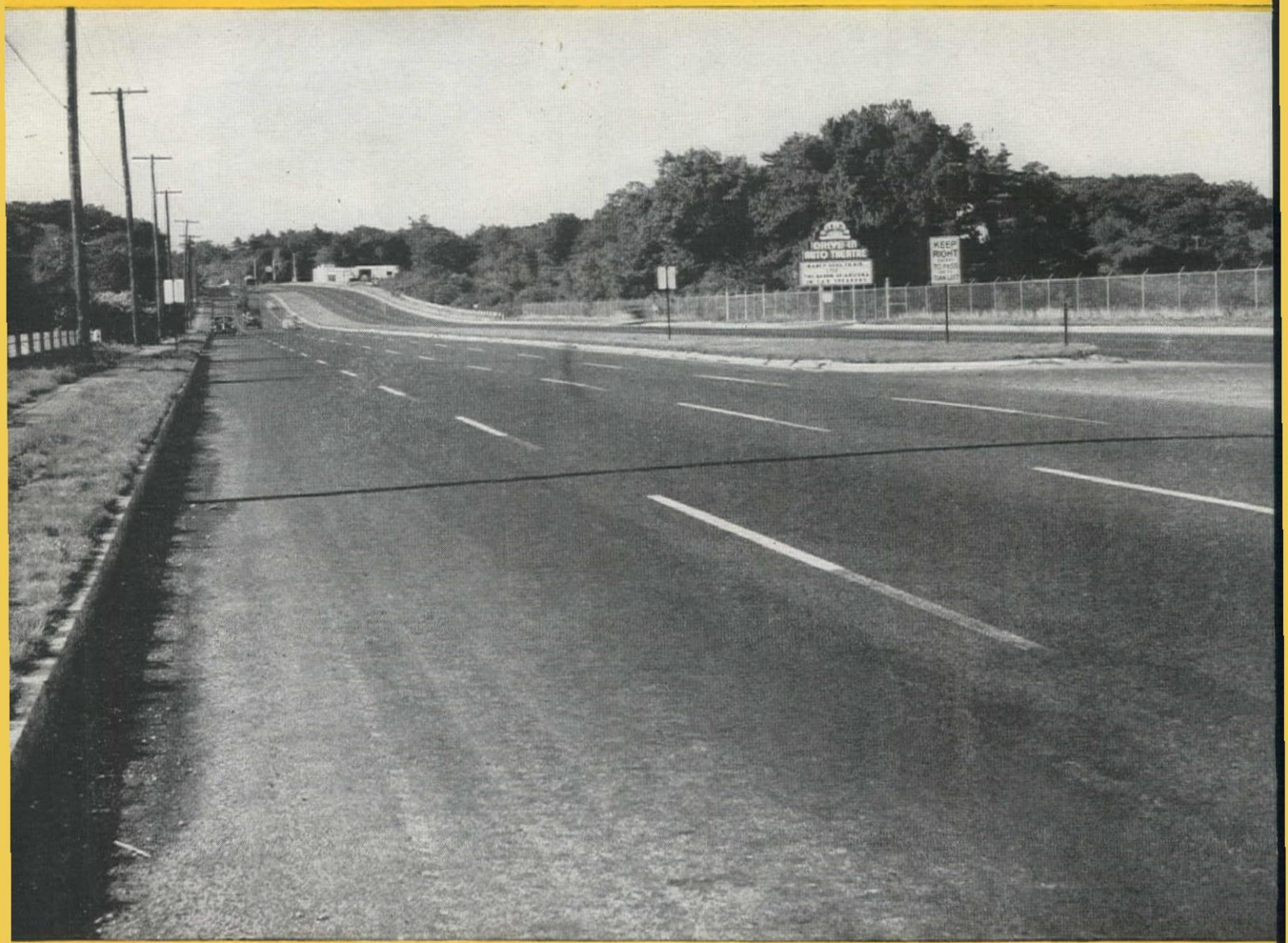
Industrial Engine Division, Chrysler Corporation, Detroit 31, Michigan.

CHRYSLER

HORSEPOWER WITH A PEDIGREE

HIGHWAYS

THROUGH LOW



THE IOWA LINE *of Material Handling Equipment Is Distributed by:*

HALL-PERRY MACHINERY CO., Butte, Great Falls, Missoula and Billings, Montana; INTERMOUNTAIN EQUIPMENT CO., Boise and Pocatello, Idaho and Spokane, Washington; WORTHAM MACHINERY CO., 517 W. 17th Strret, Cheyenne, Wyoming; KIMBALL EQUIPMENT CO., 222 W. 8th South Street, P. O. Box 1103, Salt Lake City, Utah; H. W. MOORE EQUIPMENT CO., 6th and Acoma Street, P. O. Box 2491, Denver, Colorado; CONTRACTORS EQUIPMENT CORP., 2727 S. E. Union Avenue, P. O. Box 2191, Portland 2, Oregon; JACK SAHLBERG EQUIPMENT CO., 300 Aurora Avenue, Seattle 9, Washington; CASSON-HALE CORP., 22101 Meekland Avenue, P. O. Box 629, Hayward, Calif.; ARIZONA CEDAR RAPIDS CO., 1744 W. Jackson Street, P. O. Box 6186, Phoenix, Arizona; R. L. HARRISON COMPANY, INC., 1801 N. Fourth Street, P. O. Box 1320, Albuquerque, New Mexico; SIERRA MACHINERY CO., 307 Merrill Avenue, P. O. Box 1330, Reno, Nevada; BROWN-BEVIS EQUIPMENT CO., 4900 Santa Fe Avenue, P. O. Box 174 Vernon Station, Los Angeles 58, California.

UNLIMITED

COST AGGREGATE

TODAY'S production of more and better aggregate *at lower cost* means highways unlimited for America's future . . . and unlimited opportunities for you. Roads—both black top and concrete—bridges, dams, buildings and so many other construction projects, need hundreds of millions of tons of aggregate.

When you figure future contracts, plan on the bidding advantages you get with Cedarapids equipment. Whether you need a single unit or a complete plant, for aggregate or black top, Cedarapids assures the low cost production and operation that keeps you ahead of the competitive parade. Your nearest Cedarapids distributor will be glad to give you all the details.

Cedarapids
Built by IOWA
headquarters for
Quality EQUIPMENT

MODEL "E"—the largest of the Cedarapids line of bituminous mixing plants will handle up to two tons at a batch for your big jobs. Or—if you need only a few loads for patching—use the Cedarapids continuous-mix type Patchmaster. Whatever equipment you require for mixing your black top, check with Iowa first for the best—complete plants, pug mills, driers, feeders, bins.

The JUNIOR TANDEM—best known of the Cedarapids portable plants sets the standard for quality production, big capacity, flexibility, low maintenance and trouble-free operation on average size gravel jobs. When big volume is required, pick the Master Tandem and for the smaller jobs—the Pitmaster. Add a Cedarapids Portable Primary and you have a rock plant. With Cedarapids equipment, you can meet any specification in any quantity.

IOWA MANUFACTURING COMPANY

Cedar Rapids, Iowa, U. S. A.

A Million Yard Concreting Job

Built with BLAW-KNOX cantilever STEEL FORMS

Concrete Placed with BLAW-KNOX CONCRETE BUCKETS

WITH over a million cubic yards of concrete being placed on the Mt. Morris Dam project—Blaw-Knox Steel Forms and Concrete Buckets are used to speed completion and keep costs at minimum levels.

Whenever you have a huge undertaking like this, or any tough or unusual concreting problem call on the Blaw-Knox engineering service, available to any contractor from preliminary planning to the final pour. Blaw-Knox engineers can recommend the correct forms for your job, and help you cut costs by suggesting simplified forming methods that often reduce the number of necessary operations. When you write for information, also ask for Bulletin 2035.

Model CAC 8 yd. Concrete Bucket placing concrete on the Mt. Morris Dam job. Equipped with air-operated clam gates, these Blaw-Knox buckets are designed for big-job specifications calling for air-entrained cement and 6" aggregate in the concrete.

BLAW-KNOX

BLAW-KNOX DIVISION OF BLAW-KNOX CO., Farmers Bank Bldg., Pittsburgh 22, Pa.

New York • Chicago • Philadelphia • Birmingham • Washington • San Francisco

ALL ROPES look ALIKE... but THERE'S MORE THAN MEETS THE EYE...

IN Wickwire Rope

Rope wire viewed under a microscope with 100 magnification and the correct McQuaid-Ehn grid superimposed and matched to the sample for classification.

Yes, all wire ropes *do* look alike...on the outside. But not when you go 100 times beyond the range of normal vision. That's where you find the big difference...because that's where the grain size of the steel shows up.

Steel used for Wickwire Rope is measured for proper grain size by the exacting McQuaid-Ehn test. Typical samples are carburized to 1750° F., cooled slowly, polished and etched; then examined under a high-powered microscope for the proper matching of a McQuaid-Ehn grid to the size of the crystals. Thus, we make sure that steel going into Wickwire Rope conforms to the definite grain size that will give longest, most satisfactory service.

Such quality control of basic properties is possible only with a company like Wickwire...where manufacture is integrated from molten metal to finished rope...where the know-how of 52 years experience goes into the making of every wire rope.

It explains, too, why Wickwire Rope always gives you uniform performance, enduring reliability and longer, more economical service on the job. For the *right* rope for your particular requirements, see your local Wickwire distributor. Wickwire Rope is available in all sizes and constructions, both regular lay and WISSCOLAY *Pre*formed. For your free copy of "Know Your Ropes" 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

VELVETOUCH

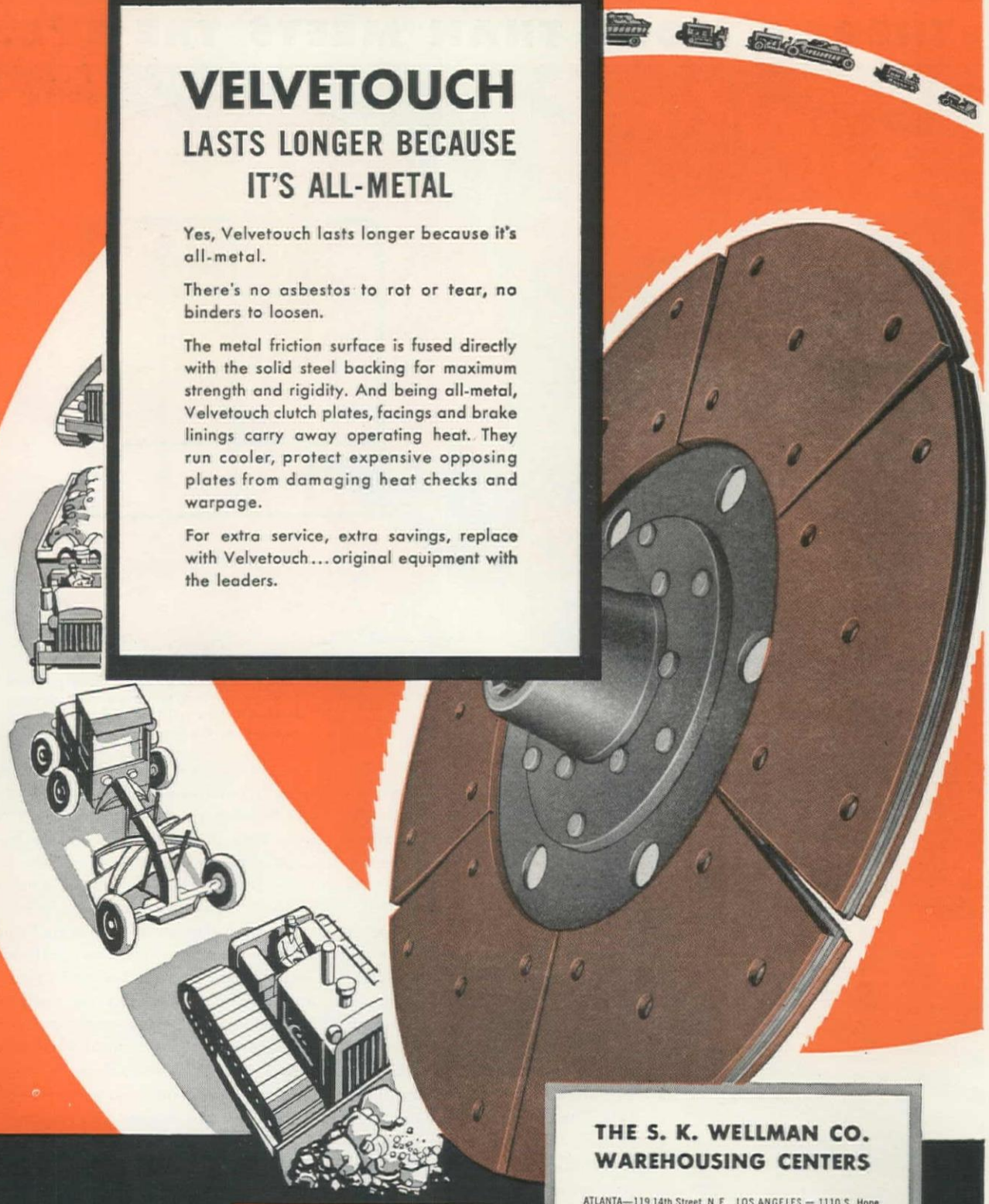
LASTS LONGER BECAUSE IT'S ALL-METAL

Yes, Velvetouch lasts longer because it's all-metal.

There's no asbestos to rot or tear, no binders to loosen.

The metal friction surface is fused directly with the solid steel backing for maximum strength and rigidity. And being all-metal, Velvetouch clutch plates, facings and brake linings carry away operating heat. They run cooler, protect expensive opposing plates from damaging heat checks and warpage.

For extra service, extra savings, replace with Velvetouch... original equipment with the leaders.



over 25 years of service
1924-1951

Velvetouch

THE S. K. WELLMAN CO • 1374 E. 51st ST • CLEVELAND 3, OHIO

THE S. K. WELLMAN CO. WAREHOUSING CENTERS

ATLANTA—119 14th Street, N.E. Atlanta 5, Georgia

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WHAT'S BEHIND THE EUCLID NAME?

Loader and Bottom-Dumps—an efficient team!

Euclid Scraper . . . 15.5 cu. yds. struck . . . 275 h.p.

15-ton Rear-Dump . . . semi-rigid or spring mounted drive axle.

EUCLID
THE PIONEER

A pioneer in the development of earth moving equipment, all of Euclid's production and service facilities have always been devoted to specialized equipment for off-the-highway work.

Features that have made "Eucs" the choice for hundreds of mining, construction and industrial jobs — long service life . . . high speed and large capacity . . . and dependable performance — assure high production at the lowest cost per ton or yard moved.

There is a Euclid model to meet every requirement for off-the-highway hauling of earth, ore, coal, or rock . . . and body designs for all types of materials.

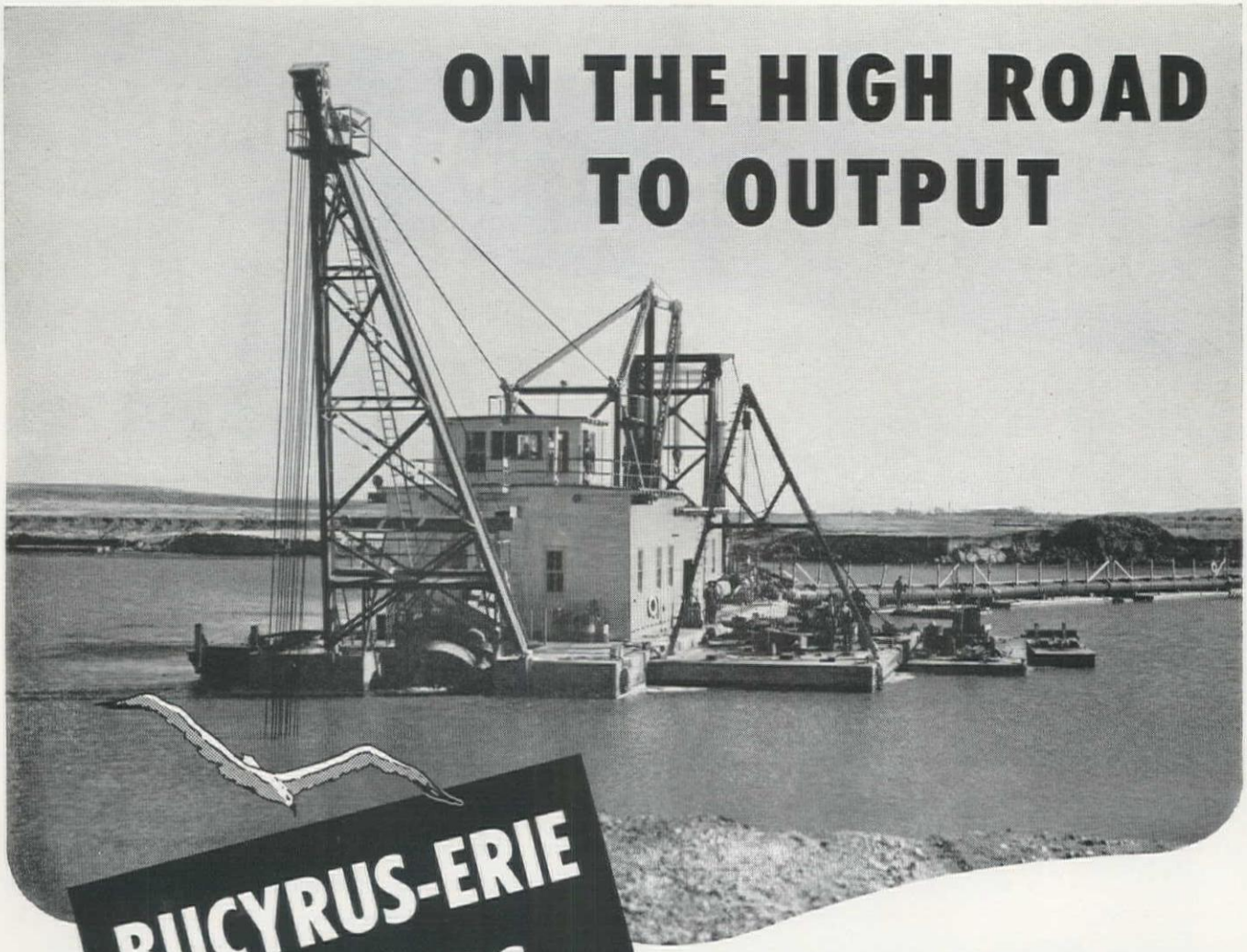
Have your Euclid Distributor show you how Euclid job-proved equipment can lower your hauling costs, or write for literature on current models.

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*



ON THE HIGH ROAD TO OUTPUT

BUCYRUS-ERIE DREDGES

YOU'LL be heading for profits when you select Bucyrus-Erie to build your dredge. Here's why:

MASTERS OF DREDGE DESIGN. Your Bucyrus-Erie dredge is designed for its work. Job requirements are thoroughly investigated beforehand. A few of the many considerations given careful attention are: wanted output; maximum and minimum digging depths below water level; prevailing marine or freshwater conditions; types of material to be handled; shortest and longest discharge lines needed; kind of fuel or power available. Guided by a complete analysis, and backed by long experience, Bucyrus-Erie engineers give you the "years ahead" design that means big output on a long-term, economical basis.

FINEST MATERIALS. From Bucyrus-Erie's laboratory come the special steels and the on-the-spot control that assure the continued high quality of castings produced in the company's steel foundries. The work of the flame-hardening and heat-treating shops receives the same constant laboratory control. Result: your Bucyrus-Erie dredge is made of the very finest in materials.

SUPERIOR CRAFTSMANSHIP. In Bucyrus-Erie's own machine, forge and erecting shops, shop men skilled in years of dredge building know-how make sure that the finished machinery will live up to its design.

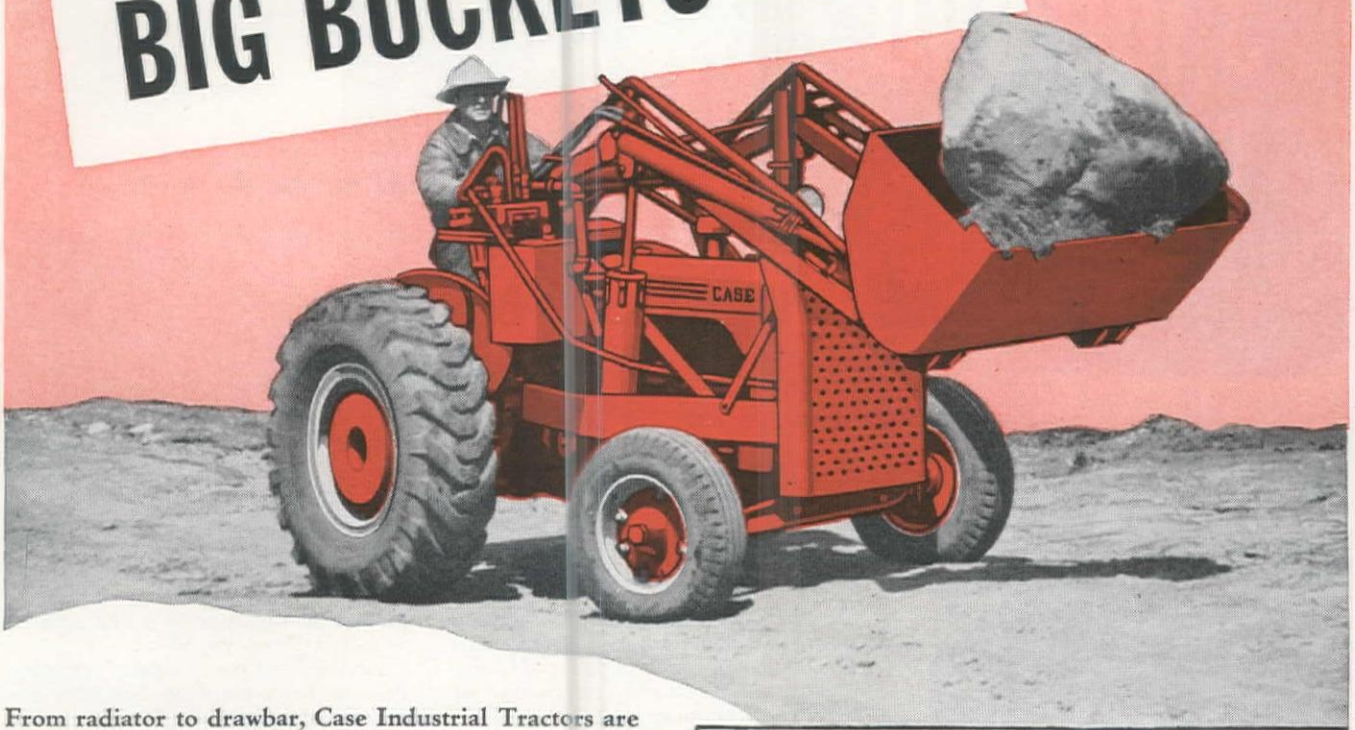
Your best guarantee of a successful dredge is the selection of Bucyrus-Erie Company as its builder.

SOUTH MILWAUKEE BUCYRUS ERIE WISCONSIN

31D50

STANDS UP UNDER BIG BUCKETS

ALL-AROUND STRENGTH IN CASE INDUSTRIAL TRACTORS



From radiator to drawbar, Case Industrial Tractors are built to take the strain of heavy mounted equipment. When you mount a loader or dozer on the front end, you know the Case heavy-duty front axle will stand the gaff. Remember, too, that the husky Case front axle is regular equipment—not an extra to buy. Also notice the sturdy square-faced casting above the axle with holes already drilled and tapped on front and sides for quick mounting of loaders, dozers, snowplows, etc. . . . providing a rigid assembly as strong as the tractor itself. For rigorous day-in-and-day-out use, you can depend on the brute strength and sturdy construction of Case Tractors.

STRONG HEAVY FRONT AXLE

REGULAR EQUIPMENT

LIGHTS AND STARTER STANDARD, TOO . . .

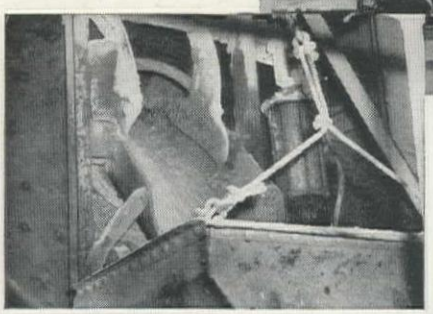
Complete electric system, with headlights and tail light, is included in regular equipment and price of the Model "DI." Case-built magneto assures utmost reliability of ignition regardless of battery condition. J. I. Case Co., Racine, Wis.

CASE
INDUSTRIAL TRACTORS

Hayward Equipment Co.	Los Angeles, Calif.
Contractors Machinery Co.	San Francisco, Calif.
Lake County Equipment Co.	Lakeport, Calif.
E. O. Mitchell, Inc.	Bakersfield, Calif.
Liberty Truck & Parts Co.	Denver, Colorado
Western Equipment Co.	Boise and Idaho Falls, Idaho and Spokane, Wash.
Hilton's, Inc.	Las Vegas, New Mexico
Electric Tool & Supply Co.	San Bernardino, Calif.
Growers Tractor & Implement Co.	Sacramento, Calif.
Hiway Farm Equipment Co., Inc.	Modesto, Calif.
Farmers Machinery & Supply Co.	Reno, Nevada
Foulger Equipment Co.	Salt Lake City, Utah
Nelson Equipment Co.	Portland, Oregon - Seattle, Washington
Wortham Machinery Co.,	Cheyenne, Sheridan and Greybull, Wyoming - Billings, Montana

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

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



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

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

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

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

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

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

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

FIND OUT WHY THERE'S MORE WORTH IN WORTHINGTON

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

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

WORTHINGTON

BUY BLUE BRUTES

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

R-1-1

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

"CAT" BULLDOZER...

America's all-purpose tool!

Owned by John H. McCosker, Inc., Berkeley, Calif., this "Cat" D8 Tractor with No. 8S 'Dozer clears and removes dirt from landslide caused by heavy rains in Oakland, California. Mr. McCosker says of this tool: "One of the finest pieces of equipment that money can buy. Low on repairs, got good traction, and she's easy to handle!" Price of a standard "Caterpillar" D8 Tractor is $15,000; No. 8S Bulldozer, $1,775; No. 25 Cable Control, $1,630, f.o.b. Peoria. Prices subject to change without notice.

THE tool that carved out the streets and leveled building sites is the same "Caterpillar" Bulldozer now protecting the community from landslide hazards. The versatility and long service life of "Cat" 'Dozers make them a prime favorite in the construction field.

These machines give you matched design—tractor and 'dozer are built to work together. This rugged team is a bear at meeting work schedules. Sturdy construction and quality materials enable it to keep punching full time without down-time, and the special steel cutting edge of the blade hammers through the toughest going. Most important of all, the precision methods used in "Caterpillar" factories build extra years of life into these tools.

For help with your equipment problems, see your "Caterpillar" dealer *now*. Today's expanding military program has high priority. But it is recognized that our national preparedness depends upon stepped-up civilian production too. We must have more lumber, coal, food and essential ores. We must continue to build and improve America's vital network of highways. So your "Caterpillar" dealer is interested in meeting your needs—through equipment replacement and by exercising his working partnership with you to keep the machinery you have *on the job.*

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

"CATERPILLAR" BULLDOZER EXTRA FEATURES

1. Tractor and 'dozer *broken to harness,* and a size for every need.
2. Moldboard curvature for active, *rolling,* higher production loads.
3. Box section side arms—extra thick at points of greatest stress.
4. Choice of straight or angling type of blade, simple to maneuver and easy to adjust or detach.
5. Your choice of hydraulic or cable controls.
6. The power of the "Caterpillar" Diesel Engine is geared to blade *capacity.*

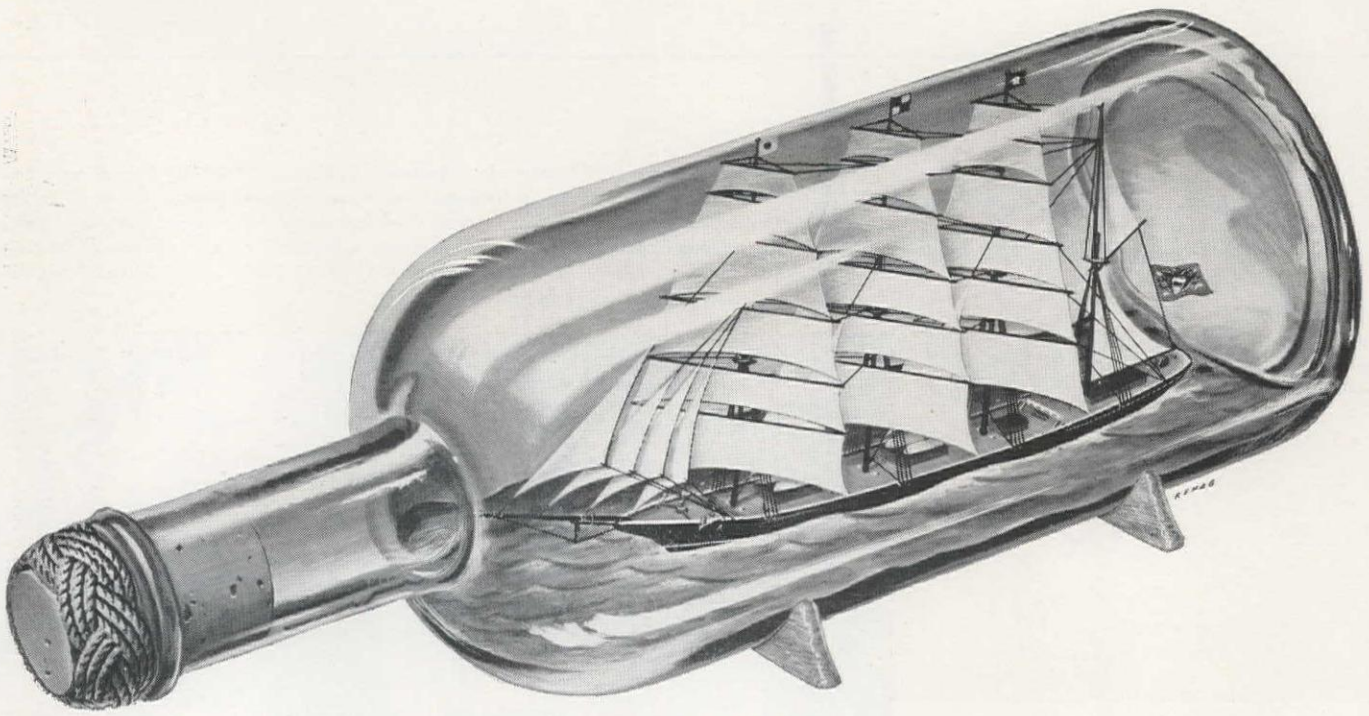
New Addition to 'Dozer Line

Here's a specialist that can increase production and cut costs. It's the brand new No. 8U 'Dozer for use with the "Caterpillar" D8 Tractor, with cable control. Working best in loose or light material, the end portions of the blade extend forward like a U, enabling it to drift large loads for longer distances and bigger job production. The versatility of this new tool gives it excellent performance on all kinds of 'dozing jobs, from stockpiling to pioneering.

CATERPILLAR

REG. U. S. PAT. OFF.

DIESEL ENGINES • TRACTORS • MOTOR GRADERS • EARTHMOVING EQUIPMENT



It's craftsmanship that counts

This example of craftsmanship symbolizes something that every producer of quality structural shapes must know: *Painstaking care is essential.*

Such craftsmanship is *fundamental* at Kaiser Steel, where every step in the production of structural shapes is rigidly and completely controlled. The result is structural shapes which measure up to precise specifications of construction engineers.

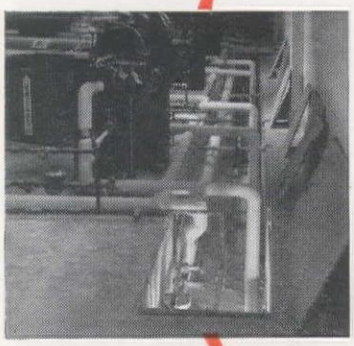
Kaiser Steel's modern facilities produce a wide range of quality structural shapes. Because these facilities are nearby, carrier delivery time is cut — and engineering service is prompt.

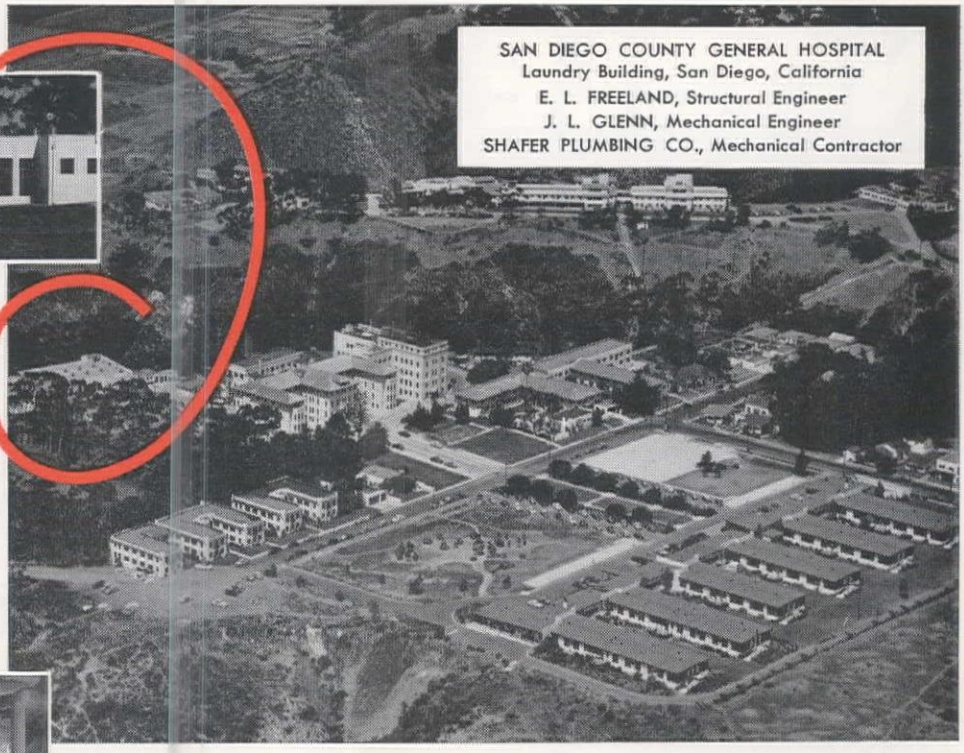
It's good business to do business with

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**





SAN DIEGO COUNTY GENERAL HOSPITAL
Laundry Building, San Diego, California
E. L. FREELAND, Structural Engineer
J. L. GLENN, Mechanical Engineer
SHAFER PLUMBING CO., Mechanical Contractor

To ban piping ills here . . . virtually every service is BYERS WROUGHT IRON

One of the most important hospital facilities is the laundry—and because of the number and type of the piping services, careful specification is essential to avoid high maintenance. In this new building, the designers took every precaution to assure long piping life. Steam supply and returns, raw water supply, circulating hot water lines, air lines, soap lines and hot and cold water lines, are all Byers Wrought Iron. Sizes range from ½-in. to 6-in., in both black and galvanized wrought iron pipe.

Maintenance records provide plenty of examples of the consequences of using non-durable materials in these services—and of the wisdom of using wrought iron. In a number of historical instances, wrought iron installed in some of the services mentioned is still on the job after 40 to 50 years of trouble-free performance.

Our booklet, THE A B C's OF WROUGHT IRON digests an interesting story of what wrought iron is, how it is made, why it resists corrosion so well, and where it can be profitably used. May we send you a copy?

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, N. Y.

WHY WROUGHT IRON LASTS

This notch-fracture test specimen illustrates the unusual fibrous structure of wrought iron—which is responsible for the unusual corrosion resistance of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and discourage pitting and penetration. They also anchor the initial protective scale, which shields the underlying metal.

BYERS

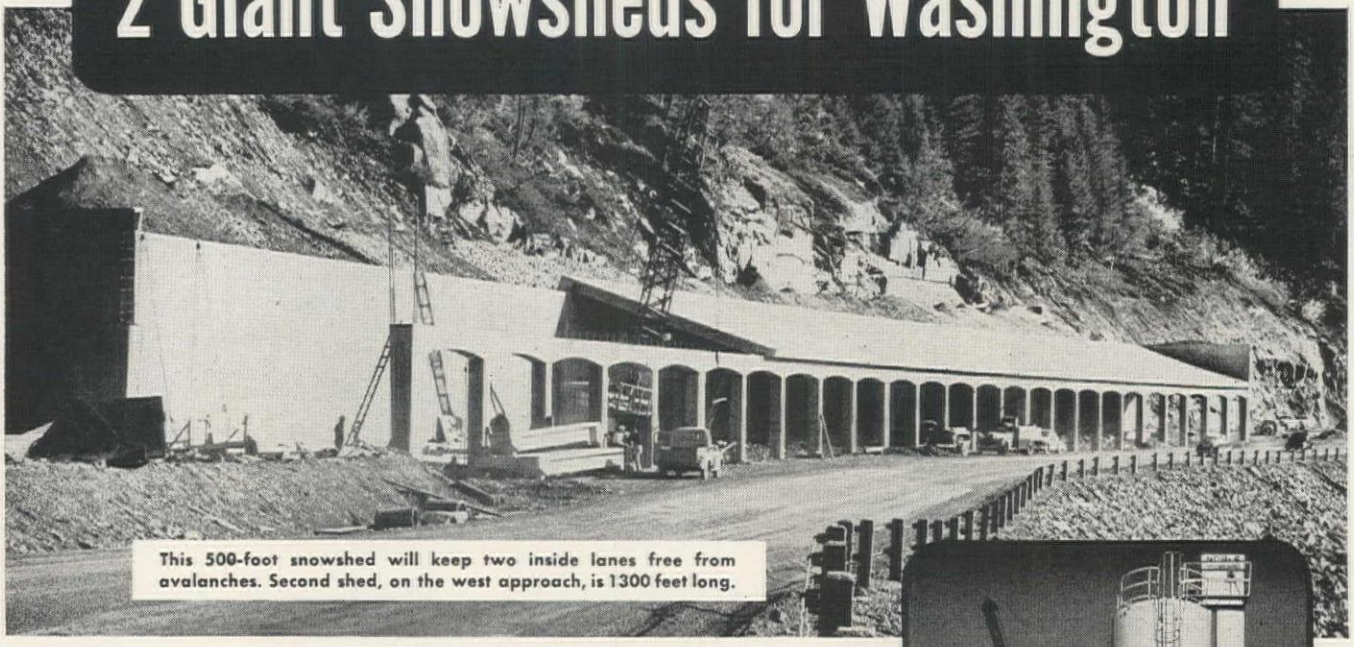
CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

NOBLE Plant Batches 2 Giant Snowsheds for Washington



This 500-foot snowshed will keep two inside lanes free from avalanches. Second shed, on the west approach, is 1300 feet long.

To slide dangerous avalanches over the top of two traffic lanes and thus keep the heavily-traveled Snoqualmie Pass highway open, Washington State Dept. of Highways last Spring contracted for two reinforced concrete snowsheds. The concrete was dry batched for contractors C. V. Wilder & Gaasland Construction Co., Inc., by a NOBLE CA104 semi-automatic batching plant. This plant was especially well suited to the contractors' needs for 3 reasons:

A. 1-MAN OPERATED B. MEETS SPECS. C. EASILY MOVED

One-man operated tells its own labor savings story. *Meeting job specifications* is important, too, in saving money. NOBLE'S exclusive photo-relay control of cement weighing gives instant, accurate louvre-gate cut-off even when cement is hot and difficult to handle. It is unaffected by heat or humidity; no leaking; no over-or-under weighing; all batches conform to rigid specifications.

Easily moved means the plant can be dismantled and moved by truck or rail to new jobs. All-welded center section, built with batching controls and motor switches in place, enables a 4-man crew to erect a NOBLE CA104 in 3 or 4 days.

NOBLE CA104 semi-automatic batching plant, with 500-bbl. bulk cement silo, batching for Snoqualmie shed.

WIDE RANGE OF SIZES

ALL NOBLE batching plants have these and many other money-making advantages. Standard units include aggregate bins from 80 to 1500 tons; cement silos from 125 to 7500 bbls.; weigh hoppers from 1 to 4 yds. Let us show you how a plant can be designed from these units to fit your exact needs. Wire, write or phone NOW. No obligation.

DESIGNERS AND BUILDERS OF

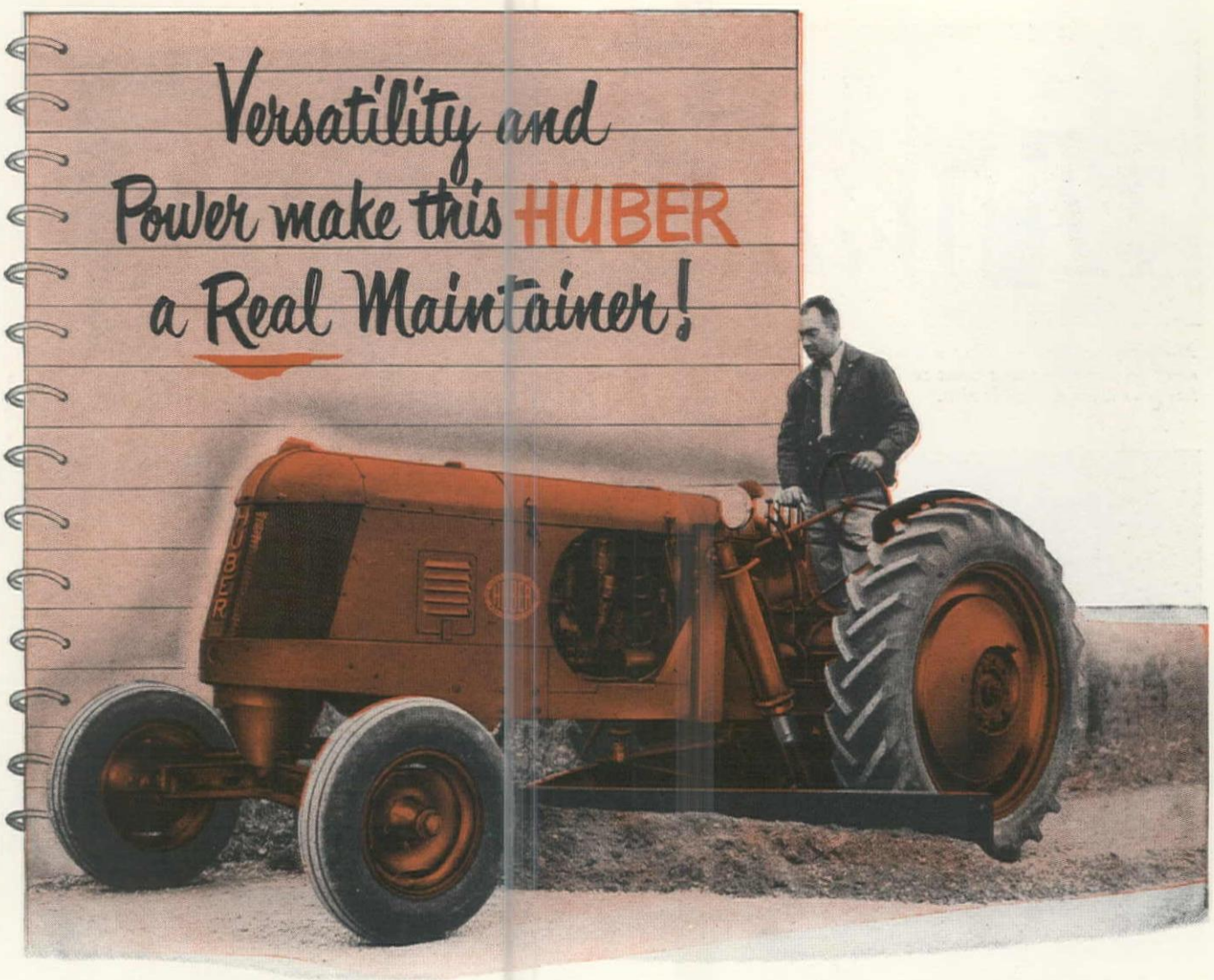
CEMENT AND AGGREGATE BATCHING PLANTS . . . BULK CEMENT PLANTS . . . AGGREGATE BINS AND CEMENT SILOS . . . STEEL FORMS FOR CONCRETE CONSTRUCTION JOBS . . TUNNEL AND DRILL JUMBOS CONVEYORS AND ELEVATORS . . WEIGH METERING DEVICES

NOBLE CO.

1860-7th STREET • OAKLAND 20, CALIFORNIA • TEMPLEBAR 2-5785

Los Angeles Office: 411 WEST FIFTH STREET • PHONE MUTUAL 8314

Star Machinery Co., Seattle 4, Wash.; Loggers & Contr. Machinery Co., Portland 14, Ore.; Tri-State Equipment Co., Spokane 6, Wash.; Intermountain Equipment Co., Boise, Ida.; Borchert-Ingersoll, Inc., St. Paul 4, Minn.; Ray L. Harrison Co., Inc., Albuquerque, N. M.; Sierra Machinery Co., Reno, Nev.; Davis, Hancock & Koster, Inc., Dallas 15, Texas; Western Contr. Supply Co., Chicago 12, Ill.



Look at its versatility! Hydraulically controlled attachments quickly and easily convert it to bulldozer, lift loader, highway mower, berm grader, broom, road planer, patch roller or snow plow service.

Look at its power! . . . . 42½ H. P.

Other important advantages: 1—The blade is PUSHED by Huber's exclusive modified A-frame design. Power is transmitted to the moldboard DIRECTLY from the driving wheels. The result: better traction, less power loss and more efficient use of the machine's 6000-pound weight.

2—The HUBER Maintainer gives you maximum work results and versatility in a single, one-man machine at modest investment and operating costs.

Get more for your maintenance dollars—your nearest HUBER Distributor will show you how.

Lee & Thatro Equipment Co. ..... **Los Angeles 21, Calif.**
Jenkins & Albright ..... **Reno, Nevada**
Contractors' Equipment & Supply Co. ..... **Albuquerque, N. M.**
Feenaughty Machinery Co. ..... **Portland 14, Oregon**
Feenaughty Machinery Co. ..... **Boise, Idaho**
Feenaughty Machinery Co. ..... **Spokane 2, Washington**
The O. S. Stapley Co. ..... **Phoenix, Arizona**
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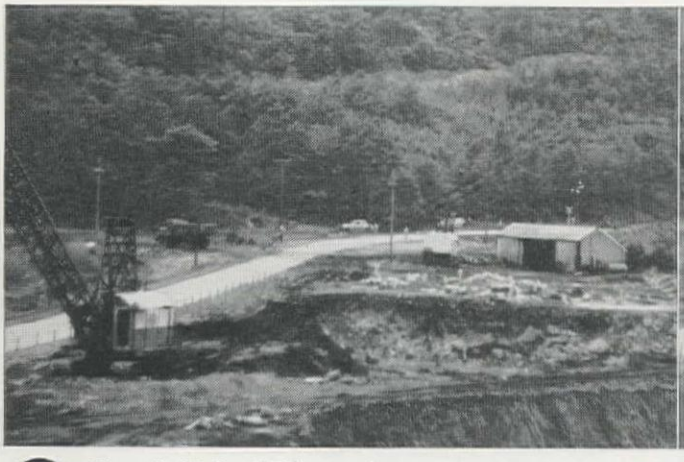
Casson Hale Corporation ..... **Hayward, Calif.**
Foulger Equipment Co., Inc. ..... **Salt Lake City 8, Utah**
The Colorado Builders' Supply Co. ..... **Denver 9, Colorado**
The Colorado Builders' Supply Co. ..... **Casper, Wyoming**
Montana Powder & Equip. Co. ..... **Helena, Billings, Montana**

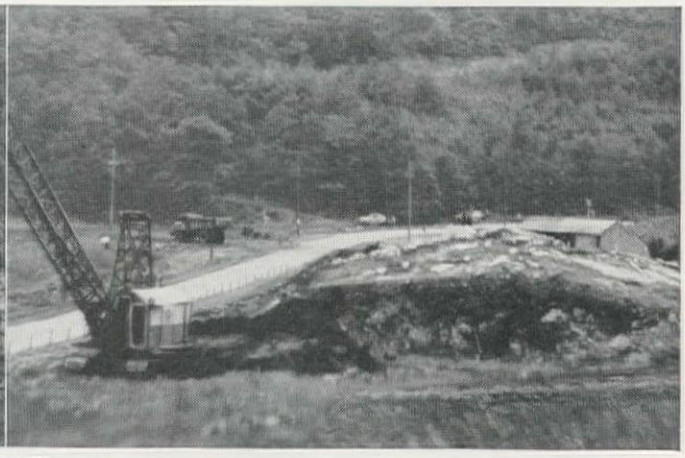
Watch this Blast

Machine-gun camera takes a photo every 1/3 second—shows what really *happens when a blast is shot.*

No wasted explosives gas



① *21 vertical holes, 9,700 pounds of dynamite ready to go.*



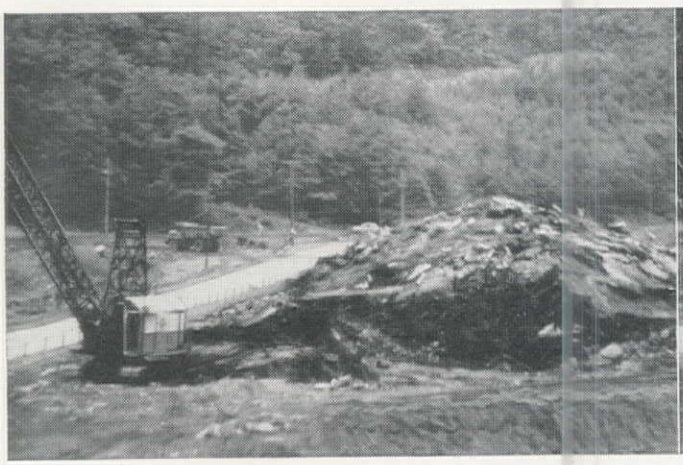
② *1/3 second later. See the rock "swell" at first instant of blast . . . but no sign of escaping gas.*

THIS was a typical ROCKMASTER blast by Fauzio Brothers at the Lehigh Navigation Coal Company's Nesquehoning, Pennsylvania stripping operation. Holes were 40 feet deep, with 18-foot spacing, 19-foot burden. The blast was initiated from the bottom of each hole, with ROCKMASTER Nos. 1, 2, 3, and 4 milli-second electric blasting caps.

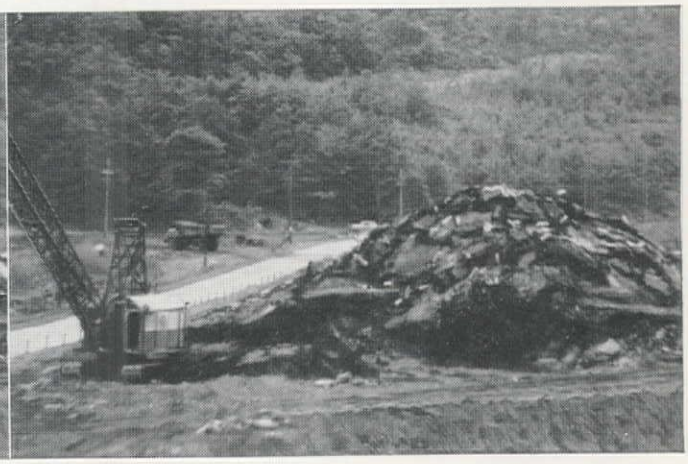
Whether your job calls for blasting rock, coal, ore, ROCKMASTER blasting means true *controlled force . . . controlled throw . . . controlled breakage*. Write today for your copy of the ROCKMASTER booklet showing how you can profit through the use of the correct numbers of the *sixteen* ROCKMASTER milli-second delay electric blasting caps teamed with the ROCKMASTER system of explosives choice and loading methods. Our technicians will be glad to assist you in applying ROCKMASTER to your operation.

GO!

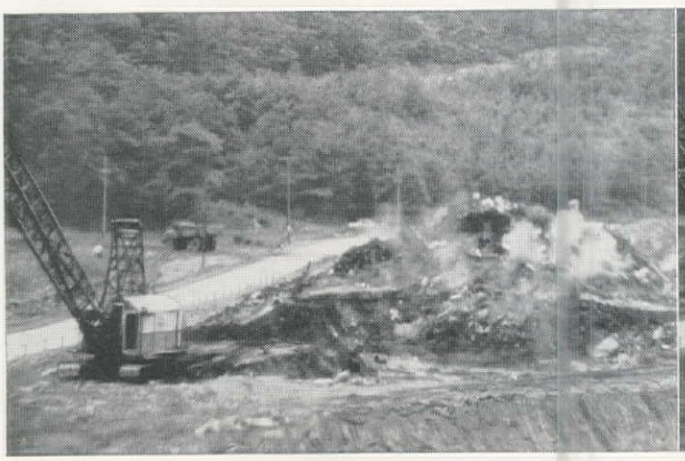
...No wild rock...even at the peak of the blast!



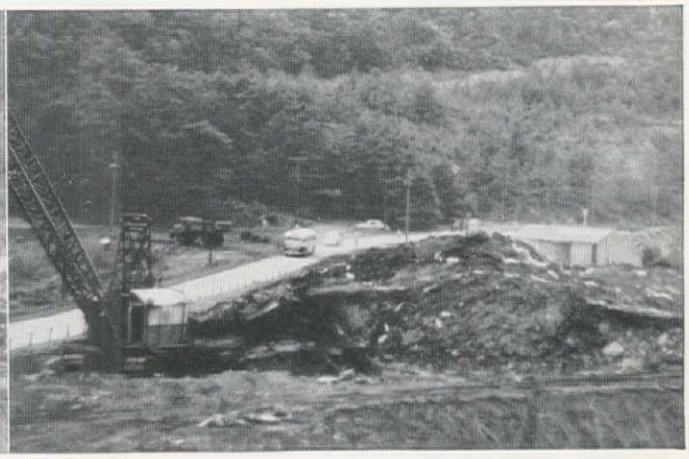
③ *⅓ second after Photo. No. 2. Rock going up... gases still confined where they do most work.*



④ *High point of the blast! Explosives gas has done maximum work.*



⑤ *As rock begins to fall, first traces of spent gases and smoke seep through broken rock. Burden completely shaken.*



⑥ *Rock ready for the shovel. Only three minutes after traffic was stopped it's on its way again.*

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.

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Wood that is PENTA-PROTECTED *lasts!* It is wood that can be re-used on future jobs to cut costs, lower bids.

Plan to use PENTA-PROTECTED wood not only for your construction timber, but in building flooring, roofing and trim. PENTA-PROTECTED wood lasts *up to four times longer* than untreated wood. PENTA* leaves wood clean and easy to handle . . . will not leach.

Make your wood a profitable investment! Use PENTA-PROTECTED wood.

*PENTA is a popular abbreviation of the chemical, PENTAchlorophenol.

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Make construction last . . . build with Penta -PROTECTED wood!

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Truck operators who do most or all of their driving on poor roads find Eaton 2-Speed Axles almost indispensable. They need extra pulling power under such conditions—and Eaton gives it to them by doubling the conventional number of gear ratios. When roads are bad, when climbing stiff grades, or when starting under full load, drivers use "low low". When highballing, they make better time because they can shift into "high high". Between these two extremes, drivers have a choice of several ratios to meet the demands of road and load conditions.

And Eaton 2-Speed Axles last for the life of the truck, because of exclusive planetary gearing, positive lubrication, and other features which your truck dealer will be glad to show you.

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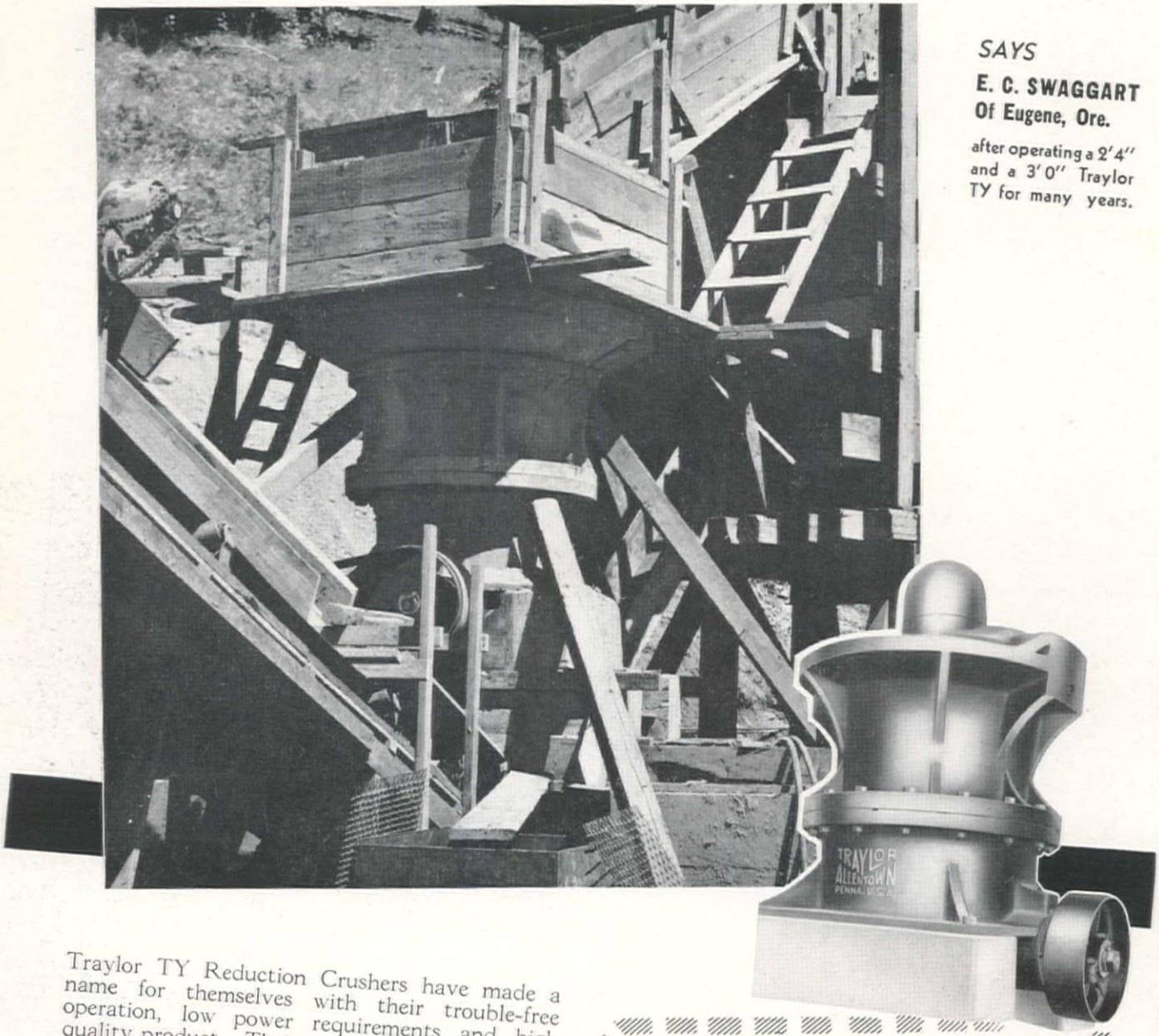
"for more production at less cost you can't beat a Traylor TY . . ."



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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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ROCK LOADING—FASTER—CHEAPER

Tough loading jobs are best handled by the Eimco 104 RockerShovel. In the pit, rock quarry, tunnel or mine this machine is unexcelled for fast, efficient loading and at lower cost per ton loaded.

The 104 is a heavy-duty, crawler mounted machine using the famous Eimco rocker-arm principle, picking up its load in front and discharging overhead to the rear. More than 6000 Eimco machines are operating every day employing this principle.

The 104 is equipped with a 1¼ or 1½ yard bucket for rock, with larger buckets available for lighter materials. The 104 can be supplied for Electric or Diesel operation.

Write for information and performance data on the 104 with regard to your rock loading job.

A301

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Operators Know . . . the

LULL Shoveloader

is

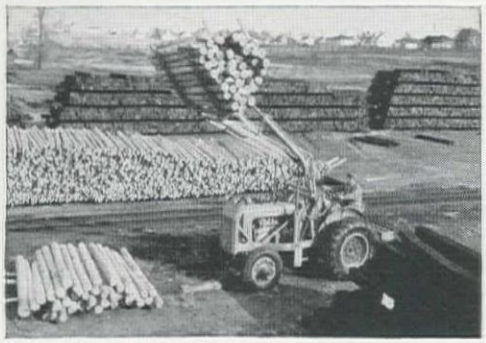
SAFER TO OPERATE

SAFER

from MOVING PARTS and FALLING ROCKS

WOULD YOU like to operate a loader which required you to sit directly between the working lift arms? Of course not! Neither would operators. They too know the danger of falling boulders and moving arms.

● **SIT IN SAFETY** in the **LULL SHOVELOADER . . .** designed for maximum operator safety.



OPERATORS KNOW their position on a loader is important to their safety. On a LULL SHOVELOADER, they know they are well clear of moving arms and falling rocks. They know they have full freedom of movement without fear of the giant they operate.

OPERATORS ARE CONFIDENT in the SHOVELOADER'S safe, versatile operation. They like its safer lifting, loading, scraping, bulldozing, digging and transporting. Accidents cost man hours, law suits, and increase insurance rates. Get the facts about LULL SHOVELOADER'S safety today!

THE LULL LOG LIFTING FORK, like all other LULL attachments, has the same LULL safety design as the SHOVELOADER. Even with the high lift of the lifting fork, the operator is well clear of falling logs and moving arms. Log stacking can be dangerous but not with a LULL LOG LIFTING FORK.

It's important that you MAIL THIS COUPON NOW for full details.

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STANDARD ENGINEER'S REPORT

DATA

LUBRICANT RPM Delo Oils

UNIT 50 diesel engines

JOB "Super Inch" gas pipeline

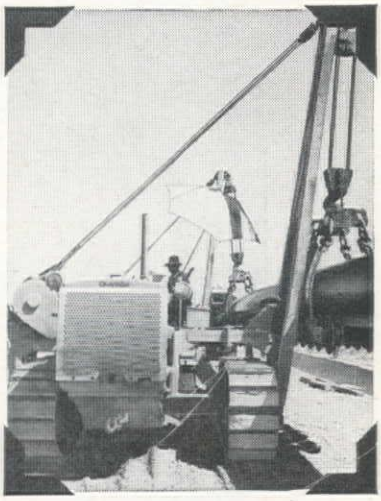
LOCATION From Arizona to California Pacific Coast

FIRM Bechtel Corp., San Francisco

Only 3 ring jobs on 50 engines in 1½ year's operation!

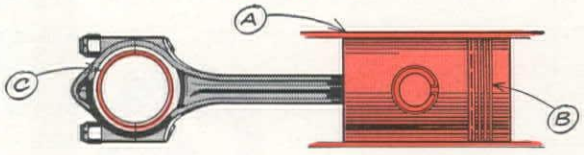
LUBRICATED WITH RPM DELO OILS, only three of the 50 heavy-duty diesel engines, used by Bechtel Corporation in building the great "Super Inch" pipeline, required ring replacements in 1½ year's work. No bearings were replaced.

WHEN BUILDING "SUPER INCH", biggest and longest gas pipeline in the world, equipment worked under every condition—in knee-deep dust, water, mud, sand and rock; in extreme heat and freezing cold. The trench, 5½ feet deep and 44 inches wide, was dug across deserts, farm areas and mountains from Topock, Ariz., to Oakland, Calif. The 34-inch pipe, welded, asphalt-coated and paper-wrapped on the job, was handled by special off-center tractors at right.



DIESELS OF ALL SIZES up to D-13000 models were on the job. Here four Caterpillar D-8's "walk" a pipe section into place along side the trench. There's an RPM DELO Lubricating Oil for every diesel.

How RPM DELO Oils reduce wear, corrosion, oxidation in Tractor, Truck and other Heavy-Duty Engines



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B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring-sticking. Detergent keeps parts clean...helps prevent piston scuffing.

C. Special compounds stop corrosion of any bearing metal and foaming in crankcase.

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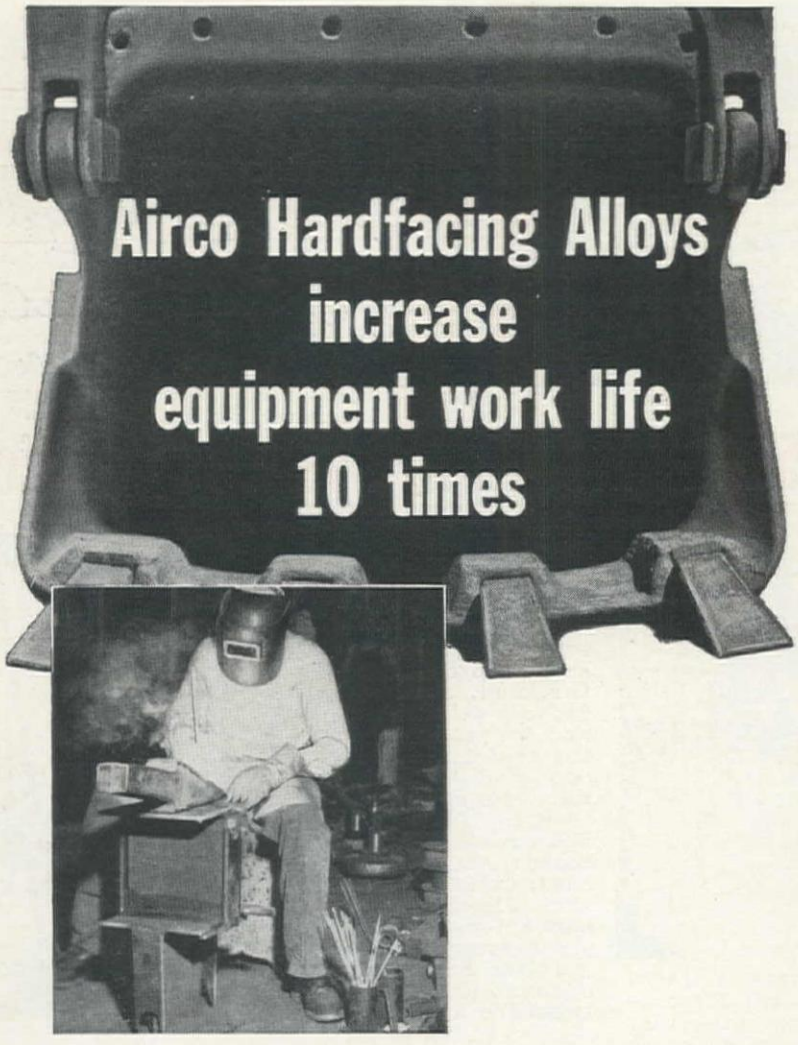
STANDARD TECHNICAL SERVICE checked this product performance. For expert help on lubrication or fuel problems, call your Standard Fuel and Lubricant Engineer or Representative; or write Standard Oil Company of California, 225 Bush St., San Francisco.

STANDARD OIL COMPANY OF CALIFORNIA



Airco Hardfacing Alloys increase equipment work life 10 times

Worn machinery and equipment need no longer mean costly replacements. Today, surfaces rebuilt with Airco Hardfacing Alloys add many months to equipment life and, in many cases, improve the operating characteristics.

For example, a large contracting firm found that hardfaced manganese bucket teeth last two to six times longer than untreated teeth. Using Airco Self-Hardening Alloy, they lay a stringer bead along the edges of the bucket teeth. This alloy, designed to counteract impact and abrasive wear because of its tough, homogeneous characteristics, saves thousands of dollars in equipment work life.

But this is only one of the many Airco Hardfacing Alloys used in their welding shop to save time, trouble and money. They follow a conscientious program of hardfacing . . . a program that helps prolong equipment work life and prevents costly "down-time."

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other AIRCO hardfacing alloys

AIRCOLITE No. 59 . . . For reclaiming bucket teeth and lips used in sand and gravel pits — dredge screens — pulverizer hammers — mixer blades, this cast alloy rod is recommended for application where abrasion resistance is particularly important. Deposit acquires a high polish in service, and maintains its high hardness at temperatures up to 800°F. Applied electrically or by gas process. Deposits test from 54-59 on Rockwell "C" scale.

AIRCOLOY No. 6 . . . For refacing exhaust diesel valves on "cats" — cranes — pumps and shovels, Aircoloy No. 6 gives excellent corrosion resistance . . . retains hardness and impact and abrasion resistance at temperatures above 700°F. . . . test from 43-47 on Rockwell "C" scale. While recommended for application by gas process, rods suitable for AC or DC electric application are available.

AIRCO TUNGTUBE . . . When building up grader blades — road plows — dredge pump cutters — scarifier teeth — churn drills, use tungsten carbide particles encased in a steel tube for application by either oxyacetylene method or electric arc — AC or DC. Used as a diamond substitute for earth removal and drilling operations. Hardness of tungsten carbide particles are over 80 Rockwell "C".

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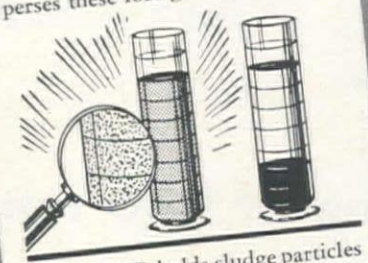
Clean Engines Last Longer
TYDOL HD
KEEPS ENGINES CLEANER!

Why TYDOL HD Keeps Engines Cleaner

1. Rich in potent detergent additives, Tydol HD quickly loosens sludge (gum, varnish, carbon) from vital parts . . . actively disperses these foreign deposits.



2. Tydol HD holds sludge particles harmlessly in suspension where they cannot cause wear. With ordinary oils, sludge settles onto valve stems and pistons; soon hardens.

3. When Tydol HD is drained, out goes sludge, too . . . because it's suspended in the oil. Valve stems, pistons and rings stay free and clean because Tydol HD gets rid of sludge that other oils can't budge.

No doubt about it. An engine that's kept clean . . . free of power-robbing sludge, carbon and varnish . . . gives you more trouble-free miles of top performance. And Heavy Duty Tydols are winning wide acclaim as the oils that drive out sludge and carbon. In fact, they *keep engines cleaner* than any other oil . . . protect far better against wear. Try them! See what you save when you switch to the heavy duty oils that *clean* as they *protect* as they *lubricate*. Get *three* jobs done; *not* just one!

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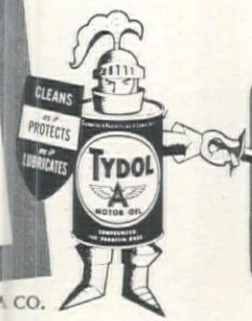
TYDOL HD—Heavy Duty oil for high-speed gasoline, butane, diesel-fueled engines in automobiles, busses, trucks, tractors and stationary units under normal conditions. SAE grades 10, 20, 30, 40, 50. Sold in cans and drums.

TYDOL HD S-1—Higher detergency level than Tydol HD. For every type of engine subjected to frequent and continued over-loading. For engines in delivery service making many stops and starts. SAE grades 10, 20, 30, 40 and 50. In drums.

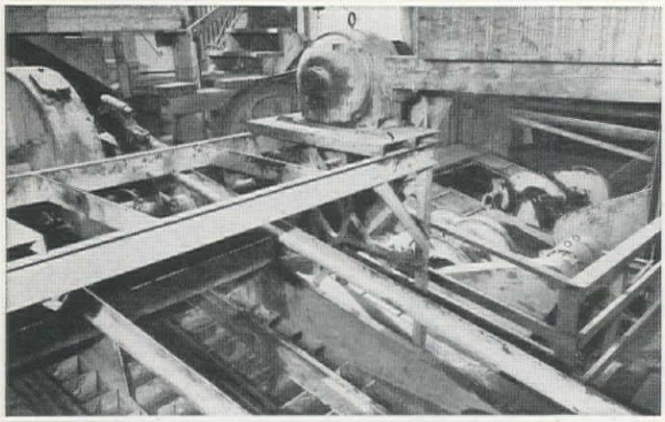
TYDOL HD S-2—Highest detergency level of the HD series. For high performance super-charged engines using all types of diesel fuels, under the most extreme operating conditions. SAE grade 30. Sold in drums.

Rely on your Associated Representative for expert help on any lubrication problem

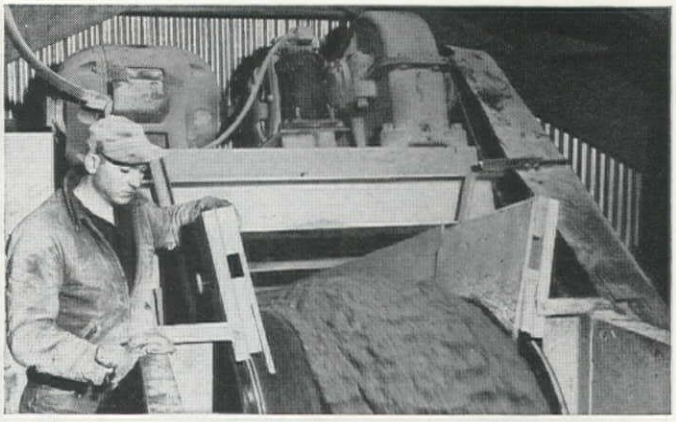


TYDOL HD
Compounded Motor Oil

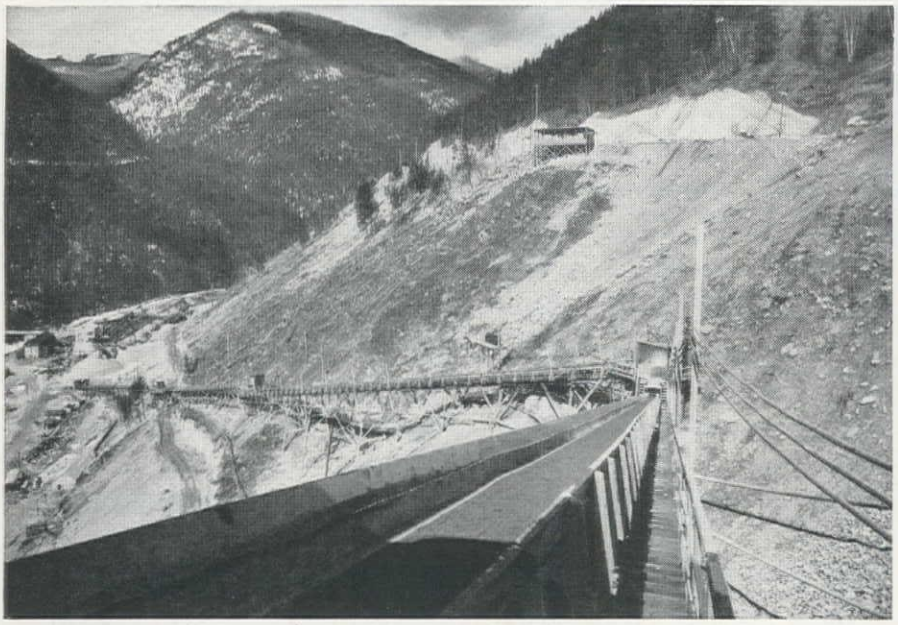
• TIDE WATER ASSOCIATED OIL COMPANY •



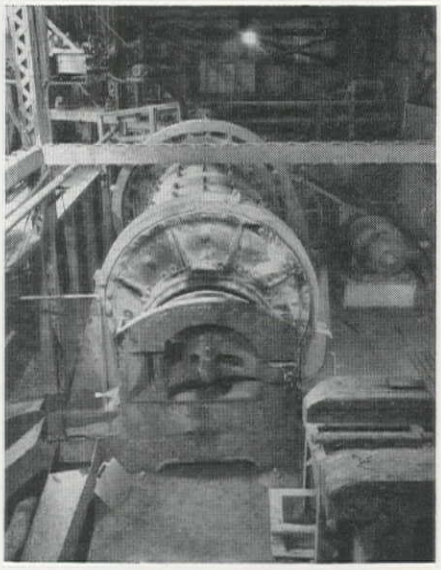
Aggregate under 6 inches is separated in shakers at screening plant. A G-E 5-hp motor drives shakers. Plant is completely automatic.



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.

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ELECTRIFIED EQUIPMENT Speeds Construction— Cuts Costs

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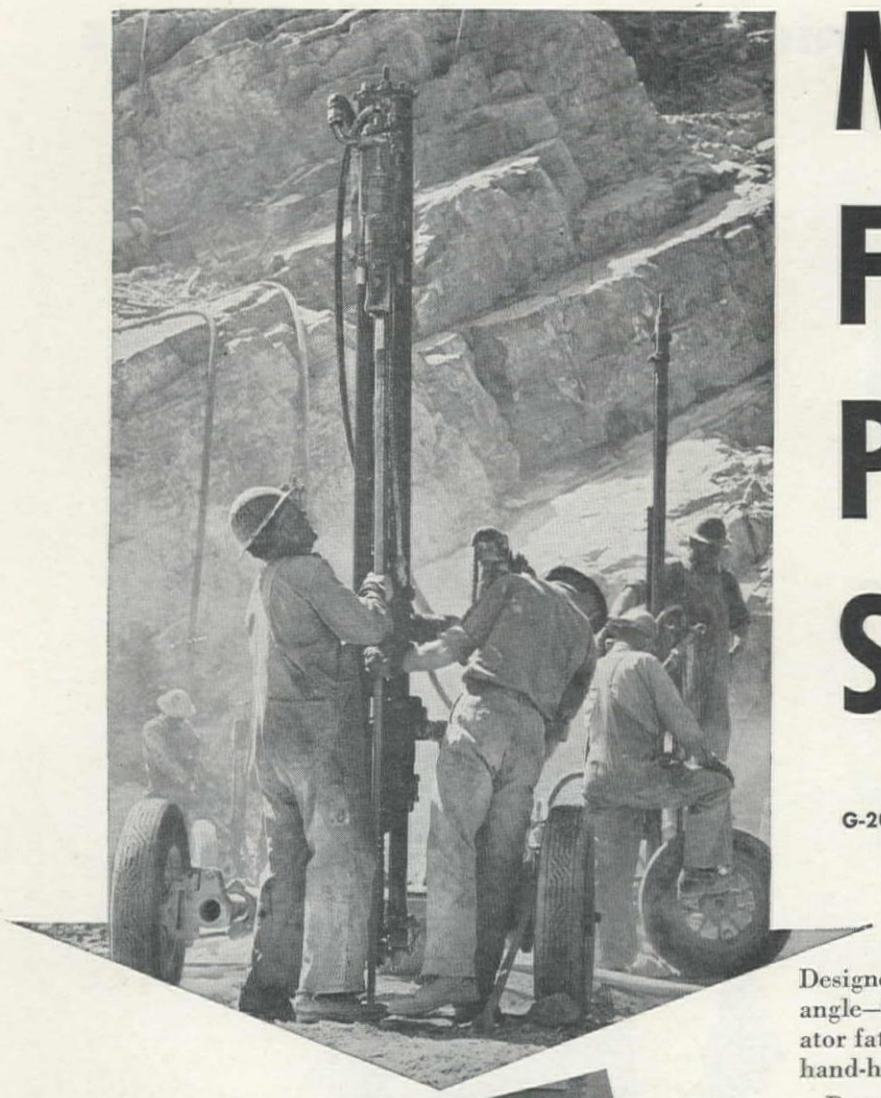


G-200R Wagon Drills speed production

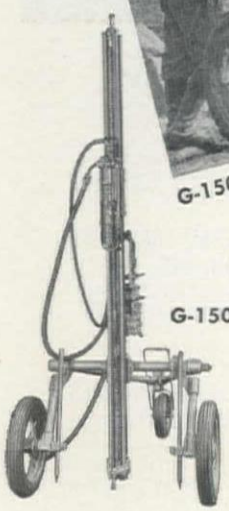
Designed for drilling on any location—at any angle—CP WAGON DRILLS, eliminating operator fatigue, frequently double the footage over hand-held methods.

Providing fast and easy operation of the more powerful CP Drifter Drills (3½-inch and 4-inch cylinder bore), the medium weight G-200R WAGON DRILL easily drills holes up to 30 feet, vertically, horizontally, or at any angle. The flexible mounting makes it quickly adjustable for toe-hole drilling or bench drilling; its wheels swivel for line drilling or drilling close to face.

A sliding cone, with a 36-inch adjustment, offsets ground irregularities and uneven steel lengths. The CP rotary air motor gives a steady feed and quick return, with plenty of power for pulling tight steel. Write for a copy of SP-1980 for full details.

G-150 Wagon Drill makes drilling easy

The lightweight G-150 WAGON DRILL—equally as versatile as the G-200R—is designed for use with the CP 59-pound Sinker or 3-inch Drifter. It drills to depth of 20 feet or more depending upon conditions. Write for a copy of SP-3010 for complete description.



G-150 Wagon Drill

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rated "TOPS"

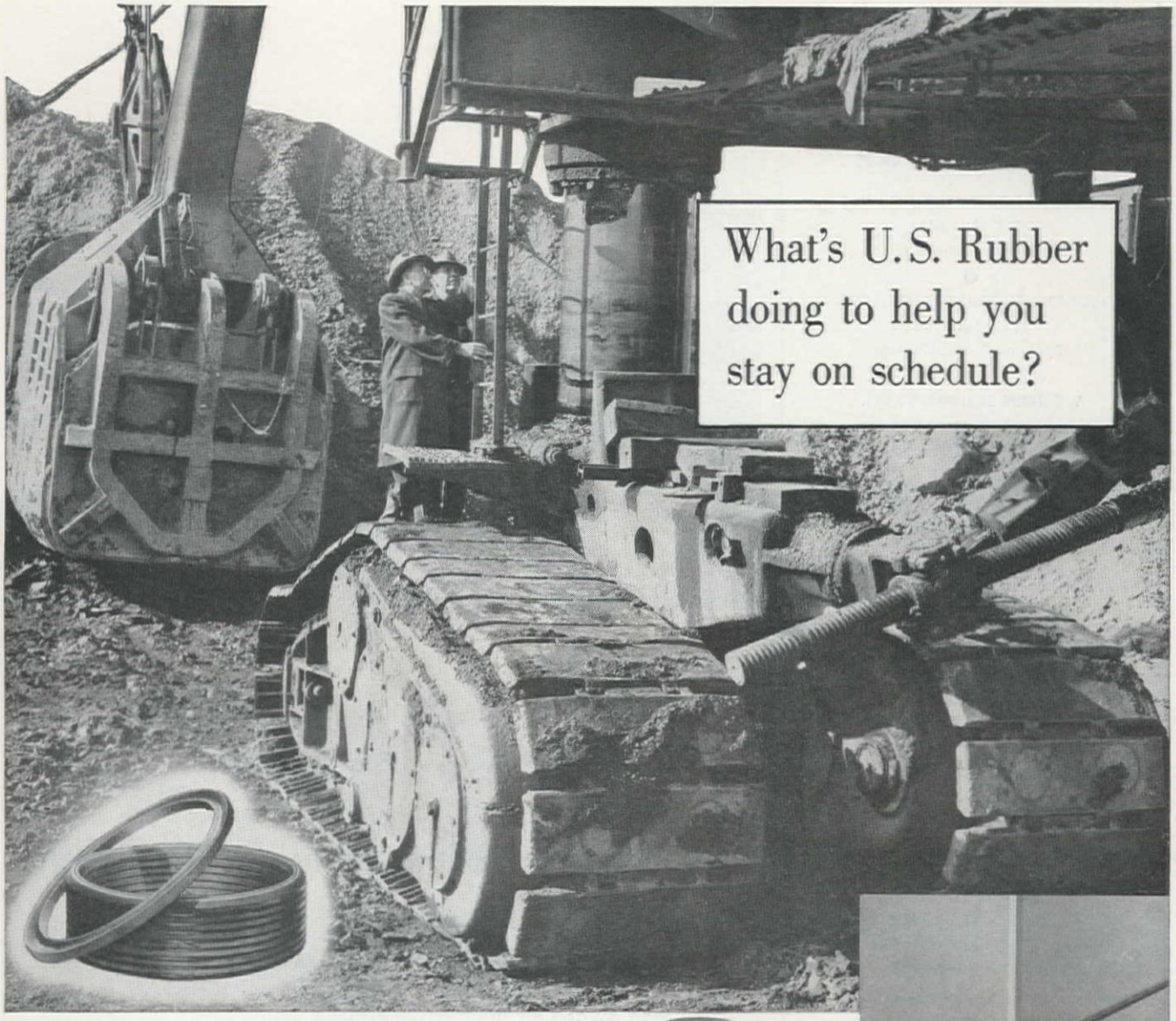
by City of Birmingham, Michigan

"Thirteen years is a lot for a machine, and we beat it badly. It was a good old machine." That's what Marx Fall, Superintendent Department of Public Works, said about the MICHIGAN 3/8 yd. truck hoe owned by the city for thirteen years.

The City of Birmingham now operates a new MICHIGAN S-4 ½ yd. truck hoe which works 48 hours a week trenching for water and sewer connections, much of the time in blue clay. Operator Tom Griffin said: "It operates easily and against other ½ yd. machines our MICHIGAN ditches faster. It's easier to drive, too."

Mr. Fall added: "We need the rubber tired mobility and the truck speed of the MICHIGAN. Its short wheel base is particularly good for our work."

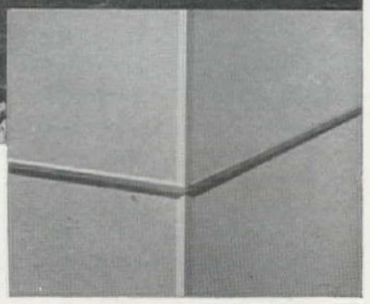
MICHIGAN POWER SHOVEL COMPANY
430 Second Street, Benton Harbor, Michigan, U. S. A.



What's U.S. Rubber doing to help you stay on schedule?

The hydraulic ram in this tremendous shovel is packed with U. S. Matchless Packing, which is self-adjusting and automatic in action. Matchless reduces wear on rods and plungers, keeps the shovel on the job longer and at less expense.

Helping you stay on schedule, or even ahead of it, is a specialty of United States Rubber Company. Hoses of all types, conveyor belting for light or heavy work, new revolutionary form linings—these are among the products which "U.S." maintains in strategically located stocks throughout the country. Designed by "U.S." engineers after careful study of construction needs, these products help contractors keep a steady, up-to-the-minute schedule.



SMOOTH, PIT-FREE SURFACES result when you use U. S. Rubber's Hydron Form Linings. Unsightly, irregular grooves are eliminated with reusable U. S. Form Strips.

← THIS IS THE ORIGINAL red sheet packing—U. S. Rainbow. It has always been famous for dependability on flanges and parallel surfaces, against hot and cold water, air, saturated steam up to 150 pounds.

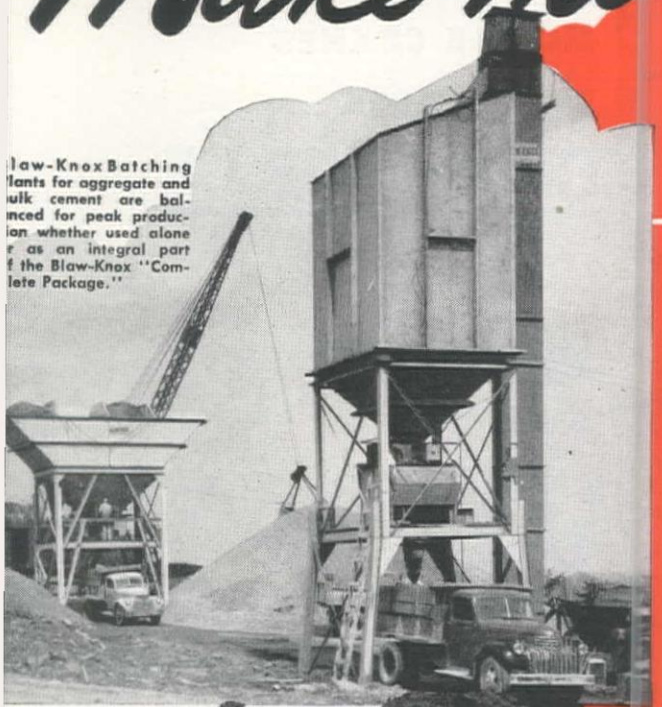
PRODUCTS OF

U.S.RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

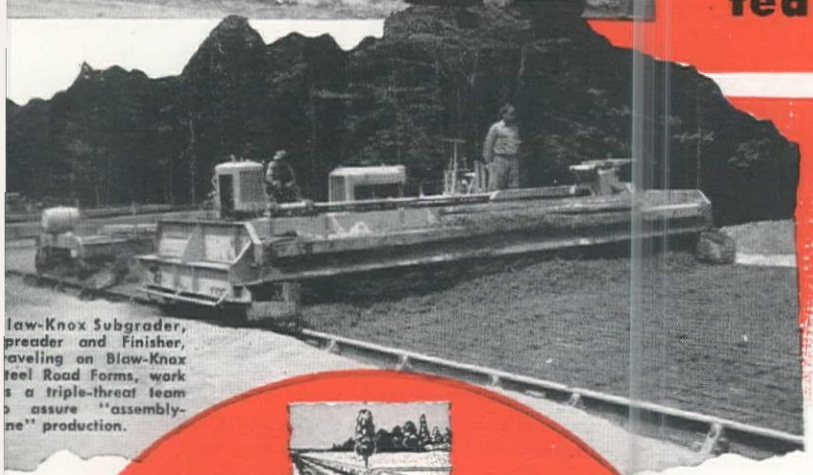
MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Make more money - with MATCHED EQUIPMENT



law-Knox Batching lants for aggregate and ulk cement are bal- nced for peak produc- ion whether used alone r as an integral part f the Blaw-Knox "Com- lete Package."

get the BLAW-KNOX "Complete Package" for balanced teamwork production



law-Knox Subgrader, preader and Finisher, aveling on Blaw-Knox teel Road Forms, work s a triple-threat team o assure "assembly- ne" production.

STEEL CURB AND GUTTER FORMS

CONCRETE BUCKETS

CLAMSHELL BUCKETS

SUBGRADERS

STEEL PAVING FORMS

e "Complete ackage" also cludes Central ixing Plants, Truck ixers and Truck Mixer oading Plants.

A balanced fleet of integrated construction units . . . each unit matched with the others, and the entire team matched to the job to earn more money for you! That's the Blaw-Knox "Complete Package" . . . a balanced team of production giants containing every piece of concrete construction equipment you need to give you assembly-line efficiency with the lower operating costs that result from 100% mechanization.

In addition, the Blaw-Knox "Complete Package" gives you a one-responsibility source of supply that means many time and money saving advantages . . . one source of genuine replacement parts . . . one responsible manufacturer to back up the field performance of your equipment . . . a dependable, helpful distributor organization with modern maintenance facilities.

You're sure to profit with the money-earning Blaw-Knox "Complete Package" and the money-saving Blaw-Knox distributor service on your team.

BLAW-KNOX

BLAW-KNOX DIVISION of Blaw-Knox Company
Farmers Bank Bldg., Pittsburgh 22, Pa.
818 Monadnock Bldg., 681 Market St., San Francisco 5, Calif.

AIR-MACK EQUIPMENT CO. ..... 614 Elliott Avenue, W. Seattle 99, Washington
CONTRACTORS EQUIPMENT CORP. ..... 2727 S. E. Union Avenue, Portland 2, Oregon
FOULGER EQUIPMENT CO. ..... 1361 South Second, West, P. O. Box 87, Salt Lake City 8, Utah
LE ROI-RIX MACHINERY CO. ..... 6403 E. Slauson Ave., Los Angeles 22, Calif. Branches at Bakersfield and Long Beach, Calif.
THE O. S. STAPLEY CO. ..... 723 Grand Avenue, P. O. Box 960, Phoenix, Arizona
WESTERN EQUIPMENT CO. ..... Boise, Idaho Falls, Idaho and Spokane, Washington
LIVELY EQUIPMENT CO. ..... 2601 No. Fourth Street, Albuquerque, New Mexico

FOR THE BEST IN MOBILE CRANES YOU NEED A CRANEMOBILE

This BAY CITY Model 190-T61 CraneMobile, owned by Sere Erection Co., is setting an 18-ton steel truss in the framework of a new Memphis church auditorium. For other steel work, longer boom and jib was used but caused no delay as boom sections are pin-connected and furnished with socketed pendant cables.

Handle 25 ton loads gently and accurately

The big capacity of the "190" CraneMobile puts you out front on heavy lifts or long boom work. With both crane and carrier built by BAY CITY you'll have a nicely balanced crane with a low center of gravity for dependable, on-the-job performance. From every angle, the solid ruggedness is apparent. Look at the specially designed carrier with long wheel base for better roadability. It is amply powered and sturdily built to match the heavy-duty construction of the crane machinery. There are many reasons contractors prefer the BAY CITY built CraneMobile . . . let us show you why. Write for latest catalog or see your nearest dealer.

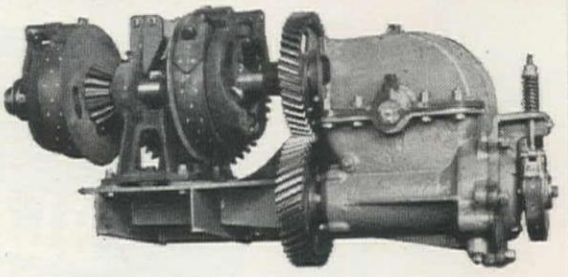
BAY CITY SHOVELS, INC.
BAY CITY, MICHIGAN

183

CHECK LIST

- 20-25 Ton Capacity
- Pin-Connected Boom
- Hi-Collapsible Gantry
- Independent Power Boom Hoist
- Precision Power Load Lowering
- Removable Counterweight
- Specially Designed Carrier
- High Road Speeds

This heavy duty independent boom hoist is of the self locking worm and worm wheel type operated by separate friction clutches to boom-up and boom-down only under power. Will readily handle boom and load. All controls conveniently located.



BAY CITY

SALES AND SERVICE

LOS ANGELES
Brown-Bevis Equipment Company
4900 Santa Fe Avenue

SAN FRANCISCO
Garfield & Company
1232 Hearst Building

PORTLAND
Feenaughty Machinery Company
112 S.E. Belmont Street

SEATTLE
Feenaughty Machinery Company
1028 Sixth Avenue, S.

SPOKANE
Feenaughty Machinery Company
N. 715 Division Street

BOISE
Feenaughty Machinery Company
600 Front Street

HELENA
Neil E. Grimes, Inc.
821 N. Main Street

SALT LAKE CITY
C. H. Jones Equipment Company
1595 So. Second, W.

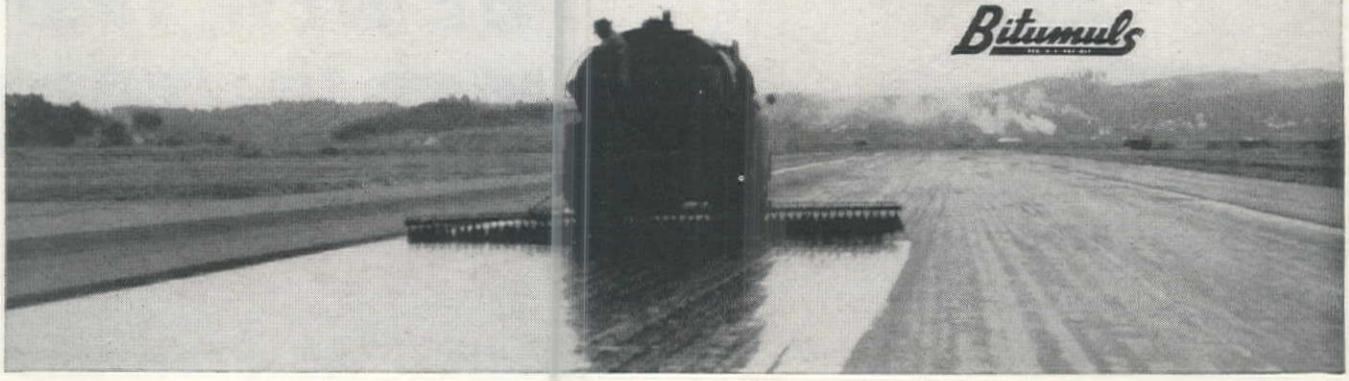
PHOENIX
Western Machinery Company
124 E. Buchanan Street

Bitumuls HV

REG. U. S. PAT. OFF.

High Viscosity
Asphaltic Emulsion
for Surface Treatment

Another Product
Pioneered By
Bitumuls



QUIZ for Paving Engineers

How do YOU answer these questions?

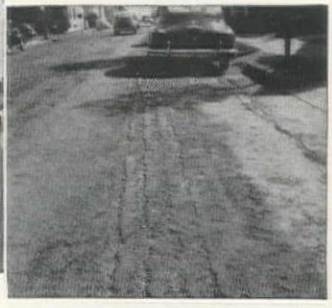
1. **Can you hold wet, round gravel or large aggregate with your present binder?**
2. **Does your binder stay on the road, when "shooting" a steep grade or high crown?**
3. **Are your surface treatments rugged, non-skid, and vapor-permeable?**

If your answer to all three questions is "Yes", you must be using *Bitumuls HV*—a "High Viscosity" asphaltic emulsion that is now used by a majority of State Highway engineers, because it really holds the aggregate, large or small, wet or dry.

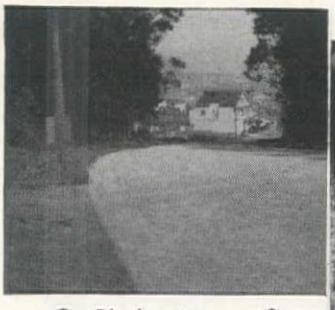
Precise application is easy. No excess binder to cause fatness or slippery pavements—or to act as a vapor barrier retarding drainage by upward evaporation. You get a non-skid, vapor-permeable seal.

If You have not used "HV", try it on one job—you, too, will adopt it.

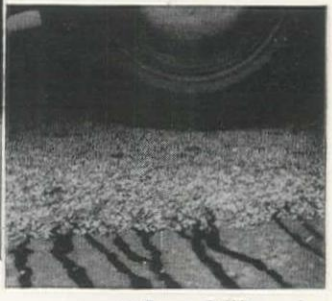
1. Stone Held?



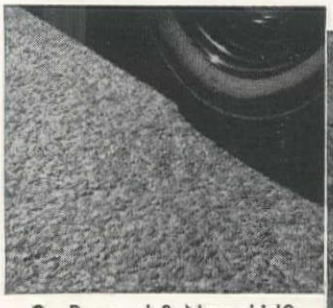
—or Ravels?



2. Binder stays put?

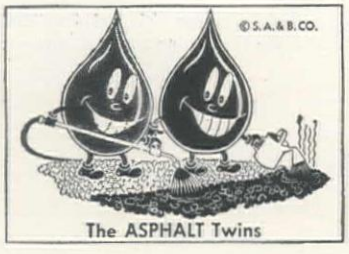


—or Runs Off?



3. Rugged & Non-skid?

—or Fat & Slippery?



The ASPHALT Twins

In the West

STANCAL ASPHALT & BITUMULS COMPANY
200 BUSH STREET · SAN FRANCISCO 4, CALIF.
Los Angeles 14, Calif. · Oakland 1, Calif. · Portland 7, Ore. · Tucson, Ariz.

In the East

AMERICAN BITUMULS COMPANY
200 BUSH STREET · SAN FRANCISCO 4, CALIF.
Washington 6, D. C. · Baltimore 3, Md. · Perth Amboy, N. J.
Columbus 15, O. · St. Louis 17, Mo. · Baton Rouge 2, La.
E. Providence 14, R. I. · San Juan 23, P. R. · Mobile, Ala.

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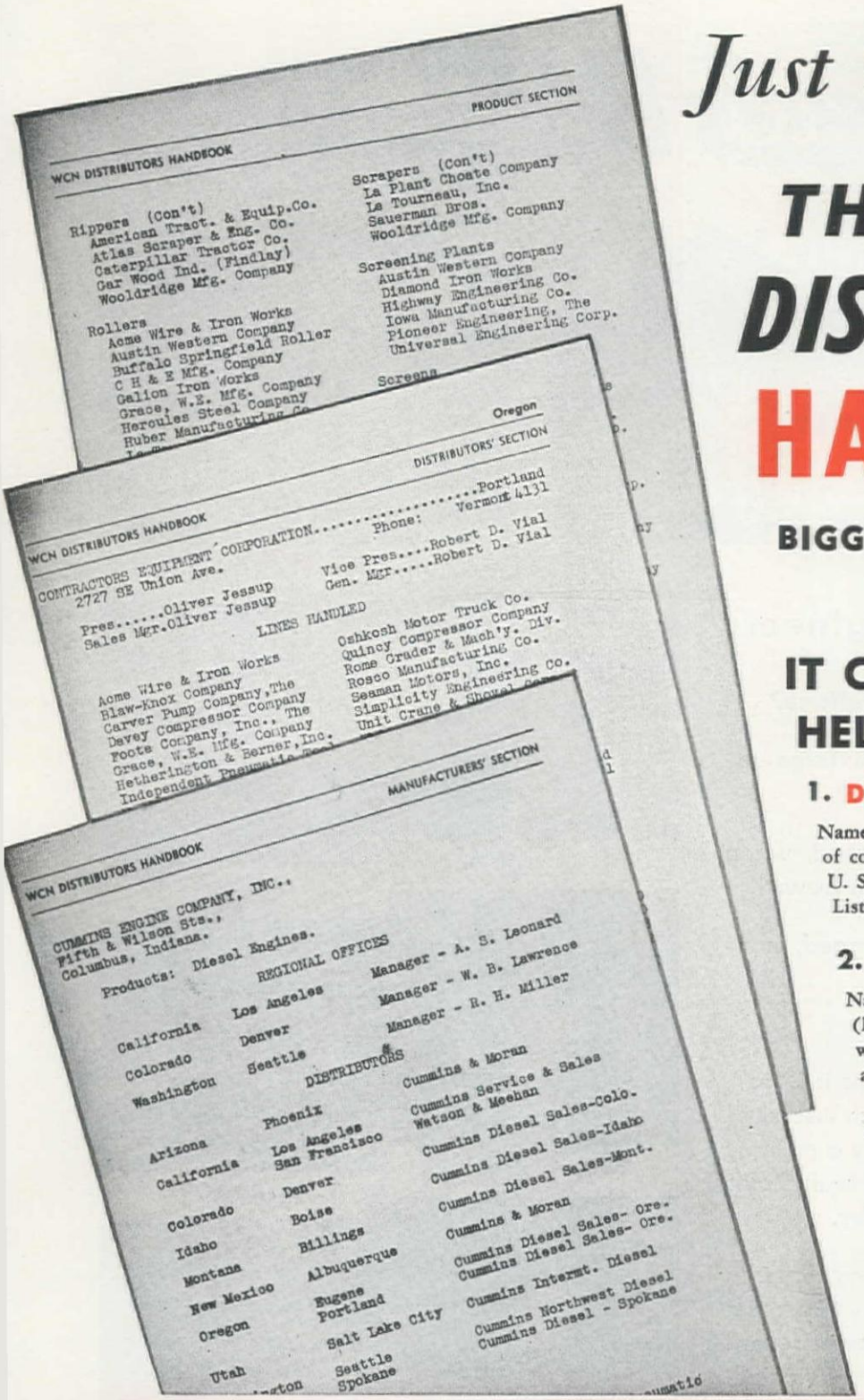
- **Tennis Courts**—Laykold & Grasstex . ☐
- **Fibrecoat**—roof and metal coating . ☐



Just Off Press

THE NEW 1951 DISTRIBUTORS HANDBOOK

BIGGER • MORE COMPLETE
SPIRAL BOUND

IT CONTAINS THESE HELPFUL LISTINGS . . .

1. DISTRIBUTORS

Names, addresses and phone numbers of distributors of construction equipment in the Western half of the U. S., the lines they handle, names of their branches. Listing is alphabetical by states.

2. MANUFACTURERS

Names of construction equipment manufacturers (listed alphabetically for entire U. S.), together with products, locations of their Western branches, and names of their Western distributors.

3. PRODUCTS

Alphabetical listing of products with names of all manufacturers making each product.

Single Copies	**$5.00 Each**
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MAIL THIS COUPON TODAY!

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YES, I enclose $..... for ..... copies of the 1951 DISTRIBUTORS HANDBOOK. (Add 3% sales tax if ordering from a California address.)

Name.....

Company .....

Address.....

City.....Zone.....State.....

NO OTHER Black Top Paver Offers SO MUCH!

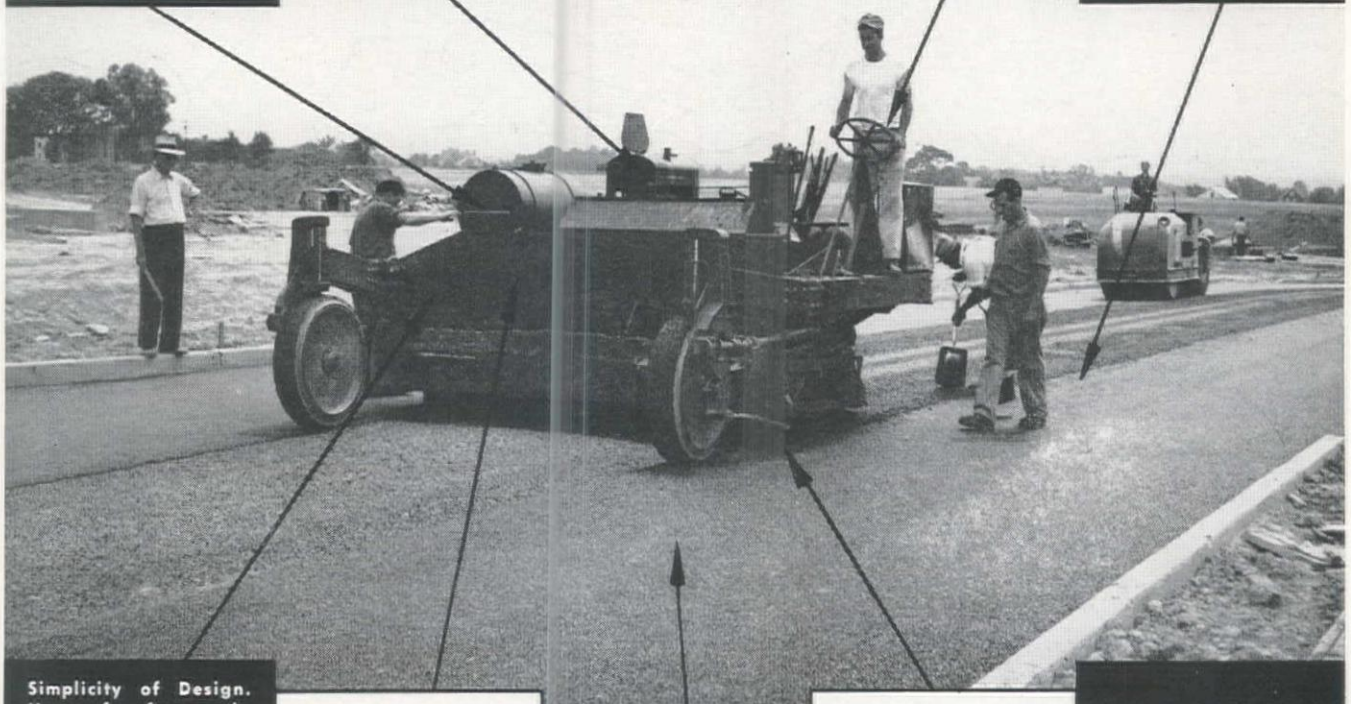
Adjustments for correcting and holding course thickness are mechanical and positive; no delicate mechanism affected by cold or weather conditions.

More engine power — handles trucks easily.

Electric Screed Heating — simple in design—no fuel no hot spots — nothing — to burn help.

Wheel steering is smooth — no jerks on curves to cause hand work — the only paver with positive traction at all times.

Lays wide road or narrow — has laid 13 ft. road successfully; changes easily made.



Simplicity of Design. Hopper free from mechanism; Only one screed; Wheel traction; Easy upkeep; Long service without rebuilding.

An all 'round machine — the only paver fully recommended for all asphaltic mixes, stone, sand, slag, soil cement, etc.

Continuous Course Correction reduces cost of subgrade preparation and gives smoother pavement.

Screed action is slow — does not increase fines, cause spalling or shake machine apart.

Other advantages that mean lower cost operation and better road.

THE FOOTE COMPANY, INC.
Subsidiary of Blaw-Knox Co.
Nunda, New York

A BLAW-KNOX PRODUCT

ADNUN TRADE MARK REGISTERED **BLACK TOP PAVER**

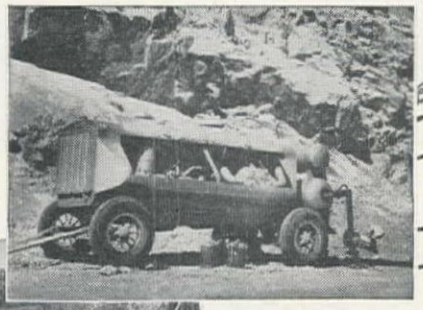
Do you pour concrete? You can save money with the Direct Pour and the MultiFoote HighLift Boom. The MultiFoote Paver, equipped with the HighLift Boom will eliminate a crane, elevator, ramps and false work.

A PRODUCT OF THE FOOTE COMPANY, INC., NUNDA, N. Y.

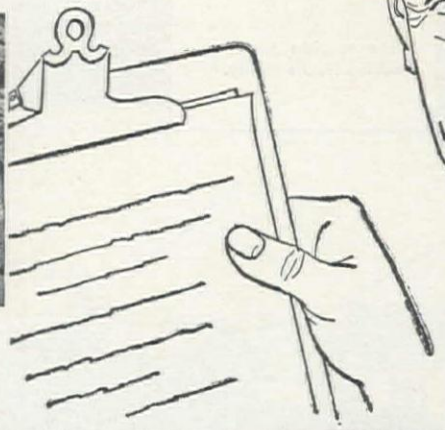
MULTIFOOTE PAVER
FOR EVERY PLACE CONCRETE MUST BE POURED

Progress Reports Reveal Faster Progress

when *Gardner-Denver's* in your picture!

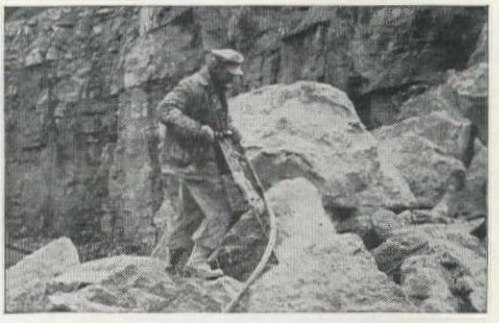


Air pressure's always up —when Gardner-Denver Portables feed your lines. Cylinders are water-cooled *all* the way down for all weather efficiency—compressors are two-stage for any altitude performance.

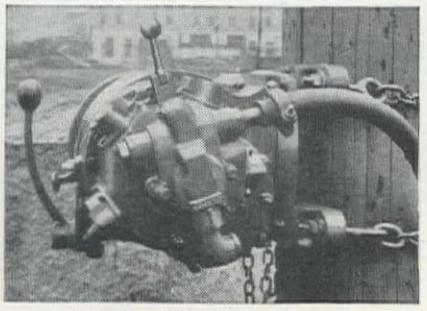


Holes are spotted quickly—drilled fast and clean with Gardner-Denver Wagon Drills.

Demolition proceeds at a steady pace—Gardner-Denver Breakers are easy on the operator—tough on concrete.



A clean hole drills faster — and Gardner-Denver Sinkers are noted for hole cleaning ability, powerful rotation.

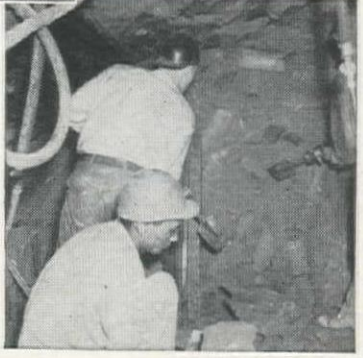


For speedy pull and haul—powerful Gardner-Denver Air Hoists are easy to control.

Saves shop time for all pneumatic tools—L012 Automatic Oiler shuts off air when it runs out of oil.

Keeps water out of your way—Top-Suction VP4 Sump Pump won't burrow in the mud—keeps grit out of the pump shaft seal.

Write for further information.



Packs backfill swiftly and firmly—Gardner-Denver Tampers are easy to hold—seldom require maintenance—non-freezing.

Clay or hardpan doesn't waste time—when tackled with Gardner-Denver Clay Spaders and Trench Diggers.

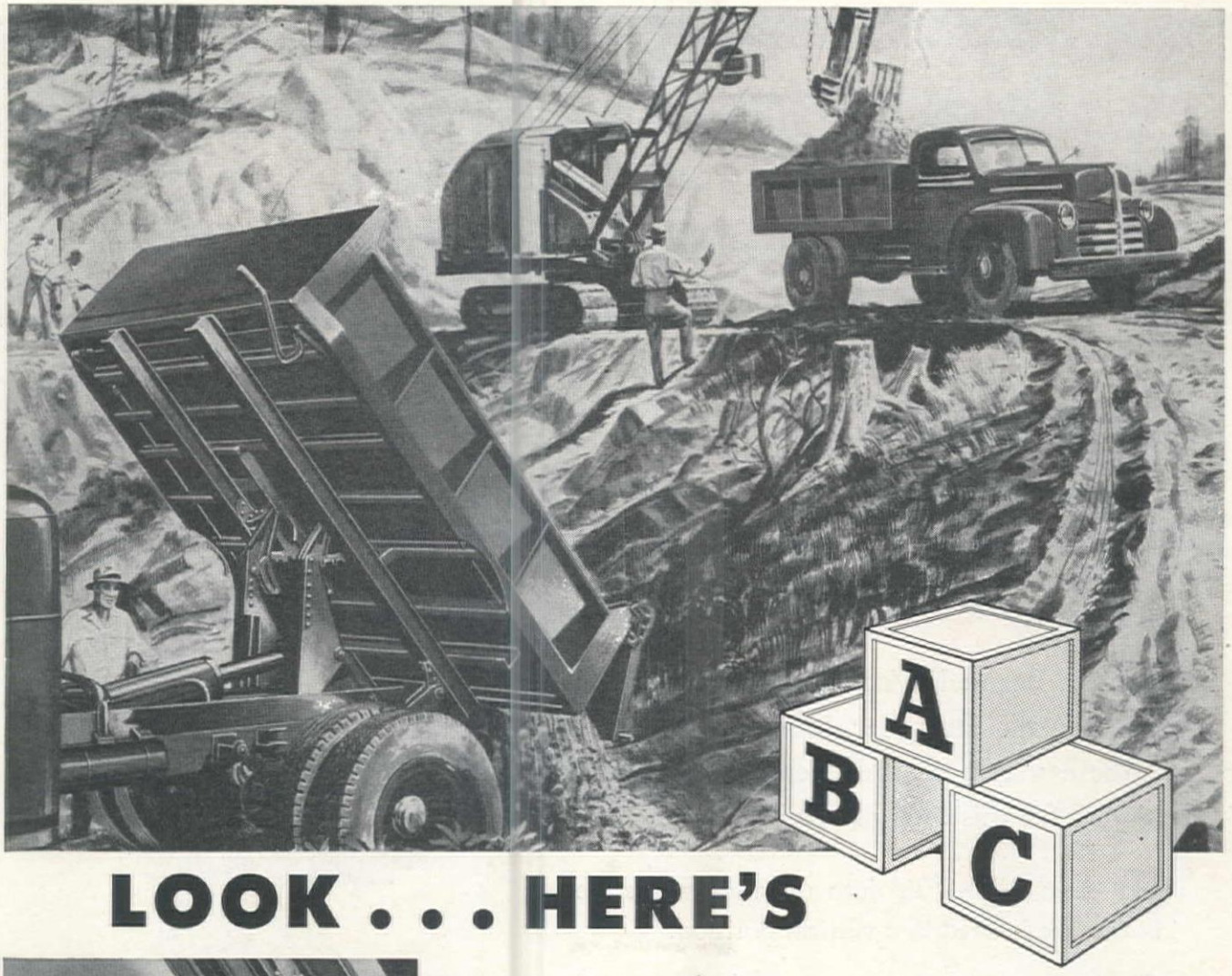
SINCE 1859

GARDNER-DENVER

THE QUALITY LEADER IN PUMPS, COMPRESSORS AND ROCK DRILLS

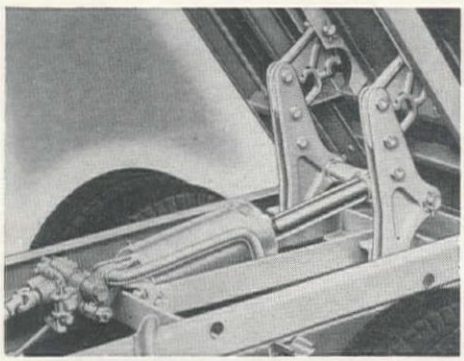
Gardner-Denver Company, Quincy, Illinois

Western Branch Offices: Butte, Montana; Denver, Colorado; Los Angeles, Calif.; Salt Lake City, Utah; San Francisco, Calif; Seattle, Washington; Wallace, Idaho; El Paso, Texas



LOOK . . . HERE'S

At work!



Scientifically positioned fulcrums and transfer linkages automatically "shift" the load at different points, eliminating lift-shock and smoothing out lifting action throughout the dumping cycle.

It isn't often that you can actually see A B C at work . . . doing a job such as Galion's great A B C combination is "coming through" on here.

And Galion is the only producer of hydraulic hoists and allsteel dump bodies with this great A B C combination . . . where an exclusive fulcrumatic hoist ACTION combines with a perfect lifting and operating BALANCE and proved quality CONSTRUCTION to do a better job for a longer time and prolong chassis life as well.

So Get the Best . . . Get Galion when you need new dump truck equipment. It will pay Big!

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

Sales and Service FROM Coast to Coast

GALION

ALLSTEEL BODY COMPANY
GALION, OHIO

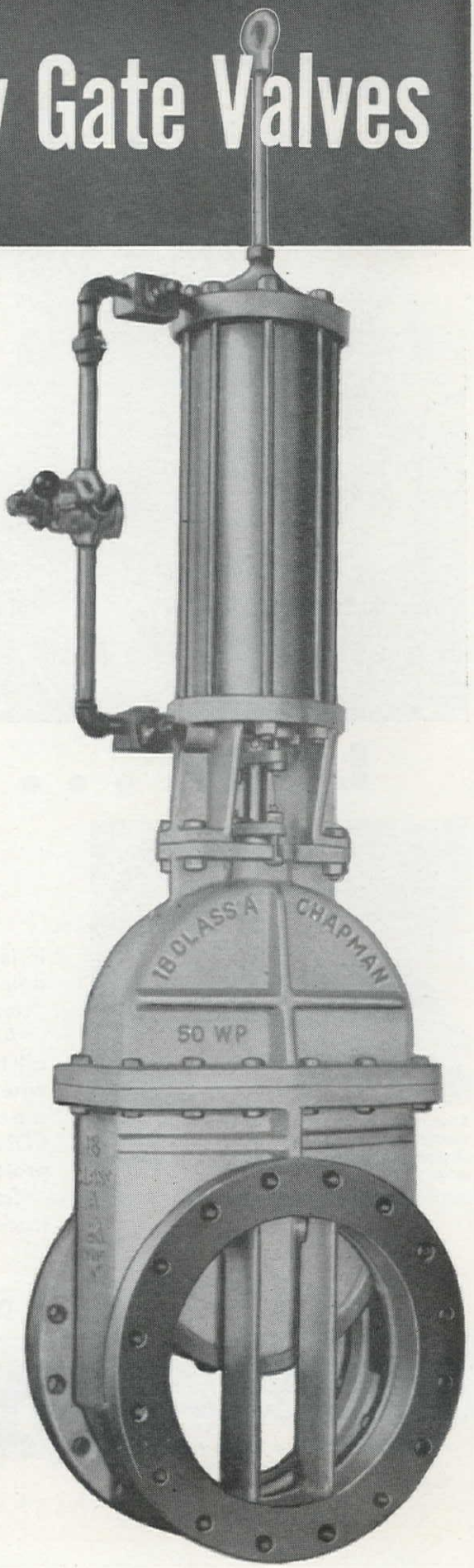
A exclusive hoist *Action*

B perfect operating *Balance*

C proved quality *Construction*

CHAPMAN
Beamed Waterway Gate Valves
give better service for

Throttling Conditions



Chapman Beamed Waterway Gate Valves are unusually efficient under throttling conditions, for these valves include features specifically designed for this type of service:

1. *Discs will not* tip into the waterway since beams are located in a vertical position.

2. *Extra bearing contact* is provided by special bronze-faced beams in the downstream port of the valve body.

3. *No uneven wear of seat rings* because the downstream disc is held securely in its relative position when throttling the flow through the valve.

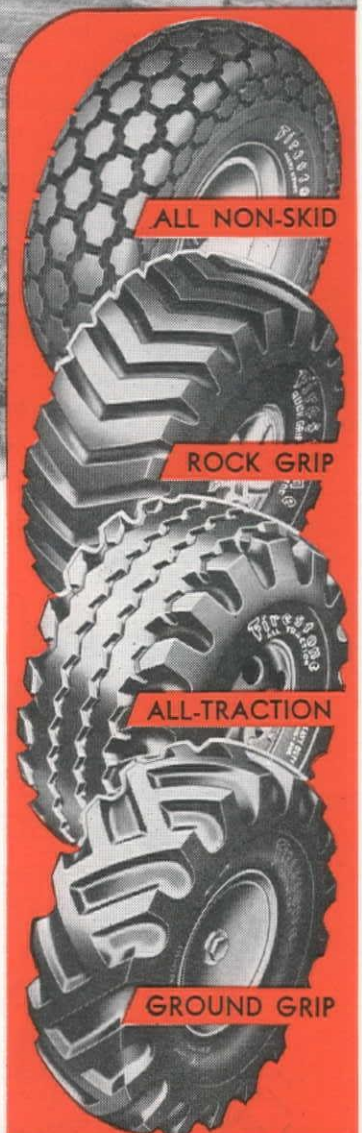
Chapman Beamed Waterway Gate Valves have stood the test of time, giving years of efficient service under severest conditions in large filtration plants.

The Chapman Valve Manufacturing Company
INDIAN ORCHARD, MASSACHUSETTS

WATCH THE LOADS GO THROUGH—
SEE THE EARNINGS GO UP!

with

Firestone TIRES



OPERATORS who keep a close eye on earnings know that they must keep tire costs at a minimum to have a profitable operation.

With Firestone Tires you can substantially reduce your costs because they are especially engineered — in tread and sidewall design . . . in bead and ply construction . . . in every minute detail — to fit your particular requirements.

Whether it's strip mining, earth moving, or rock work, Firestone has a tire that will cut downtime and maintenance costs and keep men and equipment on the job.

See your nearby Firestone Dealer or Store. Let them look over your equipment and make an on-the-job analysis of your tire requirements. Let them show you how Firestone Off-The-Highway Tires will save YOU money.

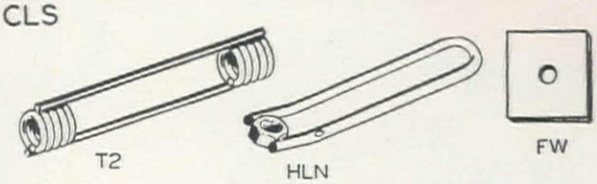
WHEN ORDERING NEW EQUIPMENT SPECIFY FIRESTONE OFF-THE-HIGHWAY TIRES

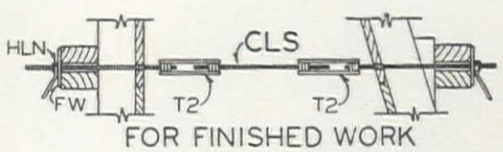
Listen to the Voice of Firestone on radio or television every Monday evening over NBC

RICHMOND CONTINUOUS THREADED LAGSTUD

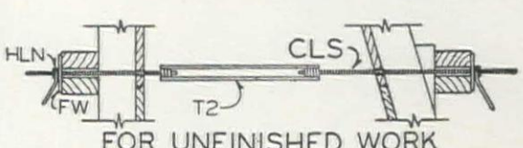
CLS

The tough, coarse-threaded Richmond Lagstuds are a versatile supplement to the Tyscru System. Every day in dozens of ways, they'll save time and money on your jobs. Used with Standard Tyscrus, they provide a fully adjustable form tieing method. They are coupling units for Adjustable Tyscrus. Imbedded in a grouted hole or in concrete, they furnish dependable anchorage. With the Handle Lagnut, they substitute for a Tylag. The Richmond Handle Lagnut in all cases replaces a wrench — makes installation and stripping fast and simple. There is no waste when using Richmond Lagstuds; even the pieces left after cutting to length can be salvaged for future use. The threads are really tough and fast.

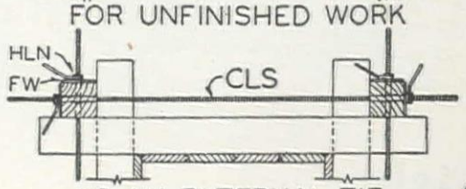




FOR FINISHED WORK



FOR UNFINISHED WORK

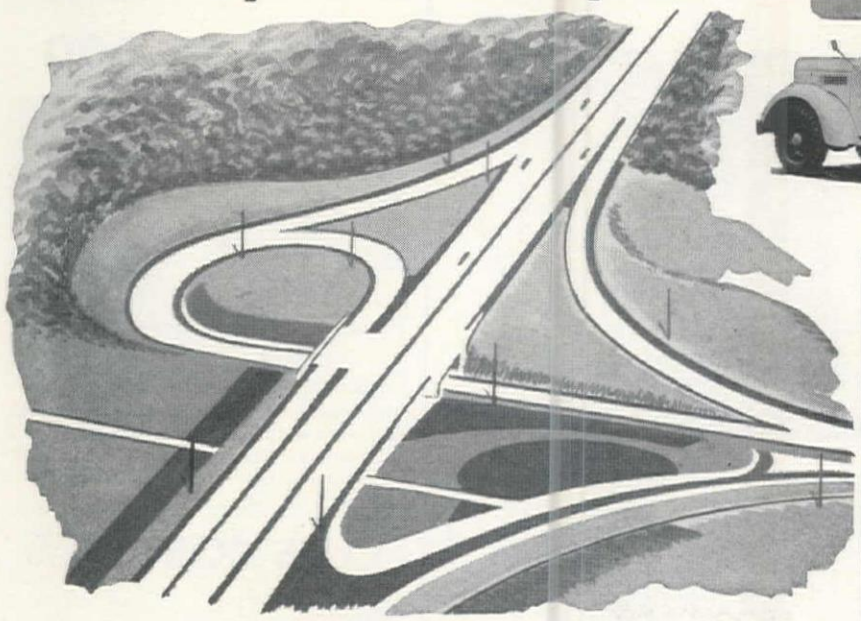


AS AN EXTERNAL TIE

RICHMOND KNOW-HOW—DEPENDABILITY—SERVICE—ESTIMATES & JOB PLANNING

17 GRADALLS

help build new extensions to Pennsylvania Turnpike



The Pennsylvania Turnpike is known today as the greatest all-weather, non-stop superhighway in the nation. When both the western and eastern extensions are completed, Pennsylvania will have a 327-mile limited access highway extending completely across the state and linking the entire Eastern Seaboard with the Midwest.

THESE WELL-KNOWN CONTRACTORS ARE USING GRADALLS ON BOTH EXTENSIONS

- H. J. Williams Company (2 Machines) York, Pennsylvania
- Latrobe Construction Company (3 Machines) Latrobe, Pennsylvania
- Ralph Myers Contracting Company Pittsburgh, Pennsylvania
- Ruth Construction Company Scottdale, Pennsylvania
- Frank Patterson Construction Company Pittsburgh, Pennsylvania
- L. G. DeFelice and Son, Incorporated Rochester, Pennsylvania
- Frank Mashuda Company Portersville, Pennsylvania
- James D. Morrisey Company Philadelphia, Pennsylvania
- James J. Skelly Construction Company Philadelphia, Pennsylvania
- C. J. Langenfelder and Son Baltimore, Maryland
- E. P. McHugh Construction Co. (2 Machines) Penndel, Pennsylvania
- C. W. Good Construction Company Reading, Pennsylvania
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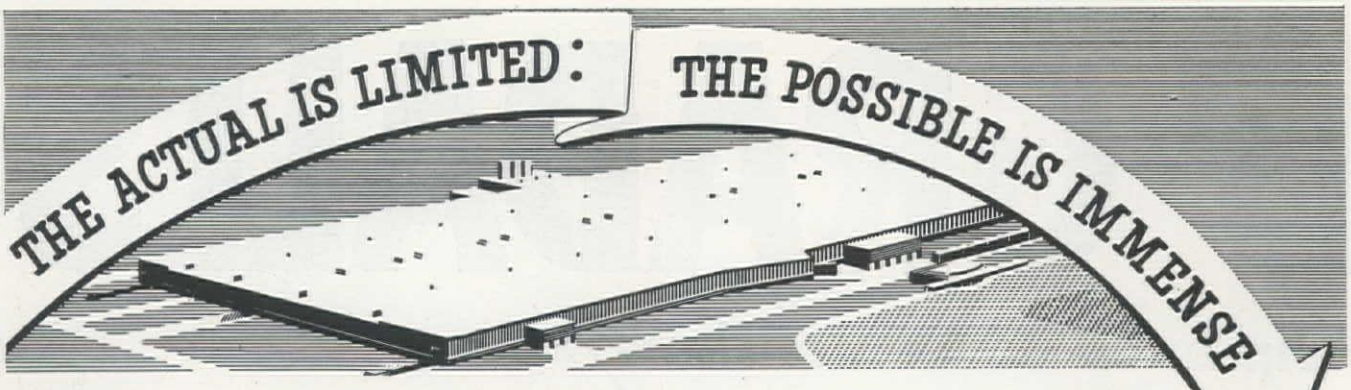

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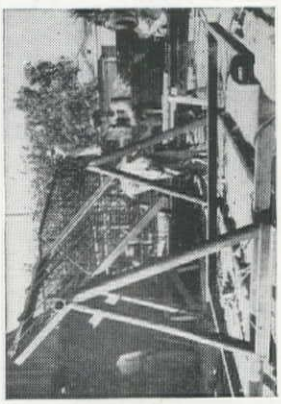
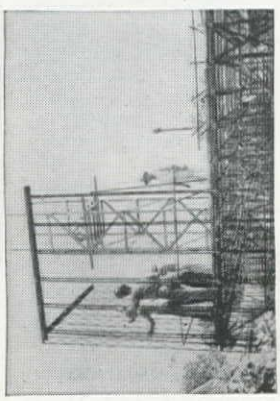
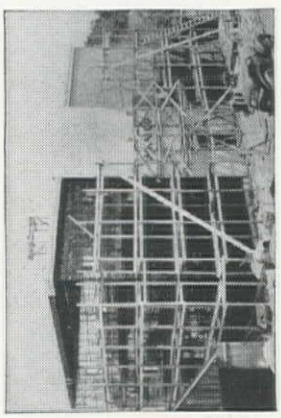


On-the-ground prefabrication of 10-foot panel sections in assembly jig for fast, downhand welding.



Second floor all-welded sectional panel held in place for tack welding.



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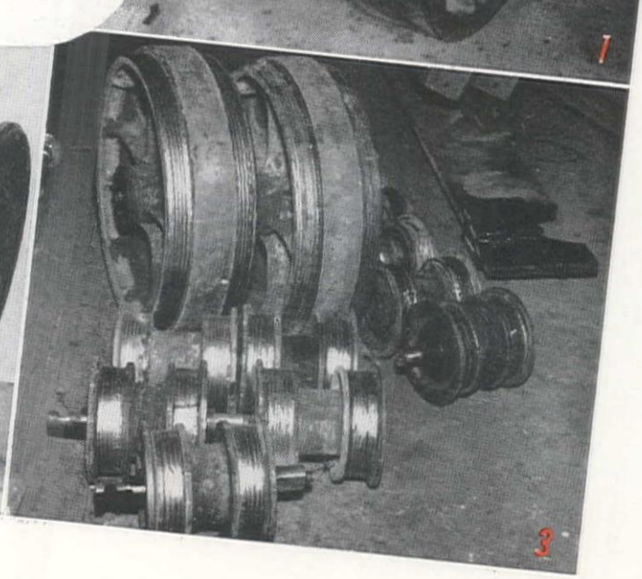
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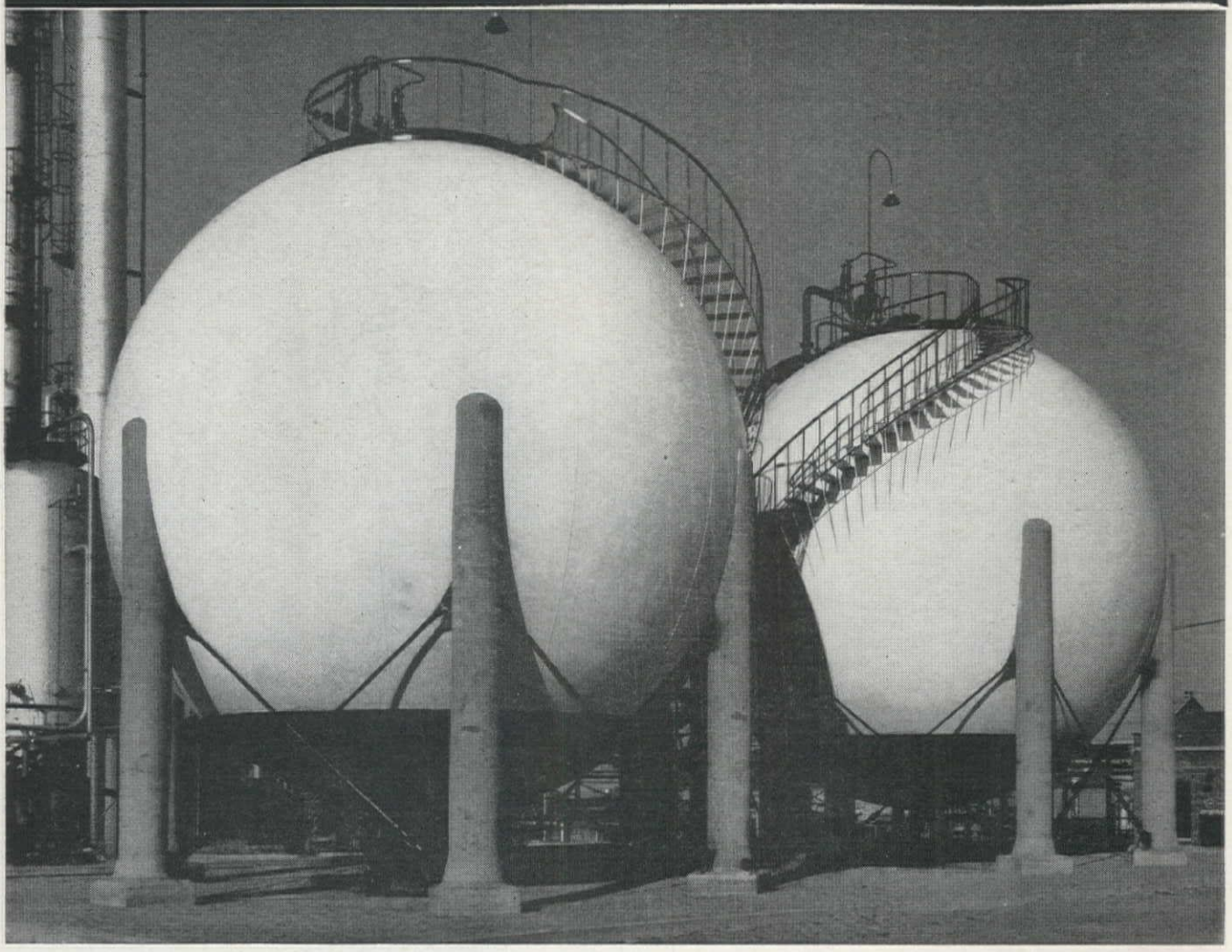

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WESTERN CONSTRUCTION

March 1951 Vol. 26, No. 3

A Michigan Professor Speaks—Off Key

WHEN a Michigan professor of transportation charges that the 18,000-lb. maximum axle load for trucks is a "road block" which the Bureau of Public Roads has thrown in the path of national progress, it serves to re-emphasize the regional difference between the West and the East in the field of highway engineering. Two comments seem appropriate.

First, the criticism is based on the Eastern approach to permissible highway loads with high axle concentrations and short trucks, as compared to the Western idea of less load per axle and a longer truck. The latter provides more pay-load per truck with less damage to the road surface. Possibly the Eastern limit on length is the road-block and not the axle load. At least, it was only last June that representatives of the Western Highway Institute, speaking for the organized trucking interests, accepted the basic figure for single axle load which is the design standard used by all state highway departments of the West. Thus, the legitimate truckers—not the overload chiselers—have elected to work with the engineers rather than be obstructionists.

At present information is being accumulated to determine the answer to this critical design problem of limiting weight, and particularly the question of who will pay for the higher costs of roads designed to serve a small percentage of vehicles. The cost has to be placed on the loads which exceed the damage level.

On the second point, and a more serious one, the accusation that the Bureau of Public Roads is acting to jeopardize the development of the nation's highways lacks any semblance of soundness or accuracy. There is no organization more conscious of the public funds invested in the highways of this entire country, or the alarming proportion of annual maintenance costs than the BPR. Its decisions also reflect the thinking of state highway departments, which are sources of sound and independent engineering ideas.

The West has grown up with the BPR and has always had the highest respect for its administrative and engineering staffs in this region, which were ably led for so many years by "Doc" Hewes. Any organization of national size must necessarily be burdened by regulations that tend to impede swift decisions, as well as rules to secure uniformity that may seem dictatorial. But for earnest purpose, sound technical approach and an honest effort to secure the most for the public's highway contribution the BPR has the complete backing and support of the highway construction industry of the West.

The professor has picked on the wrong organization and the wrong unit of poundage if he, and the interests he represents, expects to secure any support from the West.

Seattle Engineers Perform a Service

CIVIL ENGINEERS in the Puget Sound area and particularly the Seattle Section of the American Society of Civil Engineers have rendered a distinct service to the profession in the comprehensive earthquake report just completed. Too often these technical reports are hurried and lack the element of interpretation. However, the magnitude of the structural damage dictated thoroughness in analyzing the effects of the earthquake which struck that region in the spring of 1949.

A "complete" report was the goal of the study which the engineers outlined, and they could not be hurried in carrying out their carefully prepared plan.

Even a year ago when this publication requested release of the material which then represented the bulk of the data, the answer was that more findings were being added and until sources were exhausted and the analysis completed the report would not be released. With a background of this type of engineering thoroughness the final result warrants full reporting; anything less than the full account and findings would not do justice to this professional effort. *Western Construction* considers it a distinct service to bring the complete and fullest form of this study to its readers.

Emphasis Is On Maintenance

OPINIONS expressed by engineers in charge of street and road maintenance operations appear to indicate that these departments are well prepared to meet any foreseeable emergency in scarcity of men, materials and machinery. During the coming months the emphasis in street and road work will swing toward maintaining the existing surfaces, as curtailment overtakes normal new construction. Maintenance engineers, partly through a desire to be prepared for any emergency, and partly as a result of rebuilding their pool of machinery so badly worn out during the war years, have been replacing obsolete and uneconomical units. The equipment on hand today seems adequate for the immediate future, even if there should be curtailment in the supply caused by the emphasis on mobilization. In turn, this relatively new equipment reduces the problem of repair and servicing as compared to the machines used during and after the war years. Men required in the shops will be correspondingly fewer and this may be important as the supply of mechanics dwindles. Field crews on maintenance work are now mostly veterans or older men, which tends to lessen the man-power problem. Lastly, these departments, realizing the accumulation of maintenance needs at the close of the war, have been pushing hard during the last few seasons to make up this deficit. They have accomplished a lot, but the need will not lessen. If the present emergency extends from months into years, the maintenance engineers and their crews and equipment will hold the key to the public transportation system.

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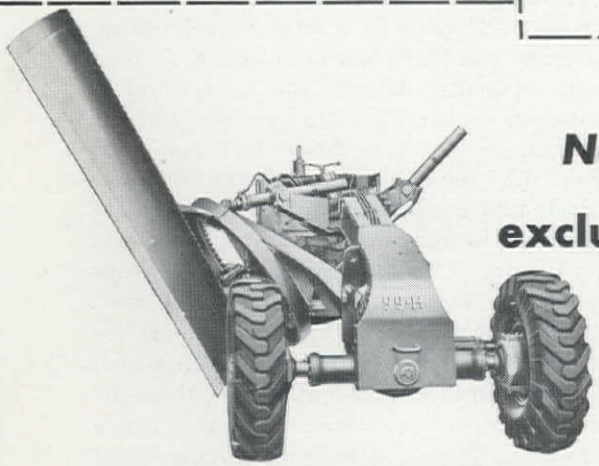

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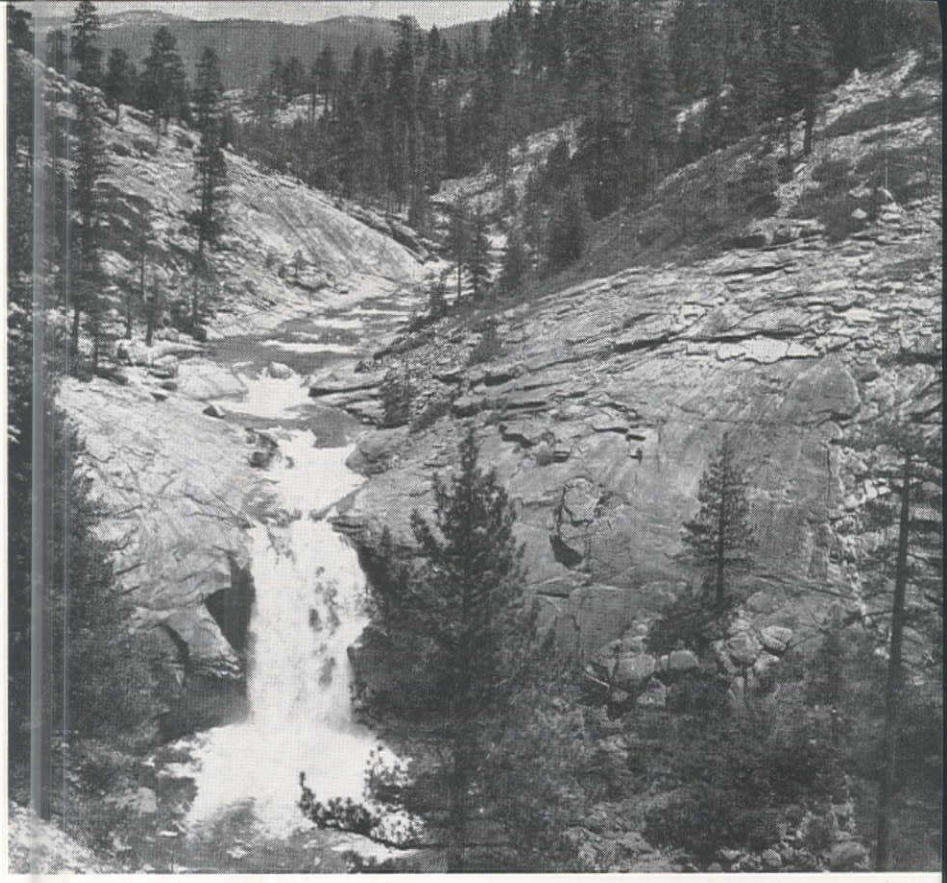


At this site on the Bear River in California, Pacific Gas and Electric Co. will build a 230-ft. rock-filled dam. The storage will create complete water conservation and flexibility of power operation on the Mokelumne River in . . .

Developing a 2,100-Ft. Hydro Plant

By T. J. CORWIN
and J. B. COOKE
of the Division of Civil Engineering,
Pacific Gas and Electric Company
San Francisco, Calif.

P. G. & E. is completing its Mokelumne River development with a 40,000-hp. unit on the Bear River, a tributary of the Mokelumne. The project is featured by a 230-ft. high rock-fill dam, a combination surge tank and creek diversion, a 2,100-ft. head penstock and a multiple jet vertical shaft impulse wheel.

On completion of this project the water stored in the new Lower Bear River reservoir will fall through a "one mile drop" to produce power in P. G. & E.'s Salt Springs, Tiger Creek, West Point and Electra plants. Below Electra plant the Mokelumne River water flows into East Bay Municipal District's Pardee reservoir in the foothills which is one of the major sources of Bay Area water supply.

A highly developed river

The Mokelumne River is a good example of a highly developed river.

On the upper Mokelumne are four reservoirs which catch the snow melt at an elevation of 8,000 ft. Farther down the river at elev. 4,000 is the Salt Springs reservoir of 146,000 ac. ft., created in 1931 by construction of the 328-ft. high Salt Springs rock-fill dam. Upstream from the new Bear River reservoir is an existing smaller rock-fill dam forming Upper Bear River reservoir. These seven reservoirs provide the storage for the Mokelumne system and farther downstream four forebay reservoirs give complete "water saving" flexibility of power operation.

In passing through the four power plants the water flows through 40 mi. of conduit consisting of concrete bench and elevated flumes, inverted steel siphons, concrete lined and unlined tunnels and steel penstocks. The flow is handled by automatic and remote controls. One power plant, West Point, is completely automatic.

The Bear River Unit means more than just an additional 40,000 hp. to the Mokelumne system. Release of the additional water to be stored at Bear River will produce energy at Tiger Creek, West Point and Electra. In addition to having longer duration peaking power available, this additional kw.-hr. output means fuel savings at the system's steam plants.

Site favors rock-fill

The damsite is at a point where two massive granite domes oppose each other at the downstream end of a high mountain valley and clean bedrock can be seen between them. This ideal site is somewhat spoiled by a low plateau beyond the right abutment which requires a wing dam, but stripping of 10 to 25 ft. of overburden will bring foundation to bedrock. Studies of concrete gravity, slab and buttress and rock-fill designs were made. The rock-fill dam proved to be the most appropriate and economic structure. There are 14 rock-fill dams of ages from 20 to 80 years in P. G. & E.'s system, some of which date back to the hydraulic gold miners dams constructed in the 1870's. Thus P. G. & E. has had considerable experience with rock-fill dams, and such experience has shown them to be both satisfactory and economic in operation as well as in first cost.

The design of the 230-ft. high Bear River Dam is largely based on experience with Salt Springs Dam and to a lesser extent on other rock-fill dams. This background of experience and the general subject of rock-fill dam design has been treated in detail in the book "Handbook of Applied Hydraulics" by C. V. Davis, in the section on rock-fill dams contributed by I. C. Steele, Vice President and Chief Engineer of P. G. & E. Company. However, the design features of the new Bear River Dam will be briefly reviewed here. Discussion is confined to the main dam only, the 100-ft. high wing dam being of conventional design for a dam of that height.

Features of rock-fill design

The basic features of the dam are the same as for Salt Springs and, along with the general dam layout, are indicated in accompanying illustration. These identical features include the slopes, general details of joints, the thickness and reinforcing of the concrete face slab. The slopes used are conveniently constructed by simply dumping from high lifts, and also produce a very stable structure. The cost of dumped rock is a minimum since it consists only of quarrying and hauling costs. A flat upstream slope permits the

use of a thin layer of the more costly placed rock which is necessary to back up the concrete face. The placed rock acts as an equalizer in smoothing out the settlement of the dam and transmits the very appreciable water load from the thin concrete face to the loose rock fill.

The shape of the face of the Bear River Dam will be moderately curved upstream in plan and concave in a line down the face. The slight arching in plan causes a closing of vertical joints due to downstream deflection. From the standpoint of watertightness the closing of joints is a better condition to contemplate and further, the shortening tends to tighten the placed rock rather than loosen it. In spite of this curvature the several joints near abutments and top of the dam may open due to a lateral component of settlement from abutments to center of dam. The concave line down the face is desirable because the placed rock and concrete slab act as a strut to resist the moderate downward component of deflection in the face. This force is very great and the concavity tends to prevent buckling. The shape of the face may be visualized as a surface of a cylinder (4,350 ft. radius, 14 ft. middle ordinate at crest of dam) tilted on a 1.3 to 1 slope. The concavity is obtained by working to a control point when the rock is being placed in the face and the settlement during construction will give the concave profile.

Record of Salt Springs Dam

Salt Springs Dam has been a very successful and economic structure. Any cracking of the concrete surface slabs with the consequent leakage and maintenance at Salt Springs Dam has not been serious. A Cippoletti wier at the base of the dam is used to measure the leakage and should a break occur, interpretation of a curve of elevation of water surface plotted against leakage in filling and emptying will locate its elevation. In an 18-yr. period the leakage has varied between 5 and 20 cfs. from minimum to maximum reservoir water surface. Average maintenance costs have been low, face repairs having been necessary only once in the last five years.

Bear River reservoir, however, is 2,100 ft. higher in elevation and winter maintenance should be kept to a minimum. Also, the water is "1,900 ft." more valuable and the required release in the small and remote tributary Bear River is less than at Salt Springs. Hence, additional expense and care is justified in attempting to improve the watertightness of the concrete face.

Changes in design

Five changes in the face of Bear River Dam, as compared to Salt Springs Dam, have been made. Accompanying illustration shows the changes which are, in order of importance, as follows:

1. The sloping joint along the abutments and 15 ft. out from the key wall joint is intended to act as a hinge in permitting the face to deflect normal to itself under water pressure. At Salt Springs there were no such joints and cracks developed parallel to the key wall and centered about 15 ft. out.

2. The upper 180 ft. of the five central vertical open joints are open 2 in. instead of 1 in. as the other vertical joints. At Salt Springs the vertical joints were all constructed open 1 in. Three of the central joints closed to the point of crushing failure for a distance of 70 to 120 ft. down from the top of the dam.

3. Along the abutments and base, for a depth of 16 ft., the voids in the placed rock are filled with ½-in. to 1½-in. graded river gravel. The placed rock in this area is subject to greatest loading and at the same time is in the transition area between a rigid key wall and a flexible mass of rock. The filling of voids will tend to "iron out" the deflection in this area. This use of gravel is adopted in part from the design of Sanderson & Porter for the Malpaso Dam, Peru.

4. Over the face of the dam the voids of the upstream ⅓ of the placed rock are also filled with ½-in. to 1½-in. graded river gravel. This serves the dual purpose of consolidating the rock immediately under the face slab and preventing concrete and grout from running into the placed rock. At Salt Springs the surface chinking in some places was inadequate to prevent the mortar of the concrete running into the voids. Maintenance of the concrete slab showed some porous honeycomb areas where this occurred.

5. Two additional horizontal joints were added through the central area of the face. The curvature of the line of deflection up the face is greatest in the central area of the face and these additional joints will increase flexibility. At Salt Springs there was crushing failure in a horizontal line along the center of the face. This failure seemed to be due both to the high compressive stress in the face and to surface crushing because of the surface being the compressive face of the deflecting slab.

6. Horizontal joints consist of a U-shaped copper seal and ½-in. redwood filler. This "soft joint" is anticipated to relieve the compressive stresses in the slab which, as noted above, are very great and caused some crushing in the face of Salt Springs Dam. The Salt Springs horizontal joints were cold joints.

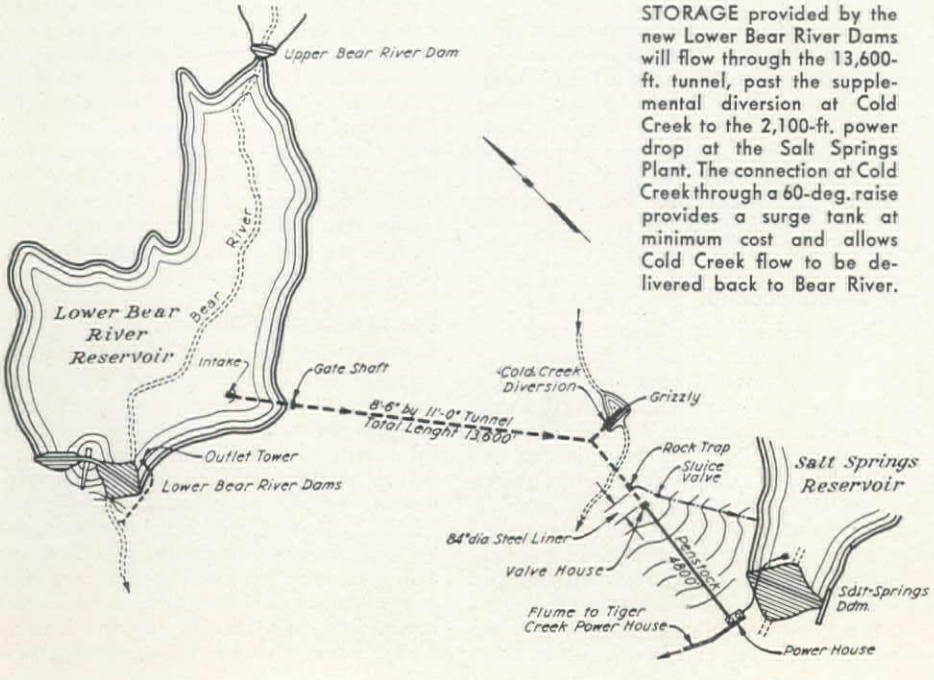
Diamond drilling provided the data from which the wing dam and quarries for both dams were located. No drilling was required for the main dam. Quarries will be practically on the dam abutments. Suitable river sand and gravel, for use in placed rock and as concrete aggregate, has been found in the reservoir site within a mile of the damsite.

The presence of a 60-ft. waterfall just 50 ft. downstream from the toe of the dam makes a large diversion flow possible with a small tunnel and a very low diversion dam.

Diversion tunnel

The temporary diversion tunnel will be the permanent dam outlet. The grizzly has 4-in. clear spacing and is for protection of the valves and personnel. The outlet system will by-pass a maximum of 1,800 cfs., and such a discharge, combined with 200 cfs. to the power house and 200 cfs. to Salt Springs reservoir, will permit rapid emergency unwatering. The 72-in. shutoff butterfly valve is oil pressure cylinder operated. Oil pressure is obtained from a pump operated by a water motor. The 60-in. free discharge butterfly valve is directly operated by water motor or hand wheel. Free discharge butterfly valves have operated satisfactorily in a number of P. G. & E. installations and, as long as provision is made for outside adjustments of the bronze seat, leakage due to erosion of the seat can be conveniently stopped. Opening the 3-ft. square slide gate will drain water below top of tower in approximately 12 hr., and thus permit inspection of the lower portion of the dam's face. Closing the gate then permits inspection or maintenance of the outlet tunnel, while storage is available below the top of the tower.

The main tunnel, supplying water to



STORAGE provided by the new Lower Bear River Dams will flow through the 13,600-ft. tunnel, past the supplemental diversion at Cold Creek to the 2,100-ft. power drop at the Salt Springs Plant. The connection at Cold Creek through a 60-deg. raise provides a surge tank at minimum cost and allows Cold Creek flow to be delivered back to Bear River.

the power house, has a short "tributary" tunnel and raise which diverts water from Cold Creek. In a dry year about 35% of Bear River reservoir will be filled by Cold Creek flow. The diversion is thus an essential feature and by making the rise 60 deg. to the horizontal, and of slightly larger area a surge tank was obtained at moderate additional cost. The 60-deg. raise is chosen as it saves length of tunnel over a vertical shaft and is also "self-mucking."

The plan (accompanying illustration), shows the tunnel and appurtenant structures. The intake structure is a galvanized steel grizzly mounted on a minimum concrete base. It is so detailed that one face can be opened to permit easy access for equipment into the tunnel should maintenance be required. The clear spacing of bars is 1 in., which is about 1/5 of the nozzle diameter, and the structure is designed for differential head of 10 ft. in either direction. The Cold Creek diversion in causing occasional "upstream flow" in the main tunnel can cause inside pressure, but it also provides a desirable self cleaning feature for the grizzly. The tunnel head gate is a Broome gate located in a shaft at the edge of the reservoir.

SALT SPRINGS DAM, shown during construction in 1931. Service record of this P. G. & E. structure furnished basic technical information that provided an improved design for the similar rock-fill dam on Bear River. Slopes are the same at 1.3 to 1 upstream; 1.4 to 1 downstream.

Simple surge tank

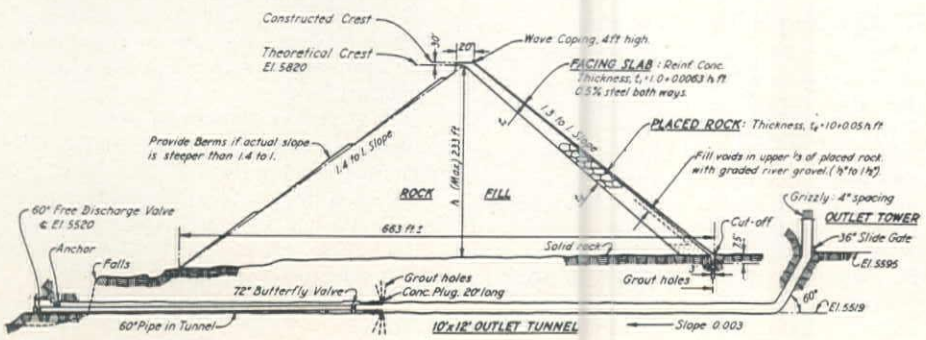
The Cold Creek diversion has a maximum capacity of 800 cfs.—600 going "upstream" to Bear River reservoir and 200 to the powerhouse. This diversion is a minimum concrete diversion dam and grizzly structure with manually operated sluice gate and shut-off gates. The diversion is in an isolated location and will be unattended. In order that ice and floating debris will not clog the grizzly, it is set horizontal and 5 ft. below the minimum water surface. The water enters the grizzly, then goes up through a short intake conduit where it passes over a weir into the "surge" shaft. Additional grizzly area is provided vertically to better provide for maximum flow. A 15-ft. pool in front of the grizzly and sluice gate in the dam is provided to catch and pass stream sand and gravels. A 3-ft. wide flashboard opening adjacent to the vertical grizzly permits clearance of floating debris.

It is convenient that the shaft is only 1,200 ft. from the beginning of the penstock and can be utilized as a simple surge tank. The limiting conditions of design are that the draw down from load on in 1 min. (reservoir at minimum operating level) will not lower the hydraulic grade line to a point less than 10 ft. above top of tunnel at the portal. The top of surge shaft is 32 ft. above maximum reservoir level, so instantaneous rejection can occur without spilling.

It is interesting that the contractor prefers to drive an 8½ by 11-ft. section, instead of the 8 by 9-ft. design section, to suit his tunnel equipment and method of driving. The tunnel is through solid granite and will be unlined. An adequate rock and gravel trap is therefore essential at the beginning of penstock, this being particularly important because of the unit's small diameter nozzles. A 36-in. butterfly valve is used as the sluice valve and is cylinder-operated with oil pressure being provided by the same pressure set that supplies the 72-in. penstock butterfly valve. At the upper end of the sluice pipe a grizzly (15-in. spacing) is placed to insure that nothing enters the 36-in. sluice pipe that will not pass the 36-in. butterfly.

P. G. & E. has had trouble in older sluicing installations with small rocks jamming in gate valve guide grooves, so butterfly valves (having no grooves) have been used on recent installations. Experience with butterfly valve sluices has shown this type to give no trouble of this kind and their rapid operation is a desirable water-saving feature. The sluice spills into Salt Springs reservoir and during the runoff period while Bear River reservoir is spilling, a flow of 200 cfs. may be by-passed through the sluice while the Bear River Unit is running. Such by-passed water, which would otherwise waste down Bear River and be lost, will produce power through Salt Springs Unit, at such times as Salt Springs reservoir is not spilling.

MAXIMUM SECTION for the 230-ft. Bear River Dam height of fill, indicating slopes, layer of placed rock on upstream face and reinforced concrete slab on the 1.3 to 1 slope.



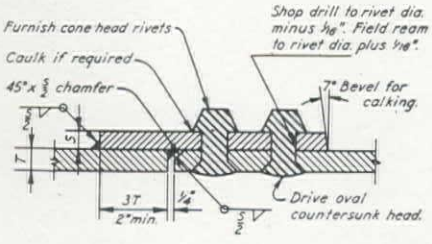
Welded steel penstock

Bear River penstock will be the Company's first welded steel penstock designed for a 2,110-ft. head. On P. G. & E.'s System there are two existing hydro plants with heads exceeding 2,000 ft.; Balch on Kings River (2,336 ft.) and Bucks on Feather River (2,562 ft.). The lower ends of both these penstocks are of banded pipe made in Germany.

The Bear River penstock is an important phase of the project. It will be 5,000 ft. long and will vary in diameter from 66 in. at the top through 62, 58, 54, 52, 50 and 48-in. diameters to 46 in. at the lower end. Thickness will vary from ⅜ in. to 1¾ in. in 1/16-in. increments. The penstock will be exposed and supported on concrete piers at 40-ft. spacing. Steel piers will be used for heights greater than 5 ft. The general description of fabrication, erection and painting, for Bear River penstock which follows here, is essentially P. G. & E.'s present penstock practice.

Penstock fabrication conforms to P. G. & E.'s practice as used on the recently

constructed West Point, Electra, Colgate, Cresta and Rock Creek plants. Steel is ASTM A-285B for thicknesses less than ½ in., and high strength silicon alloy A-212B for greater thicknesses. The pipe is shop fabricated in 40-ft. lengths with all welds made by the automatic submerged arc process. On the larger diameter pipe of previous projects 30 to 32-ft. sections have been used but studies for the 66 to 46-in. Bear River penstock indicated 40-ft. lengths to be the most economic for fabrication, shipping and erection.



PENSTOCK FIELD JOINT—Practice of stress relieving and field riveting insures high strength steel penstock shell free of internal stresses.

Ends of each section are prepared for a field riveted joint shown in the accompanying illustration. When the fitting up and all welding is completed, the longitudinal girth welds are X-rayed and any required chipping and re-welding is done. On Rock Creek penstock, the most recently fabricated, the X-rays required 11% of the welds to be chipped out and re-welded. The pipe sections are then carefully handled until stress relieved in accordance with the API Code.

Assuring high strength shell

The use of A-212B steel with its minimum elastic limit of 35,000 psi. permits higher working stresses. The practice of stress relieving and of field riveting insures a ductile high strength shell free of any possible internal stresses. High strength weldable steel was first investigated in 1946, to permit the economy of using a single penstock to the three high-head units at Electra power house. To avoid unusually great thicknesses of plate, it was hoped to find a weldable steel of about 45,000-psi. elastic limit which had been well developed and proven in wartime use and would cost less per foot of penstock.

After various steels were considered and welding and stress relieving tests were made, it was found that steels of 45,000-psi. elastic limit could not compete economically but that A-212B with 35,000-psi. elastic limit was an ideal and more economic penstock steel than A-285B. The premium price for A-212B is under .5 cents per pound; it can be handled by normal shop practice, and effects savings in fabricated price and field erection in being 23% lower in tonnage. Careful inspection and tests were made throughout Electra job and since the A-212B steel was considered entirely satisfactory, it was decided to include it on future installations. It is interesting to note that stress relieving reduced the elastic limit of the plate on an average of 7% to 10% (max. 20%) but the stress relieved value was never less than 35,000 psi.

Field erection is again handled in the same manner as the last five penstocks. Pipe sections are very tightly fitted in the shop. To make field entry easy eight jacking brackets are shop welded (before stress relieving) to each section. After the pipe is rolled in place, it is roughly wedged and jacked to approximate line, and four 20-ton hydraulic jacks are used to pull the sections together. The shop sub-drilled holes are reamed, then cone-head rivets are put in from the outside and an oval countersunk head is driven on the inside of the penstock. Experience has shown the field riveted joint to be low in cost. For example, on the Electra job 2,000 tons of penstock (3,500-ft. length) was erected in three months with only one riveting crew of five men employed on the job. The total field erection cost of handling on the job, fitting, reaming, riveting and caulking came to 5 cents per pound at Electra (1947).

Painting and coating

Painting again conforms to P. G. & E.'s standard practice. The pipe receives a shop spun coat of coal tar enamel on the inside and a coat of whitewash on the outside. The whitewash reduces the temperature of the steel and tends to keep blistering to a minimum. An occasional blister, or in cold weather a crack in handling may occur, but the hydraulic advantage of the smooth shop spun coating over hand daubed coating is very valuable, the shop coating is considered better and is cheaper to apply. The last operation before filling the penstock is a complete spark test of both field hand daubed joints and the shop spun coating. Hot coal tar enamel interior penstock coating has been P. G. & E.'s practice since 1930 and inspection of penstocks has shown all penstocks to be in practically perfect condition.

The exterior field coating is of two types; one where penstock contacts concrete and the other where it is exposed. Where pipe is in contact with concrete it is sand blasted, primed and coated with bitumastic paint before concreting. For the exterior exposed coating the pipe is sand blasted to bright metal and two coats of red lead primer and one of aluminum paint are applied. The exterior protective coating is applied a few years after penstock is in operation, during a period of good weather and at the convenience of painting crews. The rusting of mill scale during this period is desirable, since it makes it easier to remove.

Turbine beside impulse wheel

When Salt Springs power house was constructed in 1932, space was allowed for the future construction of Bear River Unit. The Bear River Project, because of the cost of the large storage reservoir, did not become an economic development until the downstream plants, Tiger Creek, West Point and Electra were in operation and could benefit from this storage. Salt Springs power house will be unusual in having a 285-ft. head Francis turbine beside a 2,100-ft. head impulse wheel, both discharging directly into a flume which carries the water to the 1,300-ft. head Tiger Creek power house.

Study of the particular requirements of the Bear River installation and of most recent impulse wheel developments resulted in P. G. & E. Turbine Specifications calling for a vertical shaft multiple nozzle impulse wheel. The primary considerations leading to this choice were:

1. Just 20 ft. beyond centerline of unit the water enters the side of the Tiger Creek flume. The velocity and turbulence in the tailrace are much lower and quieter for the vertical shaft multiple nozzle wheel for normal operation. The self-contained energy dissipator is a desirable feature for load rejection.

2. The space requirements in the existing power house were best adapted to the vertical shaft machine.

3. Having three nozzles the failure or complete plugging of a nozzle will only produce ⅓ the water hammer of the failure of a single nozzle machine. This is very valuable in security and economy of the penstock.

4. The higher efficiency as evidenced in model and full scale tests.

5. The higher efficiency at low loads due to the governing method of closing one nozzle at a time.

Between 1900 and 1932 the Mokelumne Power Development consisted of small high altitude rock-fill storage dams, wooden flume and canal conduit and the 25,000-hp. old Electra power plant. The Bear River Project brings the development capacity to some 275,000 hp. of valuable peaking power. The complete development of the river was conceived more than 20 years ago under the direction of A. H. Markwart.

The civil engineering plans and specifications for Bear River, Electra and West Point were prepared under the direction of the same group of P. G. & E. engineers, which include I. C. Steele, Walter Dreyer, T. J. Corwin, and G. C. Green, as were the plans for the original Salt Springs and Tiger Creek development in 1930.

Construction of the dams was started in the summer of 1950 and due to the 6,000-ft. altitude and consequent heavy snows the construction year will be only seven or eight months. The 14,000-ft. tunnel is being worked all year around by driving only from the lower end, access is obtained by the Salt Springs road and the 5,000-ft. long newly constructed Bear River penstock tram. The project is scheduled through three construction years with completion of the dam in the fall of 1952, to permit operation to begin with full water storage on the completion of power house and penstock in the spring of 1953.

The major contracts let are:

Dams and by-pass tunnel: Utah Construction Company.

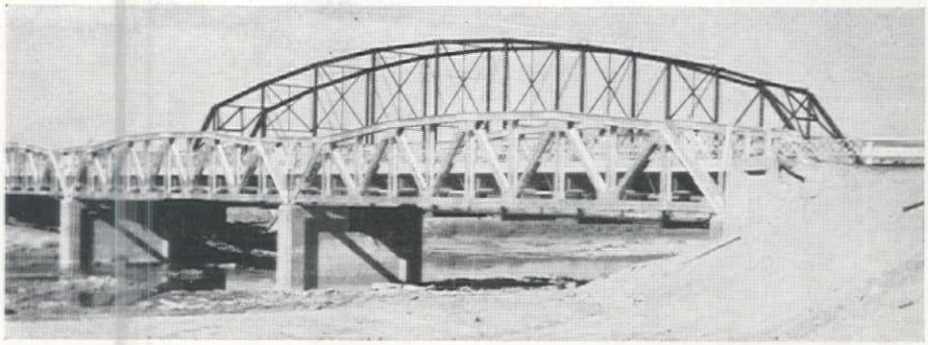
Main tunnel and appurtenant structures: Walsh Construction Co.

Penstock fabrication: Consolidated Western Steel Company.

Impulse turbine: Pelton Water Wheel Company.

Abandoned Bridge Moved to New Site

Wyoming highway relocation by-passed a bridge still in excellent condition, so the bridge's three 95-ft. steel truss spans were dismantled and hauled 30 mi. to be re-erected at a new site



THE BRIDGE re-erected at new site on new substructure. Old bridge in background was later torn down.

By WILLIAM G. AINSLEY
Project Engineer
Wyoming Highway Department
Rock Springs, Wyo.

ONE OF THE largest projects constructed to date in Wyoming under the State-County Road Construction Program of the Wyoming Highway Department was recently completed in Sweetwater County. The outstanding feature of this job involved the dis-assembling of an abandoned bridge, moving it approximately 30 miles southeast to a new location on the Green River-Linwood Road, and re-erecting it where a new bridge was a pressing need.

This bridge, by-passed because of a recent relocation job on U. S. Hwy. 30, was originally built in 1925 and consisted of three 95-ft. low steel-truss spans carrying a concrete roadway slab having a 20-ft. clear roadway width. The trusses of this bridge were in excellent condition and it was believed considerable economy could be effected in moving them to serve at the new site. The original and the new locations are both on the same stream, namely the Black's Fork River, and the topography at the new site indicated that the three spans would work out very well.

New substructure built first

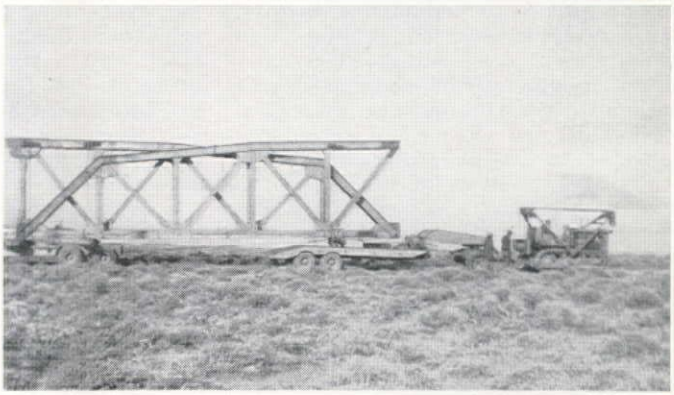
A contract was accordingly awarded to the Wyoming Construction Co. of Laramie, Wyoming on August 6, 1949 for the necessary new concrete substructure work and for moving the three truss spans. Soon after the arrival of reinforcing steel, the contractor moved onto the job and work began on the two spill-thru abutments and the two river piers, all of reinforced concrete. Footings of both piers and for the north abutment were founded in solid hard shale while the footing for the south abutment was supported on timber piling driven to refusal through sand and gravel to the same hard shale stratum.

Concrete work on the four substructures was completed during the winter months, requiring protection from freezing. A canvas house was built around each pier and abutment site and heat was supplied by a Herman-Nelson heater. Excellent results were obtained with this heater. Inside temperatures of 75 deg. were easily maintained during sub-zero weather.

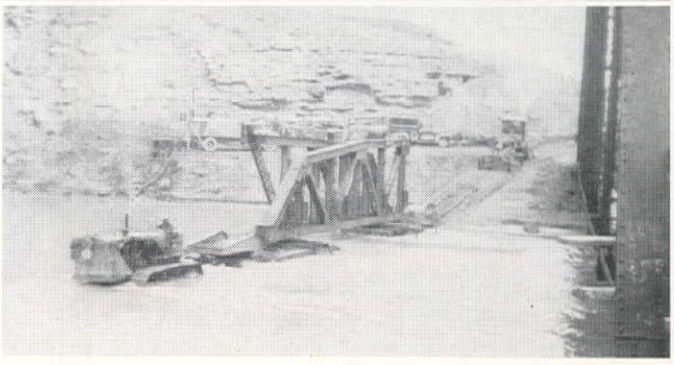
Old deck dropped into river

The original reinforced concrete deck on the old bridge was first removed by cutting it into roughly rectangular blocks with pavement breakers. These blocks were then lifted over the side of the bridge and dropped into the river, using a ¾-cu. yd. Northwest crane working from the bridge deck. General opinion was that this would be the easiest part of the job, but before it was

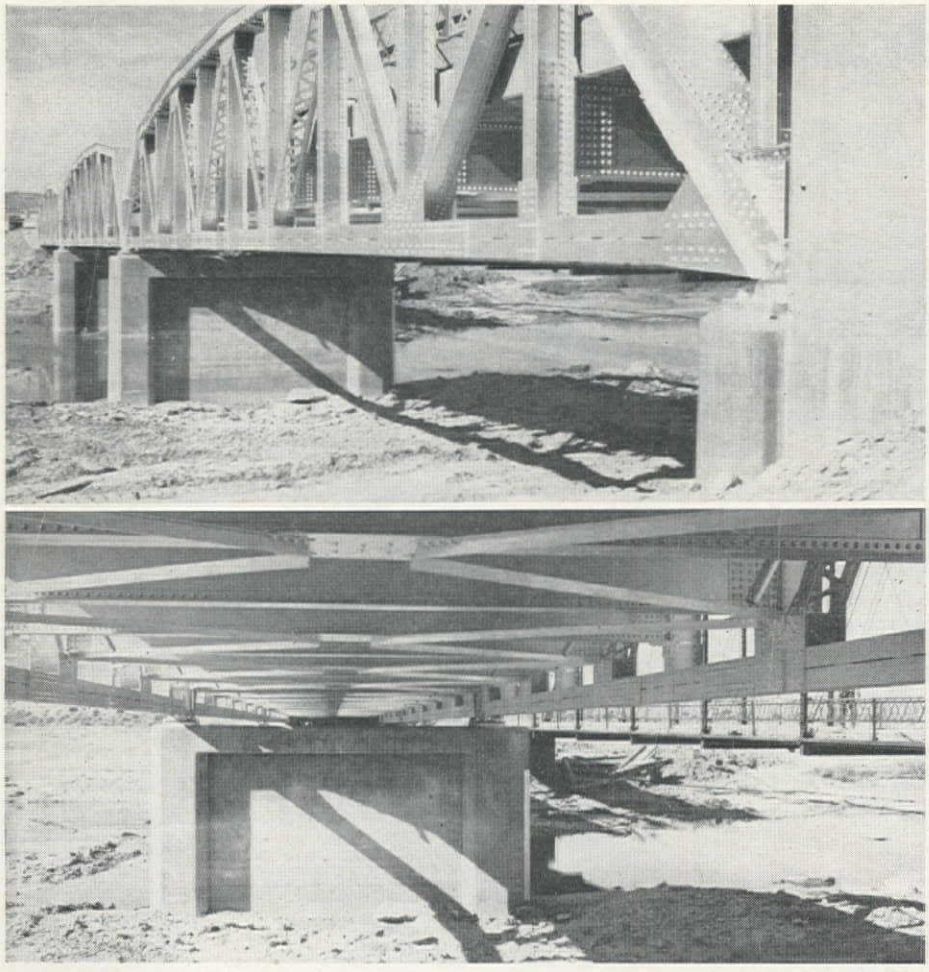
EACH dismantled truss, in two pieces, was loaded onto two trailers and hauled by truck to the access road.



A TRACTOR was hooked onto the two trailers to pull the load on the access road to the new site.



SOUTH SPAN was hauled to re-erection location by fording the river while at low stage. Gravel bottom was fairly stable.



RE-ERECTED BRIDGE viewed from near south abutment. Footings for reinforced concrete piers and north abutment are founded on solid shale while south abutment is supported on timber piling.

over everyone concerned, especially those operating the pavement breakers, had a great respect for the quality of concrete poured in 1925.

The contract called for the three truss spans, weighing approximately 50 tons each, to be dismantled in accordance with a predetermined plan. However, the contractor obtained permission to use his own plan instead, which consisted of moving each span as a unit without dis-assembling the structural steel. This plan was well conceived and consisted of first sliding the spans laterally along centers of bearings onto temporary timber cribs built adjacent to the abutments and piers and then jacking each span in turn down onto three trailers, thus giving a three-point suspension for the truss-span. Two trailers were used at the rear, one centered under each bearing shoe, and the third trailer was centered under the first floor beam in the front. A bolster made up of two I-beams was built onto the front trailer. The lower chord of each truss was secured to this bolster. Wood timbers were used to support the trusses on the two rear trailers.

Haste made waste

The reverse of this operation was scheduled to take place at the site of the new structure by the contractor's plan. An earth fill had been built at the new bridge site extending into the river, on the downstream side of the first span, wide enough to support the timber cribs that would be used to jack the span up to proper elevation whence it could then be slid onto the abutment and pier.

About this time Old Man Weather, in the form of a Chinook wind, came into the picture. The snow began to melt and the river began rising. Speed was the prime consideration and as usual, haste made waste. A minor accident, which probably could have been prevented, had more time been taken, caused the load to move forward on the front bolster while going down a rather steep grade. Fortunately only minor damage was done to the front floor beam, which was repaired without two much expense.

Because of the high water in the river it was then decided best to revert to the original plan of dismantling the truss-spans. By doing this the smaller sections could be handled from either bank using gin-poles.

Hauling and re-erection

The prime contractor dismantled the old steel truss-spans and transported them to the new bridge location. The Utah Crane & Rigging Co. of Salt Lake City subcontracted the re-erection and riveting. Dismantling of old truss-spans involved the removing of all steel floor beams by cutting rivets at end connections, and the trusses themselves were then separated into two pieces approximately 50 ft. long by cutting rivets at original field splices on both the upper and lower chords located approximately at centers of trusses.

Each dis-assembled truss, in two pieces, was then loaded onto two trailers and hauled by truck 30 mi. to the north bank of the river at the new bridge site. The river at low stage was fordable at the bridge site, with fairly stable gravel bottom. When the time came to erect the south span of bridge, a tractor was hooked onto the two trailers mentioned above that carried the dis-assembled truss-span, and pulled it to the south river bank by fording the river. Temporary timber cribs were used at center of each span to receive ends of the dis-assembled trusses when raised into place from off the trailers. Some misgivings arose as to how well the various sections would fit together again upon re-erection. This concern proved to be unfounded as good fits were obtained throughout, and only a few rivet-hole points had to be reamed and drilled for overside (7/8-in.) rivets.

New concrete deck

A 9-in. reinforced concrete deck slab, with a 20-ft. clear roadway width and two 9-inch wide curbs, was placed after all riveting of truss-spans had been completed. The steel trusses were given a prime coat of red-lead paint and a final coat of aluminum paint. From the date of the initial contract award the entire job took 13 months to complete.

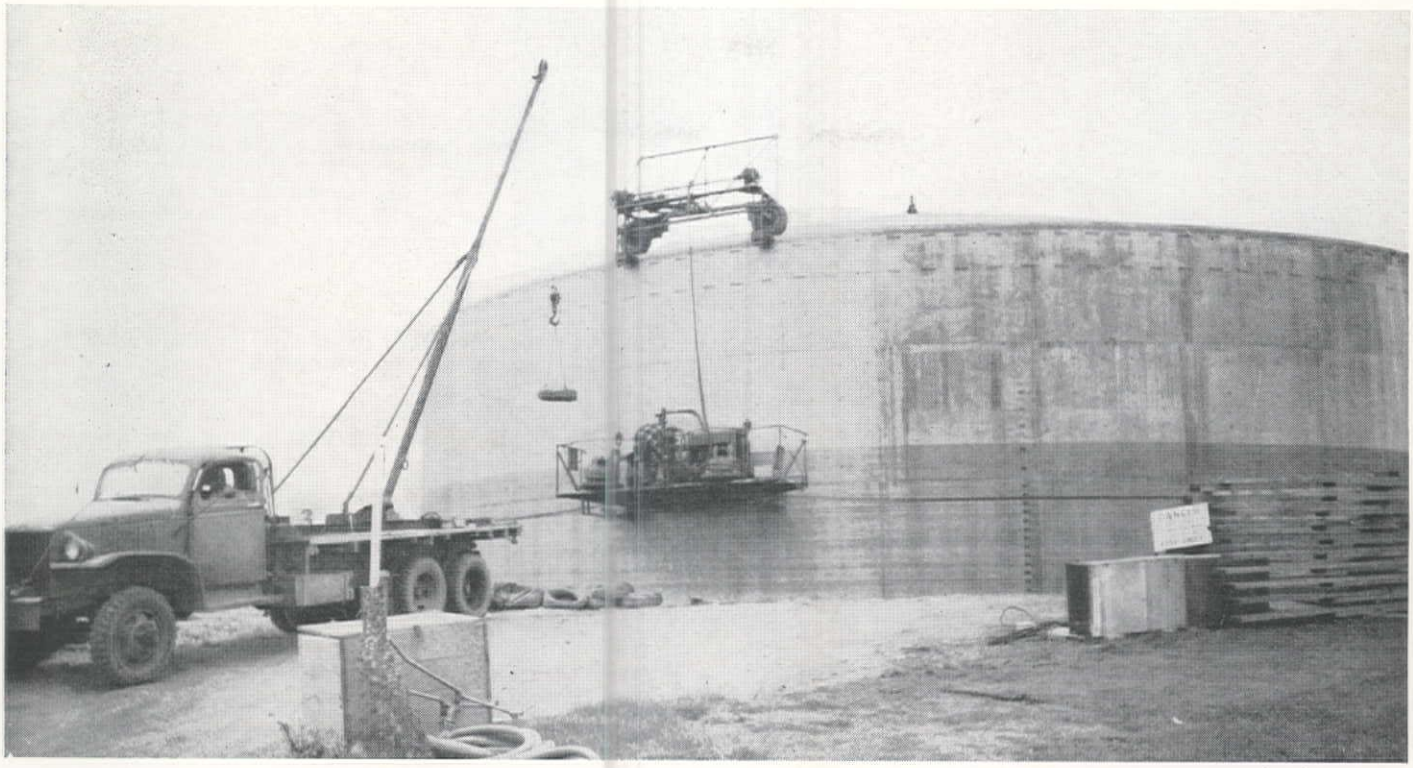
The total cost of the project, to the State-County Road Construction Fund, in which the State pays 75% and the County 25%, was $58,772.92. Although a somewhat different design plan for the bridge might have been used had not this old bridge been available, an entirely new bridge would have undoubtedly involved a much larger expense, especially at present prices for new steel. After completion, the re-built bridge fits well in its new surroundings, to all appearances just as though it had been designed especially for the new location.

Personnel

For the Wyoming Construction Co., Vern Miller was concrete foreman and Charles Stoltz supervised the bridge moving. Talcott Moore, construction engineer, and W. G. Ainsley, project engineer, directed the work for the Wyoming Highway Department. W. H. Fisher is the Bridge Engineer for the Wyoming Highway Department.

$50,000 Asked for Study of Toll Tunnel Through Cascades

AN appropriation of $50,000 has been asked of the Washington state legislature for engineering studies of a toll tunnel through the Cascade Mountains. The proposed tunnel would be located north of Chinook Pass and would provide a year-round link between Tacoma and Yakima. The pass is ordinarily closed about 6 months out of the year by snow. The original appropriation would pay for the survey, plans and specifications and proposed connections to existing arteries in the area.



East Bay District Builds Its First Reservoir of—

Wire Wrapped Prestressed Concrete

After constructing about 20 concrete reservoirs on its distribution system with the rod-prestressed method, the Utility District called for alternate bids and awarded a contract on the lower

AFTER BUILDING about 20 prestressed concrete water reservoirs during a period extending back to 1933, the East Bay Municipal Utility District has recently used the wire-winding method for the first time in the construction of the 1,000,000-gal. Peralta Reservoir.

Bids for this job, opened last May, called for the standard rod-prestressed design of the District, and as an alternate the wire-winding procedure for the same concrete structure. The low bid of $52,200 (entire reservoir project) showed an advantage of $1,300 in favor of the winding method for prestressing. As a result the District will call for the same alternate type bids for the next reservoir to be constructed. Wire-wrapping as a method of placing initial compressive stress on the walls of concrete reservoirs is a well established process, but the initial use of this method by an engineering organization with a long experience record in concrete reservoir design and construction justifies a brief review of the structure and the prestressing procedure.

A word of history

Design features of this type of reservoir have become rather standardized in the development of the distribution system of the District throughout the territory on the east side of San Francisco Bay. About ten years ago, an article by R. C. Kennedy, now chief engineer of the District, appearing in the April 1940 issue of *Western Construction*, reviewed the design features of one of these structures, including the rod method of prestressing. A special feature covered by that article was the development of a wrench, which used a nail in double shear, to equalize and limit the tension placed in the steel bands.

Design standardized

During the intervening ten years the design for these structures has not been changed in any important feature. In general the design provides:

A circular footing ring 3 ft., 8 in. wide and 12 in. thick. In the case of the Peralta Reservoir this ring follows the perimeter of a circle with radius of 47 ft. On this ring are poured the ten vertical concrete wall sections each raised in a continuous pour. Alternate sections are poured consecutively and the joint faces of the sections are in the plane of the radius. Thickness of these reinforced concrete sections starts with a 6-in. minimum at the top and increases in 2-in. increments down the wall. In the Peralta Reservoir the bottom thickness is 10 in. in the 23 ft., 4 in. height. Changes in thickness are made at 4-ft. intervals vertically to provide for economical use of plywood forms.

PICTURED AT TOP OF PAGE—

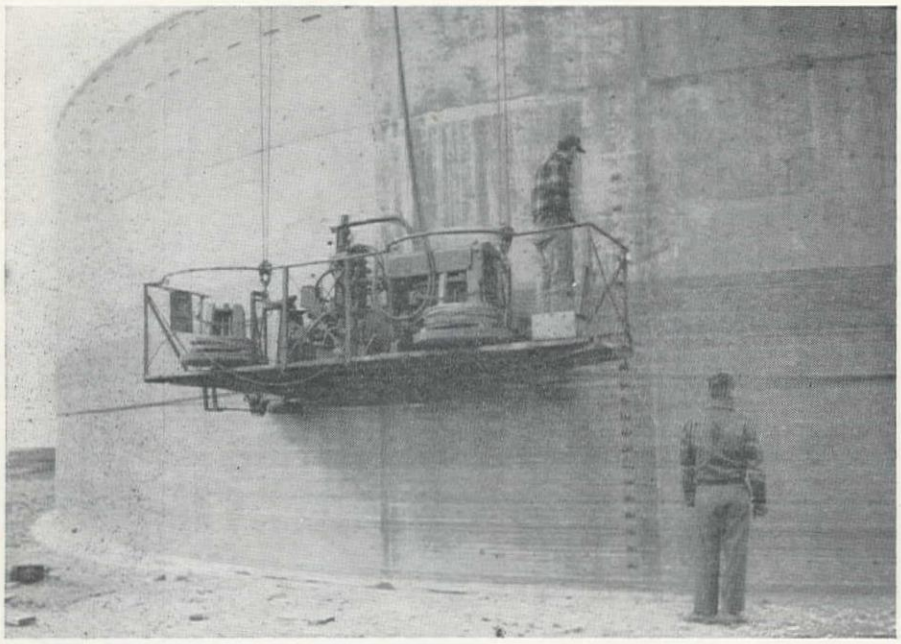
Lifting another coil of steel wire up to the wrapping machine which applies it as a continuous binding stressed to about 156,000 psi. The cylindrical concrete wall is stressed to about 500 psi. in compression.

Rod-prestressing

After the wall has been completed, and the concrete has reached the required strength of 3,000 lb. in 28 days, it is ready for prestressing. Usual procedure has been to apply ⅞-in. square steel bands made up of eight separate square bars threaded and tightened against a vertical steel beam. Spacing of these bands on the Peralta Reservoir started at 18 in. at the top and decreased to a minimum of between 4 and 5 in. at the bottom.

Tightened by the special shear-wrench, these bands were designed to be stressed at 30,500 psi. This stress corresponds to a minimum yield point of 55,000 psi. This prestressing was designed to develop not more than 500 psi. in the concrete shell. After stressing the bands are covered with a 2-in. thickness of gunite.

Then the 6-in. concrete floor slab is poured, and annular joint is sealed by a



PULLED ALONG by a driving sprocket on the chain placed around the reservoir, the machine moves at a speed of 9 ft. per second, and stretches the wire an amount equal to about 3⅛ in. per 50 ft.

special rubber-type water stop developed by the District.

Alternate bid called

In general, this was the design for the Peralta Reservoir, but as an alternative the District called for bids on wire-wrapping for stressing of the concrete shell in order to provide the same amount of initial prestress. Except for the different method of prestressing the design of the structure was not changed.

The bid schedule called for a lump sum to furnish and install the ⅞-in. square steel bands or to furnish an installed wire wrapping. The low bid figures for these two items were $4,300 for the first method and $3,000 for the second.

Just prior to prestressing the concrete dome roof was poured. The contractor elected to place three steel bands around the top of the wall and tightened them to close the top of the vertical joints. This temporary measure was carried out to insure against the possibility of grout running down into the wall joints. This would have prevented the proper closing of these joints in the final prestressing.

Wire wrapping

Wire wrapping was started nine days after the dome had been completed. At that time the dome concrete, which was mixed with high early strength cement, had reached a 7-day test of 2,500 psi.

Actual wrapping was carried out by The Preload Pacific Corp. under a subcontract. Procedure followed the well-established practice using a carriage which moved around the outside of the concrete wall supported on rubber tires running along the top. The machine is moved forward around the wall through a driving sprocket which engages a chain that is placed completely around the reservoir wall. Powered by gasoline engine, the unit moves forward pulling itself on the chain at a predetermined rate of speed.

Prior to wrapping, the District tested the wire to be used with the following results. Two tests were made on the wire of 0.162-in. diameter. The yield point average of the two tests was slightly more than 191,000 psi., with an ultimate strength of about 195,000 psi. Reduction in area in the test was approximately 35%.

Testing the stretch

As a preliminary to wrapping a field test was made on the reservoir which is referred to as a "snap back test" in this general operation. With the wire anchored on a vertical bar running up the outside of the reservoir five wraps of wire were made at the speed which was selected for this job. The wire was pulled through the die, reducing it to a diameter of 0.138 in. With this tension on the wire two scratches were made 50 ft. apart on the center wrap of the five. The tension on the wire was then released and a second measurement indicated that the 50-ft. section of stretched wire decreased 3⅛ in. in length. From this elongation placed on the wire during wrapping it was calculated that the wire had been stretched at about 156,000 psi. Such a compression on the tank was considered adequate to close the vertical pour joints in the wall, compress the concrete against the water load, allow for plastic flow in the concrete and to take care of any wear in the die during the wrapping process.

As a result of this calibration test, the speed of the wrapping machine was maintained at 9 ft. per sec. during the entire wrapping process.

As the wrapping advanced up the wall the operator clamped the wires to the vertical bar at about 6-in. intervals where the spacing was relatively small. Further up on the wall the clamp on the wire was taken at about 1-ft. vertical intervals. This precaution is to take care of possible loss in tension if the wire should break during the wrapping process. In case of breakage, which happened twice during this particular job, the operator returned to the last clamp and commenced rewinding from this point.

Rolls of wire were lifted up to the machine by a truck provided with an A-frame hoist. Splicing between rolls was done by inserting the ends of the wires in a patented steel clamp designed to provide a grip which tightens as tension is applied to the wire. Each roll of wire produces about 3,500 ft. of wrapping in place.

The initial layer of wrapping provided 480 turns around the reservoir and this operation was completed in two days.

The next operation was to cover this wrapping with gunite mixed with high early strength cement. This gunite was then screeded down to a thickness which would leave a thin film over the first layer of wire. Strength developed in this gunite sufficiently fast so that the second wrapping could be made the following day without injuring the gunite or having the second wrapping cut into it. The second layer of about 50 wraps concentrated in the lower 7 ft. of the wall was completed in about four hours.

It is interesting to note that at the conclusion of this entire wrapping operation the wear on the die was less than 0.001 in.

Wall joints close

Observation by the District inspector indicated that the vertical wall joints began to close up and the wall sections to slide in on the footing after about 60 wraps of the wire had been applied. These 60 wraps represented the winding on the lowest 2 ft. of the wall. At the completion of the wrapping all the vertical wall joints were tight as indicated by visual inspection.

Before the prestressing began, wedges of 2¼-in. thickness were placed in the 2⅜-in. groove between the inside of the wall and the floor slab. After the prestressing had been completed the wall had been drawn in and fitted snugly against these wedges indicating an inward movement of ⅛ in. This movement was similar to that which has been obtained by the method of band prestressing.

Personnel

R. C. Kennedy is Chief Engineer for the East Bay Municipal Utility District. J. W. Trahern is supervising civil engineer; G. W. Colby is construction engineer, and R. T. Tillotson was resident engineer on the project.

Contract was carried out by Elmer J. Freethy, El Cerrito, with Lloyd Vincent general superintendent. Wrapping was carried out under subcontract by The Preload Pacific Corp. of San Francisco.

THE UTAH state road commission is considering a proposed $210,000 wage hike for some 600 of its employees. The plan provides for 15c per hour raise for people in the affected categories and is designed to bring department wages up in accordance with increases in other branches of the government.

Inspecting Road- and Plant-Mix Jobs

Successful construction of bituminous surfacing is largely dependent on constant watching of operations, all the way from the sources of material to the laying of the finished product—Intelligent inspection produces specified results and aids the contractor's operations

By
LEW WULFF
Assistant Materials Engineer
California Division of Highways
San Francisco, Calif.

CONSIDERABLE TIME and thought are expended in preparing plans and specifications for road and street construction projects in order that the completed project will be satisfactory in every respect, physically and economically. The most comprehensive detailing of requirements will, however, be of little value unless compliance with them is controlled by proper inspection.

The specifications dictate

The minimum amount of inspection and control required is influenced by several factors. The most important of these are the completeness of the specifications, the experience and efficiency of the contractor's personnel, the condition and adequacy of the equipment used, the uniformity of quality of materials used and frequently the weather conditions at the time certain construction operations are performed. It is generally considered good practice, in the interest of economy, to write specifications which allow the use of alternate materials and methods within reasonable limits. In most cases, the desired end results are specified and it is provided that satisfactory fulfillment of the contract will be judged by the engineer. This means that an important part of job control rests on the qualifications of the engineer and his inspectors.

Qualifications are many

An inspector should have experience, good judgment, thorough knowledge of the specifications, the ability to make decisions quickly, sufficient confidence in his own ability to be firm in his decisions, integrity and the personality to maintain friendly yet businesslike relations with the contractor's representatives. A deficiency in any one of these seriously impairs the value of the inspector. Considerations mentioned up to this point concern inspection and control in general. The remainder of this article will cover inspection requirements for controlling the construction of subgrades, base courses and low-cost surfaces.

Rejection should be avoided

A difficulty in laying subgrades is that many of the smaller engineering organizations do not have testing equipment to determine the density at which soils and base courses are being placed. An experienced inspector can often tell whether or not a subgrade is capable of providing adequate support for surface courses. By observing the action of the rear wheels of heavily loaded equipment as it moves over the subgrade at walking speed, he can locate and mark the weak spots. Removing these weak spots may eliminate the need for ugly patches a few months after the street or road is placed in service.

Three decades ago, it was common practice to place high types of surfaces directly upon native soils which had little supporting value when saturated. Rapid deterioration and heavy maintenance costs followed. In the past 15 or 20 years this practice has been largely supplanted by that of using material from local deposits of ledge-rock or gravel.

The quality of base-course material should be thoroughly investigated at the source, and test requirements should be included in the specifications in order that the construction inspector may control the quality of material delivered to the project. Unsuitable material is present at nearly all sources in varying amounts.

The preliminary investigation must include testing of the poor material as well as the good in order that the inspector may familiarize himself with the source and be able to identify and select suitable material prior to the time it is taken.

Getting the right mix

Control tests take time, and considerable amounts of unsuitable material can sometimes be placed before test results become available. The inspector must be competent to judge the quality of material being delivered and have sufficient confidence in his judgment to reject unsuitable loads. Rejection of unsuitable material at the point of delivery sometimes results in embarrassing disputes which might have been avoided had the inspector made frequent trips to the source. By so doing he can sometimes anticipate changes in quality. In some instances, where quality of material changes rapidly, it is advisable to station an inspector at the source, because the shovel operator is being paid to load trucks, not to select material.

More expensive types of base rocks are manufactured by commercial plants and are usually controlled by more definite specifications. These sources require varying degrees of inspection dependent upon quality of the parent material and adequacy of the plant equipment and operation. Usually, preliminary tests and routine check tests, combined with the street inspector's examination of the material visually and by feel, are sufficient.

Although plant-mix bituminous surfacing still remains in the low-cost classification, it is probably now accounting for more dollars than any other road-construction item. Close inspection of the manufacture and placing of this material is of great importance on all projects, large and small.

Control at the plant

The essential properties which a bituminous mixture should possess are: workability, durability, stability and nonskid texture. Workability depends on gradation of the aggregate, amount of bituminous binder used and temperature of the mixture. Durability depends on soundness of the aggregate and the amount and character of the bituminous binder. Stability depends mainly on the amount of bituminous binder if aggregate gradation is kept within the limits usually specified. Texture depends on aggregate gradation. The plant inspector must determine the best proportions of aggregates and binder to be used within the specification tolerances and then control the mixing and proportioning operations to the end that the product maintains uniformity.

The majority of the paving plants in operation in California are permanent installations and proportion the mixture by weight. The important differences to be found in these installations are in the method of feeding the cold aggregate, the capacity of the plant and the dust-

ABOUT THIS ARTICLE—

TO PROTECT the millions of dollars expended on highway construction, the results of the field operations must match the objective set in the engineer's specifications. On bituminous street and highway work the key to this control is held in the hands of the one or more engineering inspectors who must be responsible for the quality of the materials and the adequacy of the field procedure.

Much has been written on the subject of field inspection but Mr. Wulff has presented a step-by-step guide which covers the points where control is most essential. The value of the discussion deserves a wider audience than those able to attend the annual street and road conference of the Institute of Transportation and Traffic Engineering, held in Berkeley last month.

—Editor.

control procedure. The production of the combined mix requires a series of processes to be carried out in an orderly manner and according to certain specifications. It is the plant inspector's responsibility to control the entire operation within the limits of his authority and to assist the contractor in every way possible to obtain the best results economically and efficiently. Only an experienced inspector can determine whether or not the materials used, the methods employed and the end product are the best that may be attained at any plant facility that might be used. For this reason, the duties of the inspector will be discussed in some detail.

1. **Aggregates.** The aggregates to be used should be checked for gradation, cleanliness and soundness. Preliminary tests are of considerable value when available. Handling and stockpiling of aggregates should be done in a manner that prevents segregation.

2. **Feeding the Cold Aggregates.** The inspector should, in cooperation with the plant superintendent, set the proper rate of flow of cold aggregates to the drier. The rate of feed must be consistent with the capacity of the drier and the classifying screens. At those plants which stockpile several sizes of aggregates over a tunnel it is possible to adjust the rate of feed of each size so that the combined gradation will closely match that of the designed mix. This feature eliminates almost entirely the necessity for wasting heated aggregates and thereby eases the work of the inspector.

3. **The Drier.** The function of the drier is to remove the moisture from the aggregate and to heat the aggregate to the temperature desired to produce a workable mix, but not so hot that the bituminous binder is damaged. The inspector should check the temperature of the heated aggregates by means of an armored thermometer.

4. **Classifying Screens.** The inspector should check the sizes and areas of the screens. The screens should be clean and free of breaks. Overloading of the screens causes fine material to run into the coarse-bin sizes. This is not serious if the overrun is uniform throughout the day. However, the practice of overloading should be discouraged.

5. **Proportioning.** It is the inspector's duty to run at least two sieve analyses per day of the material in each of the plant bins and to compute the weights to be used in combining the several bin sizes. As mentioned before, the combination should be the best obtainable within the range of the specification limits. Care should be taken to obtain representative samples, and sieve analyses which indicate a radical change in the combination should be scanned very carefully. The change might be a temporary condition or, on the other hand, a permanent one caused by a change in gradation of the cold aggregate.

The amount of asphaltic binder should be near that amount indicated by preliminary tests or that amount used in previous mixtures known to have been satisfactory. The exact amount will change with gradation of the aggregate, and the plant inspector must use his experience and judgment to fix the exact amount of bitumen required to produce the best mixture obtainable.

The scales used in weighing the aggregates and particularly the bitumen should be checked for accuracy.

The inspector may make the check closely enough by comparison with the platform scale weights of trucks loaded with the completed mixture.

The oil scales must be checked by using known weights.

6. **Mixing.** An experienced inspector can judge whether or not satisfactory mixing is being done. If he is not satisfied with the uniformity of texture and color throughout the mix, a check should be made of the setting and condition of the paddles, the time the material is in the mixer, and whether or not the mixer is being loaded beyond its rated capacity.

7. **Dust Control.** Most plant installations are equipped with means for collecting the dust which rises in the drier stack and, in some instances, the dust rising from the classifying screens is collected.

If all the dust is required in the combined mixture it is fed back to the heated aggregate elevator. When there is an excess of dust, the inspector determines the amounts to be wasted or returned to the bins.

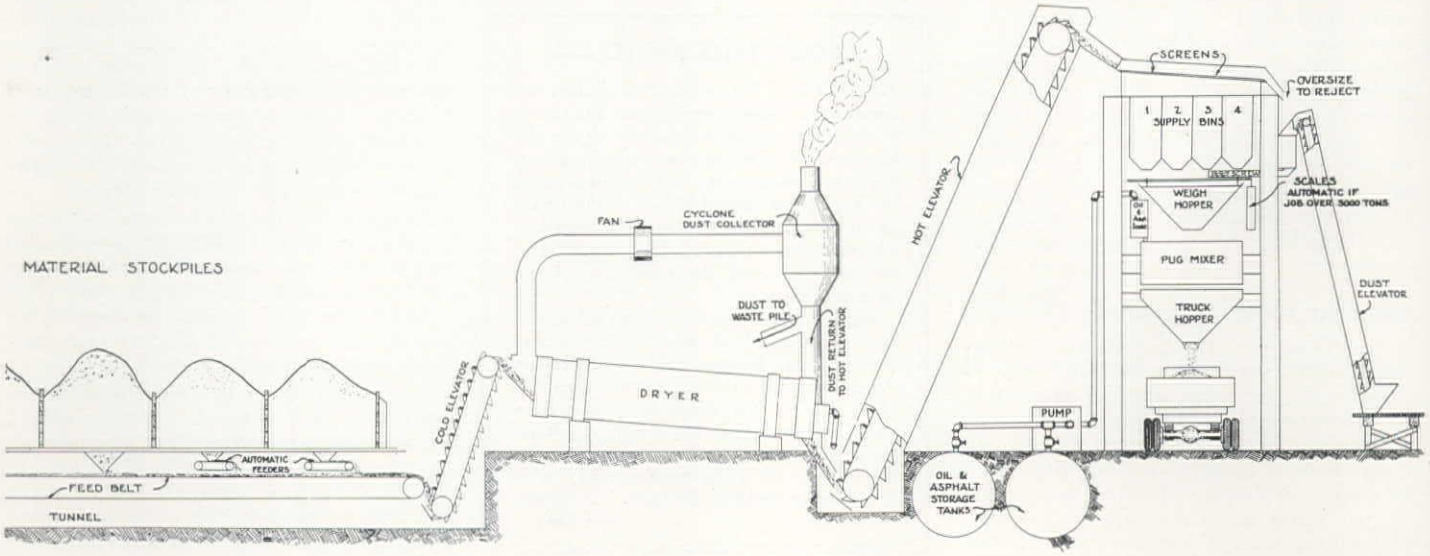
8. **Mixture Control.** When the inspector is not occupied with routine duties he should station himself on the operator's platform and observe the proportioning, mixing, and the general appearance and behavior of the mixture as it is discharged into the trucks. He must be capable of determining when the mixture is definitely unacceptable and reject such material before it is delivered to the street. As mentioned previously, rejection of unsuitable material at the source usually eliminates embarrassing disputes. At the end of each day he should make out a report giving all essential data such as:

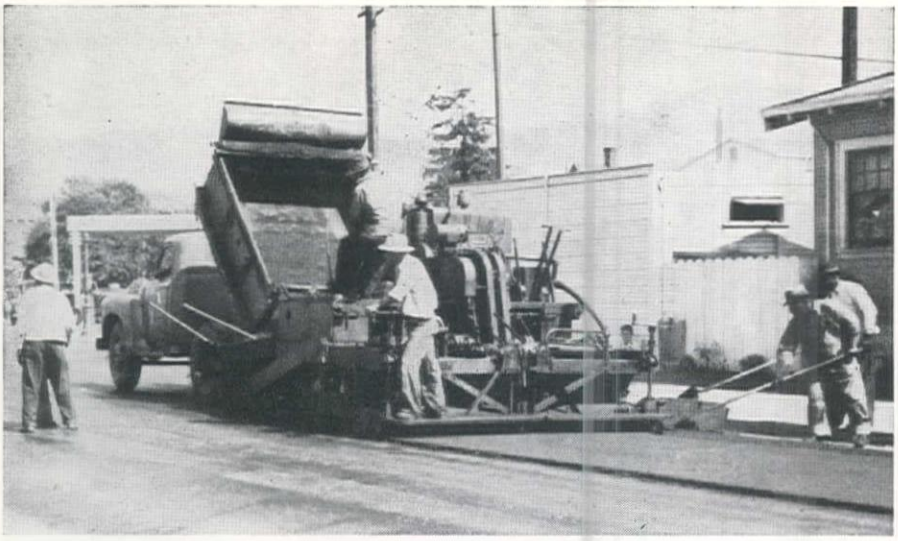
(a) Origin of materials
(b) Proportions of materials used
(c) Mechanical analysis tests made at plant
(d) Temperatures of mixture ingredients and finished mixture
(e) Total output in tons
(f) Where material was placed
(g) Reasons for delays or shutdowns

9. **Placing and Compacting.** The field inspector or, as he is more commonly known, the street inspector must be familiar with the various types of equipment used in spreading and compacting asphaltic surfacing and be able to judge whether or not the equipment is in proper mechanical condition to do a satisfactory job. When the work is begun he should observe closely the work-

Diagrammatic Sketch of Plant Installation Used in Production of Hot Bituminous Mixtures

WATCH THESE POINTS: Rate of feed, temperature of dried aggregate, load on the screens, grading in the bins, weight of materials, scales for the bitumen, appearance of the mix, condition of the mixer, handling of the dust, and the actual feeding of materials by the operator.





FIELD INSPECTION includes check on the workmanship of the contractor's crew, the condition of the mix on arrival, and the operation and adjustment of the equipment.

manship of the contractor's crew, the behavior of the mixture, check the rate of spread and then determine what minor adjustments in the design of the mixture and methods of handling are to be made to produce satisfactory results.

From field-to-plant

Requests for minor changes in the mixture coming from the plant are readily transmitted from the street inspector to the plant by the use of notes sent via the truck drivers. Only an experienced inspector is capable of determining whether or not the best results are being attained. The type of compacting equipment used is usually specified. The inspector must determine the time that rollers should begin work and the length of time compacting should be carried on. This will vary according to the grade of asphaltic binder used, the temperature of the mixture, and the thickness that the mixture is being placed.

In summarizing, the minimum inspection required when plant-mixed surfacing is being used consists of an experienced plant inspector and an experienced street inspector working in close cooperation with each other and the contractor's representatives.

Mixed-in-place jobs

The field inspection of mixed-in-place surfacings is similar in many respects to the inspection described in the foregoing paragraphs, but it requires more experience and judgment. The aggregates must be aerated to reduce the moisture content, the aggregate must be sized into a uniform windrow, the asphaltic binder must be added in the proper amount, mixing must be continued until the mixture is uniform in color and consistency and aeration or manipulation of the mixture must be carried on until the volatile material has been reduced sufficiently to allow spreading and compacting to begin. Weather greatly affects this type of work, and quite often the operations have to be scheduled to suit the temperature changes during the day. One good inspector can handle the inspecting duties required on this type of work under ordinary circumstances.

Armor and seal coats should be placed during fair weather. The only exceptions would be in cases where it is necessary to save a bituminous surfacing.

Judgment required

The inspector's duties on this type of work are to judge whether or not the aggregates conform with the specifications and to determine the proper rate of spread of the aggregates and bituminous mixture. The rate of spread will vary with the gradation of the aggregate, the shape of the aggregate particles, the texture of the original surface and the type of bituminous material being used. The exact rate of spread within the specification limits must necessarily be determined by trial as judged by a capable inspector.

The rate of spread of the aggregate is controlled very easily when an approved type of spreader box is used. The rate of spread of the bituminous material may sometimes be easily controlled, but at other times control may be very difficult. The asphalt distributor is a highly efficient machine when in good mechanical condition and when operated by experienced workmen.

Distributor is the key

Before any work is begun, the distributor should be carefully examined. It should be equipped with a tachometer, a pressure gage in the cab, a pressure gage at the rear, a full-circulating boot, clean nozzles of proper size and type and an accurate stick gage to measure the quantity of material in the tank. The control valves should be operated from the rear platform by a "boot man." A hand spray must be provided to take care of skips and odd-shaped areas.

After the inspector is satisfied that the equipment is satisfactory and the entire crew is properly organized, a short spread is made. The inspector must quickly observe the results and decide on rates of spread, changes in speed of the distributor, pressure at which the bituminous binder is being spread, height of the spray bar and any other factor which may be contributing to less than satisfactory results.

One experienced inspector can normally handle all inspection details required on this type of work.

Inspection saves money

Intelligent inspection by experienced personnel, necessary on all construction projects, is important in street and road surfacing work because of the funds involved, the number of variables encountered and the shortcomings in equipment or experience of some of the contracting organizations. Good inspection procedures can save money, assist the contractor and assure satisfactory completion.

Men Invited to Join Reserve Engineer Brigade

FORMATION of the 499th Engineering Brigade, an army reserve unit, under the sponsorship of the San Francisco Chapter of the Associated General Contractors, has been announced.

The reserve unit, first in the nation to be sponsored by an AGC chapter, will have its headquarters at the San Francisco Presidio. Charles MacClosky, a Colonel in the army reserve, will command the brigade. MacClosky served with an engineering unit in the South Pacific during World War II.

At present the initial cadre, Brigade Headquarters, is being formed with 78 of the 212 officers and enlisted men of the company recruited to date.

With the completion of the initial cadre the main section of the Brigade will be filled. When completed the brigade will have a total strength aggregating approximately 12,000 men.

An invitation has been extended to all construction men, contractors and engineers to join the new unit. Construction men in other branches of the military reserve may transfer to this brigade, MacClosky said.

Additional information on the unit may be secured from the San Francisco Chapter of the AGC or MacClosky at the Charles MacClosky Co., San Francisco.

Reclaiming of Water From Hyperion Sewer Plant Urged

LOS ANGELES City Engineer Lloyd Aldrich has urged the board of public works to take steps immediately to reclaim for domestic use the millions of gallons of water spilled into the ocean daily from the Hyperion sewage plant. Aldrich estimated that more than 200,000,000 gallons could be reclaimed daily at an initial cost of $22,000,000. The city engineer proposed that the water be piped to spreading grounds near El Segundo, and to San Fernando Valley, where it would percolate into the underground water storage basin and be pumped back into use. Annual operating cost for the plan would approximate $2,500,000.

Narrow Strip Available for Viaduct Requires—

Use of Dike Road for Working Area

Excess dirt bulldozed into lake for dike road to provide work area—Foundations below lake level call for operational speed to eliminate expensive sheeting and lagging for bank support—Balustrade of pre-cast posts requires special forming

LACK of working space and installation of footings several feet below the level of an adjoining lake without an extensive operation of sheathing and lagging for bank support were the major problems facing the Charles MacClosky Company, San Francisco, during the construction of Oakland's Frickstad Viaduct.

Constructed on a $311,612 contract the new viaduct is the first unit in the master plan for Oakland's new civic center. Considered an excellent example of architectural engineering it is named in honor of its designer, Walter N. Frickstad, former Oakland City Engineer.

The structure consists of a reinforced slab, 40 ft. wide and 90 ft. between expansion joints, curving approximately 1,000 ft. around the shore of Lake Merritt. The slab is supported by 42 concrete piers resting on pile foundations.

Limited working area

At the outset the limited working area was realized. On the south side of the site was a principal traffic artery with a constant flow of vehicles. On the north side of the site was the lake. Due to the curvature of the lake and parallel street, part of the site was inaccessible from a construction standpoint. The construction area was a tidal mud flat with the lake shore about where the center line of the new structure would be located.

Using bulldozers, the entire site area was graded with a drainage slope towards the lake. All excess dirt was pushed to the lake, spread and used to construct a dike and construction road on the lake side of the site. This dike road was used as haul road and working space throughout the construction.

To eliminate the need for sheathing and lagging to provide bank support during the excavation and subsequent pile driving, forming and pouring of footings, the MacClosky Company took advantage of the fact that the heavy gumbo soil did not permit much seepage. Speed and teamwork were the keys to carrying out operational steps.

Pile foundations

Working from the dike road a crawler crane excavated the 6-ft. deep trenches for the next step of pile driving. Using a skid mounted rig the crew drove piles in the trenches to a bearing capacity averaging 35 tons and a depth of about 80 ft. deep.

As soon as the last pile in each of the 42 trenches was driven it was mucked out and pumped. Piles were cut off to grade while a crew completed trimming the excavation and placed the forms for concrete. The reinforcing steel for the footings, which had been made up in prefabricated cages, was lowered into place in the forms and concrete poured. Forms for the footings were prefabricated and moved ahead from one pier to the next.

Production line methods kept all crews occupied throughout the operation and several footings were often completed in a single shift. There was no time lag between operations.

During the pile driving operation the adjacent lake was utilized to transport piles to the trenches. More than 66,000 lineal feet of piling was used in the viaduct.

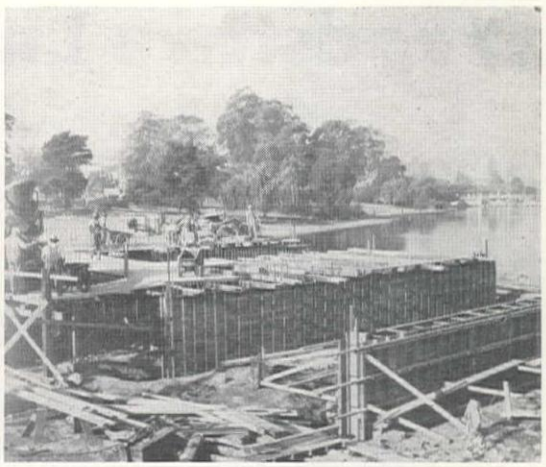
Pier and deck forming

Following the installation of the footings a second crew erected forms for the piers. Six sets of forms made of plywood panels were used. To maintain the continuous operation forms were stripped and moved ahead as soon as possible following each pour. Work on the foundations and piers was rapidly executed to have them completed before the wet season.

The falsework for deck bents consisted of rows of 8 x 8 in. timber posts running parallel to the piers. Two rows, one on each side of the pier were bedded

PICTURED AT TOP OF PAGE—

Viaduct construction proceeds on narrow strip between lake and traffic artery. Dike road built from excess dirt during site grading provided work area at left.



LEFT — Operational sequence in viaduct construction seen as crew erects forms for piers behind pile driver. Pile-caps have already been poured in area between crew and first row of piles in picture. Production line method provided speed needed to cut costly bank support.

RIGHT—Buggying concrete where piers were too wide to be reached by truck crane.

on the concrete footings and a supplemental row was set on wood cribbing mid-way between the piers.

To give intermediate support to the 22-ft. deck span each bent was capped with two laminated 9 x 16-in. timbers. To maintain camber and super-elevation in the 15-in. thickness of deck, all posts were precut to proper individual heights. The deck elevation varied from 5 ft. to more than 10 ft. above ground level. This falsework was topped with 2 x 12-in. joists covered with a plywood deck.

Each reinforced deck pour was approximately 40 ft. wide and 90 ft. between the expansion joints and contained up to 220 cu. yd. of concrete. About 10,620 lb. of bronze bearing plates were used in the expansion joints.

Balustrade

The architectural design of the structure called for a 1,480 ft. balustrade with round posts, base and cap to run along both edges of the deck. To achieve the proper effect the 8-in. diameter posts were pre-cast with reinforcing rods protruding from each end. Extreme care and precision work on the part of the sub-contractor for the balustrade, Sam Moe, Danville, was required to set the posts plumb and on line.

The outside form, laminated plywood with a masonite surface, was anchored to the deck overhang on 4-ft. centers and built up. The protruding rods were set on the deck and a template with holes to space the posts 2½ in. apart slipped over them and attached to the form. A timber was then anchored to the deck to provide a back brace. After the posts were set the forms for base and cap were completed and poured. By using this method the posts were securely anchored.

D. J. BRESSI supervised completion of Oakland's Frickstad Viaduct for Charles MacClosky Co.

The architectural design also called for a continuous curtain wall with a fluted surface to cover the vertical area from deck to ground line. The fluted surface was obtained by using 2½-in. half round moulding spaced at short intervals on a plywood back form.

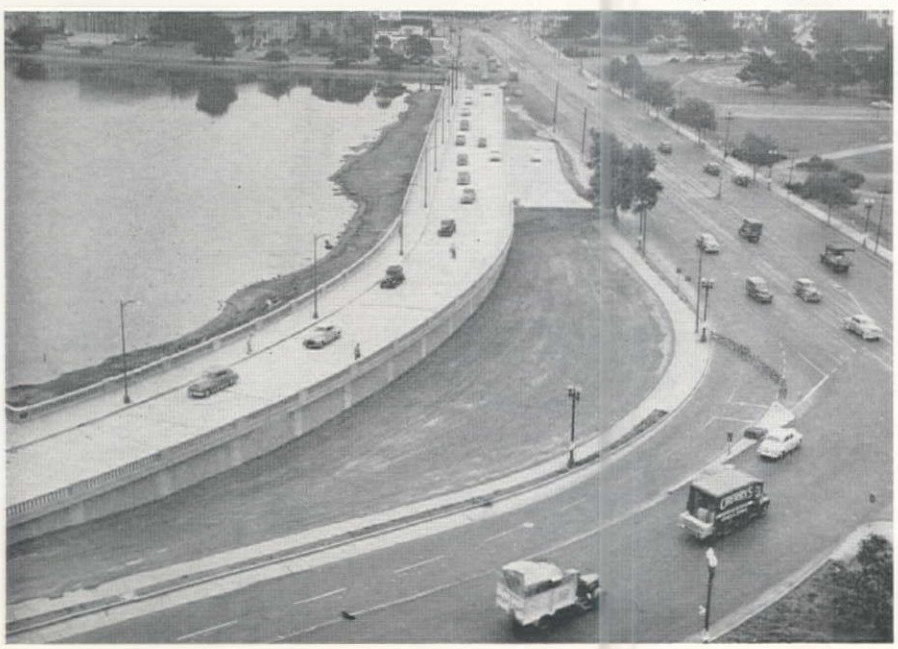
The 4,200 cu. yd. of transit-mix concrete used was placed primarily by truck crane and bucket.

Personnel

D. J. Bressi was field superintendent for the MacClosky Company; John A. Morin, supervising engineer for the City of Oakland; Sam Moe, sub-contractor for balustrade; and Raymond Concrete Pile Company, pile driving sub-contractor.

TRAFFIC MOVES over completed unit. Future plans call for an overpass to bridge street in foreground and connect to wide section of viaduct.

Oakland Tribune Photograph



BPR Tells Where to Find Data on Highway Finance

THE BUREAU of Public Roads has just published a "Selected Bibliography on Highway Finance," which provides nearly 1,400 annotated references, for the years 1939-49, in the field of highway taxation and finance in the United States. Emphasis is placed chiefly on theory, but basic sources of pertinent statistics are included.

The bibliography may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C., at 55 cents a copy.

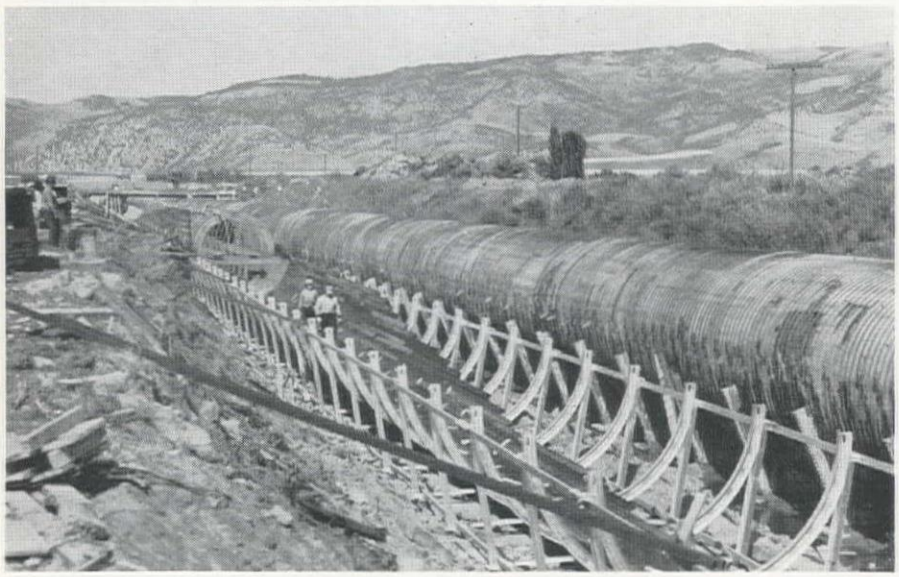
The search for solutions to the problems currently encountered by all levels of government in obtaining adequate revenues for highway operation and capital outlay has intensified the value of all types of information on finance. The booklet is the complete key to this need.

The references in the bibliography are arranged according to a useful classification scheme under seven major topics—general discussions, taxation, expenditures, borrowing, financial programs and plans, miscellaneous topics, and statistics. These major topics are suitably subdivided and cross referenced. Both geographical and author indexes are included in the publication.

Brief annotations accompany most entries to indicate the general nature of content, but evaluation of importance, accuracy, or validity has not been attempted.

While the bibliography covers intensively the years 1939-49, a limited number of significant references from earlier years are also included.

Woodstave Line Replacement Record



LOWER SECTION of the specially designed ring-type saddles in position at 8-foot spacing. Wood-stave placing is shown under way in the bottom of the saddles.

Contractor completes replacement of a 6,000-ft. section in 43 days on Idaho power project. Specially designed steel ring-type saddles reduce costs and stave thickness from 3¾ to 2⅞ in.

By HORACE GARDNER
Associate Engineer
Utah Power & Light Co.
Salt Lake City

REPLACEMENT of a 6,000-ft. section of 11 ft. 2 in. ID wood stave pipe flow line for the Grace hydroelectric plant (44,000 kw.) is another step in the Utah Power & Light Company's $61,000,000 five-year program to insure abundant power and good service to customers during peace or war. The pipe line can carry approximately 1,000 sec. ft. of water from a timber crib dam on the Bear River near Grace, Idaho, approximately 5 miles to the Grace Hydro Station where it is returned to the original river channel.

Steel saddles used

Faced with rising costs and an extensive expansion program, Utah Power & Light Company engineers were confronted with the problem of building an inexpensive replacement pipe line which would also give a long life as well as dependable service. The original pipe was supported on a concrete saddle formed and poured to the curvature of the pipe. To reduce the replacement costs of the expensive concrete saddles a steel ring type design, which is generally used on steel pipes but seldom used on wood stave lines, was specially designed by the company engineers.

This type of saddle holds the pipe in a circular shape and overcomes the tendency of the pipe to assume an elliptical cross section. Due to the fact that the section modulus of pipe is increased when held in circular shape, it was possible to reduce thickness of staves from 3¾ in. to 2⅞ in. or a savings on lumber of 24%.

SPECIAL BULKHEADS installed at both ends of the replacement section to keep the rest of the line from drying out while the new section was being built. The line is of 11 ft., 2 in. I.D. and special templates were used during erection to maintain true shape.

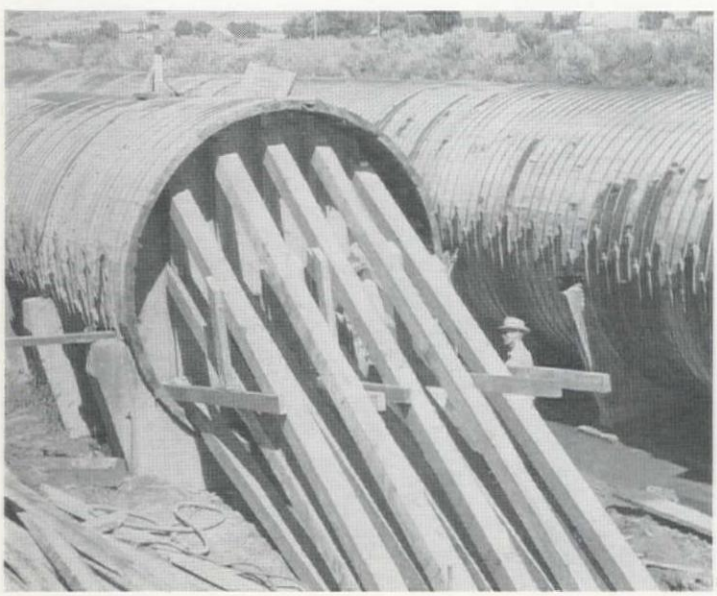
The ring type saddles were made up in two sections and spaced at 8-ft. intervals. The upper section is a rolled semicircular 5-in., 10# I-beam, and the lower section a 5-in., 10# I-beam welded to two 6-in., 12.5# I-beams which serve as supporting legs. The saddles were manufactured by Steel Engineers Co., Salt Lake City.

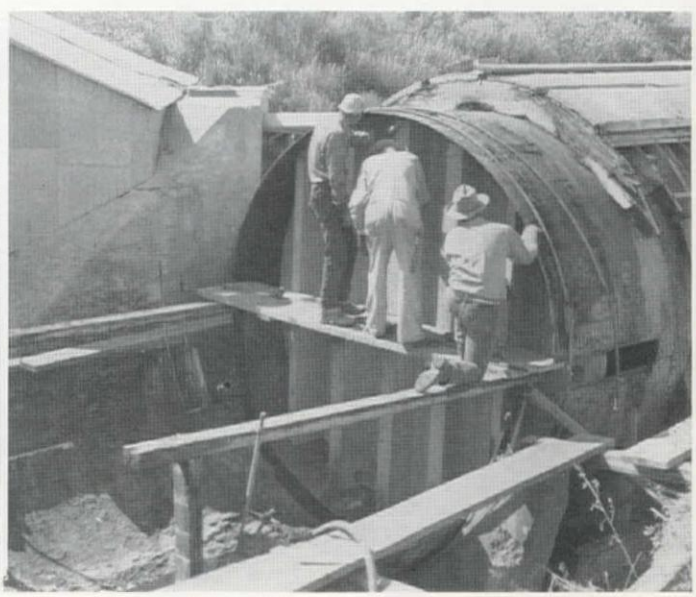
The staves are a creosoted, sound, medium-grain Douglas fir, accurately milled to shape and dimensions to insure a round watertight pipe when assembled.

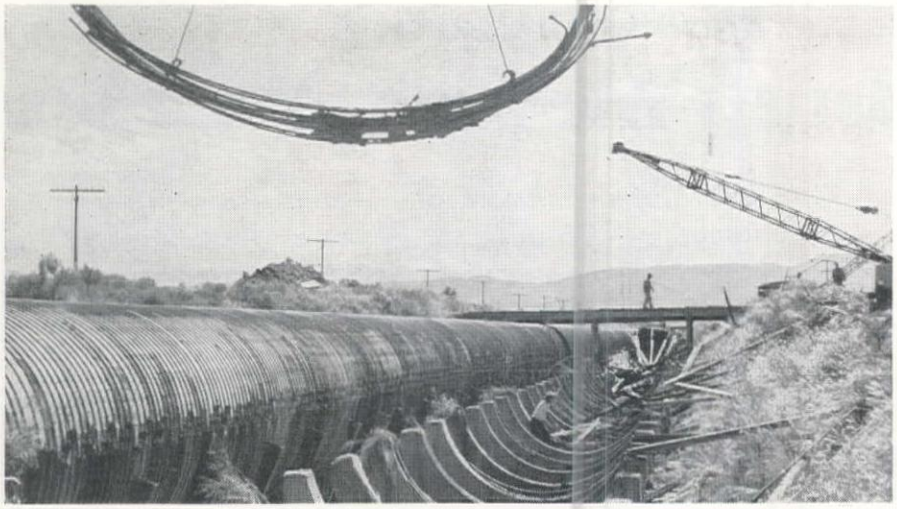
Contractor's operations

Morrison-Knudsen Co. was the contractor for the removal of the old wood pipe and concrete saddles, and the installation of the new 11 ft. 2 in. ID wood stave pipe.

To begin the work, specially designed bulkheads were installed at the upper end and lower end of the 6,000-ft. section. The purpose of the upper bulkhead was to keep the old portion of the pipe filled with water to prevent deterioration from drying out. The lower bulkhead was to keep the station operating during construction of the new pipe. Installa-







DISMANTLING of the staves and bands in the old line was scheduled to take 11 days, but the contractor organized a crew which carried out the job in only 3½ days.

tion and removal of these bulkheads was accomplished with utmost speed since it was imperative to refill the remainder of the pipe to prevent the staves from drying out.

Tight working schedule

The contractor worked under a very tight time schedule. Construction of the 6,000 ft. of pipe was to be completed within 43 days from July 29, 1950, when the pipe was drained. The contractor had a crew of approximately 175 men working in two shifts. Each day's construction schedule called for approximately 400 ft. of completed pipe.

It was estimated that the dismantling of the staves and bands of the old pipe would take 11 days. With crane equipment and a well organized crew, the contractor was able to make a record time of 3½ days in dismantling the old pipe.

Lumber was culled on the job, transported and stacked along the pipe grade in proper sizes to insure even distribution of all lengths. The continuous wood stave pipe was erected on the lower section of the steel saddles after the saddles had been properly aligned and shimmed to a final grade of 1½%. It is interesting to note that the survey crew located a permanent centerline on the existing concrete saddle sub-bases with a "Ramset" gun.

There were no unusual features in the assembly of the wood stave pipe except that special templates were used due to the large diameter of the pipe, which insured a truly circular shape and a smooth inner and outer surface.

Adjusting the bands

To take care of natural swelling of the wood, one of the most important steps following completion of the pipe, was to fill the line and properly loosen the bands. Water was gradually admitted to the pipe and for the first few days, the company engineers and contractor continually inspected the pipe for leaks which were not stopped in due time from swelling of staves. After the pipe had been filled and leaks caulked, the contractor maintained an adequate force 24 hrs. a day over a 10-day period to loosen bands and bolts as they started to crush into the wood.

Through the cooperation of the engineers and contractor, the salvage of steel bands, malleable iron shoes, and reuse of concrete saddle sub-base as the footing for the new steel ring type saddles, resulted in holding the total cost of the job to about $400,000.

The old pipe was installed in 1913.

Reclamation Construction Reaches Record in 1950

RECLAMATION construction in 17 Western States for the fiscal year 1950 reached the highest total in the 48-year history of the Bureau of Reclamation, according to the Secretary of the Interior's 1950 annual report to the President. The report shows that in the $387,000,000 Reclamation program, $277,000,000 in construction work was completed during the fiscal year. Some 900 new construction and supply contracts were awarded, totaling nearly $140,000,000.

Among the important projects completed during the year were four dams on the Missouri River Basin Project, two dams on the Columbia Basin Project, the Tracy pumping plant structure and large sections of the Delta-Mendota and Friant-Kern Canals of the Central Valley Project, and Granby Dam, which forms the main reservoir for the Colorado-Big Thompson Project.

Noted by Secretary Chapman as outstanding Reclamation accomplishments during the year were the following:

The Heart Butte, Angostura, Medicine Creek and Enders Dams on the Missouri River Basin Project, two of which were completed well in advance of construction schedules. Heart Butte was turned over to the Government by the private contractor 11 months before the deadline, and Medicine Creek almost two years in advance of the scheduled completion date.

Records were set at Bonny Dam, Missouri River Basin Project, in November 1949 for both excavation and earth placing, when 1,280,000 cu. yd. were excavated, and 1,100,000 cu. yd. of earth embankment were placed.

The Hungry Horse Dam in Montana, the largest Bureau of Reclamation dam under construction, set a record for concrete placing in June of 123,000 cu. yd.

The most critical rescue performance of the year was on the Grand Valley Project in Colorado. The 1914-built Tunnel No. 3 collapsed on March 9, 1950, imperiling the crops on 29,000 ac. of land. Within a week of the tunnel's collapse, a contract was awarded to drill a new opening. In one month and 11 days, the new tunnel was through—a month ahead of schedule—to rescue the Grand Valley farmers.

On the Columbia Basin Project in central Washington, the Grand Coulee Dam pumping plant was advanced to 83% completed during the year, within only 54% of the contract time. The Soap Lake Siphon on the same project was 80% complete, with only 55% elapsed time.

On June 30, 1950, the first unit of the Kortes power plant began to generate the first power on the Missouri River Basin Project. The Kortes Dam and power plant was 85% completed, despite a severe winter and other retarding conditions.

Among the biggest contracts let during the year, were the Olympus and Pole Hill Tunnels on the Colorado-Big Thompson Project, Colorado, $4,787,874; the Tecolote Tunnel, Cachuma, Calif., $4,750,455; Trenton Dam, Missouri River Basin, Neb., $4,726,557; and Duchesne Diversion Dam and Tunnel, Provo River Project, Utah, $4,379,961.

Everything from the use of fly ash in concrete to radioisotopes for tracing migrating weed seeds has been studied by the Bureau of Reclamation during the past year in developing the water resources of the West.

Fly ash, a waste product from steam power plants which use pulverized coal as fuel, has been used successfully to insure a better quality of concrete where the aggregate is reactive with alkalies. It is being used in the construction of Hungry Horse Dam, the largest Bureau of Reclamation dam under construction, and the Canyon Ferry Dam, both in Montana.

The use of radioactive tracer techniques to study weed control has been developed in Bureau laboratories with the guidance of a scientist trained at the Atomic Energy Commission's laboratories in Oak Ridge, Tenn.

A five-million pound universal testing machine was installed in the Denver research laboratories to determine the strength and elasticity of building materials. The machine is capable of tearing apart huge sheets of steel, crushing blocks of concrete, or of performing as delicate a task as cracking a watch crystal without otherwise impairing the mechanism.

Silt deposition and sedimentation studies are providing information which will be used to lengthen the useful lifespan of reservoirs of the Bureau's dams. The studies have already indicated a greater lifespan than previously estimated for some of the biggest reservoirs.

Western Washington's Roadside Brush Controlled by a—

Heavy-Duty Brush Mowing Machine

One operator does work of 25 men using hand cutting tools — 16 miles of highway roadside is considered good day's work — Relief valve on bar kicks out when rocks, stumps encountered

By K. G. MILLER
Associate Highway Engineer
Washington Department of Highways

IN WESTERN Washington the cutting of brush along highways is a never-ending maintenance problem. Rapid growth of brush in the counties west of the Cascade Range created a particularly serious problem during and since the war for the Washington Department of Highways. Prior to the war most of this type of maintenance work was hand work, but today the Department operates three heavy-duty brush mowing machines.

Manpower not enough

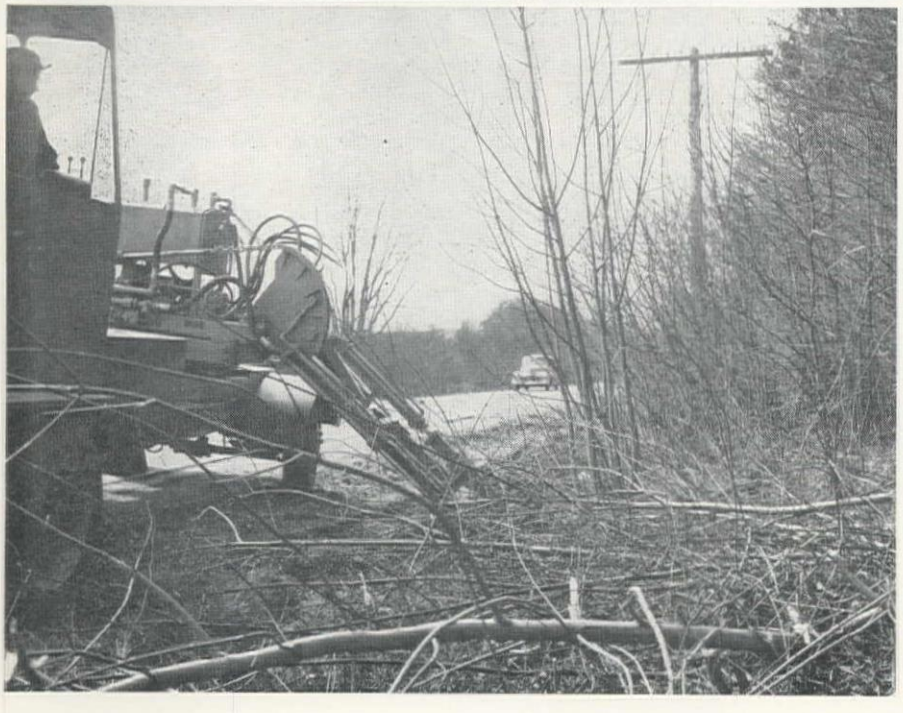
During the war years the cutting of brush along the sides of Washington highways was neglected due to the obvious lack of man power. Brush and trees made serious inroads on slopes and ditches. Following the war hand cutting was resumed but it was found uneconomical, in fact almost impossible, to control the accumulation and the new growth by this means. Development of a machine for mowing heavy brush provided the needed answer to the problem.

The machine

A heavy duty brush cutting machine was put on the market in the summer of 1947, and has proven of great value in our maintenance operations. Jointed arms and extending track and pistons allow the cutting bar to operate in 120 deg. of arc horizontally. It has a vertical and horizontal reach of 18 ft. and can cut on any contour over and behind guard rail, down the sides of embankments, in the ditches, up the slopes or over the top of slopes. All controls are hydraulically operated.

It is a one-man operation including the forward progress of the mobile unit. Road speed of the unit is the legal driving speed. We have found it advisable to add one man to the crew of each unit to clear the cutter bar at times and to cut oversize brush and remove obstructions. The machine cuts fairly heavy brush and saplings up to 2½ in. in diameter at the rate of 1½ to 2 miles per hour. Brush up to 3½ in. in diameter may be cut by slowing down the forward progress.

TOP—Hydraulically-operated cutting arm reaches up embankment to mow heavy brush and saplings up to 2½ inches in diameter at rate of 1½ to 2 miles per hour. BOTTOM—Cutter operates at road level.



Eight miles of highway per day

One swath on each side of 8 miles of highway is considered a good day's run. The rate of cut and efficiency of the operation is largely contingent on the aptness and experience of the operator. A well qualified operator may be expected to do the work of 25 to 30 men using hand tools. Another factor in a day's production is whether or not there are hidden obstructions such as stumps and boulders in the brush.

A number of our secondary roads were not originally cleared and grubbed to present state standards and obstructions form a hazard in brush cutting operations. A relief valve on the power end of the cutter bar allows that section to kick out and fold back when the bar comes in contact with such obstacles.

Experiments with chemical sprays

A few years ago the Department conducted a number of experiments in killing the growing brush by various chemical sprays. These experiments proved quite successful in achieving the kill. However, the resultant standing dead brush was very unsightly and was the subject for considerable criticism by motorists and local property holders. Then, too, the dead brush must still be cut and disposed of. Cutting and burning the dead brush was found to be more costly than in the live state. The present policy is to mow the brush while it is alive.

In some sections and on certain types of growth a fairly good percentage of kill is achieved by this operation alone. In other sections the kill on the same type of plant life would be negligible. The most economical and satisfactory method seems to be to cut the brush as

WITH HYDRAULIC cutting attachment folded back over its frame, brush cutting machine goes from job to job at legal road speeds. Cutting bar is held at front of wide vision cab by special bracket.

low as possible and when new shoots develop on the stubs they are treated with a chemical spray. The percentage of kill by this process is quite satisfactory.

Cost comparisons

Costs, and especially comparative costs of mechanical vs. hand operations, are difficult to obtain for several reasons. Hand cutting was always a spotted, intermittent chore, accomplished by regular patrol crews, augmented occasionally with temporary help. It included widening for sight distance, removal of dangerous trees and other clearing, not at all comparative with straight mechanical brush mowing.

To date conclusive costs on mechanical operation are also difficult to obtain due to the spotted nature of the work. Further, numerous delays are met in initial mowing operations because of obstructions which have no effect on hand operations. These obstructions, principally stumps, rocks, logs and oversize growth will gradually be eliminated as mechanical cutting is continued and costs should consequently diminish. In all, it appears that mechanical operations in many areas are well justified from a cost angle.

W. A. Bugge is director of the Washington Department of Highways, and R. P. Newland is Maintenance Engineer.

Corps of Engineers Wants Civilians for Overseas Work

DISTRICT OFFICES of the Corps of Engineers have been directed to recruit civilian employees for work with the Corps of Engineers in important overseas areas. Vacancies exist in Okinawa, Japan, Guam, Austria, Germany, France, Trieste and Turkey. In general the positions cover engineers, engineering aides, draftsmen, inspectors, construction superintendents, equipment and diesel power mechanics, property and supply, repair and utility foremen.

Qualification requirements for overseas positions are the same as those for the United States. In the age group from 18 through 26 only veterans will be considered for overseas appointment and they will be required to obtain a release from their draft board. Interested qualified persons should apply in person or by mail to the nearest district engineer.

Recent Advances in Asphalt Paving Technology Discussed at Convention

THE 26TH ANNUAL meeting of the Association of Asphalt Paving Technologists was held on February 5, 6 and 7, 1951, at the Cosmopolitan Hotel, Denver. Brief abstracts of the papers presented are given here for reference.

E. C. Hughes and **H. F. Hardman** of the Chemical and Physical Research Division, Standard Oil Company of Ohio, presented a paper on the composition of asphalt and correlation of this composition with physical properties. In the work described, asphalts were separated into asphaltenes and petrolenes. Particular attention was given to the character of the asphaltenes and their molecular weights. The character of the original asphalts, and the asphalts made from the recombined constituents were described. According to the authors, the recombined asphalts had properties very similar to the original materials.

Frank Odasz of the Husky Oil Company, Cody, Wyoming, presented a paper on an analytical method for predicting the characteristics of an asphalt made by any given process, providing four groups of test data, obtained at other conditions, were available. By use of the method, much experimentation might be saved and only a relatively small quantity of data need be used.

R. A. Moyer of the University of California presented a paper describing recent developments in the measurements of road roughness and skid resistance. Several devices used by the University and the California Department of Highways were described, as well as data obtained from the equipment. According to Moyer's data, bituminous surfaces could be constructed which were equal or superior to portland cement concrete surfaces in smoothness providing adequate care were taken in construction. City street surfaces were shown to be generally much rougher than similar construction on highways. The importance of skid resistance on road surfaces was emphasized by the statement that more than 1500 people in the United States lose their lives through skid-accidents each year. According to Moyer's data, oil films on either portland cement concrete or bituminous surfaces may lead to very low coefficients of friction and low skid resistance, particularly when wet. The presence of these films may greatly overweigh mere surface roughness, as with coarse aggregate, when determining skid resistance. Some relatively fine aggregates may have very high skid resistance.

B. A. Vallerga of the University of California presented two papers, one on compaction studies of bituminous mixtures and the second on the curricula and facilities for study of asphaltic materials at the University. In the compaction studies, single and double plunger methods, and the methods used by the Marshall, Tri-Axial Institute and California Research, were described and data presented as obtained by each method. Professor Vallerga noted that compaction devices might more properly be called "Particle Orientation" devices, since this is their chief function. In the data presented, it was shown that identical materials compacted to the same density by different methods, might have radically different structures developed as a result of the different methods of compaction involved. This may introduce serious errors in final stability studies. The machine developed by the California Department of Highways for compaction of materials was described. In the paper on curricula and educational facilities offered by the University, the courses and equipment available for study of asphalt and asphalt pavements were described. Approximately 200 students take the course on asphalt each year.

W. B. Warden of Miller-Warden Associates, Swarthmore, Pa., gave a very interesting account of the removal and shipment of a man-made lake of hard and semi-hard asphaltic material from the Island of Aruba, Netherlands West Indies. A system of partially submerged and floating oil-burning heaters, plus a complex system of hot asphalt circulation made the job practical.

C. A. Carpenter, J. F. Goode and **R. A. Peck** of the Bureau of Public Roads, Washington, prepared a paper, presented by Mr. Carpenter, on an improved tri-axial test cell. In this cell, the restraining effects of the rubber sleeve have been minimized through use of a floating ring at the top and bottom of the specimen, rather than through fastening the sleeve to rigid parts. A thinner sleeve also helped to reduce restraint.

R. G. Hennes of the University of Washington presented a paper on the physical interpretation of Tri-Axial test data. Professor Hennes gave particular attention to cases having zero cohesion, and to the dynamic and viscosity-cohesion effects of asphalts in tri-axial specimens. An interesting variation in the use of Mohr diagrams injecting a cohesion factor, was shown.

W. H. Goetz of the Engineering Experiment Station, Purdue University, compared test results obtained from the Marshall and tri-axial test methods on bituminous mixtures. While in general no direct correlation could be found, some very interesting relationships of the Marshall flow value and the tri-axial data were noted. Mr. Goetz concluded that the Marshall method was entirely adequate and satisfactory for the design of bituminous mixtures for pavements providing the method is correctly used and interpreted.

A paper by **J. A. Lettier** and **D. F. Fink** of the Research Laboratories of the Shell Oil Company, Wood River, Illinois and presented by Mr. Litehouser of that company, described the effect of viscosity of asphalt in mixtures tested by the Marshall Method. According to

Continued on page 81

Solving the Traffic Problem at Casper Results in—

Wyoming's First City Rerouting Plan

Through routes carrying heavy trucking from refineries and tourist traffic to Yellowstone Park were studied by the State Highway Department to develop the project to relieve business section

THE FIRST MAJOR traffic-route relocation for a Wyoming municipality has advanced through the planning and agreement stage, with initial construction contracts awarded late last season by the State Highway Department.

Casper is the location of this initial Wyoming project and the re-routing has been designed to solve serious traffic problems—both local and through—where U. S. 20-87 now traverses the business section and connects with routes leading northwest to Yellowstone National Park and south to Rawlins.

Public relation angles

The program has public relations factors which are of special significance to many of the Western states where this type of urban re-routing is relatively new. Wyoming has a recent state law which definitely prohibits the "by-passing" of any city by a state highway without the express consent of the municipality. The Casper project has been carried through preliminary planning and final acceptance with proper appreciation of mutual benefits by both the city and the state. Final agreement required not only the acceptance of the city of Casper and the Wyoming State Highway Department, but also the Bureau of Public Roads. Construction work was started at the eastern approach to the city in 1950 and present plans call for completion of the project this year.

The need for improved traffic facilities in the city of Casper was recognized and under study by the Wyoming State Highway Department as far back as 1945. The first engineering report was prepared by the Highway Department in 1946 following studies which included cooperation of the Bureau of Public Roads, the city of Casper and various interested local organizations. About that time, U. S. 87 was designated as a unit in the National System of Interstate Highways which further emphasized the Casper project as a solution to an increasing traffic problem on a major route.

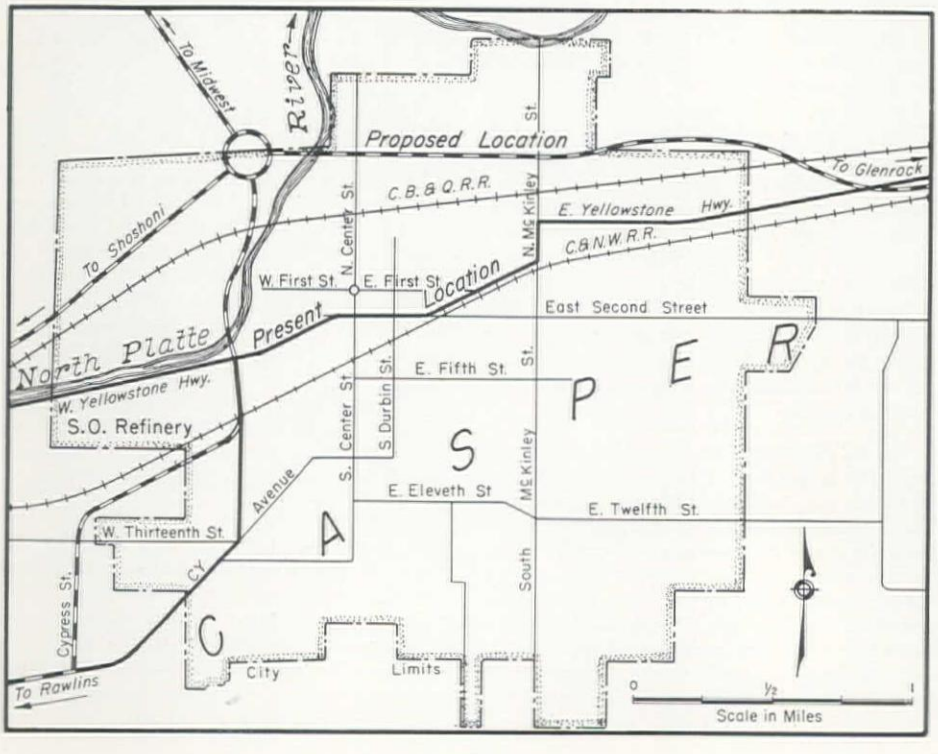
The city, which has a population of 23,557, is located on the southern and eastern bank of the North Platte River where the stream bends sharply north for about a mile before continuing to the east. In general, the area has no serious problems of topography, since the city occupies an almost level plain sloping away from the river.

As a result, the project did not involve serious problems in highway location, the obstacles and restrictions relating principally to (1) the use and occupancy of property, (2) restricted street widths, (3) railroad crossings, and (4) cost of right-of-way.

Trucks, tourists and railroads

Known as the "oil center of the Rocky Mountains," Casper occupies an important position as a center of extensive livestock and petroleum developments, with three large refineries located near the city. It serves as a hub of transportation for a large section of Wyoming and is at the intersection of important highway routes. Summer traffic requirements are particularly high in connection with tourist travel to the Yellowstone Park region.

The city is traversed by both the Burlington and the Chicago and Northwestern railroads running generally in an east-west direction. The principal business section occupies the area between the two railroads. Approaching from the east, U. S. 20-87-26 passes through the main business section, with one right angle turn and several other lesser angles before leaving the business section to follow the bank of the river on a right-of-way through the Standard Oil Co. refinery. The route then crosses the river on a narrow bridge with a sharp curve and junction at the end of the structure. This route carried all of the through traffic, including heavy trucking to and from the oil refineries, down the streets of the business section which have curb-to-curb widths averaging 46 ft., with a minimum of 36 ft. in one section. At the time studies were initiated this traffic was further hampered by angle parking permitted on both sides of the streets.



Seven requirements

General requirements for the alternate location included: (1) good alignment and grade, (2) relatively low cost of right-of-way, (3) least disturbance of existing facilities, (4) use of existing streets as service roads, (5) elimination of pedestrian cross traffic, particularly near schools, (6) best solution of the city's problem from a traffic and economic point of view, and (7) elimination of heavy truck traffic from business and residential areas.

Referring to the accompanying sketch map, one very obvious route would be to move the highway to the south side of the Chicago and Northwestern tracks and continue it through the city parallel to the railroad right-of-way.

After extended study this route was eliminated, principally because of right-of-way costs. The area adjacent to the railroad line is occupied by many warehouses, commercial establishments and loading docks. Further, this high value property would have to be purchased at several intersections to obtain sufficient area for off-and-on ramps. Where this projected route crossed Walnut Street on the west side of town, an elaborate

structure would have been required to under-pass the railroad and to serve not only the through traffic but the portion turning south onto State Route 220.

A second study explored the possibility of extending the highway along the southern side of the Burlington right-of-way. This location presented a serious problem because of an expensive interchange structure at the intersection of Center Street. It also provided high right-of-way costs and was finally abandoned for the same reason.

Final selection

The third, and recommended, selection is indicated on the accompanying sketch map and provides for a route which leaves the existing highway east of the city limits, bending north to cross the Burlington tracks and extending practically due west to an intersection beyond the river. At this junction, U. S. 20 would continue west, U. S. 87 would turn north and a new connection would provide for State Route 220 south toward Rawlins. Principal advantage of this route was its low right-of-way costs since less than sixteen low cost dwellings and no commercial or industrial buildings occupied the proposed location. Further advantages were the fact that limited access could be provided to two major city streets (Center and McKinley) where crossings at grade were proposed with a 4-lane intersection controlled by lights. This arrangement makes it possible to disperse the local traffic and at the same time prevents the heavy truck traffic from traversing residential or business districts. The acquisition of this proposed right-of-way and the entire project would cause less disruption of normal traffic and city business, thus indicating less opposition from property owners and residents.

Out of the refinery

One of the more important advantages of the selected location is the elimination of the highway through the Standard Oil refinery and the existing crossing over the river with its bad situation of grade and intersection.

Traffic on the project consists mainly of passenger cars, with a heavy percentage from local origin. Foreign passenger cars represent about 25% of the total. At the two intersections of Center and McKinley streets there would be a large influx of local cars and an increase in cross traffic. Residents of North Casper working at the Standard Oil refinery would be benefited by using the new route and thus eliminating a portion of the traffic from the city streets.

Public transportation does not represent a serious problem with only eighteen scheduled bus routes in the city and one bus line operating from Casper to North Casper.

The engineering designs will provide for an allowable 40-mi. speed through the urban section.

Rotary intersection

The main intersection west of the North Platte River will be a rotary type intersection as approved by the American Association of State Highway Officials.

The surfacing to be provided will probably consist of a 2-in. oil mat with penetration treatment on the shoulders. The North Platte River crossing will probably be a multiple span girder of deck type with a clear roadway width of approximately 56 ft. Footings can be founded in 10 to 12 ft. of shale about 20 ft. below normal river level.

Engineering plans for the Casper relocation are being carried out by the Wyoming State Highway Department under the general direction of J. R. Bromley, superintendent. G. T. Bath, planning engineer, carried out details of the studies. Construction operations will be under the general direction of the construction engineer for the Casper district.

The city of Casper has been represented in connection with the job by its mayor.

In conclusion, a somewhat similar study and program has been instituted for the city of Cheyenne, but actual construction work being started in Casper made it the first of this type of project to be undertaken in Wyoming.

Asphalt Paving Advances . . . Continued from page 79

the authors, different types of asphalt, such as cutbacks, cements or blown asphalts, have little effect on stability when the materials are tested under conditions in which the asphalts have equal viscosities.

W. M. Aldous of the Technical Development Division of the Civil Aeronautics Administration, Indianapolis, gave discussion and data relative to the development of design of flexible pavements using a "synthetic subgrade" composed of spring-loaded pins and plates which will record pressure exerted on that subgrade by bases and surface courses placed above it and loaded by plates of actual tire loads. Pavement design data, obtained from the tests, were given in chart form. The work being performed introduces several new concepts of pavement design, particularly with respect to subgrade reaction.

J. M. Griffith of the Corps of Engineers Flexible Pavement Branch, Vicksburg, gave interesting data on the behavior of high pressure tires on flexible pavements, determined by 2000 to 3000 coverages of pavement in test track operations. High pressure tires of 200 psi. or better and carrying as high as 60,000 pounds per tire, were investigated. One conclusion given by Mr. Griffith was that the optimum asphalt content of a bituminous paving mixture as given by the Marshall Test, was maximum for high pressure tires, and that mixtures having about 20% less asphalt than this optimum gave better results. The high pressures gave densities in pavement of from 2 to 2½ pounds per cubic foot higher than would be encountered under normal tire pressures.

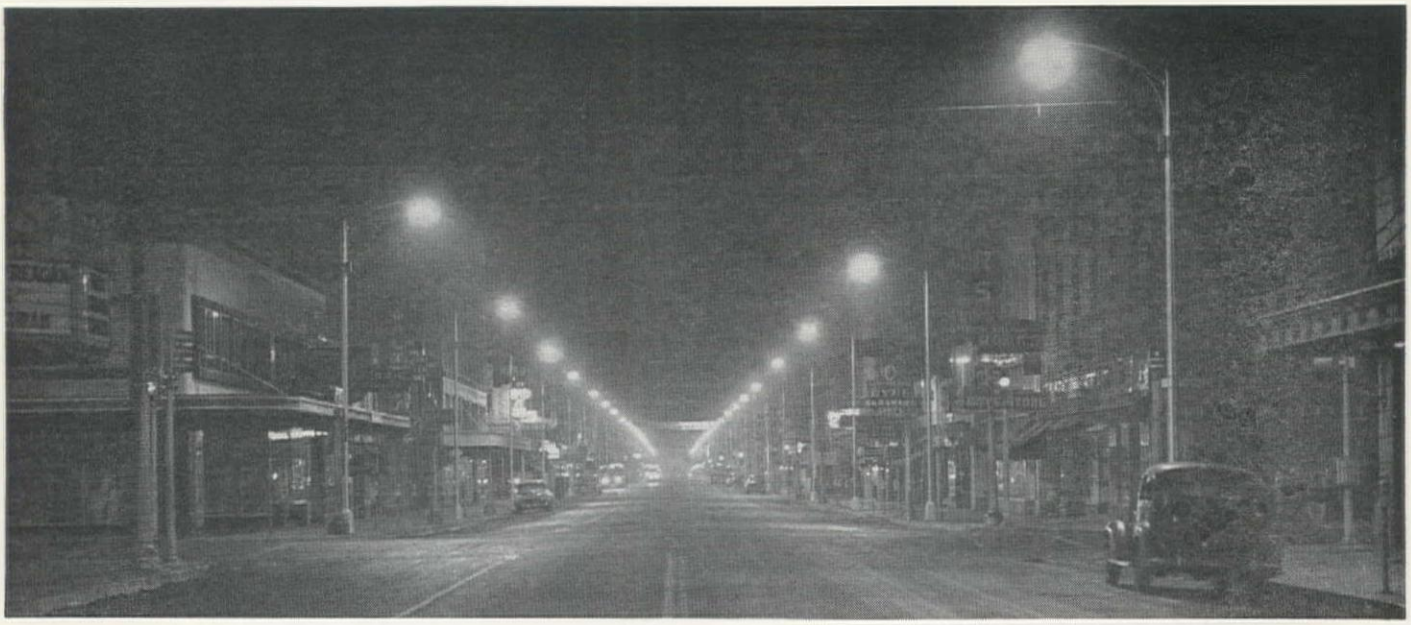
L. W. Corbutt and **Roland Vokac** of the Husky Oil Company, Cody, Wyoming, presented a paper in which they pointed out some of the fundamental properties of asphalt and the functions of some existing tests towards evaluating these properties. Some properties of asphalt which may be important to pavement design and other uses, are not indicated by present-day tests. Included in the properties mentioned by the authors were extrusion, rebound, maleability, squeezing resistance, tension ductility and torsion. Several methods for measuring these properties were suggested.

H. G. Nevitt of the Socony-Vacuum Oil Company, Kansas City, prepared a paper which was presented by **T. G. Groening** of that company, on "Sealcoating Aggregates." In this paper, Mr. Nevitt gave a theoretical analysis of the functions of a sealcoating aggregate and from this, the idea of a "critical size" of aggregate, dependent upon the type of aggregate and the amount of bitumen used, with factors of tire pressure and shape of aggregate included. In the critical size, the amount of asphalt would be sufficient to give maximum holding power to the aggregate particle, yet would not squeeze out so that contact between tire and bitumen would occur.

J. L. Stackhouse, Bituminous Engineer of the State of Washington, presented a paper on the design of asphaltic concrete mixtures, in which he particularly stressed the importance of graduation control, both in design and in construction. Mr. Stackhouse also gave a very interesting discussion of the design and construction of the asphalt pavement on the New Tacoma Narrows Bridge.

W. C. Kommes and **K. E. Stanfield** of the U. S. Bureau of Mines, Laramie, presented an interesting paper on the properties of asphalt derived from shale-oil. According to the authors, the yield of asphalt varies from 30 to 80 gallons per ton of shale, representing from 16% to 18% of the total oil recovered. The asphalts obtained are highly cracked, having a positive spot in 100% xylene but otherwise comparing with ordinary cracked asphalts.

The meetings were concluded by a visit to the laboratories of the Bureau of Reclamation on Wednesday afternoon. **Norman W. McLeod** of the Canadian Department of Transportation is the newly-elected president of the Association, succeeding **J. R. Benson,** Bituminous Engineer of the Bureau of Reclamation. Other officers of the Association are **John Goshorn,** Testing Engineer, Ohio Department of Highways, first vice president; **Frank Olmstead,** Engineer of Soils, Bureau of Public Roads, Washington, D. C., second vice president and **George Dent,** District Engineer, the Asphalt Institute, and **Francis Hveem,** California Department of Highways, directors-at-large.



Fresno, Calif. Demonstrates What Can Be Accomplished in—

Putting Traffic Engineering to Work

In four years, after the appointment of a full time traffic engineer, this city of slightly over 100,000 population moved from 57th place to a tie for first in National Traffic Safety Contest. Beginning as a one-year experiment and with no budget this program has established a record of accomplishments which has resulted in an expanding appropriation of city funds and active support by the City Commission. This record of achievement was reported at the recent annual street and highway conference of the Institute of Transportation and Traffic Engineering at Berkeley.

By ROBERT D. DIER
City Traffic Engineer
Fresno, Calif.

TRAFFIC ENGINEERING has long been recognized as one of the three important basic methods of solving the traffic problem. The value of this function has not assumed a similar degree of importance in the minds of city officials in many cities both under and over 100,000 population.

These civic leaders have failed to provide trained engineering personnel to handle their traffic engineering functions, and in many instances have not even placed these functions in their city engineering department where they belong. The National Safety Council reports that 80% of the cities participating in the National Safety Contest of the 50,000 to 100,000 population group do not employ traffic engineers. In the 25,000 to 50,000 and the 10,000 to 25,000 population groups, 43% and 54%, respectively, of the cities have not placed traffic engineering functions in their engineering departments.

Smaller cities

Every city under 100,000 population should be provided with traffic engineering services of some kind, either through the employment of a full-time traffic engineer, a traffic engineering consultant, or through the training of one or more of their qualified engineering employees at a recognized traffic engineering school of instruction. Cities must also provide the budget, organization, and public support which are so essential to a successful traffic engineering program in any community.

The establishment of traffic engineering services in a municipality will soon be justified in the eyes of city officials and the taxpayer as the engineering program progresses. The weight of many perplexing traffic problems will be removed from the shoulders of harassed city officials and other overworked city personnel. The orphan traffic engineering functions of that city will no longer be carried on in a limited, neglected and often non-standard manner but will be handled under a scientific and active program which, if given the proper community support, will produce satisfying results.

The start at Fresno

Approximately five years ago the long neglected traffic problem caught up with the rapidly growing City of Fresno to the extent that the National Safety Council was called in to make a preliminary study of traffic conditions and corrective needs. In January of 1946, Harry Porter, Jr., Traffic Engineer of the Safety Council, submitted a report recommending, among other things, the employment of a full time traffic engineer to guide the traffic engineering program of the City. In March of 1947, the City Commission authorized the Commissioner of Public Works to employ a traffic engineer on a one year contract. Was this short contract an indication of another instance where the city officials of a city under 100,000 population were uncertain as to the permanent need of a traffic engineer or that the traffic problem could be solved in one year's time?

During the first few years of the program, an organization was gradually developed. Today, traffic engineering functions are divided and coordinated between three sub-departments of the Department of Public Works, as follows:

Traffic Engineering Division

Administration—The Traffic Engineer is responsible directly to the Commissioner of Public Works but is also under the jurisdiction of the City Engineer on all matters pertaining to major traffic control improvements. A separate office is provided for the Traffic Engineer, staffed with a secretary and part-time draftsman shared with the City Electrical Engineer. Funds are provided in the budget for the employment of addi-

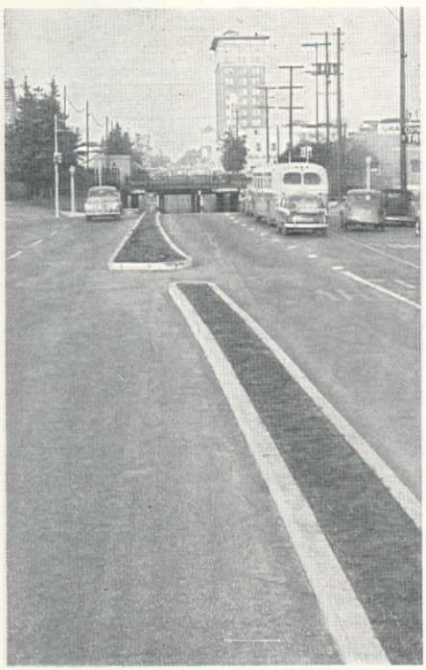
PICTURED AT TOP OF PAGE—

Modern lighting installed on the main shopping street (Fulton Street) shown during early morning hours. Lighting work is under the direction of the City Electrical Engineer, with the Traffic Engineer cooperating on studies and recommendations.

tional personnel for traffic surveys when needed. This office processes all complaints, requests and the many other assignments which develop. Accident location files, accident spot maps and records are maintained.

Traffic Painting — This function is under the supervision of the Traffic Engineer. A painter in charge and four helpers are employed full time on this work. A well-equipped paint shop, sign shop, three trucks, two striping machines, paint spray equipment, stencils, and other necessary equipment are furnished. During the wet weather periods when outside painting is impractical, the paint crew is assigned to sign maintenance and fabrication work in the sign shop.

Parking Meter Maintenance — This work is under the supervision of the Traffic Engineer. Two full time experienced parking meter maintenance men are employed. A well-equipped maintenance shop and two three-wheeled motorcycles are provided for the maintenance of approximately 1,700 parking meters.



A THREE-LANE underpass, where the center lane formerly used by street cars was paved and opened to vehicular traffic. Channelizing islands direct traffic into proper lanes, with two provided in one direction at all times, and one in the opposing direction. This location is on Fresno Street and the installation includes signals and traffic islands. The Traffic Engineer provides the design plans for these island installations.

Electrical Engineering Department

Traffic Signal Installation and Maintenance—This function is under the supervision of the City Electrical Engineer, the Traffic Engineer cooperating on design, specifications, and field inspection work. A part-time supervisor and a full time traffic signalman are employed. A well-equipped signal maintenance shop and service truck is available for this work.

Street Lighting Installation and Maintenance—Street lighting work is under the supervision of the City Electrical Engineer with the Traffic Engineer cooperating on studies and recommendations. One part-time supervisor, two electricians, and four helpers are employed on all street lighting work. Well-equipped service trucks with high extension ladders capable of servicing the high mounted luminaires are provided.

Street Maintenance Department

Traffic Sign Installation and Maintenance—This phase of the work is under the supervision of the Superintendent of Streets with the Traffic Engineer cooperating in making studies and recommendations on sign installation work. One part-time supervisor and two full time sign men are employed. A well-equipped service truck is provided.

Traffic Island Construction — Special traffic island construction projects are under the supervision of the Superintendent of Streets with the Traffic Engineer cooperating by furnishing the necessary design and construction inspection. Maintenance personnel and equipment are drafted for this type of work.

The budget is the key

Most important of all factors influencing the success of any traffic engineering program is an adequate budget with which to accomplish the many improvements needed in any city. Beginning with little or no budget the first year of the program, the traffic engineering program has since enjoyed a generous annual budget authorized by a progressive and far-sighted City Commission.

The traffic engineering budget has gradually localized in the Traffic Engineering Division during the past few years. By the end of this fiscal year a total of approximately $1,364,000 will have been spent on traffic engineering out of city funds since the year 1946. The past three years alone have averaged $274.000 annual expenditures. The 1950 to 1951 budget provides funds in the amount of $487,000 for traffic engineering administration and improvements of all types. The continued support for an adequate working budget by the City Commission is evidence that it recognizes the importance of traffic engineering in city government.

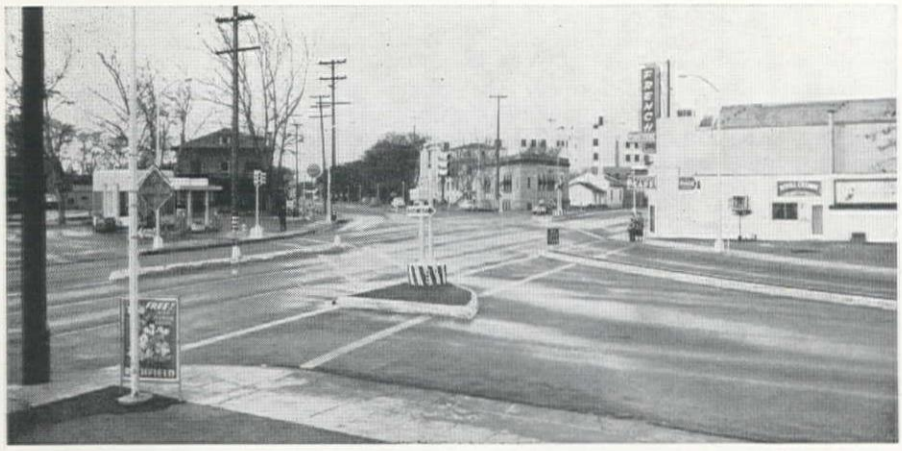
In any rapidly expanding city such as the City of Fresno, there is a terrific demand for all available monies to apply towards the seemingly ever increasing essential services and improvements that usually go with rapid growth. Unless a new service, such as the traffic engineering program, can prove its worth to the city fathers and the taxpayer, partial or complete cessation of funds and support can logically be expected. The continued support of the traffic engineering program in the City of Fresno is due to a large extent to the many services and accomplishments performed through the close cooperation of the various divisions under the Department of Public Works.

A list of activities

Due to limitations in the scope of this paper, the many activities and accomplishments of the past four years will be discussed only briefly. These are as follows:

1. A comprehensive arterial street system was planned to guide our improvement program.
2. The arterial system is now approximately 100% protected by stop signs.
3. The arterial system is almost 100% center lined, and a considerable length of the streets is lane-lined where warranted.
4. The entire central business district has been provided with standard traffic signal installations. Most outlying major arterial intersections have received signal treatment where warranted.
5. Traffic signal systems have been designed to provide the best progressive movement possible for traffic. The signal system in the central business district is completely interconnected, also

ON U. S. HIGHWAY 99 entering the downtown area the Belmont Underpass illustrates the use of signals and channelizing islands to allow effective and safe use of this three-lane structure. The Traffic Engineer cooperates on design, specifications and field inspection on signal installations.



A TOUGH intersection problem solved with installation of traffic islands, traffic signals and the "walk-wait" pedestrian signals so essential for safety on the wide lanes. The location is on the Divisadero Street widening project.

some of the outlying signal systems, to provide a more consistent service.

6. Numerous traffic islands have been constructed to channelize traffic movements and provide pedestrian protection.

7. A parking survey was made by the Traffic Engineer in the central business district. A consulting engineering firm was employed to bring this original survey up to date and make recommendations for a definite program. A valuation survey has been made on recommended sites for off-street parking, and action is now being taken towards the purchase of these sites.

8. The City of Fresno has cooperated with the Public Utilities Commission in making a hazard study of railroad grade crossings. In a follow-up installation program the city provided almost 100% sign and marking protection for these grade crossings.

9. The Traffic Engineer made studies in connection with a proposed railroad consolidation plan which will eventually eliminate congestion and hazard at numerous grade crossings.

10. The City of Fresno has cooperated with the California Division of Highways on major widening projects, underpass improvements, a freeway and resurfacing projects.

11. Studies were made and a comprehensive plan for one-way streets was developed. The engineering program received its first real setback when this one-way plan failed to receive Commission approval by a 3-2 vote. Continued action towards obtaining this approval will be taken at the earliest opportune time.

12. Continuous studies are maintained covering the traffic accident experience at intersections through the use of collision diagrams which number 300 intersections to date.

13. Each year a view obstruction survey is made at all stop sign and signal locations and is always followed up with a tree trimming and bush removal program by the City Parks Department.

14. A truck route plan was developed for through trucking on state highways and was approved by the California Division of Highways.

15. Studies have been made of hazard at school crossings. Marked crosswalks, advance pavement markings and school signs have been provided at all schools.

16. The Traffic Engineer processes hundreds of complaints, requests, and other services. Speaking engagements, radio broadcasts and contacts with the press are used to inform the public of the progress and purpose of the traffic engineering program.

17. City-wide traffic counts are made and traffic flow maps are prepared for planning purposes.

18. The Traffic Engineer initiated action towards the organization of a traffic coordinating committee and a city-county safety council in cooperation with the Governor's Coordinating Committee and the National Safety Council.

19. The Traffic Engineer is now participating in the Civil Defense Program for the City of Fresno.

A modern traffic ordinance

20. Of all the accomplishments performed in the past four years by the Traffic Engineering Division of Fresno, the development of a modern traffic ordinance is considered one of the most important. There is a great need for all cities throughout the nation to bring their traffic ordinances up to uniformity and eliminate much of the confusion now existing in traffic regulations.

Until recently, the City of Fresno was in the same position as many other cities throughout the nation and state as far as uniformity of traffic ordinance was concerned. The Fresno ordinance "grew like Topsy" and in a piece-meal fashion. It contained obsolete, impractical, and illegal regulations which were confusing to both the public and the enforcement agency. For example, one section in the ordinance made it illegal for a motorist to enter a signalized intersection at any time on a yellow light, a direct conflict with the California Vehicle Code. Innocent motorists were being cited and were paying fines on acts which were legal under the Vehicle Code. Something had to be done to correct these conditions.

Approximately two years ago the Traffic Engineer commenced work towards bringing the local traffic ordinance up to uniformity. During regular and off-working hours, the many existing traffic ordinances from the city clerk's office were studied and compared with the Vehicle Code and the uniform traffic ordinance of the League of California Cities. Gradually a semblance of order developed as obsolete, illegal, and impractical ordinances were discarded under the guidance of the uniform ordinance.

The first draft of the new ordinance was submitted to members of the City Commission, the Police Department, traffic judges, the city attorney and to interested organizations for comment. Eventually all differences of opinion were eliminated, and in December of 1950 the City Commission unanimously approved the new ordinance.

Contrary to the belief of many city officials that the modernization of a traffic ordinance is an overwhelming task and requires tremendous manpower, the Traffic Engineer accomplished this work of preparing and editing the traffic ordinance with only the assistance of a secretary, with the City Attorney making the final review. Here again was demonstrated a possible service a traffic engineering organization can provide for its community.

Reward of achievement

While the foregoing discussion of the experiences of Fresno has in a general way illustrated the effectiveness and scope of the traffic engineering program, no statistics have been given which will definitely prove the extent or volume of the work performed. This can be illustrated more effectively through the ratings received in the past few years in the National Traffic Safety Contest conducted by the National Safety Council.

In 1946, the City of Fresno ranked 57th in the nation among cities of between 50,000 and 100,000 population, in traffic engineering achievement as based on performance standards of leading cities reporting in the contest. In the next three years, Fresno advanced to within 0.6 of a point of the first place position actually won by Evanston, Illinois, long noted for its traffic safety activities. The closeness of the competition influenced the Institute of Traffic Engineers to award a duplicate first place plaque to Fresno for her efforts. This record speaks for itself.

Need for small cities

City officials in municipalities under 100,000 population who are still doubtful of the need for traffic engineering services in their communities should review the 1949 Report of the Committee on Engineering of the President's Highway Safety Conference. In this report 101 of the leading traffic safety authorities in the nation have assembled their views on what cities can gain from traffic engineering and what they should do to cooperate in the nationwide drive to solve the traffic problem. In the Recommended Action Program section of this report is found the following quoted paragraphs which should be of interest to cities under 100,000 population:

Concluded on page 117

2nd 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

STRUCTURES react to earthquakes in the same way, whether they be in Seattle, Boston, Los Angeles or Tokyo. The principal difference is in the severity, duration and characteristics of the motion and in the type of construction that is predominant. Since earthquakes have occurred before, and unquestionably will occur again in the Pacific Northwest as well as elsewhere, it is well to know (1) how structures of the various kinds were damaged on April 13, 1949, and then (2) how they can be constructed or strengthened to resist being damaged.

Older and weaker are first

In all earthquakes the older, weak masonry structures failed first, and many of them completely. This is true of the quake under discussion in which the modern masonry structures as a group performed splendidly. But where typical earthquake-type fractures did occur and where one or more walls suffered partial destruction it was reemphasized that in addition to good workmanship and substantial materials, all structures built of unit materials must be thoroughly tied together so that they move or resist movement as a whole, and be so braced that no part can move beyond its limit of elasticity. In other words, all parts of the structure must have sufficient strength and stiffness or rigidity to transmit the forces acting upon them into other members able to receive them, without serious damage to finish materials.

One need only to see the shattered, pitifully weak masonry buildings after an earthquake to recognize how necessary **good** mortar is to a building. With mortar that combines strength, workability, adhesiveness, minimum bleeding, low expansion and contraction, and impermeability, the inherent qualities of good masonry will be realized.

A test for mortar

From exhaustive research at the Bureau of Standards in cooperation with industry, a measure of workability and quality has been developed in the "water retentivity test" which is included in Federal Specification SS-C-181b. It is based upon the fact that a good mortar is one that contains good materials in adequate amounts, and in addition will hold the most water within it for hydration of the cement contained. The use of this measure of quality is gradually being adopted by the trades and codes.

Exterior finish materials such as unanchored terra cotta, ceramic veneer, brick, stone, glass, sheet metal panels, etc., cracked, shattered, spalled or fell from the twisting and bending of their related buildings.

In some cases inadequately attached brick veneers fell clear of the structures, glass facings shattered and dropped to the ground, unanchored terra cotta or ceramic veneer broke and fell, and stone work shook apart. Heavy blocks of the various materials were cracked at their points of attachment but did not fall during this quake. In the year following, however, three heavy pieces of terra cotta fell on downtown Seattle sidewalks, narrowly missing pedestrians. How many more such deathtraps exist here and in other cities cannot be determined.

Los Angeles has recognized that there are definite life hazards in connection with building facings and overhanging objects and has passed an ordinance requiring that existing parapets or appendages attached to exterior walls either be removed or strengthened so that they will resist a reasonable degree of horizontal force without becoming dislodged with danger of falling into any public way. If, after inspection, the Building Inspector finds no immediate hazard, the owner is given five years in which to make the correction.

The cities of the Pacific Northwest have fully as great, if not greater hazard to the public than Los Angeles in this respect and should adopt similar legislation. Local history demonstrates that earthquakes are a normal, natural phenomenon of this region that will be

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 (this 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 (April 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 SMALL RESIDENCE on unconsolidated fill lost its foundation when settlement dropped the concrete wall and the horizontal movement added to the damage.

anticipated by prudent persons. Therefore, since cities and towns are under a duty to the public to keep their public ways (including sidewalks) in a reasonably safe condition it normally should be expected that this duty should extend to keeping the same public ways free from hazard of falling bodies during or following earthquakes. While there is a dearth of judicial decisions of record relating to liability with reference to earthquakes there are a number of established legal rules that furnish analogies and guide lines on the subject, such as those set forth by the Bureau of Governmental Research and Services of the University of Washington in its memorandum entitled "Liability Resulting from Projections and Falling Objects Upon Public Ways with Special Reference to Earthquakes."

In addition to life hazards related to the exterior of buildings, there are many phases of the problem that are related to the structures themselves and things they support. In some cases these concern the hazards of partial or complete collapse with attendant losses.

Loading of floors

The effect of a heavy floor load on a structure must be considered if the building is to retain its good health. One 5-story warehouse structure on 1st Ave. S. in Seattle was partly occupied by a heavy hardware firm that carried a stock of metal that loaded the mid-story area thoroughly. After the quake the front wall was broken from the side wall, and the side wall was bulged out at its mid length about 5 to 7 in. at that mid-building story height. Further shaking would probably have brought complete collapse. Since this loading was on one side, also, of the large structure, torsional forces were doubtless involved.

LEFT—Unsupported by any adjoining building, the corner of this structure moved out from under the roof the distance indicated by the crack.

RIGHT—Heavily loaded floors resulted in the diagonal movement at the corner of this building which almost resulted in collapse. The wall bowed out 6 in.

The brick face of a 3-story downtown mill-constructed parking garage was fractured at numerous locations during the quake. Brick moved outward ¼ to ⅜ in. along many of these points of sheared mortar. Brick arches over small windows were broken and the keystone almost dropped out of two. These two were repaired and the structure face was given two coats of paint! It remains in a state of "suspended destruction" that will probably proceed to failure under a less intense shock than the one on April 13.

Buildings constructed without adequate space between them battered together creating clouds of dust, pulling away roof flashings, knocking trusses off their seats and fracturing fire walls. Where two buildings of different heights existed adjacent, the higher one battered against the lower and was fractured or broken above the top of the low building. Where two buildings of approximately the same height existed together and an open space occurred beyond one, the building was pushed into this open space and the front walls were fractured on the rebound by tensile forces.

Two-or-more-story store buildings having the street face open or glassed in, with small columns and no bracing in the plane of that face were fractured horizontally at the heads of the first story windows and were starting to pivot to failure on the narrow front columns and small corner sections. One-story stores and garages built (1) with long-span joists, (2) rafters or trusses unanchored to the tops of the walls, (3) having no continuous reinforced concrete bond beams, and (4) having no columns or pilasters to take the additional thrusts that occur, failed by the walls moving out or by the trusses moving off their seats. Unbraced, high store fronts built as thin walls on inadequate steel beam lintels pivoted or rocked on their narrow supports but in most cases stopped short of disaster, awaiting the added push of aftershocks that didn't occur. These street fronts should be designed as rigid frames and the structures should be given lateral stability in some acceptable manner determined by the structural engineer.

BECAUSE roof joists were not anchored to the wall, the framing pulled away and the roof collapsed. Tops of the parapet wall shook loose and fell onto the sidewalk.

Good masonry is strong

Modern masonry buildings of rectangular plan built with strong mortar on adequate foundations showed inherent strength with little or no cracking. Their minimum of weakening openings, their well-braced roof systems, and in the larger buildings their continuous concrete bond beams enabled them to withstand the movements satisfactorily. However, this satisfactory performance this time should not give the over-confidence that they will do so again.

To withstand seismic forces, every structure must be so constructed and braced that it will move as a unit within the elastic limits of component materials. This means that not only bond beams are needed but that also strengthening steel reinforcement is required both horizontally and vertically in the walls and foundations, placed according to an adequate structural design which includes horizontal diaphragms or bracing installed at the roof or plate line.

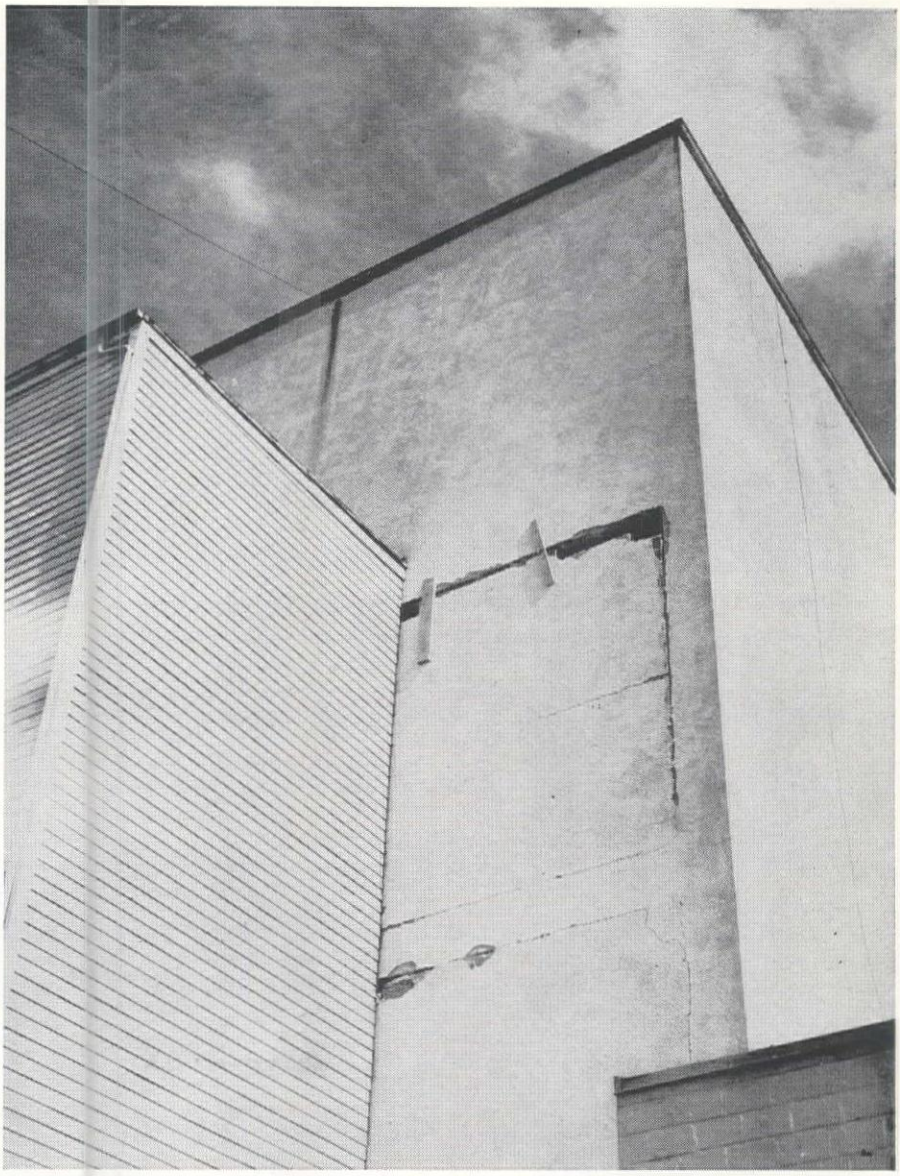
Steel joist anchors and ties for rafters and gable ends are required by most codes, but it was surprising how many damaged buildings were found without them, after the earthquake. Without secure ties between masonry and wood construction, movement of the wood framing can occur at a different rate or period of vibration than that of the masonry, resulting in damage or demolition of part of the structure. This type of failure was the basic cause of much of the early destruction experienced in this quake.

Unreinforced brick chimneys, as has been stated, behaved badly. More than 10,000 chimneys in Northwest Washington required repair. Two thousand were estimated in Centralia and 1,351 were counted in Chehalis. Whether they merely turned in their sleep or fell off their perch, the hazard to the public was the same. Far too many chimneys fell, some into the buildings to create havoc in their path, others dropped onto the ground alongside. Still others were fractured badly, with heavy sections poised above the buildings awaiting the usual aftershocks to send them crashing through the roofs. Chimneys, like buildings, can be designed to resist earthquakes. All it takes is the will to do, and a competent designer.

Appraising concrete damage

Comparatively little visible loss was suffered by reinforced concrete buildings, though they too can be damaged if not properly designed and built. They can be cracked in ways which to the lay person are unimportant but which to the trained eye of the structural engineer who is experienced in seismic matters are definitely weakening. This is especially true when the buildings have their exterior frame concealed by veneer coverings making ready inspection of the concrete frame impossible.

In engineering, as in business, there is no substitute for experience. It is easy for the uninformed, inexperienced man **to pass over the damage unrecognized.** Training, experience and integrity should be the basic recommendations for an engineer when being considered for such special investigations. However, when cost is involved, it is unfortunate that there are penny-wise owners who seemingly will employ the person who will tell them only what they want to know or hear, regardless of the facts. It may be easy for the uninformed to pass up the tell-tale cracked stone, the spalling or bulging terra cotta facing over structural connections and the windows that break during succeeding days or months. But without exposing the vital connections between columns and beams or slabs back of these bulged areas to find out what really has happened, and without remembering that structures damaged in one quake proceed toward failure in the next, it is likely that some of these structures have been weakened and left to fail and cause heavy damage or loss of life in the next quake.

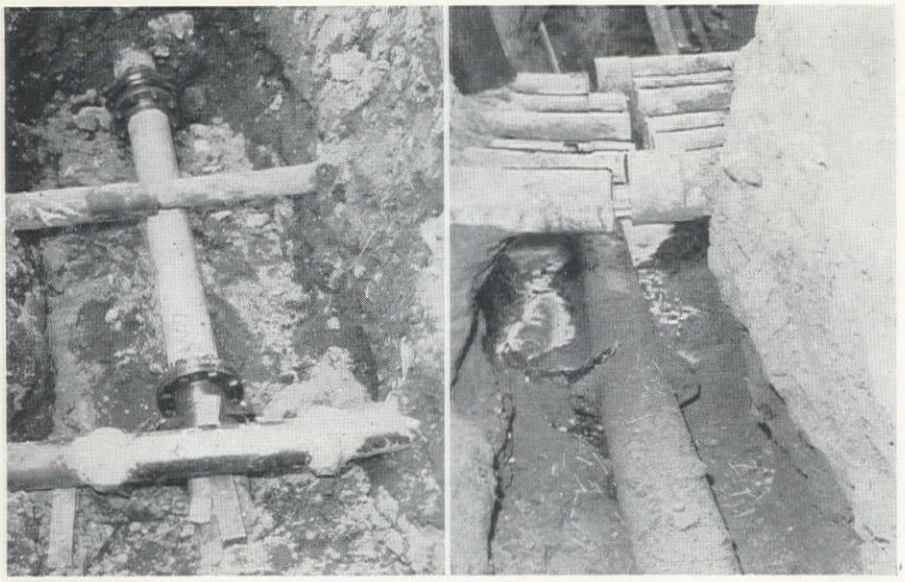


ON THIS SCHOOL building at Chehalis the action of the earthquake broke out the masonry filler walls in this concrete frame with complete separation from beams and column.

That such suspended destruction does occur was illustrated by one failure in this quake. In the 1946 earthquake a heavy reinforced concrete column and slab framework supporting a 50,000-gal. wood stave water tank 20 ft. above the roof of a large 7-story cold storage warehouse was cracked at the base and the top of the columns. The tank structure was located at the approximate center of the roof and was flanked on each side by an elevator headhouse. The building was on piles in fill along the waterfront. The damage seemed unimportant so nothing was done about it other than to clean out the breaks and fill them with gunite.

In the April 13, 1949 quake, this structure, weakened at the points of greatest stress proceeded from its state of "suspended destruction" to complete failure. The little-anchored, damaged columns broke from their moorings; the heavy concrete slab carrying the filled tank crashed down through the concrete roof to the floor below. As it fell, the reaction of the surging water and the sliding tank kicked the slab back over the headhouse of one of the elevators. The sliding tank broke over the superstructure of the other elevator, driving it, the elevator and tons of water into a heap at the bottom of the shaft 7 stories below. By some miracle the men working on the floors below had gone down on the elevator to lunch 5 minutes early that day or they, too, would have been included in the heap. The cost of extensive reinforcement or even the complete rebuilding of the tank structure in 1946 would have been far cheaper than the loss actually suffered!

In Longview and probably other places, too, connections of reinforced concrete columns to foundations and to beams of structures which had not been designed to resist the combined bending and direct stress due to earthquakes were fractured, the enclosing concrete



LEFT—Water and sewer lines fractured with pollution inevitable unless break is uncovered. RIGHT—Movement in soft ground pulled open these conduits in spite of locknuts.

was spalled from the steel reinforcement and the steel was subjected to such loads that it bulged out beyond the column line, a spectacular damage. It was fortunate that, although this earthquake was of high intensity, aftershocks did not occur so comparatively little of this type of damage was seen.

Repair work is slow

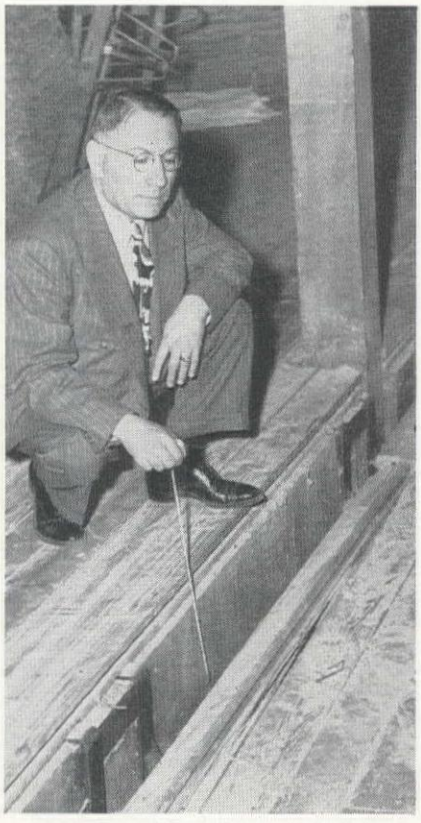
It is significant of the penny-wise thinking of people that relatively few examinations of the bulging or cracked areas of building facings have been made or ordered. It would seem that the owners should want to know that their investment was safe and not "on the skids."

Elevator shaft walls are especially subject to damage, due to the rigid characteristics of such tall, rectangular units. These characteristics often conflict with the flexibilities of adjoining areas and thus cause trouble. Not only did the shafts suffer severe cracking in this quake, but also by their action as vertical girders they brought additional forces into play, which damaged nearby structural parts of the building.

Problems of elevators

Relative rigidities of elevator shafts must be carefully studied in the seismic design of structures so a uniformly-resisting building will result. One would ordinarily think an elevator a safe place to be in a quake but a number of them were rendered inoperative immediately, through their supporting cables jumping from their sheaves, through counterweights being projected from their guides, through jamming of operating equipment, or through cage guides being twisted and torn loose by building movement. In one warehouse most of the foregoing occurred to one elevator; the vibration started the elevator going up and the counterweight down and it ended by all crashing together. Fortunately no one was in it.

Stair wells were commonplace areas of failure within a building, in this quake as in most others, and the reason is not hard to find. Stair slabs, on which the steps are superimposed, are rigid units and usually extend from floor to floor either continuously or in two flights with a landing between. Since in the motion of a building the upper floors often move more than the lower, and in different rates and directions, the stairs become in effect battering rams breaking the opposing structural members within their zones of influence.



WATERFRONT STRUCTURES supported on piles driven into fill material shows a differential settlement of 8 in. on the fill side.

Means of emergency escape from buildings were cut off in a number of instances by the jamming of fire doors in their frames due to the deformation of the buildings. This introduces a serious question of code adequacy as it relates to temblors, for in these instances, what should have been open avenues to safety were actual areas of hazard within which those seeking to escape could have been trapped. Had the quake caused greater damage or had fire resulted, these places could have been the locations of many deaths.

Waterfront structures

In this quake, as in previous quakes, waterfront and similar structures were particularly susceptible to severe movement and damage. They were also affected in the same manner as structures on direct-bearing footings, but due to the flexibility of long piling, a greater lateral deflection and consequently a different period of motion occurred. Subject to the particular characteristics of the earthquake, it is possible that the harmful effects of seismic action on free-standing structures supported on long piles may be materially reduced due to the pile flexibility, but the evidence in this respect was not conclusive in this quake.

In design procedure, where such structures are connected to adjoining structures on earth or on piling which is materially restrained by earth fill, especial design consideration must be given to connections between such structures. Different periods and different amplitudes of movement tend to occur that can and did in this quake cause rupture and damage along these lines of connection in a number of waterfront structures.

The effects of earthquakes on friction piles, bulkheads and fills, together with the subsidence of such fills are matters logically associated with waterfront structures. Seismic vibration of natural and artificial fills is deep-seated, and often results in consolidation of material that otherwise would take many years to accomplish, starting at a considerable distance below the surface. In this earthquake such consolidation often brought a settlement of up to 8 inches in fills around and under structures, and 4 to 6 inches in friction piles under load, and dropped the ground level around bearing piles a similar amount. This consolidation around heavily-loaded friction piles increases the bearing capacity of the piles, but without load the piles tend to rise during the earthquake.

Subsidence of filled ground due to the earthquake caused breakage of water, sewer and other buried lines serving structures, with consequent great danger from fire. It is therefore pertinent to say here at the risk of repeating elsewhere, that particularly where facilities extend through bulkheads and exist at other places where shear stresses may be occasioned by fill subsidence, the hazard of piping breakage could and should be reduced by installing these lines with unbreakable pipe having flexible joints where necessary.

Three-part article to be concluded in the April issue.

Western Association Officers—1951

Associated General Contractors

Portland Chapter

Henry A. Kuckenberg of Kuckenberg Construction Co. is the newly elected president of Portland Chapter, A.G.C., succeeding **Karl F. Jacobsen. Herb G. Palmberg** is vice president; **W. Ray Rogers,** 2nd vice president; **Frank Lyons,** secretary-treasurer. **A. H. Harding** continues as manager.

Intermountain Branch

George R. Putnam is the new president of Intermountain Branch, A.G.C., succeeding to the office held last year by **Perce Young.** Other officers are: vice president, **Walter Christiansen,** and secretary-treasurer, **G. M. Paulson. Allan E. Mecham** continues in the post of manager-counsel.

Northern California Chapter

A. E. Holt, vice president of the Guy F. Atkinson Co., is president of Northern California Chapter, A.G.C. **Harold O. Parish** of Parish Bros. was reelected as vice president. **James M. Smith** of Eaton & Smith was elected treasurer. **Winfield H. Arata** is manager.

Nevada Chapter

E. E. Games was elected president of Nevada Chapter, A.G.C. The other officers include: **W. J. Boudwin,** 1st vice president, **F. R. Smith,** 2nd vice president and **C. V. Isbell,** treasurer. **Edward L. Pine** was reappointed secretary-manager.

Southern California Chapter

Ben P. Griffith, executive vice president of the Griffith Company, was elected president of Southern California Chapter, A.G.C. Other officers include vice presidents **R. A. Smith,** P. J. Walker Co.; **R. V. Edwards,** American Pipe & Construction Co.; **C. L. Parkhill,** Parkhill-Wade; and treasurer **Donald E. Reed** of Stanton Reed Co. **W. D. Shaw** is secretary-manager.

Central California Chapter

Bert O. Summers of Erbentraut & Summers was elected president of Central California Chapter, A.G.C. **Frank F. Burrows** of Williams & Burrows is vice president; **Harold O. Sjoberg** of the firm of N. H. Sjoberg & Son is treasurer, and **Frank G. Corker** is secretary-manager.

Alaska Chapter

D. L. Cheney of S. Birch & Sons Construction Co., Seattle, is the new president of Alaska Chapter, A.G.C. The new vice president is **A. M. Strandberg** of J. B. Warrack Co., Anchorage, and **John Grove** of Stock & Grove, Anchorage, is secretary-treasurer. **L. A. Moore** is manager.

Idaho Branch

C. B. Lauch of C. B. Lauch Construction Co., Boise, is the newly elected president of Idaho Branch, A.G.C. **W. B. Curtis** is vice president and **L. D. Robbins** is secretary-treasurer. **J. T. R. McCorkle** continues in the position of manager.

DECKER
Montana Building Chapter of A.G.C.

DICKSON
Tacoma A.G.C.

Montana Building Chapter

E. J. Decker of McKinnon-Decker Co., Helena, was elected president of Montana Building Chapter, A.G.C., Inc. **Frank Messmer** is vice president and **L. G. Hardy** is treasurer. **J. Edward Hergert** is retained as secretary-manager.

Oklahoma Chapter

H. C. Bass of Enid was elected president of the Oklahoma chapter of the Associated General Contractors of America, Inc., at the group's yearly convention in Oklahoma City. **Clarence Smith,** Tulsa, and **Earl W. Tankersley,** Oklahoma City, were named vice presidents.

Montana Contractors' Association, Inc.

George Nilson of Nilson-Smith Construction Co., Great Falls, is the new president of Montana Contractors' Association, Inc. **Edward O'Neil** was elected vice president and **Frank Fly,** treasurer. **J. Edward Hergert** is secretary-manager.

Associated Contractors of New Mexico

Marshall J. Wylie, partner in the firm of Wylie Brothers, Albuquerque, N. M., is reelected president of Associated Contractors of New Mexico for 1951. Other officers elected are: **T. R. Brown,** vice president and **W. T. Bookout,** secretary-treasurer. **Clyde O. Fault** is manager.

Tacoma Chapter

Lige Dickson of Lige Dickson Co. is the newly elected president of Tacoma Chapter, A.G.C. Also elected are **Roy T. Earley** as vice president and **P. F. Stevens** as treasurer. Chapter manager is **Clarence W. Todd.**

Eastern Washington Builders Chapter

Vern W. Johnson, partner in Busboom & Rauh, Spokane, has been elected president of Eastern Washington Builders Chapter, A.G.C., succeeding **Henry George. Harold A. Sewell** was named vice president.

Seattle Chapter

Howard Lease of Lease & Leigland is the newly elected president of Seattle Chapter, A.G.C. He succeeds **Cliff Mortensen.** Other 1951 officers are: **W. D. Brown,** 1st vice president; **Elmer Edwards,** 2nd vice president; **Paul Odegard,** secretary, and **P. D. Koon,** treasurer.

North Dakota Chapter

J. M. Powers is president of North Dakota Chapter, A.G.C. Other officers include vice presidents **A. C. Johnson** and **J. B. Jardine,** and secretary-treasurer **T. C. Sornsin. R. J. Hendershott** is manager.

Colorado Contractors Association, Inc.

Walter Steinwald of the Colorado Constructors, Inc., of Denver, has been

STEINWALD
Colorado Contractors Association

KUCKENBERG
Portland A.G.C.

WYLIE
Associated Contractors of New Mexico

PUTNAM
Intermountain A.G.C.

GAMES
Nevada A.G.C.

GRIFFITH
Southern California A.G.C.

HOLT
Northern California A.G.C.

ARNOLD
San Diego
A.S.C.E.

LAVERTY
Los Angeles
A.S.C.E.

McGEE
Sacramento
A.S.C.E.

OLSON
Tacoma
A.S.C.E.

WISKOCIL
San Francisco
A.S.C.E.

elected president of the Colorado Contractors Association, Inc. **Dan G. Bell** and **C. L. Hubner** have been elected 1st and 2nd vice presidents respectively. Secretary-treasurer is **M. J. Sears,** and **Earle W. Devalon** is managing director.

Mountain Pacific Chapter

T. H. Youell was elected president of Mountain Pacific Chapter, A.G.C., Seattle. Other officers are: **Don L. Cooney,** vice president; **Alex McEachern,** treasurer and **Paul Fredrickson,** secretary-manager.

American Society of Civil Engineers

San Diego Section

G. E. Arnold, director of the water department of the city of San Diego, has been elected president of the San Diego Section, ASCE. First vice president is **E. A. Lawrence** and second vice president is **R. H. Wilken. Quentin Rust** is treasurer and **R. K. Fogg,** secretary. **J. F. Jorgensen** is junior past president.

Los Angeles Section

Finley B. Laverty, chief hydraulic engineer of the Los Angeles County Flood Control District, is the newly elected president of Los Angeles Section, ASCE. Other officers elected are: vice presidents, **Roy L. Anderson** and **Walter H. Cates;** secretary, **L. LeRoy Crandall;** treasurer, **Ralph C. Durke.**

Sacramento Section

Henderson E. McGee is the new president of Sacramento Section, ASCE. **J. S. Barrish** has been elected first vice president; **Walter G. Schulz,** second vice president, **Raymond J. Ivy,** secretary-treasurer. **R. M. Gillis** is junior past president.

Tacoma Section

N. E. Olson is the newly elected president of Tacoma Section, ASCE. He is an engineer with the Washington Toll Bridge Authority, which has just completed the new Tacoma Narrows Bridge. **Roy L. Greene** is vice president, and **C. C. McDonald** is secretary-treasurer.

San Francisco Section

Clement T. Wiskocil, Professor of Civil Engineering at the University of California, is the new president of San Francisco Section, ASCE, succeeding **Glenn B. Woodruff.** Vice presidents elected are: **John S. Longwell** and **J. G. Wright. H. C. Medberry** is treasurer and **R. D. Dewell** is secretary.

Spokane Section

William A. Hill is the 1951 president of Spokane Section, ASCE. He is a consulting engineer of Spokane and Newport. Other officers are: **Emmett B. Moore,** 1st vice president; **Robert E. Tobin,** 2nd vice president, and **John P. Esvelt,** secretary-treasurer.

New Mexico Section

G. C. Lassetter of Santa Fe is 1951 president of New Mexico Section, A. S. C. E. First vice president is **Don Johnstone,** Los Alamos; 2nd vice president is **Rowland W. Fife,** Albuquerque. **Eugene Zwoyer,** Albuquerque, is secretary-treasurer.

Other Groups

Structural Engineers of No. California

John E. Rinne, head of the civil engineering and architectural division for Standard Oil Co. of California, San Francisco, is the new president of the Structural Engineers Association of Northern California. He succeeds **Arthur W. Anderson,** architect-engineer of Oakland. **John J. Gould** is vice president; **W. W. Brewer, Jr.,** secretary, and **Franklin P. Ulrich,** treasurer.

Engineers Club of San Francisco

Lewis A. Parsons, assistant consulting engineer for Calaveras Cement Co., has been elected president of The Engineers Club of San Francisco. Other newly-elected officers include: vice president, **Eric S. Warner,** assistant chief engineer, Standard Oil Co. of Calif.; secretary, **Robert D. Dewell;** treasurer, **D. A. Stivers, Jr.**

RINNE
Structural Engineers
of No. California

PARSONS
Engineers Club
of San Francisco

Spokane Construction Council

R. B. Moran was recently elected president of the Spokane Construction Council. He succeeds **Eric Plath. Russell Babcock** was named vice president; **Edwin Atwood,** recording secretary, and **Sheldon F. Kiser,** treasurer.

Arizona Building Contractors

I. G. Homes has been elected president of Arizona Building Contractors, Phoenix Chapter, succeeding **Louis Karpe.** Other officers elected are: **Dan Mardian,** 1st vice president; **H. R. Meadows,** 2nd vice president, and **J. R. Porter,** treasurer. **John A. Murphy** was renamed as legal counsel and executive secretary.

Structural Engineers of So. California

Donald F. Shugart is the new president of the Structural Engineers Association of Southern California. Other new officers are: **Harold P. King,** vice president; **Robert J. Short,** secretary-treasurer. Shugard succeeds **Ernest C. Hillman.**

Structural Engineers of Cent. California

Allen H. Brownfield of Sacramento is the newly elected president of the Structural Engineers Association of Central California. **M. A. Ewing** was elected vice president and **O. T. Illerich** was chosen secretary-treasurer.

Professional Engineers of Oregon

Hilbert S. Johnson of Portland has been elected president of the Professional Engineers of Oregon. **W. C. Williams** of Salem was elected vice president, and **R. C. Shoemaker,** Portland, treasurer.

Bibliography of Books and Articles on Construction

THE SMALL AMOUNT of published information directly pertinent to construction job organization and management is difficult and time-consuming to locate in the mass of management literature, most of which deals with the manufacturing industries.

To make such papers easily and quickly available, the Engineering Societies Library has compiled an annotated bibliography of 52 selected references to books and periodical articles which deal with construction job planning, work scheduling, costing, organization, preparation of material-requirement charts, material-delivery time scheduling, job progress records, time studies, material and equipment control, and contracting procedures on various kinds of contracting and building jobs such as small and large-scale housing, office and factory building, tunnel, highway and dam construction.

This "ESL Bibliography No. 8" may be purchased from the Engineering Societies Library, 29 West 39th Street, New York 18, N. Y. Price $2.00.

Modern All-Metal Frictions And Their Use on Equipment

By
G. O. ABELL
West Coast
District Sales Mgr.
S. K. Wellman Co.

EFFICIENT clutch and brake maintenance is important in reducing the cost of operation on track type tractors, auxiliary equipment such as cable units, and winches, as well as wheel-type earth movers.

First installation

Until the middle 1930's all of such equipment used asbestos brake linings and clutch facings. These clutch facings and brake linings were supplied in two types of material—woven and moulded. Equipment manufacturers selected either type for their clutches or brakes, depending upon the job the clutch or brake had to do. As the engine horsepower increased and the loads became greater, the clutches and brakes required more frequent adjustments and replacement of linings or facings.

In 1936 clutch facings made from sintered powdered metals fused with a steel backing plate, were introduced on the West Coast by The S. K. Wellman Co. of Cleveland, Ohio. These facings were designed to increase the wear life, withstand high temperatures, and maintain friction value in the presence of oil or grease. The United States Forest Service was the first organization on the West Coast to adopt this product as replacement for use in the flywheel and steering clutches of its Caterpillar tractors. In 1937 it was placed on the Government supply schedule.

A new development

The initial installation of all-metal clutch facings in the steering clutches of an RD-8 Caterpillar tractor was made by a West Coast contractor, the L. A. & R. S. Crow Construction Co. of Los Angeles, Calif. The original set of all-metal facings lasted over seven years and delivered more than 27,000 hours of service. Later developments of sintered powdered metal friction material offered replacements for external brake band linings, cone clutch linings, and some internal expanding shoe brakes. Clutch plates with sintered metal facings used as replacements in trucks, motor graders, and heavy earth-moving equipment were soon to follow.

In the late 1930's the RD-8 Caterpillar was factory equipped with all-metal steering clutch facings, and Allis-Chalmers turned to all-metal facings for their HD-14 steering clutches. Today it is difficult to name a producer of large tractors and heavy duty equipment who does not supply sintered powdered metal frictions in one unit or more, either as standard or optional equipment.

All-metal clutch facings and brake linings are available as replacements for track type tractors, power control units, rubber-tired earth movers, industrial equipment, and most heavy duty clutches and brakes of a popular nature. The West Coast has been a proving ground for this material, as well as many other improvements now offered on the market. In the West Coast region earth-moving and logging equipment is subjected to terrific strain and punishment due to extreme temperatures, rugged mountainous terrain, and soil with dust as fine as face powder. These conditions contribute to the short life of clutch facings and brake linings. Sintered powdered metal friction materials, when properly installed, have greatly extended the life of clutches and brakes.

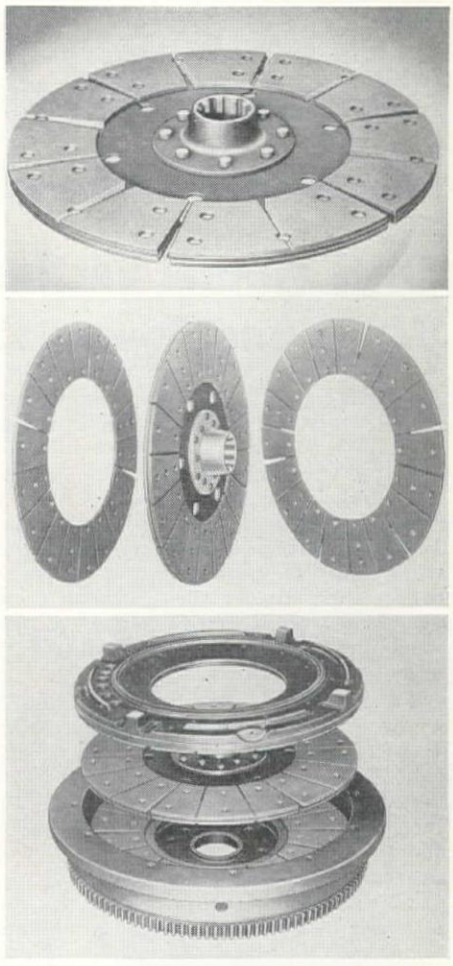
Rules for long life

A new development in this field for flywheel disc clutches has proved to be highly satisfactory. This installation is made by using all-metal clutch facings on the driven clutch disc, plus an all-metal facing as a wear surface on both the opposing surfaces, which in most cases are the flywheels and pressure plates. This type of installation delivers higher friction action and insures a positive power transfer that will keep the equipment in operation considerably longer. The costly replacement of heat-checked flywheels and pressure plates is also eliminated. The installation of the facings on the flywheel and pressure plate is done in an easy manner. It is necessary only to machine down the wear surfaces of the flywheel and pressure plate, follow the rivet pattern for drilling, and secure the facings in place.

The advantages of all-metal clutch facings and brake linings are: increased life of the friction material; dissipation of heat from the friction surfaces, and protection against damage by oil or grease to the friction material. Another feature found in all-metal clutch facings and brake lining design is the steel backing to which the friction material is fused. This backing provides extra strength for heavy duty operation, permits the frictions to be securely fastened to the clutch plate or brake bond.

Clutch and brake life can be greatly lengthened by the observance of a few simple installation and maintenance rules. These rules are as follows:

1. The opposing surface against which the clutch facing or brake lining operates should be free from heat-checks, cracks, or ridges.



EVOLUTION OF CLUTCH-PLATE ASSEMBLY

TOP—Facings of standard type replacement clutch plate rub directly against the wear surfaces of the cast iron flywheel and pressure plate. Such clutch plates, whether faced with asbestos, composition or all-metal friction material (metal shown), are designed to meet normal service requirements. Under abnormal operating conditions, however, the high temperatures generated by clutch action often cause the flywheel and pressure plate to become heat-checked and warped, making replacement necessary.

CENTER—Engineered primarily for extra heavy duty use, clutch plate sets are now available for trucks, tractors, earthmoving equipment and logging units. These sets have all-metal friction surfaces and in addition to a standard-type clutch plate, include opposing friction material facings for mounting on the flywheel and pressure plate. In this way, the flywheel and pressure plate are protected against damaging heat checks and warpage, and greater holding power is obtained because of friction-to-friction operation.

BOTTOM—New clutch plate sets with the protective friction material facings mounted on a standard flywheel and pressure plate.

2. New grease seals should be installed when the clutch or brake is down to prevent grease leaks in the future.

3. Linkage and mechanism should be thoroughly checked and worn parts replaced as the pressure applied to the clutch or brake is highly essential in obtaining efficiency. Clutches using springs to generate pressure should be carefully checked. If the springs are not up to standard pressure they should be replaced.

HOW IT WAS DONE . . .

Steel Tunnel Sections Launched From Ways and Towed 125 Miles to Job Site

A UNIQUE TYPE of launching was recently witnessed on the end-launching ways of U. S. Steel's Consolidated Western Steel Corporation at Orange, Texas. The first fabricated steel section of a new vehicular tunnel being built for the Texas Highway Department left the ways and slid into the water preparatory to its trip to the Houston Ship Channel. Here it will form part of the new highway system linking Baytown with LaPorte, Texas.

The tunnel, when completed, will form a concrete-lined tube about 2,550 ft. long. It will consist of nine cylindrical sections of ½-in. steel plate about 35 ft. in diameter. Six of the sections are 300 ft. long and three are 250 ft. long. Each section is stiffened with annular T-sections.

To make each section seaworthy for towing to the tunnel site and permit its being sunk in place, a watertight bulkhead of 7/16-in. plate, reinforced with 18-in. and 24-in. WF stiffeners is welded to each end. The sections are assembled on the ways on cribbing 6 ft. high located under the longitudinal centerline of the tube and arranged to give support under each annular stiffener ring. To prevent deformation from transverse stresses, tension spiders are installed at each stiffener ring. These spiders are not removed till after the tube is afloat.

Because of the arrangement and condition of the yard facilities, the tube sections are end launched. This imposes critical compressive longitudinal stresses in the upper shell. So, to prevent buckling, two I-beam stiffeners are tacked along the top outer surface, crossing the point of maximum bending moment.

In preparing for launching, the weight of the tube is transferred to timber cradles set on continuous sliding ways. Standard "wedging up" procedure of typical ship launchings is employed. The tube section is released by burning through sole plates on each sliding way.

About 75 tons of reinforcing steel are placed in the bottom of each tube before launching to serve as ballast. The tube, when afloat, draws between 4 and 4½ ft. of water.

Because of the large square dam plates at both ends and saddles and other projections on the bottom of the tube, the cradles and sliding ways cannot be withdrawn as a complete unit after launching. It was necessary to devise a method to pull out the cradles and sliding way from each side of the tube. To eliminate the use of divers, crossed wire cables were used to tie the starboard sliding way to the port side of the tube above water and vice versa. Loose timber spreaders were used to separate the sliding ways. This arrangement permitted side removal of port and starboard cradles and sliding ways as two separate units.

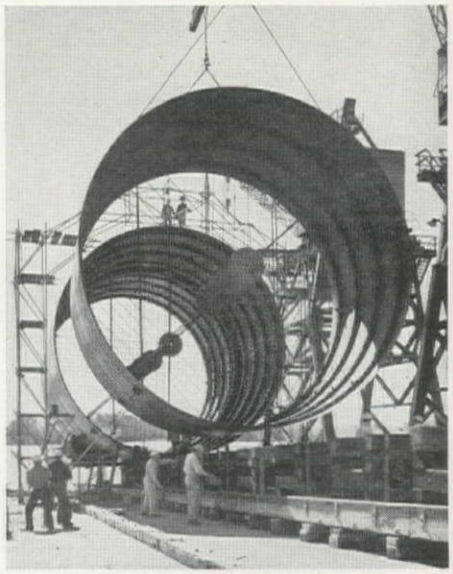
The dam plates and underwater saddles also offer tremendous resistance to movement of the tube through the water during launching. This posed a critical problem in launching velocity which was complicated by the ungreased condition of the underwater ground ways. The coating of grease applied when the ways were built in 1941 had long since been worn off during the wartime shipbuilding program. There are no appreciable tides on the Gulf coast to expose the ways for regreasing and raising them for this purpose was too costly a project.

With no information available as to the possible friction to be encountered on the ungreased portion of the ways, assumed values had to be taken to calculate the probable maximum velocity of the tube in launching. With all factors considered, the margin of safety against the tube's stopping before being completely afloat was ample. The first tube attained an actual velocity only slightly less than the calculated velocity, but sufficient to eliminate all concern on this score.

When afloat in the quiet waters of the Sabine River, tie rods were removed and the tube was checked for ballast distribution. The 125-mi. journey to the job site was accomplished by the use of two tugs, one towing the big tube and another keeping it on course by means of draglines. It sailed down the Sabine, along the Intracoastal Canal, through Galveston Bay and to the job site in the Houston Ship Channel. The trip took two days.

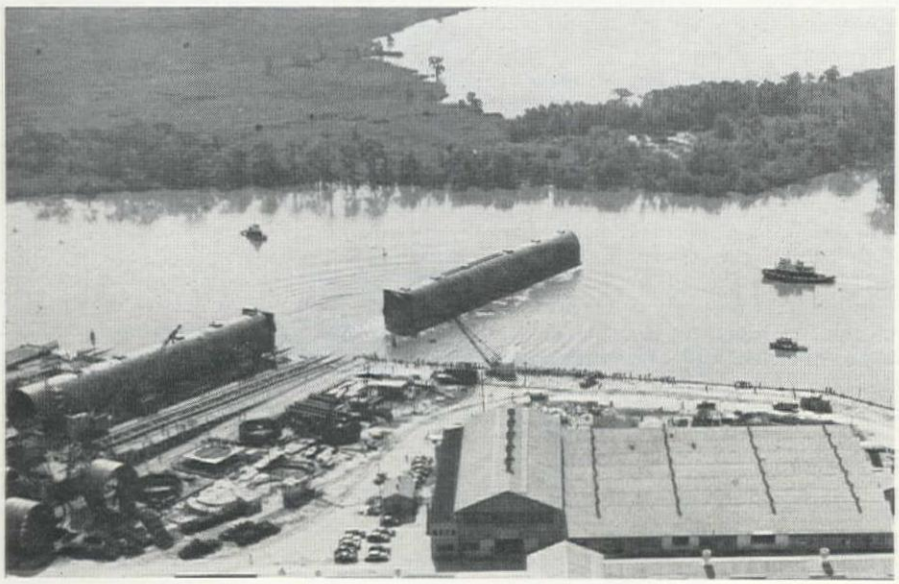
A deep ditch is being cut across the floor of the channel to receive the tunnel sections. When all of the nine sections are delivered, they will be lined with reinforcing concrete and the road-

Continued on page 94



FABRICATING one of the 300-ft. sections of underwater tunnel. To facilitate launching when completed, sections are assembled on shipways.

AFTER being made seaworthy, fabricated steel section for underwater vehicular tunnel is launched from ways like ship. Tugs tow section to job site where it is sunk in prepared trench.



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Tunnel Sections Launched

. . . Continued from page 92

way will be laid before they are sunk 50 ft. into the channel bed. Here the joints will be sealed by steel bands and concrete, after which the bulkheads will be removed.

The tunnel roadway will be 22 ft. wide. A railed-off walk will be provided for pedestrians. Safety factors in the new tunnel will include pumps, fire extinguishers and fire alarm boxes. The 2.19 mi. of tunnel and approaches will be ready for traffic in the summer of 1952.

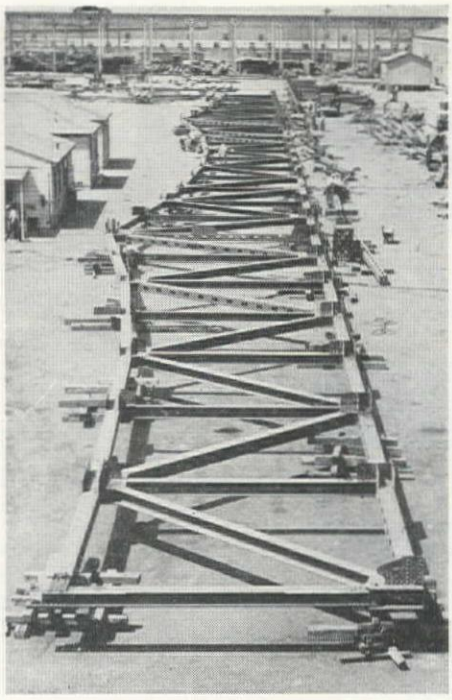
Small Hoist in Truck Trailer Eases Heavy Motor Handling

MEYER and Welch of Los Angeles, California, makes interesting and profitable use of small hoists. This firm has installed P&H Electric Hoists in ten truck trailers for safe, quick handling of motors. Serving Ford dealers in California and parts of Arizona and Utah, the

ONE MAN using electric hoist can lift heavy motor from any position in the trailer for easy unloading.

trucks pick up old motors and deliver rebuilt units.

The hoist installations permit one man, by merely pressing buttons, to lift motors from the street and place them anywhere within the trailer. This is possible because the hoists are mounted on runway rails for fore and aft, side to side travel. The hoists travel the full length of the trailers on side-mounted rails. Physical labor in lifting motors in and out of the trailer is virtually eliminated, and one man easily handles the motors. The electric operation of the hoists with their ability to lower motors gently and accurately in place, eliminates motor damage.

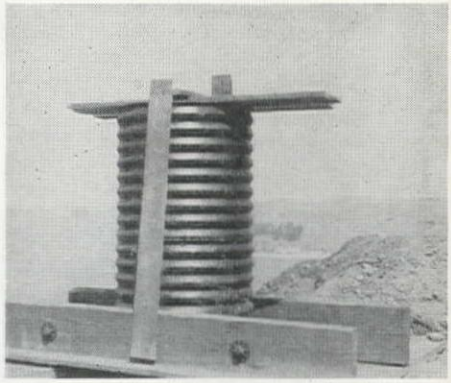


CHECKING A BRIDGE TRUSS

TWO 520-FT. truss sections for the Metaline Falls Washington highway bridge were assembled in the Consolidated Western Steel Corp.'s Maywood yard to make certain each part met specifications. After being checked the 225-ton trusses were dismantled and shipped to site of bridge for erection.

Ventilators in Drain Tunnels Increase Life of Timbers

THE SOUTHERN PACIFIC Railroad has a number of drain tunnels driven in an old slide about ¼ mi. south and west of the Carquinez Bridge near Crockett, Calif. It was found that timbers of these drain tunnels were decaying very rapidly due to lack of ventilation. Experience elsewhere had shown that five times as much life could be obtained from the timbers by this simple expedient of ventilating the drain tunnels. Therefore, at the proper point, a vertical shaft was driven 49 ft. from the surface down to intersect the upper ends of one of these drain tunnels. To insure that the opening would remain in effect, a 24-in. corrugated ventilator was inserted in this shaft and its top was capped with a concrete casement. An interesting feature of this job was the fact that the Casey

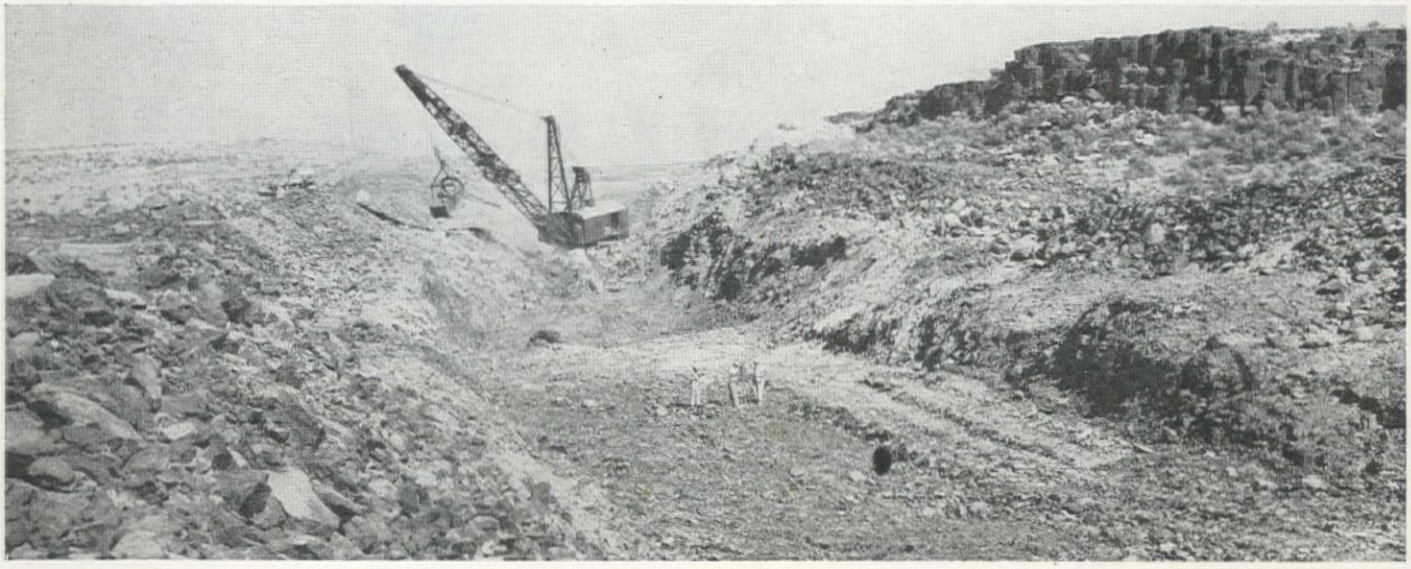


TO INSURE tunnel opening would remain unobstructed, 24-in. corrugated ventilator was inserted in the shaft.

& Case Foundation Co. of Berkeley bored the 49-ft. vertical shaft in about 9 hours, which was considered record time for such a job. The ventilator and the concrete casement were later placed by the railway company's B & B forces.

ROUGH GOING: Guy F. Atkinson Co. has rugged going at times during canal construction on the Columbia Basin Project. A Bucyrus-Erie 120-B electric dragline with 90-ft. boom and six-yard bucket is shown working on the first section of Potholes East Canal. Holes are drilled 24 ft. deep on 9 by 10 ft. pattern, sprung and loaded with Free Flow No. 5, and special 40% dynamite supplied by Columbia Powder Co. In some cases delays are used in outside holes along canal banks. Fragmentation is reported as good with only a small amount of plugging and shooting on big stuff.

Bur. of Recla. Photo.



REPORTS *from the* COURTS

By
HOWARD S. BURNSIDE
Registered Professional Engineer
Attorney at Law

Contractor's Funds Advanced by U. S. Taxed by State

WHEN the federal and state governments act in a governmental capacity conducting the necessary affairs of sovereign bodies their activities and properties are not taxable, one government by the other. This immunity is afforded by the Constitution of the United States. When a contractor is working for the United States under a cost plus contract the question often arises whether various sorts of property belong to the United States so as to be immune from state taxation or whether they belong to the contractor and are subject to ordinary taxes levied by the state.

In Timm Aircraft Corp. v. Bryam[1] an independent contractor working under a cost plus fixed fee contract with the United States made a special bank deposit. The funds deposited consisted of moneys advanced under the contract. They were to be used exclusively as a revolving fund for carrying out the contract. Provision was made for replenishing the funds as used. Withdrawals were subject to prior approval by the contracting officer and the United States retained a lien on any balance in the account if the contract was terminated. The United States had title to completed work and took title to reimbursable materials, equipment and supplies upon delivery to the contractor.

On tax day ad valorem taxes were levied by the state on the balance in the special account as a solvent credit of the contractor. The contractor paid the taxes under protest and then sued to recover contending that the deposit was owned by the United States and constitutionally exempt from taxation by a state. The basic question before the court was whether the contractor or the United States owned the funds. The contractor was held to be the owner.

The court drew an analogy to the situation existing if the contractor had financed its operations with a deposit of private funds in which case the contractor would clearly be the owner. Also "the ownership of a lien (by the U. S. here) in personal property precludes legal title in the lienor." As for the provisions for prior approval of expenditures by the contracting officer, the court said, "the imposition of reasonable restrictions upon the use of property * * * does not make the United States the owner * * * for tax purposes."

In Alabama v. Boozer,[2] cited in the Timm case, a similar situation existed. A builder contracted with the United States to construct a camp on a cost plus fixed fee basis. Title to materials vested in the United States upon delivery and all purchases were subject to the prior approval of the contracting officer. A purchase of lumber was made by the builder with approval of the contracting officer and the State of Alabama sought to collect a sales tax on the transaction from the Seller. The Seller resisted the collection asserting that the builder purchased as agent of the United States and that the tax was therefore invalid. The contention that prior approval of purchases established any agency between the contractor and the United States was rejected. "But however extensively the Government may have reserved the right to restrict or control the action of the contractors * * * neither the reservation nor the exercise of that power gave the contractors the status of agents of the Government to enter into contracts or to pledge its credit."

[1] Timm Aircraft Corp. v. Bryan 34 C. 2d 632.
[2] Alabama v. Boozer 314 US 1.

Liability From Failure to Beat Freeze Order

COGNIZANT of a rumored "freeze" order by the Federal Government on commercial construction the defendant contractor agreed in January 1946 to make an immediate application for a building permit. About two months later the defendant did apply for the permit but shortly thereafter on March 26 the Federal Government prohibited issuance of permits for commercial building so that the permit for plaintiff's structure did not issue. It normally required about three or four weeks after applying for a permit to be issued.

Plaintiff alleged damages for defendant's failure to act promptly. While the defendant denied any agreement to immediately apply for a permit, the trial court found that he negligently failed to exercise reasonable diligence in filing plans and applying for a permit and that the plaintiff suffered damages therefrom.

Evidence indicated that other builders took out foundation permits, obtainable in one day, which allowed work to start before the impending freeze. However, the defendant took no such step on behalf of plaintiff though the type of foundation required was known and he had done this for another client. Plaintiff had approved completed plans.

The judgment of the lower court in favor of the plaintiff in the sum of $4,000 was affirmed by the appellate court.[1]

It is noted that the current "freeze" order on commercial construction under NPA Order M-4, amended January 13, 1951 provides that "after midnight October 26, 1950, no person shall commence construction of any building, structure or project to be used for"—the specified functions, mostly commercial operations. "Construction means the erection of any building, structure, or project, or addition or extension thereto, or alteration thereof, through the incorporation-in-place on the site of materials which are to be an integral and permanent part of the building, structure or project. 'Commence construction' means to incorporate . . . a substantial quantity of materials which are to be an integral and permanent part . . . (for example, the pouring or placing of footings or other foundations)." Thus it is not related to the issuance of a building permit. However, the principle of the above case would remain though the manner of prohibiting construction differs.

[1] Stewart v. Kaplan 202 P2d 1061.

Use of State Highway Funds For Publicity

FOR THE PURPOSE of preventing a diversion of funds to other uses a state constitution provided that money from taxation relating to motor fuels or use of vehicles shall be spent only on administration, construction, maintenance, repair, rights-of-way, highway obligations, law enforcement and for statutory purposes. In this state the question arose whether costs incurred by the highway department for printing and distributing road maps, bulletins, photographs and advertisements in motor magazines could be paid out of these funds.

The Court of Appeals of Kentucky, reversing a ruling below, held that they could be. In the opinion of the court such costs were includible in the broad category of administration and maintenance which also applies to routing and traffic control. "Our highway system could hardly be maintained without the publication of maps. The fact that these maps are gotten up . . . to attract tourists, as well as to help them . . . does not prevent the maps from being a proper charge against the road fund."[1] This reasoning was also applied to the booklet.

The paid advertisements in motor magazines gave the court more concern but they too were found to be useful by making highway information available to prospective travelers.

[1] Keck v. Manning, 231 S.W. 2d 604.

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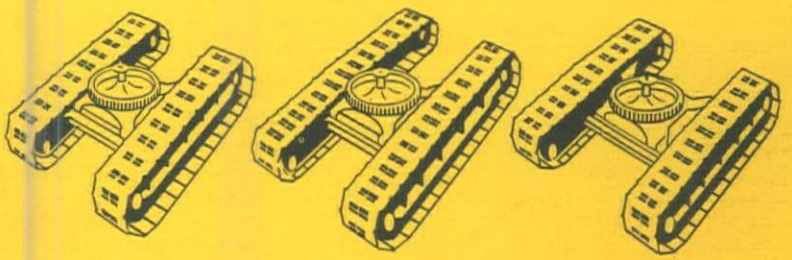

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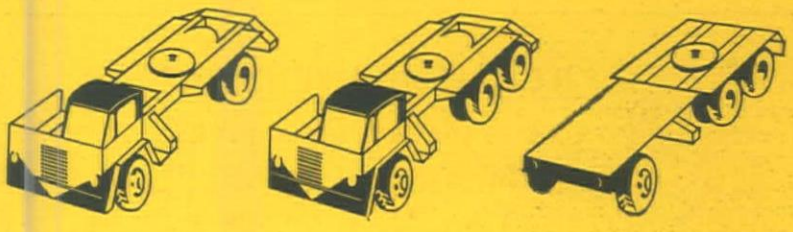

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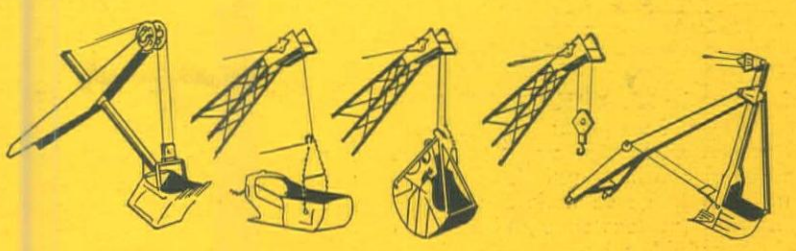

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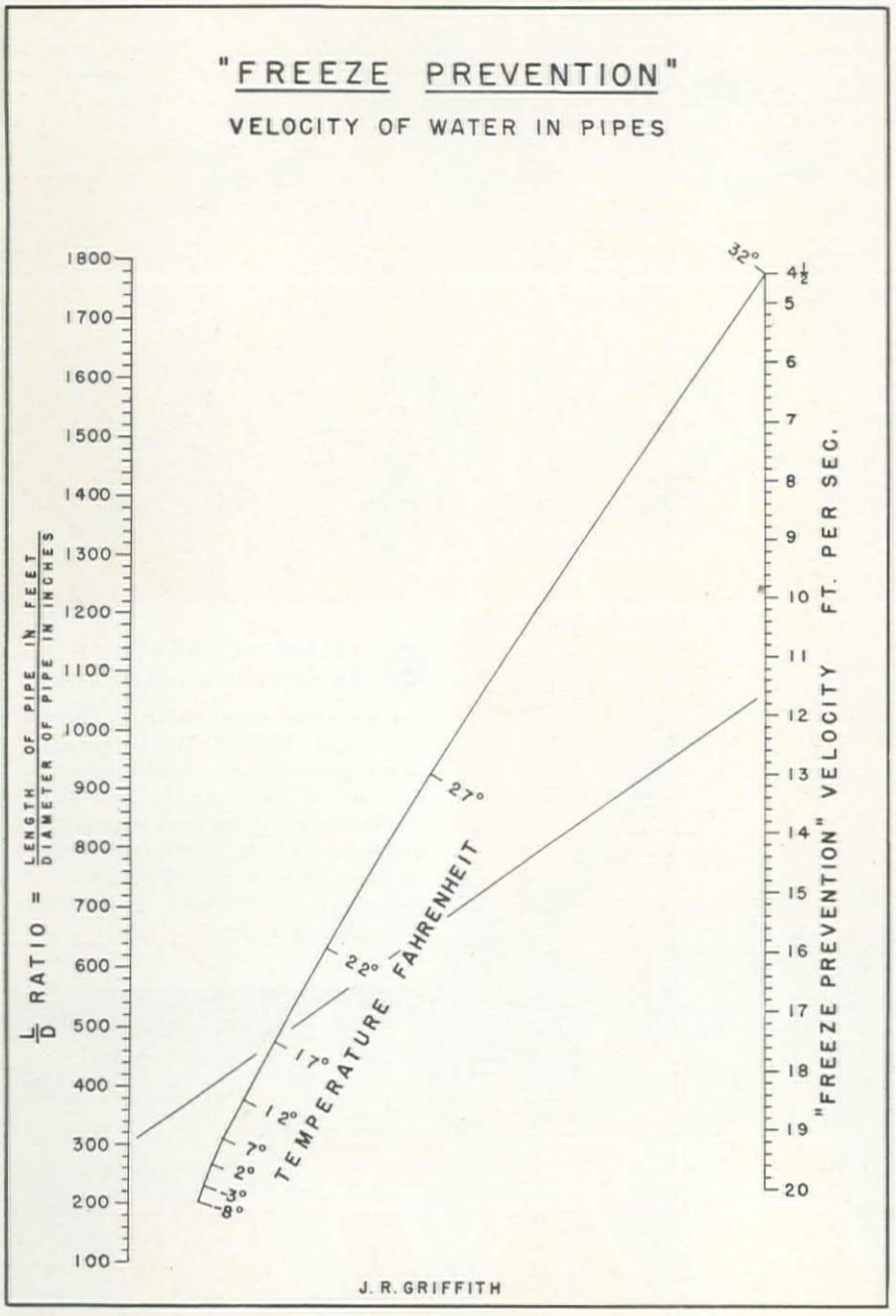
CONSTRUCTION DESIGN CHART

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

CXXVIX . . . Freezing Velocity of Water in Pipes

BELOW FREEZING temperatures sometimes catch us with exposed water pipes before they can be backfilled or insulated. In Pacific Coast house construction, where temperatures seldom go far below freezing, non-insulated water pipes in unheated below-floor areas cause trouble during spells of unusually cold weather. The idea for the accompanying chart came to me during the month of freezing weather in Portland, Ore., in February 1949. We experienced an epidemic of frozen water pipes. In all such cases, the old proverb concerning the ounce of prevention is aptly demonstrated by providing for a sufficient movement of water in the pipes to prevent freezing. When I was a boy in Indiana, we always let the water faucets run a little during the cold winter nights when the stove was not burning.

In the *Handbook of Welded Steel Pipe*,[1] a chart is given in Fig. No. 44 for the determination of minimum velocities in pipes to prevent freezing. The accompanying chart is this same information in nomographic form. The chart is solved by a single straight line intersecting all scales. A solution line has been drawn on the chart for the following illustrative problem:



It is assumed that a run of 600 ft. of 2-in. pipe is exposed during a time when the temperature is expected to drop to 17 deg. F.

$$\text{Ratio } \frac{L}{D} = \frac{600}{2} = 300$$

The solution line on the chart has been drawn from the above ratio, through a temperature of 17 deg.F. On the velocity scale a value of 11.6 ft. per sec. will be noted. Fig. 44[1] which was used to plot the accompanying chart gives the same velocity reading of 11.6 ft. per sec.

In order to translate the required freeze prevention velocity to terms of discharge, the reader may either resort to computations, or refer to one of the pipe flow charts in the booklet *Construction Design Charts*.[2]

By computation we have

Area of 2-in. pipe = 3.1416 sq. in.

$$\text{Discharge, } Q = AV = \frac{3.1416}{144} \times 11.6$$

$$= 0.255 \text{ cu. ft. per sec.}$$
$$= 0.255 \times 448.8$$
$$= 114 \text{ gal. per min.}$$

By reference to the chart for Flow of Water in Fire Hose,[2] page 164, a solution line drawn from a 2-in. diameter to a velocity of 11.6 ft. per sec., gives on the discharge scale the values:

$$Q = 0.25 \text{ cu. ft. per sec.}$$
$$= 112 \text{ gal. per min.}$$

On the accompanying chart it will be noted that a velocity of 4.5 ft. per sec. will prevent freezing of water in all pipe sizes for a temperature of 32 deg. F. Reference (1) gives a table of time elements for solid freezing of water in unprotected pipes at a temperature of —8 deg.F., as follows:

Pipe Diameter	*Freezing Time*
4 in.	24 hr.
6 in.	36 hr.
8 in.	49 hr.
10 in.	61 hr.
12 in.	72 hr.

[1] Armco Drainage and Metal Products, Inc.
[2] Fourth Edition, *Western Construction*.

The "Kick-Off" at Albeni Falls

SNOW didn't stop about 3200 visitors from witnessing the "kick-off" blast at Albeni Fall Dam, Washington, on January 26. They cheered loudly as powder holes were detonated along 600 feet of the river bank, for the Columbia Basin's latest power project.

NEWS OF WESTERN CONSTRUCTION

MARCH 1951

Three States Shuffling Highway Commissions

STATE HIGHWAY commissions were under discussion by legislative committees of three Western States last month. In Washington, where no state highway commission has previously existed, the house roads and bridges committee by a vote of 11-10 decided to bring a bill, which would create a five-man commission for the state, to the house floor. Sponsored mainly by the Washington Good Roads Association, the bill has the support of farm groups and certain contractors. Under the terms of the measure the commissioners would be appointed by the government with the consent of the senate. Each appointee would be from a different congressional district and not more than three could be of the same political party. Terms would be for six years each, but the first terms would be staggered. The commissioners would appoint a state highway director, who would act for them and be directly responsible to them. At the present time the governor appoints the director. A vehement debate is expected when the measure is discussed before the assembled legislature.

In Montana, the state house of representatives highway committee approved a bill which would replace the present 5-man highway administration with a

Series of Storage Dams on Colorado River Approved

CONSTRUCTION of the $1,139,000,000 Upper Colorado River Basin water development project has been recommended by Oscar L. Chapman, Secretary of the Interior. The plan, which is aimed at turning the dry lands of five Rocky Mountain states into useful and important farm and industrial centers, is expected to be ready for Congress in 90 days with the recommendations and comments of the states involved included.

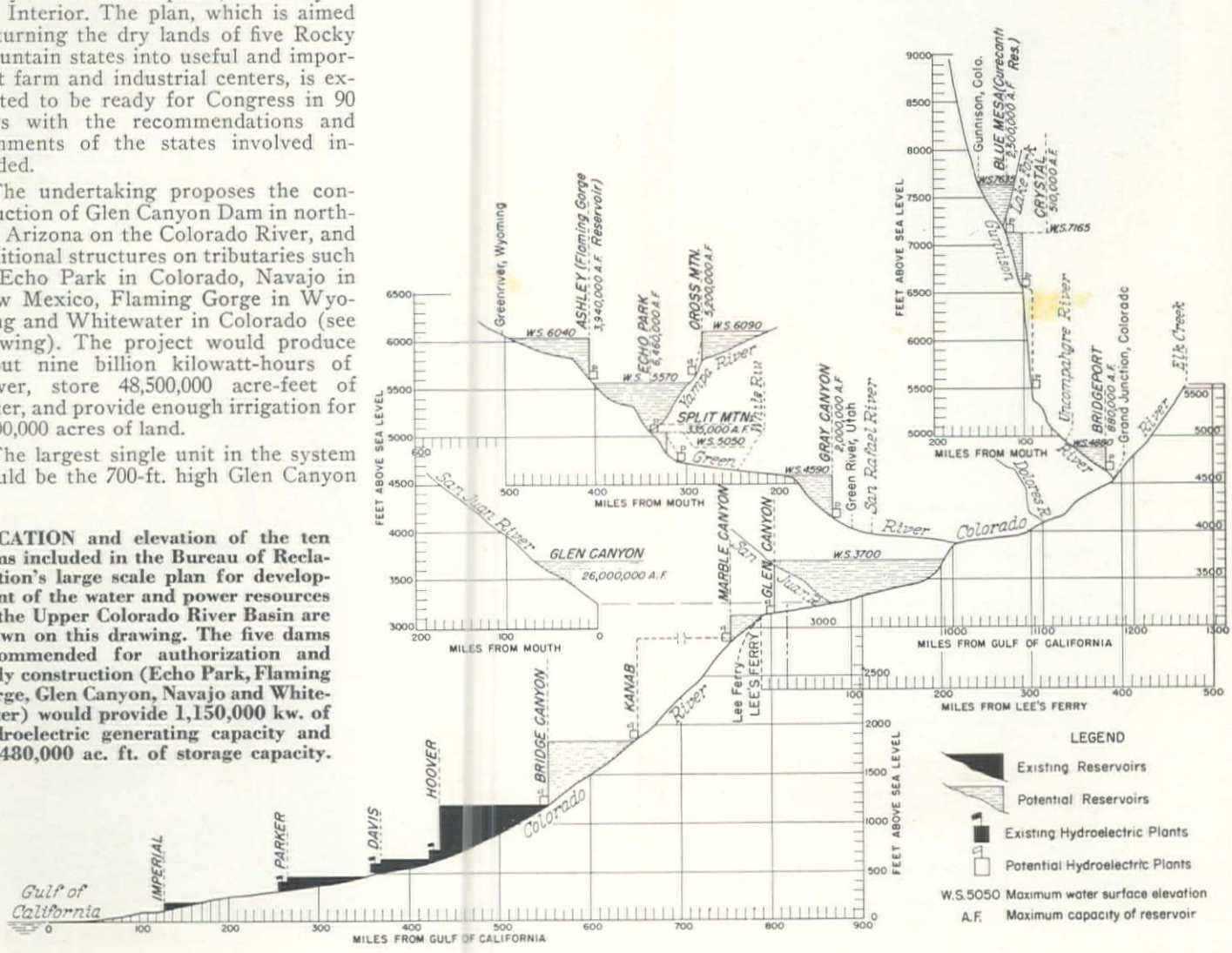
The undertaking proposes the construction of Glen Canyon Dam in northern Arizona on the Colorado River, and additional structures on tributaries such as Echo Park in Colorado, Navajo in New Mexico, Flaming Gorge in Wyoming and Whitewater in Colorado (see drawing). The project would produce about nine billion kilowatt-hours of power, store 48,500,000 acre-feet of water, and provide enough irrigation for 2,000,000 acres of land.

The largest single unit in the system would be the 700-ft. high Glen Canyon Dam with a reservoir covering 153,000 acres, storing more than 30,000,000 acre-feet of water to guarantee delivery of 75,000,000 acre-feet every 10 years from the upper to the lower basins.

The huge storage reserve is said to be necessary to assure the lower basin delivery while maintaining enough excess water to develop upper basin projects in Wyoming, Utah, Colorado, New Mexico and Nevada.

A complete preview of the project was presented on page 73 of the February 1950 *Western Construction*.

LOCATION and elevation of the ten dams included in the Bureau of Reclamation's large scale plan for development of the water and power resources of the Upper Colorado River Basin are shown on this drawing. The five dams recommended for authorization and early construction (Echo Park, Flaming Gorge, Glen Canyon, Navajo and Whitewater) would provide 1,150,000 kw. of hydroelectric generating capacity and 38,430,000 ac. ft. of storage capacity.



12-man commission—one man from each financial district, and an even split along political lines. A three-man executive committee within the commission would carry out policy through a state engineer. Late last month, the bill was rejected by a vote of 47-34.

In Wyoming the state senate decided unanimously to consider a bill which would increase the size of the state highway commission to seven members. They would continue to be appointed by the governor, but one would be chosen from each of the seven judicial districts. Political affiliation is not considered in the proposed measure, but the governor would be required to rotate the appointments among the counties in each district.

Underground Garage Project Starts at Los Angeles

A PROBLEM which has long been of concern to the city of Los Angeles, Calif., is now on its way to partial solution with construction beginning on the centrally located 2000-car underground garage at Pershing Square.

The $5,000,000 project, which is designed to alleviate a serious parking problem, should require from 12 to 18 months to complete. It will have three underground floors and be of reinforced concrete construction.

A special permit from the National Production Authority was required to start construction on the privately financed garage at this time. In the event of air attack the structure could also serve as bomb shelter for an estimated 30,000 persons.

Actual building of the structure will be in sections, and excavation will be continuous during the construction. About 270,000 tons of soil will be removed, about 31,000 of which will be returned to the garage roof for the restoration of the park.

City Park Garage, Inc. will build the garage. Contractors are Ford J. Twaits Co., T. S. Construction Engineers, Inc., and Morrison-Knudsen Co., Inc. Stiles Clements is the architect.

Northwest Power Projects Come in a Flurry

PLANS for several major power plant and dam projects are being advanced by power companies in the Pacific Northwest. The Pend Oreille County public utility district has received permission from the Federal Power Commission to construct its proposed Box Canyon Dam on the Pend Oreille river north of Ione, Wash. Beginning approximately in the winter of 1952-53 the project should produce about 50,000 kilowatts of electricity. Preliminary estimates of the cost of the dam range from $10,000,000 to $12,000,000.

In Oregon, the Pacific Power & Light

SOME EQUIPMENT COMES HOME

IT WAS a long trip for this load of construction equipment from the U. S. to the Pacific islands, and now back to the U. S. again. Schnitzer Steel Products Co., Portland, Oregon, purchased $750,000 worth of this equipment, which is being transported in five complete shiploads. In that Portland plant, 30 men are busy reconstructing and converting the purchases. Picture below shows unloading first shipload, acquired in the Philippine Islands.

Company of Portland requested government approval of a plan to construct a $26,000,000 hydroelectric project at its Yale site on the Lewis River in southwestern Washington. The plant is designed to add 100,000 kilowatts of power to area production power by the latter part of 1952. The arch-type concrete dam would rise 285 ft. above the normal river level and 305 ft. above bedrock. It would be almost a duplicate of the company's Merwin dam 12 mi. downstream from the Yale site.

The Washington Water Power Co. won approval from the Montana State legislature for its plan to store water in that state. This means that construction will begin almost immediately on the firm's proposed $40.000,000 hydroelectric plant east of Clark Fork, Idaho, near the Montana state line. The Cabinet Gorge hydroelectric project, the largest in Idaho, will have a dam which is to rise 170 ft. from bedrock, with a length of 500 ft. on the top. Output of the plant will more than double the firm's installed capacity.

Still another company, Idaho Power of Boise, asked permission of the Federal Power Commission for a license to build a $24,925,000 power project on the Snake River in Idaho and Oregon. Plans include a rock-fill dam and a concrete spillway across the Snake River at Oxbow site, south of Homestead, Ore. A reservoir, canal, intake works, penstocks and a powerhouse plant.

NEWS IN BRIEF...

Bond Issue for L. A. Water System

A $10,000,000 revenue bond issue will be floated this spring by the Los Angeles, Calif. department of water and power to improve and enlarge the city's municipal water system. Reservoirs will be improved, major water trunk lines installed, and new quantities of Colorado River water made available by the bonds, which will be liquidated entirely out of water department revenues.

Bids for Last Step at McNary

BIDS were invited early in February by the District Corps of Engineers at Walla Walla, Wash., for completion of McNary lock and dam on the Columbia River near Umatilla, Ore. Pre-bid conference is scheduled for March 12 at 9 a.m. in Walla Walla.

According to Col. William Mills, district engineer, the contract calls for final completion of the major work on the dam by August 1, 1954. The estimated $60,000,000 contract will include construction of the powerhouse substructure for 12 main units; powerhouse substructure for 14 units; remainder of the spillway dam; completion of abutment embankments and raising the upstream sill in the navigation lock.

The 14 power units will have almost twice the installed power capacity of Bonneville and will facilitate great ad-

vancements in the industrial growth of the Pacific Northwest.

Work on the project will be awarded to one bidder, and officials said the contract is expected to be the largest ever awarded by the Corps of Engineers in the West.

A Bridge, But No Water

Several Nebraskan investors found to their amazement that they had nearly built their bridge, but no water was going to flow under it. Two years ago the idea was prevalent that the army engineers were going to shift the Missouri River water to flow under the site of the present bridge. Though nature's intentions could have been changed, the minds of an economy-minded Congress could not. About $50,000,000 was deleted from the rivers-and-harbors proposal, and the Missouri was not going to have its face listed. Discussions are under way, however, to see whether a meeting of the new bridge and old river can not be arranged.

Power Shovel Causes Explosion

A serious explosion occurred in St. Johns, Ore., when a city power shovel working on street repairs severed a one-inch gas pipe in the street. Three rapid blasts followed the accident during which men on the job and people nearby were injured, houses were damaged, and one man was killed. Injured workmen tried to plug the leak and warn occupants in the area of the danger.

PIPE GOES IN FOR LATERAL ON COLUMBIA BASIN PROJECT

A HAIRPIN-RIGGED crane helps construction crews on the Columbia Basin Project fit into place a section of 42-in. concrete pipe. The pipe is for a main lateral being built to carry irrigation water to farms in east central Washington. Mild weather has enabled contractors to keep going in the Northwest late into the winter months. Lateral being placed above is southwest of Ephrata.

Expediting Libby Dam

Information is being prepared by Montana officials for presentation to a Canadian-American commission which meets this month to expedite the building of the $242,000,000 Libby Dam on the Kootenai River. The dam, authorized by Congress and President Truman is expected to produce 618,000 kilowatt hours of electric power and is an important step in the development of the 30-million kilowatt hour power potential of the Northwest.

Westerner to Head Building Officials

Harold O. Rasmussen of Santa Ana, Calif., first vice-president of the American Society of Building Officials, has compiled data on uniform building codes for presentation at the Society's national convention this month.

Rasmussen, the unopposed nominee for national president when elections are held to replace Walker Lee, believes that the standardization of building codes is the most important problem

facing the building industry today. Hal Colling of Los Angeles, national secretary of the organization, is assisting Rasmussen.

Hiring at Hungry Horse Soon

Weather permitting, hiring will begin at Hungry Horse Dam in Montana this month, where it will be necessary to place 1,200,000 cu. yd. of concrete this year to keep the dam on schedule. About 1,000,000 cubic yards was poured last year, but since the height of the big dam is now 234 feet above bedrock, crews will no longer have to fight with the run-off problems they faced last year. The world's fourth largest dam will be 564 feet high when it is completed sometime in 1953.

Pollution Engineers Needed

Twelve new water pollution engineers will be chosen by Civil Service examination to fill key engineering posts with the State of California. The positions require 3 to 5 years' experience in the treatment and disposal of sewage and industrial waste plus a degree in engineering. Salary range from $436 to $505 monthly. Nine regional water control boards have been established throughout the state. Engineers appointed to these boards will help cities and counties realize an effective sewage and industrial waste program.

Orange County Sewer Project

The largest sewer construction project in Orange County, Calif., in the last twenty years (*Western Construction* — January 1948, pg. 72) is now under way. The joint outfall sewer program began in the southwestern part of the county and will continue for about six months. The Magnolia trunk will be built in units by V. C. K. Construction Co. of Los Angeles, Calif., the Charles T. Brown Co. and the Paul Vukich Construction Co., also of Los Angeles and A. H. Famularo and J. L. McElvaney of Santa Ana. Nelson M. Launer, joint outfall sewer manager, said that the new sewer line will relieve pressure on the line which now serves Orange, Anaheim and Fullerton and the sanitation districts of Buena Park, La Habra, Placentia, and Garden Grove by about August 15.

CALENDAR OF MEETINGS

March 12-14—American Road Builders' Association, annual meeting, at Schroeder Hotel, Milwaukee, Wis.

April 2-4—Twelfth Annual Highway Engineering Conference, at Salt Lake City, Utah. Sponsored by the Dept. of Civil Engineering, University of Utah. Exhibit of equipment and materials in connection with the conference. Contact A. Diefendorf, Head, Dept. of Civil Engineering, 102 Civil Engineering Bldg., University of Utah, Salt Lake City 1.

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.

PERSONALLY SPEAKING

Hammond Ashley, former office engineer for the construction of the Dorena Dam built by the Portland, Ore. district, is now a construction specialist in the Technical Control branch of the Corps of Engineers, Alaska District.

* * *

Smith

Newman B. Smith, for the past five years city engineer of San Gabriel, Calif., is the new Chief Engineer of the Riverside County Flood Control and Water Conservation District. Smith spent 10 years with the Metropolitan Water District of Southern California during the construction of the Colorado River Aqueduct.

* * *

Edgar Metcalf is the project engineer on the enlargement of Rock Island Dam, near Wenatchee, Wash. Formerly of Niagara, N. Y., and Columbus, Neb., Metcalf has been with the public utility district of Chelan County for the past four years.

* * *

Lyle F. Warnock, former Colorado River Indian Reservation general engineer, is now project engineer on the San Carlos irrigation project, Coolidge, Ariz. He is in charge of irrigation and power systems for the U. S. Department of Interior, Bureau of Indian Affairs project. He succeeds **B. J. Moody** who retired from government service.

* * *

Michael P. Baumann, Bureau of Reclamation carpenter, has received a certificate of honorable mention and a cash award of $20 from the Bureau for his work at Hungry Horse project. Award was made by Construction Engineer **C. H. Spencer.** Baumann developed a special babbitt or lead-filled saw file handle which is designed to reduce wear and breakage of saw files.

* * *

C. William Burningham, Bureau of Reclamation engineer and former chief of the Bureau's project office at Klamath Falls, Ore., will go to Saudi Arabia. He was requested by the foreign government to conduct a survey of selected areas in Saudi Arabia to determine the feasibility of developing additional water supplies for new irrigation projects and rehabilitation and expansion of existing irrigation facilities.

* * *

Marshall Jones, a Bureau of Reclamation engineer with wide experience in the field of water conservation, is the new district manager of the Bureau's Sacramento Valley district. Jones, who has spent a great deal of time in the Central Valley basin, succeeds **James K. Carr,** who has been transferred to Washington, D. C.

* * *

R. M. Arenz of the Portland, Ore., division offices of the Federal Bureau of Public Roads Planning and Survey division is now in charge of the Montana district offices in Missoula, Montana. He will be assisted by a staff of 17 highway engineers.

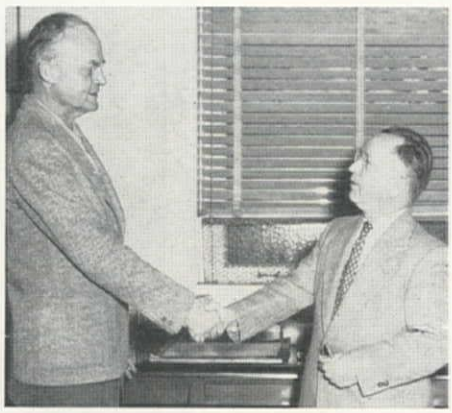
* * *

C. G. Woolley, city planning engineer, and **Roy W. McLeese,** city engineer, are Salt Lake City's representatives on a committee to guide the drafting of a master highway plan for the Salt Lake City-County area.

* * *

Warden W. Gano, structural engineer, has been transferred to the Missoula, Montana regional office of the U. S. Forest Service.

* * *



EXCHANGE POSITIONS: As of Feb. 1, *Huston D. Mills*, left, replaced *W. T. (Bill) Holcomb* as Nevada State Highway Engineer. Holcomb, right, has been appointed to succeed Mills as Assistant Highway Engineer. Both men have been with the highway department for the past 30 years. Mills had held the office of Assistant Highway Engineer since 1931. The appointment was made by the incoming governor, Charles H. Russell.

* * *

Howard B. Solt is now an engineer with Peter Kiewit Sons' Co., Quincy, Wash. He is working on construction of a Columbia Basin project canal. Solt was formerly working as an engineer on Friant-Kern Canal near Shafter, Calif.

* * *

Fred W. Clayton is now a supervisory civil engineer with Earl & Wright, San Francisco, Calif. He was formerly engaged in his own business as a consulting engineer with offices in Reno, Nev., and Eugene, Ore. He is a member of many engineering organizations in the Northern California area.

* * *

Hugo Marek, Jr., Bureau of Reclamation engineer, is enroute to New Delhi, India, for a year's tour of duty as technical adviser to that government on foundation explorations and treatment at Indian dam sites. He will devote particular attention to construction of the Kakrapar Dam on the Tapti River in the State of Bombay and Hirakus Dam on the Mehanedi River in the State of Orissa. Marek was requested by the Indian government. He is the 29th member of the Bureau of Reclamation's technical staff to be loaned to a foreign government.

* * *

A. Parent is the project engineer on the Takotna project for the Corps of Engineers construction of an A. C. & W. station near McGrath, Alaska. Parent was formerly the chief, roads and runway section, engineering department, Corps of Engineers, Anchorage, Alaska. Haddock Engineers, Ltd., is the contractor for the current project.

* * *

C. F. Hamlin has resigned his position as senior bridge engineer with the California Division of Highways to become general manager of the Bailey Bridge Equipment Co. He will be associated with his father, **R. P. Hamlin,** in the new enterprise which will specialize in portable bridges for emergency and construction detour service. Headquarters will be in San Luis Obispo.

* * *

W. L. Chadwick and **J. F. Davenport** are new vice presidents of the Southern California Edison Co. **Harry Lott** is the new executive engineer. Chadwick, manager of engineering since 1945, is vice president in charge of engineering and construction. Davenport has been with the company since 1926. He has served

Davenport

Chadwick

as hydro engineer, superintendent of hydroelectric generation and assistant manager of operation. Lott also joined the company in 1926. He was chief of system planning before this latest appointment.

* * *

Harry R. McBirney, ace canal designer for the Bureau of Reclamation, has been awarded the Department of the Interior Gold Medal for distinguished service. A veteran of more than 42 years with the department—41 of them in the Bureau of Reclamation—McBirney retired from active duty on July 31, 1950.

He was chief of the canals division in the office of the chief engineer, Denver, a position which he had held since 1927. His most famous works are the All-American Canal and the Friant-Kern Canal in California.

* * *

Wade H. Taylor, former assistant regional power manager, has been appointed regional power manager to supervise the technical phases of the Bureau of Reclamation's hydroelectric power program in the lower Colorado River basin. As a member of the regional director's immediate staff he will head the branch of power utilization, which exercises technical supervision over the bureau's operations at Hoover, Davis, and Parker Dam powerplants and their integrated transmission systems in California, Arizona and Nevada. Taylor succeeds **Roy V. Sprague,** who retired July 1.

* * *

Three new State Directors for the National Reclamation Assn. were elected at the annual meeting at Spokane, Washington. **H. L. Buck,** Billings, Montana; **LaSelle Coles,** Princeville, Ore., and **Lloyd Miller,** Sunnyside, Wash. are association directors for their states. **Harry E. Polk** from Williston, No. Dakota is the new president of the Association, with **Clifford H. Stone** of Denver, Colo. as first vice-president, **J. E. Sturrock** from Austin, Texas as second vice-president and **C. P. Peterson,** Lincoln, Nebraska, as treasurer. **W. E. Welsh** of Washington, D. C., will serve as secretary-manager and **Merl B. Peek** of the same city will be his assistant.

* * *

The Department of the Interior Gold Medal for Distinguished Service has been awarded posthumously to **Jacob Warnock,** former head of the Bureau of Reclamation's Hydraulic Laboratory in Denver, Colo. The medal was awarded for Warnock's many achievements in the field of hydraulic engineering.

* * *

Walter L. Carson, who was formerly with the State of California Division of Highways, is now a first lieutenant battalion intelligence officer with the 224th Infantry, Camp Cook, California.

* * *

Gordon K. Ebersole, Bureau of Reclamation engineer on Canyon Ferry Dam, has been assigned to the foreign activities section of the bureau in Washington, D. C. In his new capacity, Ebersole will make assignments for American engineers visiting foreign countries and arrange tours for foreign engineers in the United States.

* * *

One of Europe's outstanding construction engineers before the war and now a nationally known U. S. consulting engineer, **Dr. Jaroslav J. Polivka** has been appointed a lecturer in architecture at Stanford University. Before coming to the United States in 1938, he had been an engineer on such projects as the Podolsko Bridge, longest con-

crete span in central Europe, and navigation locks in Bohemia. In this country, he has collaborated with Frank Lloyd Wright in designing the proposed low-level bridge crossing of San Francisco Bay and the proposed Guggenheim Gallery in New York City.

* * *

R. H. Benker, hydraulic engineer for the U. S. Geological Survey, Department of Interior, has been transferred from Helena to the survey's new office in Kalispell, Mont. The new office will record stream flow west of the continental divide in Montana, a function formerly handled by the Helena office.

* * *

A number of promotions have been announced by the California Division of Highways. **Ridgway M. Gillis,** assistant state highway engineer, has been appointed deputy state highway engineer to succeed **Fred J. Grumm,** who retired. **Earl Withycombe,** construction engineer will succeed Gillis as assistant state highway engineer, and **Charles E. Waite,** engineer of design, will be in charge of personnel and public relations with the rank of assistant state highway engineer, succeeding **J. G. Standley** who retired. **E. T. Telford** will succeed Waite, and **F. N. Hveem** will succeed Earl Withycombe.

* * *

Promotion of **Col. O. E. Walsh,** North Pacific Division Engineer, to the rank of brigadier general is reported by Major General Lewis A. Pick, Chief of Engineers of the Corps of Engineers, Wash., D. C. No change of duty was indicated with the elevation in rank.

* * *

Clarence C. Davis, a resident engineer at Detroit dam, received a promotion to the rank of Colonel with the army organized reserve technical service unit. Davis came to Portland, Oregon in February 1950, for the dam project. He has been on active duty with Corps of Engineers since 1942.

* * *

C. A. Stoldt is the new Oklahoma Director of Highways. The new director, a resident of Oklahoma City, has been the project manager of the U. S. Army Corps of Engineers' $4,250,000 Arnold engineering development center at Tullahoma, Tenn.

* * *

Alden S. Ingraham is superintendent of operation and development on the Bureau of Reclamation's Riverton project near Cody, Wyoming. For the past several years Ingraham worked on the Shoshone project.

* * *

The Arizona State Highway Commission has reappointed **W. C. Lefebvre** as state engineer, and **J. Melvin Goodson** executive secretary of the group.

* * *

Hobart H. Mahon, Columbia Falls city engineer, is back on active duty with the United States Navy civil engineering corps. Commander Mahon served in the Navy for six years before and including

the last war. His duty was in the Caribbean constructing a naval air station on Jamaica, and various undertakings on Pacific Islands with the Seabees.

* * *

H. E. Bailey is the manager of construction of the Oklahoma City-Tulsa turnpike. During the four years he occupied the position of state director of highways, Oklahoma's highway construction progress reached the all-time high record of 5,356 miles, including 827 bridges, contracted for $94,549,578.

OBITUARIES . . .

Albert A. Coddington, 62, died in his home in Ross, Calif. of a heart ailment. He was one of San Francisco's most prominent consulting engineers, and a constant friend to newcomers in the field.

* * *

Wilfred L. Wilson, 45, died after a short illness in Mesa, Arizona. He was an engineer with the Salt River Valley Water User's Association.

* * *

Sid Beasley, 44, of Muskogee, Okla., was killed in a 55-ft. fall from a Columbia River bridge being constructed near Bridgeport, Wash. While supervising riveting work, Beasley slipped from the bottom stringer of a span and landed on bedrock. He died shortly after reaching the hospital.

* * *

Charles H. Mullin, 45, former Montana highway department engineer, died suddenly in his Helena, Montana home. He was with the Montana highway department from 1945 to 1949 and worked for the Kaiser Co. prior to that.

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Tom Stone, private contractor formerly of Spokane, Wash., died suddenly in Hamilton, Texas.

* * *

John F. Wilson, retired contractor of Lancaster, Calif., died early in February. He was 76.

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Thoralf I. Rivenes, District Engineer with the Alaska Road Commission, was killed instantly in an automobile accident on a snow and ice covered highway near Anchorage, Alaska. His car plunged over a 30-ft. embankment.

* * *

Joseph Snell, 64, Marin County, Calif., general contractor, died suddenly on January 21.

* * *

Sidney Cleefeld, 53, West Los Angeles, Calif., building contractor, was found shot to death in his garage in his automobile.

* * *

Thomas Bennett, 46, district manager of the Forestry Service at Fairbanks, Alaska, was found with a bullet through his temple in his downtown Fairbanks office on January 25.

SUPERVISING THE JOBS

C. G. Marrs is the job superintendent for Robert E. McKee General Contractor, Inc. of Santa Fe, N. M., on the general construction work for the new Bataan Memorial Methodist hospital in Albuquerque, N. M. **Carl Olson** is the project engineer.

Carl D. Rice is project manager and **D. "Ross" Rossiter,** job superintendent, on a $1,112,000 highway construction contract for Winston Bros. Company. The work consists of grading and paving, construction of two grade separation structures and one pedestrian crossing to provide a 6-lane divided freeway known as the Santa Ana Freeway. **Roy Harer** is assistant superintendent of the job, which is located at Fremont and 6th St. in Los Angeles.

* * *

Harry Boswell is the general superintendent and **Harry Dutton,** the carpenter foreman on a limit height building project for Gershom-Scott Development Co. at 6361 Wilshire Blvd. in Los Angeles, Calif. **Richard Himes** is the labor foreman, **Wallace Merrill,** the job engineer, and **Pete F. Schwartz,** the office manager on the project. **Harry Boswell** is also supervising on the Associated Veterans Bldg., a $400,000 project for the same contractor, L. E. Dixon Co. of San Gabriel, Calif., **Robert King** is the foreman on this other Wilshire Blvd. building job.

* * *

Dean Saddler, president of the Concrete Construction Service, Inc., of Gardena, Calif., is personally supervising construction on the company's large projects in the Southern California area. The company has a subcontract on all bridges and structures with A. Teichert & Son on the Ridge Route highway construction. **William Pullman** is the superintendent on this job, and **Frank Jackson** is the superintendent on the company's construction of an eight-story apartment building on Wilshire Blvd. in Los Angeles, Calif.

* * *

Talbot Bailey is the project manager for the Fredrickson & Watson Construction Co., Oakland, Calif., for bridge and highway construction on the Moun-

Los Angeles Excavators Pool Equipment, Ideas

THE EXCAVATING and Grading Contractors Association of Los Angeles recently undertook an interesting means of raising money for its treasury. One of the members of the association received an excavating and grading subcontract from Don Ely, general contractor for the new Culver City Memorial Hospital. The contract included about 5,000 cu. yd. of dirt and 100 truck loads of rubbish. The member turned this contract over to the association and a majority of the members donated sufficient tractors, skid loaders, draglines, dump trucks and scrapers to complete the job in one day. Featuring the unified effort was an assembled fleet of Allis-Chalmers HD-5G Tracto-Shovels to handle the excavating and grading (see picture below).

tain Blvd. Freeway near the Oakland, Calif., Montclair district. The joint State and City venture is being built at a cost of $830,000, with **Les Christman** as excavating superintendent, **Ted Johnson** as carpenter superintendent, **Glen Sears** as concrete tunnel superintendent assisted by **Ed Norton.** Construction will probably be completed by August 1951.

* * *

Richard Olbert is the engineer, **Roy Chennici,** the general superintendent, and **William Pfau,** the assistant superintendent on the Santa Ana Freeway project under construction for the State of California by the United Concrete Pipe Corp. and Richard A. Bell, joint venturers of Baldwin Park, Calif. The project will last approximately another year and a half.

* * *

Sam Macri, Jr., is the job superintendent for the S. Marci Construction Co., Anchorage, Alaska, on the $370,918 dam and intake water treatment plant at East Fort Richardson, near Anchorage, Alaska. **John J. Doane** is the general manager and **William E. Benson** is the assistant superintendent on the project for the Anchorage contractors.

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J. C. Chadderton is the general superintendent for W. C. Kier Co., Los Angeles, Calif., on the Farr Company factory building in El Segundo, Calif. The $300,000 project will probably end in May of this year.

* * *

The Robinsons Beverly department store project in Beverly Hills, Calif., has **Oscar Erickson** as general superintendent, **Carl Erickson** as assistant superintendent, and **Eddie Demaine** and **George**

BORROW PIT SPRINKLED

TO PROVIDE specified soil density for fill, Morrison-Knudsen Co., Inc. uses a 1,500 ft. sprinkler system for wetting down the borrow pit before moving the material onto the embankment for sheepsfoot compaction during construction of Folsom Dam. Top photo shows Caterpillar D7700 providing power for the pump. The system includes 35 sprinklers 20 ft. apart on a 4-in. line. Lower photo shows sprinklers in action.

Mahan as carpenter foremen, for the William Simpson Construction Co. of Los Angeles, California. **Paul Jeffers** is the structural engineer on the project which should be completed in approximately another year.

* * *

Lou P. Ronneberg is the job superintendent for Peterson & Baker Co. on the Hollywood Freeway project between Wilton Pl. and Sunset Blvd., in Hollywood.

* * *

R. W. Bailey is superintendent and **Frank Morrell** is assistant superintendent on the $1,750,000 addition to California Institute for Men at Chino, Calif., being built by the Robert E. McKee Co., West Los Angeles, Calif., contractors. **R. C. Smith** is the job engineer, and **O. E. Lesh** is the field engineer. **Bill Dvorak, Pete Bailey,** and **L. E. Davis** are the carpenter foremen. **James Gatewood** and **Ken Estes** are the labor foremen on the project which is scheduled for completion on July 1, 1951.

"SOMEWHERE in the Far East," William (Bill) N. Jones from Phoenix, Arizona, is bossing the airport runway construction project shown at right.

Charlie Champion is the project manager, **Tommie Champion** is carpenter superintendent and **John Wright** is carpenter foreman for the S. U. H. B. Co. on construction of the Bureau of Reclamation's Tracy Pumping Plant near Tracy, Calif. The project, which will probably end in August 1951, has **Virgil Welton** as excavation superintendent and **Morgan Jones** as labor foreman.

* * *

Construction on Sears Roebuck & Company's North Hollywood, Calif., department store is being supervised by **Joe H. Thomas** for the Haddock Engineers, Ltd., of Montebello, Calif. The $1,500,000 project has **Richard Thomas, Jr.** and **Fred Cavanaugh** as carpenter foremen, and **Pete Vakoff** as labor foreman. The company engineer is **Ben Powell** and **Lloyd Lindsey** is the office manager.

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B. L. Gustafson, for many years in the trucking business in Huntington Park, Calif., is now engaged in heavy construction work, principally paving on road work in Phoenix, Arizona. **Clyde Connell** is his superintendent.

* * *

Leo Gosliner is the project manager and **Lloyd Miller** is the general superintendent for the $500,000 high school project of the Acalanes School District. **James Wade** is the assistant superintendent for Haas & Rothschild, San Francisco, Calif.

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Boyd Hall is the superintendent for the Fontana Steel Company, Fontana, Calif., which is sub-contracting reinforcing steel on all structures for the Mohawk Canal project east of Yuma, Arizona.

* * *

The heavy construction near Augusta, Ga., has **George Waters** as project manager and **Charlie Ballard** as field superintendent for the Bateson-Stolte Co. of Augusta, Ga.

* * *

Sinclair McPhee is the general superintendent on the MacDonald Products Co. $2,000,000 shopping center project at Walnut Creek, Calif., and **Timothy Moriarty** is the assistant superintendent. Work is scheduled for completion by July, 1951.

* * *

The National State Guard Armory project at Burbank, Calif., has **W. P. Murphy** as general superintendent and **Roy Jacobson** as carpenter foreman for

the Mandebach Construction Co. of Burbank. July 1951 is the tentative time of completion.

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The Santa Ana Canyon Highway project, near Corona, Calif., is nearing completion under the supervision of **B. E. Grounds.** Peter Kiewit Sons' Co., El Segundo, Calif., is the contractor.

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G. H. McCullough is the job superintendent for Robert E. McKee, Santa Fe, N. M. He is working on the 115-bed Bataan Memorial Methodist Hospital in Albuquerque, N. M.

* * *

D. "Ross" Rossiter is the general superintendent on the $1,112,000 Santa Ana Freeway project between Downey and Anaheim, Calif. Winston Brothers Company, Monrovia, Calif., has **Carl D. Rice** as the project manager and **Roy Harer** as excavation superintendent. Work on the Freeway has just begun.

Blast Knocks Pins From Under Bridge

Concussion from a dynamite blast 40 ft. away collapsed a portion of the Piru Creek bridge on the Southern California Ridge Route last month. No one was injured and traffic was rerouted to avoid the scene of the accident. Apparently the bridge had been weakened by repeated blasts in the area during the relining of the road and construction of a divided highway in the area.

Gravel Meets Macadam at Portland

There was lots in a name south of Portland, Ore., last month when a truckload of gravel was spilled on S.W. Macadam avenue as the result of a highway collision. No one was seriously injured in the broadside crash, and state police separated the gravel from its rival material.

Idaho Approves Northwest Compact

After a full morning of debate in the Idaho house of representatives, a bill which calls for a commission to negotiate a water compact with states of the Northwest (Washington, Oregon, Montana, Utah, Nevada, and Wyoming). An attempt was made to have the measure referred for amendments, but this was defeated 32 to 21.

Highway Bond Issue Urged

The $65,000,000 bond issue for state highways in Washington has received the approval of the Columbia Basin Commission. About 67% of the bonds would go for improvement of U. S. Highway 99, the main north-south route, and of the rest improvements and construction would be made on the Kennewick-Pasco bridge, Columbia irrigation district roads, and a truck passing lane on U. S. Highway 10 across the Cascades. Several members of the commission will attend the legislative hearing and ask for the measure's passage.

K. C. DACK, owner of his own construction outfit at Milton, Ore., has one of his Caterpillar tractor-scraper combinations hauling rock for a dike on the Walla Walla River.

Contracts . . .

A Summary of Bids and Awards For Major Projects in the West

Alaska

$10,000,000, approx.—**Patti-MacDonald Construction Co.,** Station No. 1, Anchorage—Fort Richardson steel frame and metal siding, 3-story building, central heating and power plant; by Corps of Engineers.

California

$341,162—**Guy F. Atkinson Co.,** 223rd St. & Santa Fe Ave., Long Beach—Low bid for construction of a bridge extension and about 0.5 mi. in length detour and bridge approach to be graded and surfaced, in San Diego; by Division of Highways.

$823,382—**Barrett & Hilp** and **DeLuia & Sons** (joint venturers) 918 Harrison St., San Francisco—Contract for construction of sewage disposal project in Monterey; by City Engineer.

$763,802—**Charles T. Brown** and **Paul Vukich Construction Co.** (joint venturers) 6465 Northside Dr., Los Angeles—Low bid for construction of Unit III of the Magnolia trunk sewer, pumping plant, force main and appurtenant facilities, a portion of the Orange County joint outfall sewer; by Anaheim City Council.

$208,587—**Charles J. Dorfman,** 124 N. La Brea Ave., Los Angeles—Low bid for construction of Ocean Beach storm drains, San Diego; by City Council.

$121,672—**A. H. Famularo,** 2720 W. 7th St., Santa Ana, and **J. L. McElvany,** S. 8th St., El Centro—Low bid for construction of Unit IV of the Magnolia trunk sewer, pumping plant, and force main and appurtenant facilities, a portion of the Orange County joint outfall sewer; by Anaheim City Council.

$1,025,283—**Claude Fisher Co., Ltd.,** 2455 E. 55th St., Los Angeles—Low bid for grading and surfacing of about 5.1 mi. of highway in Los Angeles County between north city limits of Los Angeles, near Tunnel Station Bridge and Pico Canyon Rd.; by Division of Highways.

$320,941—**Fredericksen & Kasler,** 212 13th St., Sacramento—Construction of a reinforced concrete box girder bridge for an overcrossing to be constructed on Hollywood Freeway at Hollywood Blvd. in Los Angeles; by Division of Highways.

$1,769,133—**J. E. Haddock, Ltd.,** P. O. Box 188E, Pasadena—Grading and paving of highway and 4 bridges to be constructed on Ramona Freeway near Helen Dr. and Hellman Ave., to provide a 6-lane divided highway with frontage roads; by Division of Highways.

$223,751—**Pacific Coast Engineering Co.,** P. O. Drawer E, Alameda—Contract for construction of a caisson of steel plates and shapes, and related work. Naval shipyard, San Francisco; by District Public Works Office.

$917,600—**A. Teichert & Son,** Box 1113, Sacramento—Low bid on grading and surfacing about 6.1 mi. of highway between Peralta school and Riverside County line, Orange County; by Division of Highways.

$607,094—**Transocean Engineering Co.,** 999 Lewelling Blvd., San Lorenzo—Low bid on clearing and grubbing roadway area about 6.5 mi. in Fresno County, near Trimmer, and construction of roadbed and surface; by Corps of Engineers.

$748,770—**V C K Construction Co.,** 6124 Ferguson Dr., Los Angeles—Low bid on construction of Units I and II of the Magnolia trunk sewer, pumping plant and force main and appurtenant facilities, a portion of the Orange County joint outfall sewer; by Anaheim City Council.

$902,791—**Webb & White,** 7220½ Melrose, Los Angeles—Contract for grading and paving about 0.5 mi., and a reinforced concrete outer highway over-crossing to be constructed on Hollywood-Santa Ana Freeway in Los Angeles, between Grand Ave. and Los Angeles St.; by Division of Highways.

Colorado

$270,794—**Mann Construction Co.,** 2700 S. Elati St., Engelwood—Low bid for construction work on Schedule II of the Colorado-Big Thompson project 8 mi. west of Campion.

$1,897,700—**Newstrom-Davis & Co.,** 2000 W. 8th Ave., Denver—Low bid on construction of the 200-unit Sun Valley Homes housing project in Denver; by Denver Housing Authority.

$258,431—**United Engineers,** Philadelphia, Pa.—Low bid for work on Schedule I of the Colorado-Big Thompson project 8 mi. west of Campion.

Nevada

$129,011—**Dodge Construction, Inc.,** Fallon—Contract for construction of a section of state highway in Ormsby County from the Carson River Bridge to a junction with FAS 681; from junction with U. S. 395 north of Carson City to junction with U. S. 50 at New Empire; by State Highway Department.

$225,550—**Wells Cargo, Inc.,** P. O. Box 1511, 1800 E. 4th St., Reno—Low bid for street repairs, paving curbs, gutters, etc., in Las Vegas.

New Mexico

$90,261—**Bridgeman Construction Co.,** Box 305, Albuquerque—Contract for construction of 26 mi. of 69 kv. transmission line for Socorro Electric Cooperative, Inc.; by Socorro Electric Cooperative.

$832,003—**J & J Construction Co.,** 1801 Petroleum Bldg., Oklahoma City, Okla.—Contract for construction of 489 mi. of line to serve 716 members of Columbus Electric Cooperative; by Columbus Electric Cooperative.

Oregon

$170,772—**General Construction Co.,** 4850 N.W. Front Ave., Portland—Contract for redecking of a steel bridge in Portland; by State Highway Commission.

$928,821—**Vernie Jarl,** Box 254, Gresham—Low bid for grading and paving of 3.7 mi., and grading and oil mat surfacing on the Herman Creek section of Columbia River Highway in Hood River County; by State Highway Commission.

$850,862—**Leonard & Slate, Oregon, Ltd.,** and **E. C. Hall Co.,** 7805 S.W. 40th Ave., Portland—Contract for 6 mi. of grading and other work in Union County on the east unit, LaGrande to Ladd Canyon section, of the relocated Old Oregon Trail; by State Highway Commission.

$553,788—**Tom Lillebo,** Reedsport—Low bid for construction of concrete and steel bridges over Coos River on the Coos River secondary highway; by State Highway Commission.

$1,992,361—**Lookout Point Constructors** (a joint venture of **Wm. A. Smith Contracting Co.,** Kansas City, Mo., and **Wm. A. Smith Contracting Co.,** Los Angeles, Calif.), 921 American National Bank Bldg., Portland—Low bid for construction of approx. 16 mi. of track on Southern Pacific Co.'s relocated main line and a shoofly track, in Lane County, on middle fork of Willamette River, near Lowell; by Corps of Engineers.

Utah

$799,772—**Jacobsen Construction Co.,** Salt Lake City—Low bid for contractor's temporary housing near Dugway, Utah.

$203,231—**Wheelwright Construction,** Ogden — Low bid for ½-mi. square grid, Dugway.

Washington

$134,281—**General Construction Co.,** Seattle—Low bid on renewal of the north apron at the Spokane St. terminal of the Port of Seattle; by Port of Seattle.

$2,473,000—**L. H. Hoffman Construction Co.,** Portland—Contract for construction of the hot semiworks at Hanford, Wash., atomic project. Fifteen structures, several windowless and all-steel buildings, and underground tanks and cribs are included.

$1,072,308—**Macdonald Construction Co.,** 1517 S. Tacoma Way, Tacoma—Low bid for construction of Tacoma Central Library building addition. All bids higher than monies allotted for project.

$70,971—**Moffatt & Britton Electric Co.,** Box 745, Troutdale, Ore.—Contract for construction of 5.9 mi. of 66-kv. transmission line, 5.7 mi. underbuild, plus removal of 5.5 mi. of line in Klickitat County; by Public Utility District No. 1, Klickitat County.

$1,088,604—**Morrison-Knudsen Co., Inc.,** and **City Electric & Fixture Co.** (joint venturers), Seattle—Contract for bid items 1 and 2 for construction of steel towers at the naval communications station near Arlington; 13th Naval District.

$1,028,909—**A. Ritchie & Co.,** 2102 Melrose, Walla Walla—Low bid for the construction of the 20-classroom Jason Lee elementary school in Richland.

$193,122—**Smith Bros. General Contractors, Inc.,** 29 Algona Dr., Vancouver, Wash.—Construction of Primary State Highway No. 13, Joe Creek to Pacific County line; by Department of Highways.

$2,175,314—**United Concrete Pipe Corporation & Ralph A. Bell** (joint venturers), P. O. Box 425, Baldwin Park, Calif.—Contract for construction of West Canal-Frenchmen Hills tunnel, approx. 20 mi. south of Quincy, Wash.; by Bureau of Reclamation, Denver, Colo.

Wyoming

$269,328—**Etlin E. Peterson,** 602 E. 15th St., Casper—Contract for construction of 4 R. C. culverts, 2 concrete and steel bridges over Salt Creek and miscellaneous work on 11.01 mi. of Midwest-Casper Road in Natrona County; by Highway Commission.

BPA Power to California? Northwest Says NO!

THE DEPARTMENT of the Interior's proposed plan to build a power line between the Northwest and California (*Western Construction* — February 1951, p. 90) has aroused angry criticism in the Northwest.

The Washington state senate formally voiced protest to President Truman and Congress on the basis that the proposed power line is "not necessary and actually means that our basic resource will be tapped and siphoned away to another area." Governor Arthur Langlie also wired Washington to protest the plan.

Senator Warren Magnusen (D., Wash.) said he was in accord with the state senate action, and Representative Russell Mack (Rep., Wash.) said he had stated his objections to Commissioner Michael Straus of the Bureau of Reclamation. He deemed the proposal unsound, because he believes that the power production in the Northwest is at the present time insufficient for the demands of interests in that area.

The proposed line would provide a link between the generating capacity of the Pacific Northwest, the many hydroelectric and steam plants of California, and those of the lower Colorado river basin, according to Richard L. Boke, regional director of the Bureau of Reclamation.

Traffic Engineering

. . . Concluded from page 84

"Par. 1a. There is a particular need to impress legislators and administrators with the fact that engineering standards cannot be translated into highway safety unless adequate funds and suitable engineering personnel are made available."

"Par. 8. In specific recognition of the need for better staffing of official agencies concerned with highway engineering problems, it is recommended that there be established:"

"C. In cities having between 50,000 and 100,000 population at least one full time traffic engineer vested with sufficient authority to insure the adoption of appropriate engineering measures for traffic operation and safety."

"D. In cities having less than 50,000 population, an engineer, preferably the director of the department of public works, the city engineer, or some member of his staff—with qualifications and experience necessary to perform the functions of traffic engineer."

The experience of the City of Fresno without doubt has proven the soundness of the recommendations of the President's Highway Safety Conference for cities between 50,000 and 100,000 population. What Fresno has done other cities can do providing a traffic engineering program is backed by an adequate engineering set-up, a generous budget and plenty of public support—all of which are so essential to an effective program.

Distributor Problems in the Mobilization Effort Feature—

National AED Convention at Chicago

Record-breaking attendance indicates serious problems facing distributors and manufacturers in the present emergency — R. L. Arnold of Salt Lake City named national AED president

REPRESENTING *Western Construction* at the A.E.D. National Convention were **Arthur J. Urbain**, News Editor, and **Arthur C. Petersen**, District Manager at the Chicago Office. Also present were **Franklin Lyons** of New York and **Richard C. Burns** of Cleveland.

MORE THAN 2,000 distributors and manufacturers of construction equipment attended the 32nd Annual Meeting of the Associated Equipment Distributors in Chicago Jan. 28-Feb. 1. This represented a record-breaking attendance and the interest shown indicated the serious problems facing the construction machinery industry in the present mobilization effort. At the close of the meeting, R. L. Arnold of the Arnold Machinery Co., Inc., Salt Lake City, Utah, was elected president for 1951, succeeding C. F. Halladay of Sioux Falls, S. Dak.

An innovation in the program was "Meet Your Manufacturer Day" on Tuesday, when business sessions were eliminated from the program and the convention hall was divided into "booths" where representatives of manufacturers gathered and were available for conferences with any distributor who wished to make contact with a particular company. This arrangement received much favorable comment and may become an annual feature.

Resolutions passed

Among the resolutions passed by the convention was one cautioning members concerning the practice of shipping equipment across state lines without giving proper consideration to safety regulations provided by individual state laws. Members were urged to give attention to these state safety regulations in connection with out-of-state sales. A further resolution provided that the A. E. D. appoint a National Affairs Committee of at least 12 members and establish a Washington resident-secretary.

Of particular importance to the members was a resolution relating to the return of products upon cancellation of a selling agreement with any manufacturer. Indicating that in the past some manufacturers have refused such return of products or parts, the convention passed a resolution expressing the attitude that manufacturers should accept the return of any machines and parts (not obsolete) with full credit.

R. L. ARNOLD, 1951 National President of AED. President of Arnold Machinery Co., Salt Lake City, he has been a member of the construction equipment industry for 20 years.

BEAL SHAW, president and treasurer of Shaw Sales & Service Co., Los Angeles, is Director of AED's Region 11.

FRANK SKIDMORE, secretary-treasurer and general manager of Contractor's Equipment & Supply Co., Albuquerque, was re-elected Director of AED's Region 14.

LYMAN E. JONES, president of the Hall-Perry Machinery Co., Butte, Mont., was re-elected Director of AED's Region 12.

1951 OFFICERS of the Associated Equipment Distributors. Left to right—E. J. CROSBY, Boston, Mass., treasurer; S. JOHN OECHSLE, Philadelphia, Pa., vice president; J. A. BENSON, Houston, Texas, vice president; R. L. ARNOLD, Salt Lake City, Utah, president; H. J. HUSH, New York City, executive vice president; S. A. STEPHENS, JR., Montreal, Canada, vice president, and P. D. HERMANN, Chicago, Ill., executive secretary.

The usual resolution was passed urging the Congress to practice every possible economy in domestic expenditures because of the sacrifices which the Government was asking all citizens to make.

The keynote address of President Halladay reminded the opening session of the convention that the 1951 meeting found "the nation at war again, with soldiers fighting on foreign soil and businessmen called upon to mobilize and establish their business in a controlled economy." Mr. Halladay also indicated that businessmen face many uncertainties as to the adjustment in their businesses in the months ahead.

At this session announcement was made of the appointment of John H. Randle as traveling field secretary. Mr. Randle is well known to members of the A.E.D. and his function will be to es-

Westerners Who Attended the AED Convention

Arizona

Neil B. McGinnis Co., Phoenix—Sam Baar.
O. S. Stapley Co., Phoenix—H. E. Walters.
State Tractor & Equipment Co., Phoenix—J. R. Robinson.

California

Aikins & Williams Tractor Co., Eureka—E. L. Aikins and Don R. Williams.
Edward R. Bacon Co., San Francisco—Jack H. How.
Bay Cities Equipment Co., Inc., Oakland—Howard L. Stilley.
Brown-Bevis Equipment Co., Los Angeles—John A. Beynon and Charles M. Weinberg.
Coast Equipment Co., San Francisco—Paul R. Egli and W. M. Nosman.
Garlinghouse Brothers, Los Angeles—R. N. Armstrong and A. F. Garlinghouse.
C. H. Grant Co., Berkeley—Charles H. Grant.
Harron, Rickard & McCone Co., Los Angeles—James W. Savage and Alex B. Todd.
Hudson Corporation, San Diego—W. H. Hudson.
Industrial Equipment Co., Los Angeles—C. E. Skidmore.
Ingersoll-Rand Co., San Francisco—T. J. Riley.
Jenison Machinery Co., San Francisco—E. S. Jenison.
Le Roi-Rix Machinery Co., Los Angeles—W. Z. Bancroft, R. F. Deane and Howard E. Hintz.
The Merrill-Brose Co., San Francisco—George B. Brose.
Moore Equipment Co., Stockton—T. E. Mackrell and L. W. Ribal.
Sacramento Valley Tractor Co., Sacramento—W. H. Pahl.
Shaw Sales & Service Co., Los Angeles—Beal Shaw.
Smith Booth Usher Co., Los Angeles—C. E. Baker and Alex Kostyzak.
Western Machinery Co., San Francisco—H. J. Mayer and L. T. McGuire.

Colorado

Colorado Builders Supply Co., Denver—Chas. E. Berry, Chas. B. Hansen, James D. Maitland.
Constructors Equipment Co., Denver—D. G. Gibson and T. M. Sanders.
Ray Corson Machinery Co., Denver—R. E. Corson.
Gunderson Taylor Machinery Co., Denver—William N. Gunderson and Edward F. Taylor.
King & Kringel Machinery Corp., Denver—J. M. East and K. J. King.
Liberty Truck & Parts Co., Denver—F. V. Altvater, R. F. Carlson and W. W. Carlson.
McKelvy Machinery Co., Denver—J. Emmett Goggin and J. R. McKelvy.
H. W. Moore Equipment Co., Denver—Walter Babcock, John C. Moore.
Western Machinery Co., Denver—L. M. Jones.

Idaho

Engineering Sales Service, Inc., Boise—H. W. Hurd.
Intermountain Equipment Co., Boise—Philip A. Dufford, E. A. Collins and R. W. Stevens.
Olson Mfg. Co., Boise—H. J. Agee.
Southern Idaho Equipment Co., Idaho Falls—M. G. Gooch.
Western Equipment Co., Boise—K. E. Ahern, G. M. Gehrke and Craig Taylor.

Montana

Caird Engineering Works, Helena—G. A. Porte.
Hall-Perry Machinery Co., Butte—L. E. Jones and Ben L. Smith.
Industrial Equipment Co., Billings—W. C. Hardie.
Montana Powder & Equipment Co., Helena—W. T. McCullough.
Mountain Tractor Company, Missoula—V. R. Howell
Normont Equipment Co., Great Falls—J. B. Beatty.
Seitz Machinery Co., Inc., Billings—Melvin Seitz.
Steffeck Equipment Co., Helena—A. J. Steffeck.
Western Construction Equipment Co., Billings—Harold Doolen and Lloyd J. Klingler.

New Mexico

J. D. Coggins Co., Albuquerque—Harold R. Bone, J. D. Coggins.
Contractors' Equipment & Supply Co., Albuquerque—Dave Rakestraw and Frank Skidmore.
Harry Cornelius Co., Albuquerque—W. H. Cornelius.
Lively Equipment Co., Albuquerque—W. E. Lively, Jr.
N. C. Ribble Company, Albuquerque—Frank Dempsey and N. C. Ribble.

Oregon

Andersen Machinery, Portland—Roy G. Andersen.
Cal-Ore Machinery Co., Inc., Medford—Walter G. Garner.
Clyde Equipment Co., Portland—Oscar B. Bjorge and W. T. Euster.
Columbia Equipment Co., Portland—F. B. McBath.
Contractors Equipment Corp., Portland—Robert D. Vial.
Cramer Machinery Co., Portland—C. P. Cramer and G. W. Schriver.
P. L. Crooks & Co., Inc., Portland—P. L. Crooks, Jr.
Feenaughty Machinery Co., Portland—D. J. Feenaughty and M. B. Mack.
Howard-Cooper Corp., Portland—F. R. Cooper and W. A. Wylie.
Loggers & Contractors Machinery Co., Portland—A. F. Sersanous.
Western Equipment Co., Eugene—M. W. McCann.
Wood Tractor Co., Portland—Roy E. Wood.

Utah

Arnold Machinery Co., Salt Lake City—R. G. Arnold and R. L. Arnold.
Cate Equipment Company, Salt Lake City—David E. Hughes.
Heiner Equipment & Supply Co., Salt Lake City—K. P Heiner.
C. H. Jones Equipment Co., Salt Lake City—R. S. Stewart.
Kimball Equipment Co., Salt Lake City—William F. Allen.
The Lang Co., Inc., Salt Lake City—H. E. Howe, John Lang, and R. H. Rampton.
Lund Machinery Co., Salt Lake City—Joseph N. McRae.
H. H. Nielsen Co., Salt Lake City—Hubert H. Nielsen.
Robison-Kershaw Co., Salt Lake City—Walter W. Kershaw.
Western Machinery Co., Salt Lake City—L. T. McGuire.
J. K. Wheeler Machinery Co., Salt Lake City—L. W. Gurr.

Washington

American Machine Co., Spokane—H. A. Briggs and F. H. Etter.
Bow Lake Equipment Co., Seattle—Conrad R. Creim and Scott O. Simenstad.
A. H. Cox & Co., Seattle—G. H. Jamison.
General Machinery Co., Spokane—E. J. Simons, Jr.
Jameson Engineering Sales, Inc., Seattle—E. S. Morgan.
Modern Machinery Co., Inc., Spokane—C. H Davis, E. C. Stephenson.
Pacific Hoist & Derrick Co., Seattle—George F. Schoen.
Star Machinery Co., Seattle—J. T. Hatten and I. B. Rabel.
Fred M. Viles & Co., Spokane—Fred M. Viles.
Washington Machinery & Storage, Seattle—J. H. Hope and J. P. Studebaker.
Western Machinery Co., Spokane—H. A. Myers.

Wyoming

Wilson Equipment & Supply Co., Cheyenne—H. E. Martin and Glen Moss.

tablish careful contact between members and national headquarters.

On the third day of the convention the meeting opened with new officers presiding and the principal address was by General Eugene Reybold, executive head of the American Road Builders Assn. General Reybold opened his remarks by stating: "I should like nothing better than to be able to say to you that you will not feel the effects of the war effort. But war, or even the threat of war, disrupts all business and I am sure that all of you here are only too well aware of the fact that the equipment distributors of our country don't expect a continuation of business as usual. I am sure also that you all realize that the time has passed for that kind of unrealistic optimism. For even before the formal proclamation of a national emergency by the President, it had become clear that the threat of war, if not actual war, is going to dominate our lives for many years to come. In adjusting ourselves—our personal lives and our businesses—it is important that we bear in mind the fact that our current preparedness endeavors are by no means entirely confined to the speedy mobilization of an adequate fighting force."

At the same sessions Arthur J. Hamer, C.P.A. of Olson Hamer & Co., Chicago, reviewed in some detail the taxation problem, with particular emphasis on Federal Income Tax and the gift and estate taxes.

The final day was featured by an open panel discussion which included six representatives of the A.E.D. and six from leading manufacturing concerns. This session was sponsored by the manufacturer members and was devoted to an informal discussion of any problems which might affect "Development and Retention of Markets for Construction Equipment." Kenneth Lindsay of Iowa Manufacturing Co. served as chairman of this meeting and Tom Callaway of Goodyear Tire & Rubber Co. acted as moderator.

NEWS of DISTRIBUTORS AND FACTORY BRANCHES

J. M. EAST is the new vice president and general manager for the *King and Kringle Machinery Corp.* of Denver, Colo. He has long been familiar with contracting, mining and industrial interests in Colorado.

☆ ☆ ☆

Western Machinery Co., Phoenix, Ariz., announces that DON MURDOCK and KEN WELLS are joining the firm's expanding sales force.

☆ ☆ ☆

E. H. COOPER, well known in construction circles as area sales manager for

COOPER

BRUMBAUGH

Barber-Greene Company's Number 7 Area (Texas, New Mexico, Colorado, Kansas, etc.) is now retired. Cooper, a member of the company's sales force since 1924, has been succeeded by CHARLES H. BRUMBAUGH, assistant area sales manager since July 1950. Headquarters for the area is at Dallas, Texas.

☆ ☆ ☆

The new district representative for the *Frank G. Hough Co.* of Libertyville, Ill., is MARSHALL O. NYSTROM, who will work with distributors in the states of California, Nevada, Utah and Arizona. Before joining the firm in May 1950, Nystrom was an engineer in the bridge and building department of the New York Central Railroad.

☆ ☆ ☆

FRED F. WELCH of Portland is the new manager of the *Hyster Company's* retail store in Seattle, Washington. The Hyster Seattle store supervises sales of lift trucks, cranes and auxiliary attachments in a territory comprising most of the state of Washington and about half of Montana and Idaho. Welch joined Hyster in De-

cember, 1948, and for the past two years has been one of the division's leading salesmen.

☆ ☆ ☆

Cummins Diesel Sales of Montana, Inc., is in the process of constructing a new sales and service shop in Billings, Mont. Some of the equipment to be included in the new shop will be a new engine dynamometer test stand, a new chassis dynamometer, and also the only magnaflux machine available for commercial use in the Montana territory. The estimated completion date for the new structure is July 1, 1951.

☆ ☆ ☆

KENNETH E. KOEHLER, Seattle architect, is a new member of the technical staff of the *Concrete Products Association of Washington*. Koehler will be available to give advice on the best use of company products, as well as to develop new uses and improvements for them.

☆ ☆ ☆

The *White Motor Co.* of Cleveland, Ohio, has put its service and parts operations on a mobilized basis to keep White trucks and busses rolling during the national emergency. The formation of an Emergency Service Corps is announced by J. N. BAUMAN, vice president of the company. The nation-wide truck and bus conservation and parts availability program has already been launched among the company's more than 500 outlets.

☆ ☆ ☆

Engineering Sales Service, Inc., Boise, Idaho, negotiates agreement with *Skagit Steel & Iron Works* to represent them in southern Idaho and eastern Oregon. MYRON SWENDSEN is president; DICK FARNSWORTH, secretary and office manager; and HARRY HURD, vice-president and sales manager, of the Boise firm.

☆ ☆ ☆

Southwest Machinery Co., Oklahoma City, Okla., is now the statewide distributor of excavators and hydrocranes for the *Bucyrus-Erie Co.*, South Milwaukee, Wis. The distributor has branch offices in Tulsa, Hobart, and Guymon, Oklahoma.

☆ ☆ ☆

TIARKS

E. A. TIARKS, Western division district representative at Seattle, Washington, has been promoted to assistant sales manager in that division, with headquarters in Spokane, Wash., according to B. L. HAGGLUND, Western sales manager for *Caterpillar Tractor Co.*, San Leandro, Calif. R. M. RICHARDS, who has been Tiarks' assistant, has been promoted to succeed him as district representative, and will continue to headquarter at Portland, Ore.

☆ ☆ ☆

Plans for construction of a 9,000-sq. ft. warehouse and salesroom for *Garlinghouse Brothers*, one of Los Angeles' oldest construction equipment distributors, have been

Continued on page 122

NEWS of DISTRIBUTORS AND FACTORY BRANCHES

Continued from page 121

announced. Located at 2415 East Washington Blvd., the structure will incorporate an office building of modern design plus spacious salesroom and warehouse facilities of the concrete tilt-up type of construction. Need for additional manufacturing area by the Gar-bro Mfg. Company, a Garlinghouse subsidiary turning out concrete placing equipment, resulted in the decision to build. Space now occupied by the Garlinghouse offices will be moved to the new structure. The new warehouse and salesroom will adjoin a large shop building which was built and occupied by the company about six months ago. Construction of the warehouse and salesroom will be handled by MacIsaac, Menke and Roach, Inc., general contractors of Los Angeles.

☆ ☆ ☆

CUMMINS

JACK CUMMINS, prominent figure in the asphalt industry for many years, joins the staff of *Macmillan Petroleum Corporation*, Los Angeles, Calif., asphalt division. Cummins entered the industry in 1925 and his experience has included road building activities in all the Western States, both for state governments and private industry.

☆ ☆ ☆

Standard Steel Corporation of Los Angeles, Calif., is now the exclusive Southern California distributor for the portable steam generators and tank car heaters manufactured by *Cleaver-Brooks Co.* of Milwaukee, Wis.

☆ ☆ ☆

American Air Filter Co., Inc., Louisville, Ky., announces the opening of a local district office with E. C. SANFORD as manager at 225 Bush Street in San Francisco, Calif.

☆ ☆ ☆

GAIL E. SPAIN, vice president of the *Caterpillar Tractor Co.* of San Leandro, Calif., announces the creation of an additional sales division to meet the expanding and pressing needs brought on by the national emergency. The new unit, which is to be known as the "Plains Division," has KENNETH F. AMES, former head of sales training, as sales manager, and LEE MORGAN and GORDON FOWLER serving as assistant sales managers.

☆ ☆ ☆

R. E. VADNAIS, manager of the Seattle branch of the *Nelson Equipment Co.*, Portland, Ore., announces the appointment of TED HENRY as sales manager at this branch. Henry was with Schramm, Inc.,

Continued on page 124

UNIT BID SUMMARY

Dam . . .

First Stage Construction at Albeni Falls Dam

Idaho—Bonner County—Corps of Engineers. Macco Corporation, Paramount, Calif., on a low bid of $519,500, was awarded a contract by the Corps of Engineers for first stage construction of Albeni Falls Dam, near Priest River. Work consists of initial rock excavation and construction of cofferdams. Unit bids were as follows:

(1) Macco Corporation $519,500.00
(2) Morrison-Knudsen Co. 524,250.00
(3) Foley Brothers, Inc. 592,145.00
(4) Peter Kiewit Sons' Co. $677,800.00
(5) Engineer's Estimate 508,824.00

	(1)	(2)	(3)	(4)	(5)
Lump sum, clearing	$2,000	$5,000	$1,620	$10,000	$1,437
133,000 cu. yd. unclassified excav., dry	2.25	2.25	2.42	2.90	2.33
21,000 cu. yd. unclassified excav., wet	2.25	3.00	3.64	4.60	3.44
5,000 cu. yd. blasted rock	1.70	1.00	.95	1.50	1.35
14,000 cu. yd. borrow excav. for impervious fills	2.30	2.50	.79	3.20	1.60
21,000 cu. yd. borrow excav. for gravel filters	2.30	2.00	.79	2.20	1.34
Lump sum, constructing cofferdams	$70,000	$40,000	$134,625	$55,000	$56,295
Lump sum, unwatering cofferdam inclosure	$12,000	$35,000	$25,200	$32,000	$11,672

Sewerage . . .

Sewer Lines at Nampa, Idaho

Idaho—Canyon County—City of Nampa. Mountain States Construction Co. and Statewide Plumbing Co., Pocatello, were low for construction of sewer lines for Nampa Improvement District No. 40. Unit bid was as follows:

(1) Mountain States Construction Co. and Statewide Plumbing Co. $374,094

400 ft. 30-in. sewer	9.71	3,350 ft. 12-in. sewer	4.05
200 ft. 30-in. sewer	43.75	52,000 ft. 8-in. sewer	1.64
700 ft. 30-in. sewer	43.75	8-in. siphon crossing	
10,700 ft. 30-in. sewer	10.91	100 wyes	6.32
4,300 ft. 24-in. sewer	8.31	1,000 cu. yd. overhaul	1.00
3,920 ft. 18-in. sewer	7.20	220 manholes	201.40
1,700 ft. 15-in. sewer	4.97		

Tunnel, Concrete Lining and Concrete Sewer Pipe in Place

Oregon—Multnomah County—City. P. S. Lord, Portland, Ore., with a total bid of $586,110, was low before the City purchasing agent for construction of the lateral system of the east Glisan-Greeley Unit of the Intercepting Sewer and Sewage Treatment Project. Unit bids were submitted as follows:

(1) P. S. Lord $586,110
(2) Porter W. Yett 597,526
(3) Empire Construction Co. 609,220
(4) A. J. Cheff $688,934
(5) Kuckenburg Construction Co. 713,574

	(1)	(2)	(3)	(4)	(5)
1,325 lin. ft. tunnel excav. for 38x66-in. monolithic lining for Lloyd Blvd. tunnel	55.00	59.00	50.00	56.00	60.00
1,325 lin. ft. monolithic 38x66-in. conc. lining in place in Lloyd Blvd. tunnel	41.50	20.50	45.00	38.00	45.00
625 ft. tunnel excav. for 34x60-in. monolithic conc. lining for 49th Ave. tunnel	54.00	50.00	45.00	56.00	60.00
625 ft. 34x60-in. monolithic conc. lining in place in 49th Ave. tunnel	34.00	18.00	42.50	38.00	45.00
710 ft. tunnel excav. and backfilling, incl. timbering for 24-in. pipe in Wheeler Pl. tunnel	60.00	46.40	37.00	60.00	30.00
400 lin. ft. 24-in. extra str. reinf. conc. culv. pipe in place in Wheeler Pl. tunnel	10.50	14.20	13.00	10.00	6.00
1,200 lin. ft. tunnel excav. and backfill, incl. timbering for 12-in. pipe in Thompson St. tunnel	58.00	58.40	35.00	60.00	30.00
1,200 lin. ft. 12-in. std. reinf. culv. pipe in place in Thompson St. tunnel	3.55	9.04	7.00	8.00	6.00
60,000 lb. reinf. steel in monolithic conc. tunnel lining	.125	.14	.13	.14	.12
500 lin. ft. 8-in. drain pipe in tunnel, incl. excav.	3.00	1.08	3.50	1.50	2.50
26,000 cu. yd. excav. and backfill in open sewer trenches	5.00	3.01	3.85	5.00	10.00
2,290 lin. ft. 36-in. reinf. conc. sewer pipe in place	8.60	12.18	13.00	13.00	8.00
1,290 lin. ft. 27-in. reinf. conc. sewer pipe in place	8.25	12.09	11.00	12.00	6.50
840 lin. ft. 24-in. reinf. conc. sewer pipe in place	6.35	9.66	9.00	10.00	6.00
725 lin. ft. 21-in. reinf. conc. sewer pipe in place	5.30	5.60	7.50	8.00	5.00
305 lin. ft. 15-in. B&S conc. sewer pipe in place	4.00	3.82	5.00	6.00	3.00
5,550 lin. ft. 12-in. B&S conc. sewer pipe in place	2.25	3.16	3.50	4.40	2.50
1,540 lin. ft. 10-in. B&S conc. sewer pipe in place	1.50	2.01	3.00	4.30	2.00
4,500 lin. ft. 8-in. B&S conc. sewer pipe in place	1.45	2.08	2.60	4.20	1.90
600 lin. ft. 6-in. B&S conc. sewer pipe in place	1.20	1.58	2.50	4.00	1.50
8 ea. 24x6-in. wyes in place	15.00	38.55	35.00	24.00	30.00
9 ea. 21x6-in. wyes in place	13.00	12.75	25.00	20.00	25.00
10 ea. 15x6-in. wyes in place	11.50	15.31	12.00	15.00	15.00
53 ea. 12x6-in. wyes in place	8.50	12.66	5.00	10.00	13.00
30 ea. 8x6-in. wyes in place	5.00	8.35	4.50	7.00	6.00
30 ea. ⅛ bends in place, 6-in.	2.50	3.56	3.00	3.00	3.00
10 ea. old storm inlets to be plugged and gratings	30.00	34.00	25.00	25.00	25.00
20 ea. gratings and frames for new storm sewer inlets in place	30.00	34.00	30.00	40.00	50.00
50 cu. yd. Cl. 4 conc. (4 sacks per cu. yd.) in cradles, ftgs., etc.	40.00	43.50	45.00	28.00	55.00
60 cu. yd. screened gravel for drains in place	5.00	6.96	7.00	5.00	5.00
40 cu. yd. bank-run sand-gravel for backfilling	1.50	6.96	4.50	4.00	5.00
5,000 sq. yd. pavement cut and replaced	4.00	6.00	7.00	6.00	4.50
20 sq. yd. sidewalk cut and replaced	3.00	6.96	5.50	6.00	4.50
40 lin. ft. curb cut and replaced	2.50	3.48	2.00	3.00	3.00
73 ea. std. manholes, Type A, for base depth of 7 ft., complete	175.00	255.00	210.00	200.00	250.00
8 ea. drop manholes, Type B, with 8-in. drop pipes, base depth 7 ft.	225.00	278.00	300.00	300.00	300.00
1 ea. drop manhole, Type B, with 10-in. drop pipe, base depth 7 ft.	225.00	295.00	325.00	350.00	350.00
3 ea. drop manholes, Type B, with 12-in. drop pipe, base depth 7 ft.	250.00	313.00	350.00	400.00	400.00

(Continued on next page)

Load it and Move it *FASTER* on a FRUEHAUF CARRYALL!

This Fruehauf Carryall is owned and operated by Oilfields Trucking Company of Bakersfield, California. It is loaded with a 127 ft. mast being moved for Bender Derrick of Bakersfield. A second Carryall moved the full sub-base of this unit for the same company at the same time.

WHETHER your hauls are over-the-road or off-the-road, a Fruehauf Carryall is designed for the job.

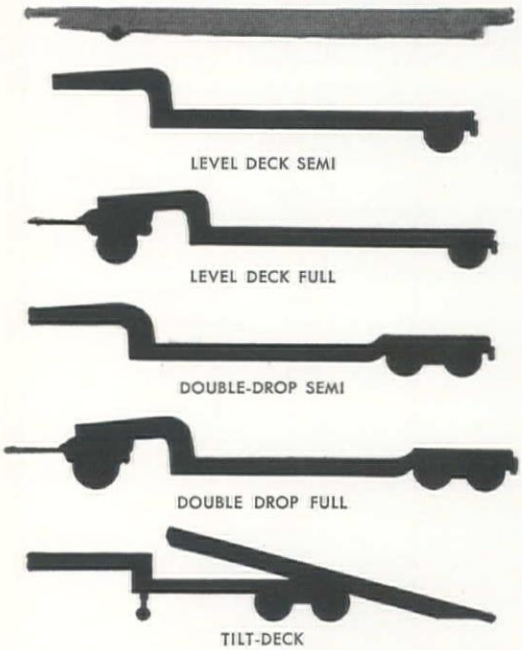
They're extra sturdy, extra tough . . . *engineered* to do the big jobs faster because design features make loading easier, hauling faster.

Features such as a lower bed, with a lower center of gravity, plenty of bull rings and thick hardwood floors for greater load stability and longer life make it easy *to get the job done now!*

Fruehauf Carryalls are available in capacities from 10 to 24 tons in standard models . . . to 110 tons in specials. No matter what your hauling problem may be there's a Fruehauf Carryall to fit your job!

FRUEHAUF TRAILER COMPANY
10978 Harper Ave. • Detroit 32, Michigan

There's a FRUEHAUF TRAILER *for every heavy hauling need!*



FRUEHAUF Trailers
"ENGINEERED TRANSPORTATION"

FIRST IN TRUCK-TRAILER TRANSPORT!

NEWS of DISTRIBUTORS AND FACTORY BRANCHES

Continued from page 122

for more than 20 years and brings with him a great amount of experience in the field. The company has also added MALCOLM FOX and DEWITT HARRINGTON to the sales staff. Fox will work in the Seattle area, while Harrington will operate in eastern Washington.

☆ ☆ ☆

Aikins & Williams bought the branches of the *Buran Equipment Co.*, Oakland, Calif., at Willits and Eureka, Calif. Both are well known in the construction field. The Allis-Chalmers franchise was included in the sale of these branches.

☆ ☆ ☆

J. E. CANNON, president of *Cummins Diesel Sales of Washington* announces the appointment of HAROLD M. DAGG as manager of the Seattle offices. Dagg is widely known throughout the construction field.

☆ ☆ ☆

EVERETT L. SWART was recently appointed branch manager of the Seattle office of *Independent Pneumatic Tool Co.*, Aurora, Ill. He comes to the coast from Minneapolis where he was with the same company for more than 5 years. L. OLSON continues as office manager at Seattle.

NEWS of MANUFACTURERS

The election of three executive vice presidents to fill newly-created posts in the *General Electric Co.*, New York., N. Y., is announced by RALPH CORDINER, president of the company. HENRY V. ERBEN, HARDAGE L. ANDREWS, and ROY W. JOHNSON. the new vice presidents, will have their headquarters at the G-E executive offices in New York. Their responsibilities will be assigned by the president of the company.

☆ ☆ ☆

Four new cement storage silos with a total capacity of 75,000 barrels are being constructed for the *Calaveras Cement Co.* at San Andreas, Calif., by the *Rust Engineering Co.*, of Birmingham, Ala., and Pittsburgh, Pa.

☆ ☆ ☆

ROY FRUEHAUF, president of the *Fruehauf Trailer Co.* of Detroit, Mich., has announced the promotion of A. K. TICE to assistant to the vice president in charge of sales for the company. Tice joined the truck trailer manufacturer in 1935.

☆ ☆ ☆

CARL R. OLSON, vice president of *Kaiser Industries, Inc.*, Oakland, Calif., reveals three appointments in several companies. WALLACE A. MARSH is now vice president

Continued on page 127

Lump sum, offset manhole Type C for total depth of 15 ft. EC104	600.00	$3,742	$2,500	900.00	$1,500
Lump sum, offset drop manhole (EC100) Type C for total depth of 26 ft.	$1,000	$6,469	$3,500	$2,460	$3,000
Lump sum, std. manhole with backwater gate (EC48), total depth 14 ft.	650.00	$1,024	850.00	850.00	$2,000
11 ea. std. diversion manholes for 8-in. diversion sewer, base depth 7 ft., complete	400.00	556.00	$1,500	400.00	$1,000
2 ea. std. diversion manholes for 12-in. diversion sewer, base depth 7 ft., complete	725.00	$1,974	$2,500	600.00	$1,100
Lump sum, diversion manhole (EC109) for 36-in. diversion sewer per drawing EC 16	$3,200	$3,915	$4,600	$3,800	$4,000
Lump sum, diversion manhole (EC13) for 18-in. diversion sewer per drawing NE 20	$3,000	$2,958	$3,200	$3,800	$2,000
Lump sum, diversion manhole (EC127) for 27-inch diversion sewer per drawing EC 17	$3,600	$3,480	$4,500	$3,800	$2,000
Lump sum, diversion manhole (EC93) for 24-in. diversion sewer per drawings EC17 & 18	$3,300	$3,833	$4,000	$3,800	$2,000
Lump sum, special manhole (EC120) junction of 27-in. and 30-in. per drawing EC16	$1,575	$2,422	$3,700	$3,800	$2,000
730 lin. ft. depth of std. drop and diversion manhole in excess of base depth of 7 ft.	18.00	33.50	35.00	50.00	30.00
Lump sum, changing slope of main sewer for diversion manhole EC93 per drawing EC18	300.00	$29,580	$3,500	$2,200	500.00
Lump sum, changing slope of sewer for diversion manhole EC9 per drawing EC18	400.00	$1,259	$1,200	800.00	500.00
Lump sum, changing slope of sewer for diversion manhole EC17 per drawing EC18	400.00	$1,259	$1,200	500.00	500.00
200 cu. yd. gravel or crushed rock surfacing	4.00	5.22	5.50	4.00	3.50
1,000 sq. yd. oiled surfacing	3.00	1.82	1.40	2.00	4.00

Irrigation . . .

Earthwork, Concrete Canal Lining and Structures

Colorado—Larimer County—Bureau of Reclamation. Paul G. Van Sickle Corp., Denver., with a low bid of $239,269, was awarded a contract by the Bureau of Reclamation for construction of earthwork, concrete canal lining and structures for Poudre Supply Canal, Windsor Section, Colorado-Big Thompson Project. The work is located near Ft. Collins. Unit bids were as follows:

(1) Paul G. Van Sickle Corp. $239,269.00
(2) C. M. Hanes Const. Co. 244,759.00
(3) United Engineers, Inc. 256,358.00
(4) Peter Kiewit Sons' Co. 268,490.50
(5) Long Construction Co. $269,762.80
— Western Paving Const. Co. 295,114.00
— Otto B. Ashbach & Sons 307,291.23
(6) Engineer's Estimate 212,996.00

	(1)	(2)	(3)	(4)	(5)	(6)
2,730 cu. yd. excav., common, for canal	1.00	2.30	.30	.90	.30	.60
330 cu. yd. excav., rock, for canal	2.00	2.30	2.00	.95	3.00	2.00
700 cu. yd. excav., common, for drainage channels and dikes	1.00	2.00	.30	2.25	.40	.75
100 cu. yd. excav., rock, for drainage chans. and dikes	5.00	8.00	2.00	4.50	3.00	3.00
600 cu. yd. excav., all classes, for roadway	1.50	2.30	1.00	2.00	1.00	1.25
12,760 cu. yd. excav., common, for structs.	2.00	2.30	2.00	1.35	2.50	1.00
12,700 cu. yd. excav., rock, for structs.	2.00	2.30	4.00	1.40	2.50	3.00
1,200 sq. yd. preparing rock foundatns. for conc. lining	1.00	1.00	1.50	3.20	2.00	1.75
1,800 sq. yd. trimming earth foundatns. for conc. lining	.50	1.00	.50	3.20	2.00	.70
2,910 cu. yd. backfill	1.00	.90	.40	1.50	1.00	.50
85 cu. yd. backfill at top of conc. canal lining	1.00	2.00	1.00	3.00	2.00	1.00
1,630 cu. yd. compacting backfill	.50	2.00	2.25	4.00	2.00	4.00
460 cu. yd. compacting embankment	.50	1.00	.50	1.00	.25	.50
425 cu. yd. loose rock backfill	5.00	5.60	4.00	5.50	5.00	.75
1,000 cu. yd. 36-in. riprap	1.50	6.20	4.00	6.00	5.50	5.00
215 cu. yd. gravel bedding under riprap	3.00	6.00	4.00	5.50	3.00	5.00
100 sq. yd. dry-rock paving	3.00	5.50	8.00	7.00	5.00	6.00
1,406 cu. yd. concrete in structures	70.00	57.50	65.00	74.00	78.80	50.00
350 cu. yd. conc. in unreinf. canal lining	40.00	40.00	40.00	50.00	25.00	28.00
234,800 lb. furn. and placing reinf. bars	.17	.15	.15	.17	.15	.14
2,634 bbl. furn. and handling cement	5.00	5.00	4.50	6.00	5.00	5.00
75 sq. ft. furn. and placing ½-in. elastic filler matl. in joints	1.00	.80	3.00	2.00	2.00	1.80
40 sq. ft. furn. and placing ¾-in. elastic filler matl. in joints	1.00	.90	4.00	3.00	2.00	2.00
1,950 lin. ft. placing rubber water stops in joints	1.00	1.30	.50	1.00	1.00	2.00
1,500 lin. ft. furn. and laying 6-in. diam. underdrains with uncemented joints	1.00	3.00	2.00	3.00	3.00	2.00
70 lin. ft. furn. and laying 6-in. diam. underdrains with cemented joints	1.50	3.50	2.25	3.00	2.00	1.80
9,000 bbl. installing gates and gate hoists	.05	.10	.10	.25	.30	.20
1.13 M.B.M. furn. and erecting timber in structs.	200.00	500.00	400.00	400.00	200.00	275.00
1,600 lb. furn. and installing miscl. metalwork	.22	.40	.70	2.00	.75	.50
46 lin. ft. furn. and laying 24-in. diam. std. str. conc. culvert pipe	4.00	8.00	7.00	13.00	6.00	8.00
68 lin. ft. furn. and laying 36-in. diam. std. str. conc. culvert pipe	6.00	14.00	12.00	27.00	10.00	13.00
31 lin. ft. furn. and laying 24-in. diam. corru. metal culvert pipe	3.00	6.00	6.00	11.00	6.00	6.50
36 ft. furn. and laying 36-in. diam. corru. metal pipe	5.00	12.00	9.00	13.00	10.00	10.00
0.5 mi. furn. matls. and construct. barbed-wire right-of-way fence	$1,000	$1,000	$1,000	$4,000	$2,000	$1,500
1 gate furn. and installing metal fence gate	40.00	50.00	40.00	100.00	50.00	60.00
900 lb. furn. and installing blow-off valves, pipe, and pipe connections	.50	.40	.70	.60	.50	.70
1.8 M.B.M. removing timber bulkhead	50.00	50.00	40.00	50.00	10.00	40.00

Bridge and Grade Separation . . .

Structural Steel Beam Bridge

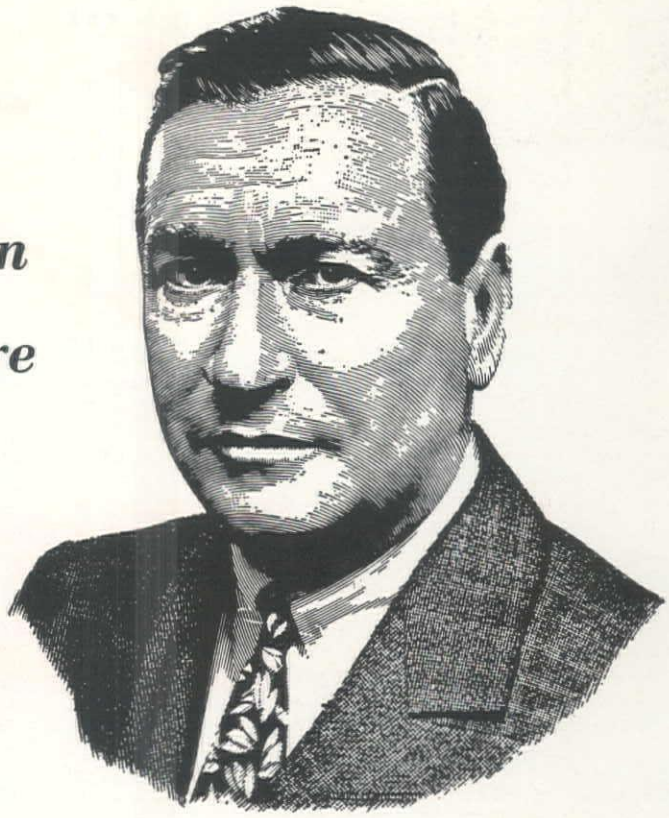
New Mexico—Catron County—Bureau of Public Roads. M. C. Jacobs Construction Co., Denver, Colo., with a bid of $91,450, was low before the Bureau of Public Roads, Denver, for construction of a steel beam bridge, 26 ft. wide, on Alpine-Reserve Route 22. Unit bids were as follows:

(1) M. C. Jacobs Constr. Co. $91,450.00
(2) E. M. Silver $99,390.00

	(1)	(2)
500 cu. yd. unclassified excav.	1.25	.70
1,400 cu. yd. unclassified excav. for structs.	5.00	9.00

(Continued on next page)

"You Build for your own and your country's future when you save..."



BENJAMIN F. FAIRLESS

President, U. S. Steel Corporation

"A free economy, such as ours, is built on the savings of the people. And the future security of America depends on the initiative and the growth of every citizen. We in U. S. Steel encourage our employees to join the Payroll Savings Plan, and we are proud that the National Tube Company, one of our subsidiaries, was the first of the large industrial companies of the nation in 1950 to have more than 80% of its employees participating. Remember, you build for your own and your country's future when you save."

Mr. Fairless is not expressing a personal opinion, nor is he speaking for other far-seeing executives when he tells you that our economy is built on the savings of the people and a man builds for his own and his country's future when he saves.

Actually, Mr. Fairless is merely putting in words the thoughts and action of the millions of employed men and women who *now hold* more than 50 billion dollars in U.S. Savings Bonds.

$50,000,000,000! Who *sold* all those bonds to millions of people? The answer is, nobody sold them.

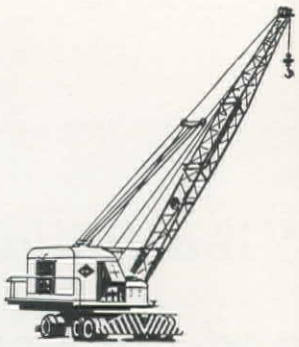
80% of the employees of the National Tube Company . . . 75% of the employees of Carnegie-Illinois Steel Company . . . thousands of employees of other U.S. Steel subsidiaries . . . more than 8 million employees of other companies bought U.S. Savings Bonds and are buying them every month on the easy, automatic Payroll Savings Plan. Their employers merely offered these men and women an opportunity to save for their future. There was no pressure, no emotional appeal.

How does employee participation in *your* Payroll Savings Plan match up with the 80% of National Tube, the 75% of Carnegie-Illinois? Or, perhaps you are one of the relatively few large companies that do not have a Plan? In either case, wire or write, Savings Bond Division, U.S. Treasury Department, Suite 700, Washington Bldg., Washington, D.C. Your State Director is ready to help you with a package plan—application blanks, promotional material, practical suggestions and all the personal assistance you may desire.

The U. S. Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the G. M. Basford Company and

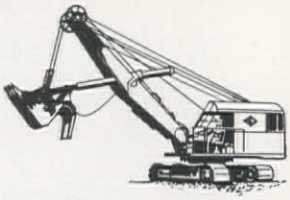
WESTERN CONSTRUCTION

609 Mission St., San Francisco 5, Calif.

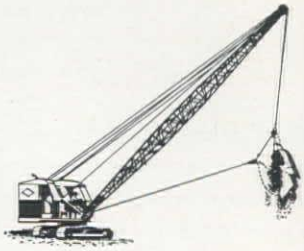


CRANES—Full range of Capacities up to 110 tons, crawler and rubber mounted. Designed for maximum lift and reach.

A New Symbol of Service to Industry



SHOVELS—Capacities from 3/4-yd. to 6-yds.



DRAGLINES—Available in variable capacities.

T2100

LIMA

CRANES
SHOVELS
DRAGLINES

This new trademark is the symbol of a pool of engineering experience that has few rivals in American industry. This important basic resource is reinforced by increased manufacturing facilities, and an expanded organization to serve you.

These things will all contribute to the continuing development that has kept Lima Shovels, Draglines and Cranes always abreast of expanding needs. In the future, as in the past our every effort will be devoted to making our products so good that our customers will continue to be our best salesmen.

BALDWIN-LIMA-HAMILTON CORPORATION
Lima-Hamilton Division, Lima, Ohio, U. S. A.

BALDWIN-LIMA-HAMILTON

LIMA EQUIPMENT SOLD AND SERVICED BY: Our Seattle Office: 1932 First Ave. So., Seattle 4, Wash. Our San Francisco Office: 1232 Hearst Bldg., San Francisco 3, Calif.

SALES AGENTS: Cascade Industrial Supply, 515 Market St., Klamath Falls, Ore.; Contractors' Equipment & Supply Co., P. O. Box 456, Albuquerque, N. M.; Feenaughty Machinery Co., 112 S.E. Belmont St., Portland 14, Ore.; Feenaughty Machinery Co., 600 Front St., Boise, Ida.; H. H. Nielsen Company, 216 Paxton Ave., Salt Lake City, Utah; Garfield and Company, 1232 Hearst Bldg., San Francisco 3, Calif.; Jameson Engineering Sales, 573 Dexter Horton Bldg., Seattle, Wash.; Modern Machinery Co., Inc., 4412 Trent Ave., Spokane 2, Wash.; Smith Booth Usher Co., 2001 Santa Fe Ave., Los Angeles 54, Calif.; Tulsa Equipment Co., Inc., 418 East 2nd St., Tulsa 3, Oklahoma.

5,000 cu. yd. unclassified excav. for borrow		.85	.60
650 cu. yd. conc. Class A (air entrained concrete Type II cement)		63.50	72.00
86,000 lb. reinforcing steel		.145	.14
164,000 lb. struct. steel—furn., fabricated and erected		.1575	.15

Section of Alaskan Way Viaduct in Seattle

Washington—King County—State. Morrison-Knudsen Co. and Rumsey & Co. (joint bidders), Seattle, with a low bid of $3,691,400.50, was awarded contract by the Washington Department of Highways for construction of the Pike to King St. second section of the Alaskan Way viaduct in Seattle. Unit bids were as follows:

(1) Morrison-Knudsen Co. and Rumsey & Co. $3,691,400.50
(2) J. C. Boespflug Const. Co. and Manson Const. & Eng. Co. 3,737,228.68
(3) MacRae Bros. $3,839,887.80
(4) General Construction Co. 3,867,246.00
(5) Guy F. Atkinson Co. 4,432,537.00

	(1)	(2)	(3)	(4)	(5)
Lump sum, preparation of site	$32,750	$73,740	$3,200	$33,000	$20,000
2 only remove and reset std. inlet	26.00	111.00	75.00	50.00	52.00
5,100 lin. ft. plain conc. or V.C. sewer pipe, 6-in. diam., in place	1.95	3.33	2.20	3.00	2.40
28,400 lb. cast iron special in place	.30	.60	.25	.30	.32
7 only st. inlets, city std. complete in place	65.00	80.00	65.00	60.00	57.00
1,750 ton ballast in place	2.50	6.00	5.00	5.00	4.40
440 ton cr. stone surf. top course in place	2.60	10.00	5.25	5.00	4.20
BRIDGE					
10,378 cu. yd. struct. excav.	8.00	6.00	8.10	7.00	11.10
15,650 cu. yd. conc. Class "AS" in place	46.00	50.50	52.00	54.00	73.80
16,050 cu. yd. conc. Class "ES" in col. gir. and beams, in place	53.00	50.50	52.00	52.00	68.45
3,454 cu. yd. conc. Class "ES" in foundations, in place	26.50	50.50	52.00	35.00	23.90
15,609 lin. ft. reinf. conc. bridge railing, in place	4.30	4.52	6.00	6.00	5.00
9,873,000 lb. steel reinf. bars, in place	.11	.106	.11	.11	.12
85,000 lin. ft. furn. steel piling	3.95	3.44	3.65	4.00	3.85
1,400 only driving st. piles, first 10-ft. of penetration	32.00	32.00	58.00	32.00	20.00
71,000 lin. ft. driving st. piles, beyond first 10-ft. of penet.	.23	.11	.10	.15	.10
40,400 lin. ft. furn. reinf. conc. piling	3.40	3.30	3.50	3.50	3.10
1,096 only driv. reinf. conc. piles first 10-ft. of penet.	42.00	40.00	48.75	40.00	38.00
29,440 lin. ft. driv. reinf. conc. piles beyond first 10-ft. of penet.	.12	.10	.10	.15	.10
33,500 lb. structl. carbon steel, in place	.24	.30	.40	.20	.20
62,000 lb. galv. steel, in place	.35	.33	.25	.35	.37
194 only bridge inlets, Type 1, comp., in place	25.00	30.00	35.00	20.00	30.00
11 only bridge inlets, Type 2, comp., in place	56.00	40.00	40.00	70.00	50.00
278 only deck drains, complete, in place	12.50	5.00	15.00	10.00	3.50
8,800 lin. ft. downspouts	9.40	7.70	6.50	11.00	7.00
5 M.B.M. timber and lumber (untr.), in place	300.00	350.00	425.00	200.00	350.00
Lump sum, reconstruct. Marion St. footbridge	$28,000	$24,000	$17,500	$23,000	$30,500
Lump sum, alterations to Pike St. footbridge	$1,200	$2,400	$1,500	$4,300	$4,000

Plant-mix Surfacing and Two Reinforced Concrete Bridges

California—Marin County—State. Granite Construction Co., Watsonville, with a low bid of $1,032,455, was awarded a contract by the California Division of Highways for highway construction between Ignacio and Forbes Overhead. The work consists of grading and surfacing 5.5 miles, constructing two reinforced concrete bridges, repairing one bridge and installing a traffic system and highway lighting system. Unit bids were as follows:

(1) Granite Construction Co. $1,032,455.00
(2) A. G. Raisch Co. 1,047,926.90
(3) Harms Bros. and Charles MacClosky Co. 1,111,786.00
(4) Fredrickson & Watson Construction Co. $1,154,773.80
(5) Eaton & Smith and Clement & Co. 1,192,771.10
(6) Chas. L. Harney, Inc. 1,259,109.10

	(1)	(2)	(3)	(4)	(5)	(6)
2,700 cu. yd. removing concrete	3.00	3.00	6.00	4.50	5.30	3.60
400 lin. ft. removing raised bars	.50	.20	.40	.70	.50	.40
Lump sum, clearing and grubbing	$28,000	$15,000	$15,000	$9,900	$30,000	$24,000
200,000 cu. yd. roadway excav.	.40	.65	.68	.78	.63	.84
7,600 cu. yd. struct. excav.	2.50	4.00	3.00	3.50	4.60	4.20
830 cu. yd. struct. excav. (bridge)	3.00	5.00	3.00	3.50	8.50	4.20
4,450 cu. yd. ditch and channel excav.	1.20	2.00	1.50	1.45	1.15	1.25
96,000 sq. yd. compacting orig. ground	.05	.05	.05	.06	.06	.06
4,100,000 sta. yd. overhaul	.005	.005	.004	.006	.004	.005
13,900 sq. yd. preparing slopes (eros. control)	.10	.25	.12	.07	.15	.08
17 ton straw cover matl. (eros. control)	60.00	100.00	60.00	60.00	58.00	72.00
Lump sum, dev. water supply and furn. wat. equip.	$5,000	$2,500	$7,000	$7,000	$25,000	$10,000
12,700 M. gal. applying water	1.25	1.50	1.50	1.50	.70	2.70
Lump sum, finishing roadway	$6,000	$5,000	$8,000	$6,400	$4,300	$9,400
40,000 ton C. R. B.	3.00	2.85	2.95	3.03	3.20	3.40
1,850 cu. yd. salv. and relay. C. R. B.	1.50	1.50	1.95	1.90	5.00	3.60
59,000 ton mineral aggregate (C.T.B.)	2.50	2.30	2.60	2.50	2.85	3.10
9,500 bbl. Portland cement (C.T.B.)	4.00	4.25	4.00	4.45	3.65	3.90
131,000 sq. yd. mixing and compacting (C.T.B.)	.15	.25	.18	.23	.29	.24
168 ton liquid asph., SC-1 (pen. tr. and pr. ct.)	28.00	30.00	32.00	33.00	30.00	32.00
60 ton liquid asph., SC-2 (pen. tr.)	30.00	30.00	32.00	32.00	30.00	31.00
70 ton liquid asph., SC-6 (armor ct.)	35.00	30.00	30.00	31.50	27.50	30.00
222 ton asph. emuls. (cur. sl., pt. bdr. and sl. ct.)	35.00	35.00	45.00	40.00	35.00	41.00
510 ton sand (pen. tr. and sl. ct.)	5.00	5.00	6.00	6.00	5.00	6.00
1,865 ton screenings (sl. ct. and armor ct.)	6.00	4.50	7.00	5.80	3.80	6.00
28,500 ton mineral aggr. (P.M.S.)	4.80	4.00	5.00	4.40	4.35	4.60
1,425 ton pav. asph. (P.M.S.)	25.00	22.00	24.00	26.00	24.00	26.00
15,000 sq. ft. placing P.M.S. walkways and islands	.10	.05	.06	.25	.10	.06
3,100 lin. ft. placing P.M.S. dikes	.15	.15	.15	.25	.10	.21
1,600 lin. ft. placing P.M.S. gutters	.12	.20	.30	.60	.20	.30
2,600 lin. ft. raised traffic bars	1.25	1.20	1.25	1.40	.75	1.50
0.7 M.F.B.M. redwood timber	500.00	400.00	650.00	350.00	$1,000	360.00
2,140 cu. yd. Cl. "A" P.C.C. (struc.)	45.00	47.50	49.00	54.00	57.50	57.00
168 lin. ft. conc. rail	6.00	8.00	5.00	7.40	10.00	7.20
480 lin. ft. furnishing conc. piling	4.00	4.10	4.00	4.60	3.40	5.10
840 lin. ft. furnishing steel piling	3.50	3.55	3.25	3.80	2.75	3.90
10 ea. steel pile splices	35.00	35.00	35.00	20.00	32.00	42.00
44 ea. driving piles	225.00	190.00	180.00	225.00	150.00	220.00
120 cu. yd. sacked conc. riprap	30.00	36.00	30.00	35.00	32.00	36.00
5 cu. yd. broken conc. riprap	5.00	30.00	15.00	23.00	40.00	60.00
260 cu. yd. Cl. "B" P.C.C. (curbs and gutters)	50.00	45.00	35.00	40.00	45.30	42.00
270 cu. yd. Cl. "B" P.C.C. (sdwlks., pavement and island pave.)	25.00	30.00	28.00	35.00	25.50	34.00
360 ea. curb dowels	.75	.50	.60	.90	.70	.50
218 ea. right-of-way monuments	7.00	5.00	8.00	5.30	5.00	5.50
23 ea. survey monuments	30.00	25.00	40.00	41.00	25.00	28.00

(Continued on next page)

NEWS of MANUFACTURERS

Continued from page 124

and general manager of Permanente Cement Co., Glacier Sand and Gravel Co., and Permanente Steamship Corporation. CLAUDE E. HARPER is the new vice president and general manager of the Kaiser Gypsum division, and ROBERT S. BARNEYBACK is now vice president and general manager of the Kaiser Co. Sand and Gravel division.

☆ ☆ ☆

WALTER GEIST, president of the *Allis-Chalmers Mfg. Co.*, Milwaukee, Wis., died suddenly of heart failure January 28. Geist, 56, had been chief executive of the industrial concern in Wisconsin since 1942. He joined the company in 1909 as an errand boy and worked his way up through the company departments. He was responsible for the development of the multiple V-belt Texrope Drive, a contribution which won him the plaque of the "Modern Pioneer," awarded by a group of distinguished scientists. Geist was also active in many civic and philanthropic activities.

WALTER GEIST, chief executive of Allis-Chalmers Mfg. Co. since 1942 and with the firm since 1909, dies of heart failure January 28.

☆ ☆ ☆

Eutectic Welding Alloys Corp., New York, N. Y., is celebrating its tenth anniversary as a developer and supplier of specialized welding rods and electrodes for unusual joining applications.

☆ ☆ ☆

W. E. MILES, manager of the industrial division of the *Oliver Corporation* of Chicago, Ill., is now the vice president in charge of crawler tractor and industrial sales for the company according to A. KING MCCHORD, Oliver president. Miles joined the company in 1919.

☆ ☆ ☆

The second major expansion in the last few months is planned by *Cummins Engine Co., Inc.*, of Columbus, Ind. The plans outlined by R. E. HUTHSTEINER, executive vice president, include an immediate extension on the DD fuel pump building, completed only 18 months ago, and new machinery for increasing the manufacturing capacity for the recently announced new Cummins DD fuel pump and component parts. An expenditure of about $400,000 is involved.

☆ ☆ ☆

San Francisco, Calif., headquarters for *J. H. Baxter & Co.*, producers of pressure

Continued on page 130

THE FINEST EVER BUILT

COMPARE THESE OTHER GMC EXTRA-DUTY FEATURES:

Full-Pressure Lubrication of all main bearing and piston pins • Synchro-Mesh Transmission • Tocco-Hardened Crankshaft • Cooler-Operating Rear Brake Drums • Husky 35-Amp. Generator • Airplane-Type Main and Rod Bearings • Lifetime Weathersealed "Six-Footer" Cab with Ventipane-Controlled Ventilation—*your choice of the widest variety of engine-body-chassis combinations, 9 smart new colors!*

LIGHT TRUCKS BY GMC!

Unsurpassed in horsepower—you've never seen ½- to 2-tonners like these—built for keeps from the rims up with many "big truck" features

THESE new lightweight champs are a lot more than just newly dressed-up models. They're built to carry you through the critical times ahead. To produce them, we threw away the book and started fresh.

Keep hauling years longer

The moment you put one of these GMC's on the road, you feel the surge of extra power that's turned out by their new engines — horsepower that's *unsurpassed* in the ½- to 2-ton truck field! This extra drive is due to such GMC features as new carburetion design, rotating Free-Valve action in the new "248" engine design that never lets carbon get set to steal power — Turbo-Top pistons that develop higher power without "knock" *even when using standard-grade gasolines!*

Feature upon feature from each individual model tells you these GMC's are built to stay young and free of trouble *from rims to roof.* Things like heavier axles, longer "pillow-action" springs, the protection of a built-in radiator overflow tank—all typify the plus values in these new trucks.

Greater Safety—More Comfort

Touch the brakes. Feel the "Twin Action" of the wider hydraulics—now included on all 1½- and 2-ton models in this safer line of new light trucks!

Or check for comfort. See how the GMC "Six-Footer" Cab has new Ventipane-controlled ventilation, non-glare instrument panel and easy-turn steering with recirculating ball-bearing action.

One Package—"No Extras"

Yet all this GMC extra value is included in one thrifty price! Feature for feature, no truck in its class has been so completely engineered to meet the challenge of the times.

To prove it, go to your GMC dealer's showroom. Select from the wide variety of models in 9 smart new colors. Compare the unsurpassed horsepower — the tough GMC frame — *the lifetime engineering in every detail.* You'll find one fact stands out above all else:

In price, in product—in operating economy—*there's never been a better buy in light hauling!*

GMC Truck & Coach Division of General Motors

GMC

GASOLINE & DIESEL TRUCKS

½ TO 20 TONS

Your key to greater hauling profits

GM

GENERAL MOTORS

NEWS of MANUFACTURERS

Continued from page 127

treated forest products, are now in the Standard Oil Building at 200 Bush Street. The new offices occupy the two penthouse floors of the building.

☆ ☆ ☆

United States Pipe and Foundry Co. of Burlington, New Jersey, states that it has acquired complete ownership of *Pontusco Corp.*, which it jointly owned with *Compagnie de Pont-a-Mousson* of Nancy, France. Through an agreement made between the two companies all of the Pontusco stock owned by the French company was purchased by the United States Pipe and Foundry Company. Pontusco Corporation is owner of all the common stock of the pipe company in California.

☆ ☆ ☆

ROBERT T. HASLAM is a newly elected member of the board of directors of the *Worthington Pump and Machinery Corp.* of Harrison, N. J. Haslam was, until recently, a vice president and director of Standard Oil Co. of New Jersey.

☆ ☆ ☆

Worthington Pump and Machinery Corporation of Harrison, N. J., announces the reorganization of the construction equipment sales divisions whereby the Holyoke, Mass., and Dunellen, N. J., divisions are grouped together with headquarters at the Dunellen, N. J., plant. W. J. FLEMING has been named works sales manager of the consolidated division, and J. S. BACHMAN is the field sales manager.

☆ ☆ ☆

The *Mir-O-Col Alloy Co., Inc.*, Los Angeles, Calif., has announced the addition of ROBERT R. APPLEGATE to its engineering staff as metallurgical engineer. Applegate has been associated with the welding industry since 1920.

☆ ☆ ☆

The appointments of WORTHINGTON J. GROSS as manager, governmental division at Washington, D. C., and BERT C. LANDSTROM as district representative for the seven Eastern States and the northeastern part of Canada, are revealed by T. V. SHEA, general sales manager of *Athey Products Corporation*, Chicago, Ill.

☆ ☆ ☆

ROBERT W. LEA, retiring as president of the *Johns-Manville Corp.*, is joining *Olin Industries, Inc.*, New York, N. Y., JOHN M. OLIN, president of the company, announces. Lea has been a director of Olin Industries since April, 1950. He offers wide experience in manufacturing, sales, business management and banking to his new position.

☆ ☆ ☆

EDGAR H. BETTS is the new chairman of the board of *W. & L. E. Gurley* engineering manufacturing company of Troy, N. Y.

Continued on page 132

540 ea. culv. markers, clear. mkrs., guide posts and mon. mkrs.	6.00	5.50	5.00	5.30	6.00	6.50
35 ea. horiz. reflector units	15.00	10.00	7.50	8.00	6.00	6.00
5.3 mi. new property fence (Type A)	$1,500	$2,500	$2,500	$3,350	$2,500	$3,500
0.2 mi. new property fence (Type B)	$2,000	$2,500	$2,750	$3,200	$2,200	$3,300
0.3 mi. new property fence (Type C)	$2,000	$2,700	$2,800	$3,375	$2,300	$3,500
1.1 mi. salv. exist. property fences	500.00	600.00	750.00	800.00	700.00	850.00
1.0 mi. reconstruct. salv. property fences	$1,000	$1,200	$1,000	940.00	$1,000	950.00
9,150 lin. ft. chain link fence	1.50	1.60	1.50	1.51	1.45	1.60
2,155 lin. ft. salv. exist. chain link fence	.40	.30	.35	.36	.40	.37
2,155 lin. ft. reconstruct. salv. chain link fence	.80	.60	.85	.80	.90	.85
1 ea. drive gate (14-ft.)	80.00	60.00	65.00	70.00	55.00	60.00
11 ea. drive gates (16-ft.)	100.00	70.00	75.00	85.00	65.00	90.00
1,144 lin. ft. 12-in. R.C.P. (std. str.)	2.50	2.00	2.50	2.10	2.50	2.30
396 lin. ft. 12-in. R.C.P. (3000-D)	3.00	2.00	3.00	2.10	2.85	2.30
1,568 lin. ft. 18-in. R.C.P. (std. str.)	4.00	3.00	4.00	3.60	3.55	3.60
1,414 lin. ft. 24-in. R.C.P. (std. str.)	6.00	4.75	6.00	5.70	5.80	5.70
132 lin. ft. 27-in. R.C.P. (3000-D)	9.00	6.50	7.50	7.30	8.25	7.20
1,204 lin. ft. 30-in. R.C.P. (std. str.)	9.00	5.75	7.00	7.60	7.50	6.80
76 lin. ft. 12-in. C.M.P. (16-ga.)	2.50	2.50	2.50	2.60	3.50	2.50
132 lin. ft. 22-in. x 13-in. C.M.P. arch (16-ga.)	4.00	3.50	4.00	4.20	5.00	5.00
438 lin. ft. 6-in. perf. met. pipe underdrs.	1.50	1.35	1.50	1.40	1.80	1.50
200 ton filter material	3.00	4.00	6.50	6.00	3.75	6.00
4 ea. spillway assemblies	30.00	35.00	40.00	32.00	45.00	40.00
108 lin. ft. 8-in. C.M.P. downdrains (16-ga.)	2.00	1.70	2.25	2.60	2.00	3.00
224 lin. ft. salv. exist. pipe culv.	1.00	1.00	1.50	1.20	1.50	1.80
150 lin. ft. relay. salv. C.M.P. culv.	1.00	1.00	1.50	1.20	1.20	1.00
2 ea. salv. spillway assemblies	20.00	10.00	15.00	25.00	25.00	25.00
318,000 lb. bar reinf. steel	.12	.106	.11	.115	.115	.115
16,500 lb. misc. iron and steel	.30	.29	.30	.30	.30	.33
505 lin. ft. steel railing	5.00	7.60	8.00	7.80	7.50	7.50
1,350 sq. yd. obliterating exist. road.	.16	.15	.20	.25	.25	.30
200 lin. ft. 2-in. galv. steel water pipe	1.00	1.00	2.00	1.20	1.50	2.60
Lump sum, constr. timber bridge	$8,500	$3,800	$4,800	$6,000	$8,500	$3,500
Lump sum, furn. and instal. truck weigh. scales	$4,000	$3,600	$3,800	$4,000	$8,000	$3,800
Lump sum, new scale house	$3,000	$2,900	$3,900	$5,000	$7,000	$3,200
Lump sum, relocat. bus stop shelters and sentry box	200.00	300.00	750.00	$1,200	$1,000	600.00
1,610 lin. ft. met. plate guard rail.	3.00	4.00	4.00	3.40	3.80	3.70
Lump sum, traffic signal sys. and hgwy. light. systems	$28,000	$26,000	$25,500	$28,000	$40,000	$29,000

Steel and Concrete Bridge

Montana—Yellowstone County—State. Barry O'Leary, Inc., Billings, with the low bid of $49,500, was awarded a contract by the Montana State Highway Commission for construction of the 106.0-ft. steel and concrete bridge over Automatic Creek, on Pompey's Pillar-Hysham highway. Unit bids were as follows:

(1) Barry O'Leary, Inc. $49,500
(2) W. P. Roscoe Co. 50,517
(3) Inland Construction Co. 52,677
(4) Walter Mackin & Son $53,954
(5) Long Construction Co. 59,944

	(1)	(2)	(3)	(4)	(5)
84,000 lb. structural steel	.225	.21	.22	.20	.20
30,600 lb. reinforcing steel	.185	.18	.20	.18	.20
150.0 cu. yd. Class "A" concrete	64.00	76.80	65.00	80.00	95.00
84.4 cu. yd. Class "AD" concrete	68.00	76.80	105.00	90.00	85.00
220 lin. ft. steel beam bridge rail	7.50	4.00	4.50	10.00	5.00
1,700 lin. ft. tr. timber found. piles	3.00	1.50	2.75	3.00	3.50
475 cu. yd. structure excavation	6.00	12.50	8.00	10.00	18.00

Reinforced Concrete Viaduct Approaches

Oregon—Marion-Polk Counties—State. General Construction Co., Portland, with a low bid of $787,736, awarded contract by Oregon State Highway Department for constructing approaches to the Marion Street Bridge over the Willamette River near Salem. The work consists of approximately 2,442 lin. ft. of reinforced concrete viaduct approaches, and placing deck and rail on approximately 770 ft. of steel spans. Unit bids were as follows:

(1) General Construction Co. $787,736.00
(2) Lindstrom Bros. 797,015.00
(3) Guy F. Atkinson Co. 841,550.00
(4) Lee Hoffman & J. A. Troxell $845,715.00
(5) C. J. Montag & Sons 903,165.00

	(1)	(2)	(3)	(4)	(5)
3,180 cu. yd. structural excav.	6.00	15.00	4.00	3.00	10.00
20 cu. yd. structural excav. below eleva. shown	10.00	20.00	10.00	20.00	20.00
16,900 lin. ft. furn. treated timber piling	1.23	1.45	1.60	1.75	1.50
1,150 lin. ft. furn. steel piling	4.50	7.00	3.40	5.00	4.00
566 only drive timber piles	25.00	45.00	60.00	35.00	60.00
16 only drive steel piles	114.00	60.00	200.00	140.00	60.00
6,770 cu. yd. Class "A" conc.	60.00	60.00	68.40	74.00	74.00
660 sq. yd. conc. pavement	5.00	6.00	6.00	6.00	4.00
1,218,000 lb. metal reinforcing	.11	.11	.115	.12	.12
6,310 lin. ft. metal rail	11.00	11.75	12.00	10.00	12.00
All required, painting structural steel	$27,500	$21,750	$25,000	$24,000	$25,000
All required, electric heating system in place	$28,600	$31,300	$34,000	$22,000	$35,000
All required, electric lighting system in place	$8,000	$11,700	$12,000	$8,000	$13,000
2,300 cu. yd. special gravel fill	3.00	2.00	1.80	3.50	2.25
40 lin. ft. 8-in. conc. sewer pipe	2.00	4.00	2.40	4.00	1.50
60 M. gal. sprinkling	3.00	5.00	3.60	4.00	3.00
200 ton Class "B" asphaltic conc.	8.00	8.40	10.00	8.00	10.00
2 ton RS-1 emulsified asphalt	50.00	52.50	75.00	50.00	60.00
10 cu. yd. aggregate in seal coat	5.00	5.25	10.00	5.00	6.00

Highway and Street . . .

Grading and Asphaltic Concrete Paving

Oregon—Coos County—State. Coos Bay Dredging Co., Coos Bay, with a bid of $298,774.90, was low before the Oregon State Highway Department for grading and paving on the Cedar Point to Coquille section of the Oregon Coast Highway. Unit bids were as follows:

(1) Coos Bay Dredging Co. $298,774.90
(2) Peter W. Yett 299,217.50
(3) Warren Northwest, Inc. 308,547.50
(4) Rogers Construction Co. and Babler Bros. $314,340.00
(5) J. G. Watts Construction Co. 375,844.00

	(1)	(2)	(3)	(4)	(5)
All specified, clearing and grubbing	$9,000	$2,500	$7,500	$10,000	$8,000
3,000 sq. yd. removal of pavement and walks	.65	.60	1.00	.80	1.50

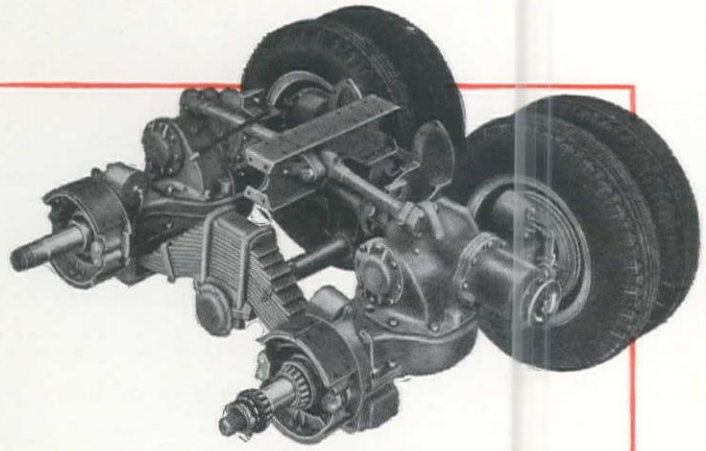
(Continued on next page)

MACKS make light of heavy loads . . .

Big Mack super-duty trucks make the hard jobs look easy . . . because in design and construction they incorporate numerous outstanding features that contribute to easy maneuverability, ease of control and positive traction regardless of terrain.

Powerful Diesel Engines! Hydraulic Power Steering! Air Assist Clutch! Flexible Rubber Shock Insulators! Mack's famed Balanced Bogie and Power Divider. All are Mack features that assure power and strength for the heaviest loads; flotation and traction for the most slippery mud or sand.

Your nearest Mack branch or distributor will give you the full story on what Macks can do for you in trouble-free, uninterrupted schedules . . . greater profits through greater output at lower cost. You'll find it's a story well worth hearing.



Only Mack gives you all the advantages of the famed Balanced Bogie. Positive traction because of exclusive Power Divider. No spring twist because of Mack Rubber Shock Insulators. Inherent flexibility eliminates chassis distortion. Extended tire life because of uniform tire loading. Minimum maintenance because of simplicity of design.

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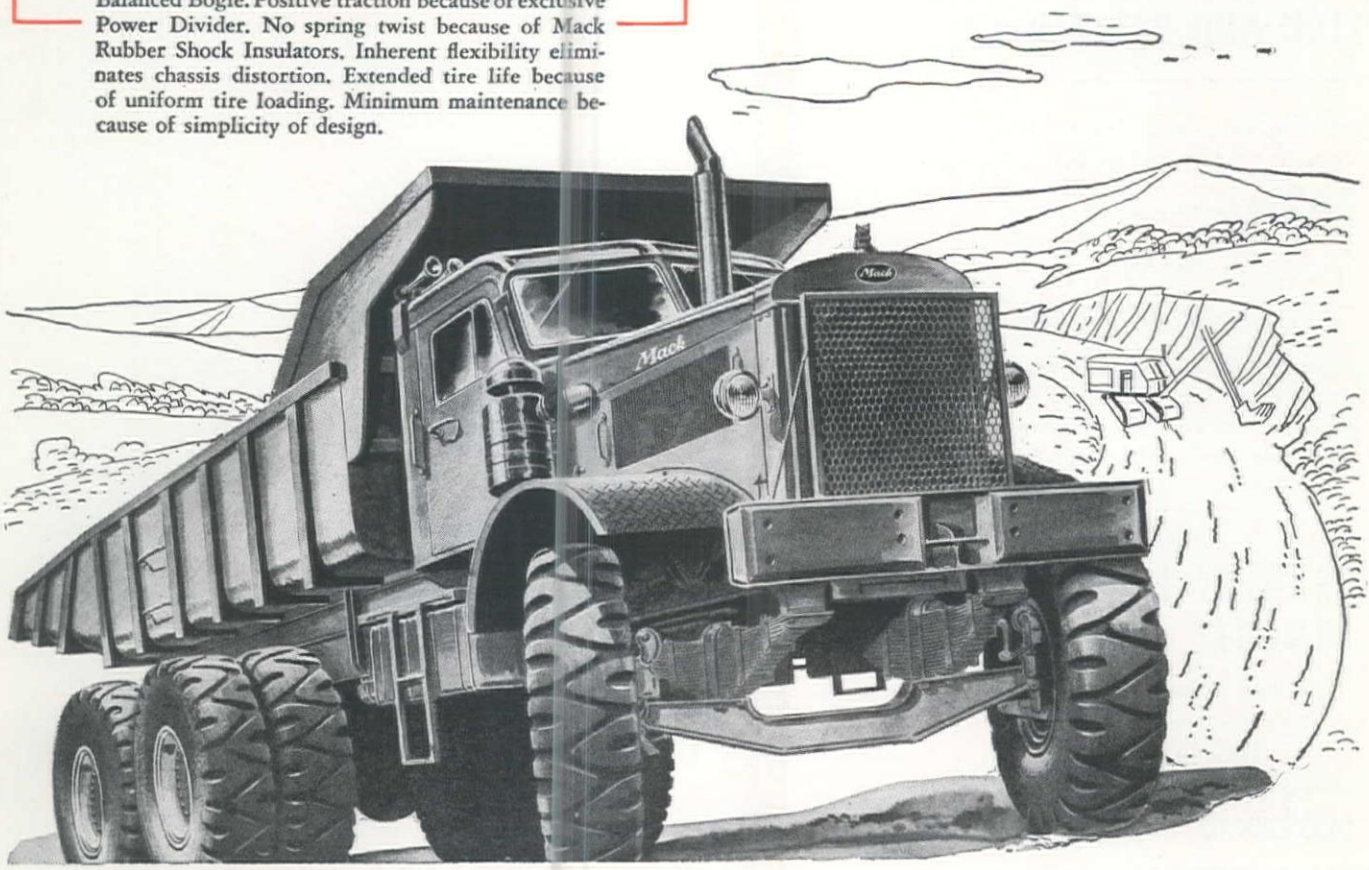
Mack Trucks, Inc. — Los Angeles • Denver • San Francisco Seattle • Portland • Salt Lake City • Factory branches and distributors in all principal cities for service and parts.



NEWS of MANUFACTURERS

Continued from page 130

CHARLES A. SMART was reelected to a new term as president of the 106-year-old company.

☆ ☆ ☆

PAUL JONES, president of *Cummins Business Machines Corp.*, Chicago, Ill., announces the change of that company's name to *Cummins-Chicago Corp.* Internal growth and external expansion, which indicated the desirability of a corporate title, were given as reasons for the 64-year-old company's name change. The firm manufactures portable electric tools.

NEW BOOKS...

WELDED DECK HIGHWAY BRIDGES—Edited by James G. Clark. Published by The James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio. 247 pages. Price $2.00.

This book presents the thinking of some of the world's foremost bridge designers and fabricators on the subject of what is the best way to make an all-welded 120-foot deck highway bridge. Structural types, floor systems, new sections, special connections and details, quantities and costs are all discussed. Over 100 drawings of bridges and details are included.

170	lin. ft. removal of curbs	.50	.50	1.00	1.00	1.00
6	only removal of catch basins	25.00	30.00	20.00	25.00	30.00
1,280	cu. yd. struct. excav., unclassified	3.25	3.00	3.00	3.00	6.00
12	cu. yd. trench excav., unclassified	2.75	4.00	3.00	3.00	15.00
53,000	cu. yd. general excav., unclassified	.465	.50	.50	.50	.75
116,000	yd. sta. short overhaul	.015	.02	.03	.02	.03
6,200	cu. yd. sta. long overhaul	.58	.40	.50	.50	.60
2.02	mi. finishing roadbed and slopes	780.00	500.00	600.00	$1,000	$1,000
7,000	lin. ft. rounding cutbanks	.22	.15	.20	.20	.15
20	lin. ft. 18-in. corru. metal pipe	4.75	3.80	4.25	4.00	5.00
10	lin. ft. 30-in. corru. metal pipe	9.55	7.00	8.50	8.00	8.50
110	lin. ft. 36-in. corru. metal pipe	13.50	11.00	13.00	12.00	11.50
90	lin. ft. 42-in. corru. metal pipe	15.50	16.00	15.00	15.00	12.50
24	lin. ft. 48-in. corru. metal pipe	19.50	19.00	18.00	20.00	15.00
60	lin. ft. 12-in. perf. metal drain pipe, coated	3.33	3.00	3.00	3.00	4.00
950	lin. ft. 12-in. concrete pipe	1.85	2.00	2.00	2.00	2.50
190	lin. ft. 18-in. concrete pipe	3.45	2.75	4.00	4.00	3.50
390	lin. ft. 8-in. sewer pipe	1.35	1.25	1.50	2.00	1.50
100	lin. ft. extra for installing pipe under pavement	5.00	5.00	3.00	5.00	3.50
320	lin. ft. salvaging culvert pipe	1.50	1.50	2.00	3.00	2.50
20	cu. yd. ⅜-in - 0-in. backfill in drains	4.00	4.00	5.00	7.00	6.00
10	only concrete catch basins	57.50	50.00	60.00	60.00	70.00
5	only adjustment of manholes	30.00	30.00	50.00	30.00	60.00
1	only adjustment of catch basins	30.00	30.00	25.00	50.00	100.00
280	cu. yd. concrete curbs and gutter	53.00	50.00	54.00	55.00	45.00
100	only ¾-in. x 18-in. dowel bars in gutter	.75	.75	.75	.80	.50
430	sq. yd. concrete driveways	4.50	4.00	4.00	5.00	4.00
800	sq. yd. concrete walks	3.60	3.60	3.60	3.60	2.50
115	cu. yd. Class "A" conc. in retaining wall	54.00	60.00	54.00	70.00	60.00
15,000	lb. metal reinf. in retaining wall	.125	.15	.125	.15	.12
16,600	cu. yd. 2½-in. - 0-in. material in base	3.45	3.75	3.35	3.80	5.00
3,400	cu. yd. ¾-in. - 0-in. material in base and shoulders	3.85	4.00	4.25	4.00	5.50
350	M. gal. sprinkling	2.50	3.00	3.00	2.00	4.00
300	cu. yd. ¾-in. - 0-in. material in binder course	4.75	4.00	5.00	6.00	5.50
60	ton furn. and placing RC-3 asph. in binder course	45.00	50.00	55.00	50.00	50.00
13,400	ton Class "B" asph. conc.	8.00	8.30	8.60	8.00	10.00
34	ton emulsified asph. in seal coat	55.00	55.00	55.00	50.00	50.00
200	cu. yd. aggregate in seal coat	6.00	6.00	6.00	8.00	6.00
All specified, preparation of exist. bridge at Cunningham						
All specified, shoring, cribbing, etc. at Cunningham Creek						
130	cu. yd. excav. at Cunningham Creek	10.00	10.00	10.00	10.00	8.00
All specified, preparations of exist. bridge at Budd Creek						
All specified, shoring, cribbing, etc. at Budd Creek						
70	cu. yd. excav. at Budd Creek	10.00	10.00	10.00	10.00	8.00
20	cu. yd. excav. below elevations shown	15.00	20.00	20.00	20.00	12.00
2,100	lin. ft. furn. untreated piling	.55	.55	.55	.60	.50
61	only drive timber piles	35.00	40.00	40.00	40.00	50.00
40	cu. yd. riprap	5.00	10.00	10.00	12.00	7.00
190	cu. yd. Class "A" concrete	54.00	50.00	54.00	60.00	60.00
21,700	lb. metal reinforcement	.125	.12	.125	.12	.12

Crushed Rock Base and Road-mix Bituminous Surface

Utah—Iron and Washington Counties—State. The Strong Company, Springville, Utah, was low bidder before the State Road Commission for construction of 11 mi. of 2-in. road mixed bituminous surfaced road. Unit bids were as follows:

(1) Strong Co. $219,329
(2) Reynolds Construction Co. 224,030
(3) LeGrand Johnson 227,009
(4) J. M. Sumsion & Sons 229,938
(5) Parson & Fife Construction Co. 235,223
— Thorn Construction Co., Inc. $241,561
— W. W. Clyde & Co. 256,479
— L. T. Johnson Construction Co. 256,168
(6) Engineer's estimate 245,137

		(1)	(2)	(3)	(4)	(5)	(6)
241,000	gal. bituminous material, Type SC-3	.14	.13	.12	.1175	.14	.12
43,000	gal. bituminous material, Type RC-4	.16	.14	.15	.1375	.16	.14
44,000	gal. bituminous material, Type MC-1	.16	.14	.14	.13	.15	.14
10.978	mi. scarifying and mixing	650.00	600.00	650.00	600.00	600.00	700.00
2,100	ton cover material	2.50	3.00	3.50	2.75	3.00	2.50
58,000	ton cr. rock or cr. grav. surface course	.62	.65	.60	.78	.75	.75
85,000	ton gravel or crushed rock base course	.52	.60	.60	.67	.60	.70
125,000	cu. yd. unclasified excav.	.17	.18	.22	.18	.18	.20
74,000	sta. yd. overhaul, Class "A"	.015	.01	.015	.015	.015	.015
500	yd. mi. overhaul, Class "B"	.25	.20	.20	.30	.25	.15
3,900	1,000 gal. watering	1.50	1.00	1.25	1.25	1.25	2.00
2,100	hr. rolling	4.50	5.00	4.00	4.00	5.00	4.50
220	lin. ft. 12-in. C.G.M. pipe	2.35	2.35	2.20	2.00	2.20	2.20
262	lin. ft. 18-in. C.G.M. pipe	3.00	3.15	3.00	3.00	2.95	3.00
1,188	lin. ft. 24-in. C.G.M. pipe	4.40	4.60	4.40	4.20	4.40	4.70
144	lin. ft. 30-in. C.G.M. pipe	6.00	5.80	6.00	5.00	5.65	6.00
15	lin. ft. 36-in. C.G.M. pipe	10.00	9.00	9.00	8.00	8.75	9.30
52	lin. ft. C.M. pipe arches 29-in. x 18-in.	5.00	4.90	5.00	4.50	5.00	5.00
74	lin. ft. C.M. pipe arches 58-in. x 36-in.	13.50	11.00	12.00	11.00	13.20	12.50
72	lin. ft. relaying 18-in. C.G.M. pipe	1.50	1.00	1.50	1.00	1.00	.75
62	lin. ft. relaying 24-in. C.G.M. pipe	2.00	1.00	2.00	1.00	1.00	1.00
32	lin. ft. relaying 36-in. C.G.M. pipe	3.00	2.00	2.50	2.00	1.00	1.25
49	cu. yd. concrete, Class "A"	70.00	65.00	70.00	64.00	80.00	65.00
8,000	lb. reinforcing steel	.15	.15	.14	.14	.15	.15
700	cu. yd. excavation for structures	2.00	1.00	2.00	1.50	1.50	2.00
3,200	cu. yd. channel excavation	.30	.50	.50	.40	.40	.30
48,000	lin. ft. right-of-way fence, Type "B"	.24	.25	.28	.22	.25	.30
31	ea. 16-ft. gates	32.50	35.00	33.00	34.00	35.00	35.00
140	ea. right-of-way markers	6.00	6.00	5.00	4.00	6.00	5.00
2	ea. F.A.P. markers	25.00	20.00	20.00	20.00	25.00	20.00
10,000	ton cr. rk. or cr. grav. surf. crse. (pl. in stkpl.)	.58	.55	.55	.53	.60	.65
3,000	ton cover material (place in stkpl.)	2.00	2.00	2.00	2.00	1.75	2.00

Clearing, Heavy Excavation for Grading and Drainage

Washington—Cowlitz County—State. Northwest Construction Co., Seattle, with a low bid of $393,853.85, was awarded a contract by the Washington Department of Highways for clearing, grading and draining 2.4 miles of the Pacific Highway from the Toutle River north. Units bids were as follows:

(1) Northwest Construction Co. $393,853.85
(2) Marshall, Haas & Royce 411,112.50
(3) R. A. Heintz Construction Co. 415,631.73
(4) Leonard & Slate, Oregon Ltd. 416,154.15
(5) Smith Bros., General Contractors Inc. and John Havlik, Jr. $431,392.41
(6) Erickson Paving Co. 435,368.40
— Goatz & Brannan 467,985.80
— Peter Kiewit Sons' Co. 472,086.05

		(1)	(2)	(3)	(4)	(5)	(6)
77.41	ac. clearing	325.00	450.00	500.00	500.00	565.00	400.00
48.46	ac. grubbing	300.00	400.00	400.00	500.00	400.00	425.00
28.81	ac. roadside cleanup	300.00	400.00	300.00	500.00	450.00	400.00

(Continued on next page)

552,560 cu. yd. common excav. incl. haul of 600-ft.	.32	.32	.32	.35	.31	.34
45,860 cu. yd. solid rock excav. incl. haul of 600-ft.	1.00	1.00	.95	.35	1.15	1.00
8,995 cu. yd. common trench excav. incl. haul of 600-ft.	1.00	1.00	.90	.75	1.50	1.60
10 cu. yd. solid rock tr. excav. incl. haul of 600-ft.	8.00	10.00	5.00	10.00	10.00	10.00
394,310 cu. yd. stas. overhaul	.01	.01	.01	.01	.01	.02
2,362.54 M. cu. yd. stas. overhaul	5.00	5.00	4.50	7.50	4.00	5.00
1,050 cu. yd. excav. of unsuitable matl. incl. haul	1.50	.50	1.50	1.00	2.50	1.50
2,850 cu. yd. struct. excav.	3.00	3.00	2.75	3.00	2.50	3.00
330 day tamping roller	50.00	64.00	50.00	50.00	60.00	65.00
112 day pneumatic tired roller	45.00	40.00	45.00	50.00	30.00	35.00
76 day mechanical tamper	35.00	30.00	35.00	30.00	40.00	40.00
17,610 lin. ft. slope treatment Class A	.15	.20	.15	.15	.15	.15
187.5 stas. (100-ft.) finishing roadway	15.00	15.00	14.00	15.00	15.00	15.00
81 M. gal. water in place	3.00	5.00	3.00	3.00	4.00	2.50
135 cu. yd. gravel backfill for foundatns. in place	4.50	5.00	4.00	3.00	5.00	7.00
125 cu. yd. gravel backfill for drains in place	8.00	5.00	6.00	5.00	7.00	7.00
15,620 ton selected roadway borrow in place	1.20	1.00	1.90	1.50	1.50	1.25
590 ton cr. stone surf. top course in place	3.75	4.00	4.00	3.00	4.00	4.50
1,165 ton cr. stone surf. base course in place	3.75	4.00	4.00	3.00	3.75	4.50
1.0 cu. yd. conc. Class C in place	80.00	100.00	80.00	100.00	100.00	100.00
51 lin. ft. conc. or V.C. drain pipe 8-in. diam., in pl.	1.10	2.00	1.10	1.25	1.55	1.50
540 lin. ft. conc. or V.C. drain pipe 10-in. diam., in pl.	1.30	2.00	1.30	1.35	1.65	1.65
39 lin. ft. std. reinf. conc. culv. pipe 12-in. dia., in pl.	2.25	2.50	2.40	3.00	2.50	2.40
651 lin. ft. std. reinf. conc. culv. pipe 18-in. dia., in pl.	3.50	3.50	3.30	4.00	3.60	4.00
2,214 lin. ft. std. reinf. conc. culv. pipe 24-in. dia., in pl.	5.00	5.00	4.50	5.00	5.25	5.25
393 lin. ft. std. reinf. conc. culv. pipe 30-in. dia., in pl.	9.00	7.50	7.25	8.00	7.75	8.00
261 lin. ft. extra str. reinf. conc. culv. pipe 36-in. dia., in pl.	13.50	10.00	10.50	10.00	11.00	11.00
267 lin. ft. extra str. reinf. conc. culv. pipe 42-in. dia., in pl.	17.00	15.00	13.50	12.00	13.50	13.00
1 only catch basin in place	100.00	200.00	110.00	100.00	100.00	200.00
1,600 lin. ft. std. beam guard rail in place	2.60	3.00	3.40	4.00	3.25	3.00
80 only reinf. conc. right-of-way markers in place	6.00	5.00	6.00	10.00	6.00	6.00
120 lin. ft. galv. iron water pipe ¾-in. diam., in place	1.00	1.00	1.00	1.00	1.00	1.50
395 lin. ft. relay. galv. iron water pipe ¾-in. diam.	.80	1.00	.75	1.00	.75	1.00

Grade and Drain Roadway Over New Alignment

Arizona—Topock—State. W. J. Henson, Contractor, was low bidder for construction of 6.75 mi. of the Topock-Kingman Highway, consisting of grading and draining the roadway over new alignment. Unit bids were received as follows:

(1)	W. J. Henson, Contractor	$325,766	
(2)	Pioneer Contracting Co., Inc.	326,426	
(3)	Tanner Construction Co.	330,907	
(4)	Wallace & Wallace	333,987	
(5)	Lyle Price, Contractor	334,629	
(6)	Winston Brothers Co.	335,477	
—	Arizona Sand and Rock Co.	339,551	
—	Larsen Contracting Co.	$343,695	
—	Western Constructors, Inc.	346,771	
—	Vinnell Company, Inc.	364,108	
—	Daley Construction-Acme Materials Co.	364,819	
—	Phoenix-Tempe Stone Co.	399,785	
—	Isbell Construction Co.	498,063	

	(1)	(2)	(3)	(4)	(5)	(6)
660,450 cu. yd. roadway excav.	.22	.20	.21	.23	.20	.21
10,125 cu. yd. drainage excav.	.25	.25	.25	.22	.20	.30
8,950 lin. ft. grader ditches	.04	.03	.05	.05	.05	.04
1,350 lin. ft. crown ditches	.18	.20	.08	.12	.12	.30
2,100 cu. yd. structural excav.	1.20	1.00	1.75	1.25	1.80	1.60
24,200 cu. yd. mi. overhaul	.22	.21	.20	.20	.20	.20
74,800 cu. yd. borrow	.22	.20	.23	.20	.19	.22
22,100 M. gal. watering (CIP)	1.30	1.85	1.50	1.30	2.05	1.70
5,800 hr. rolling	5.50	6.00	5.50	5.80	6.00	5.80
1,630 cu. yd. Class "A" concrete (incl. cement)	36.00	38.00	39.00	36.00	36.50	37.00
173,900 lb. reinforcing steel (bars) (CIP)	.095	.09	.10	.10	.10	.10
410 lin. ft. 24-in. corru. metal pipe (CIP except excav.)	4.80	4.10	4.00	4.50	4.10	5.50
242 lin. ft. 24-in. bitum. coated corru. metal pipe (CIP except excav.)	5.40	4.50	5.50	5.00	4.50	6.00
178 lin. ft. 30-in. corru. metal pipe (CIP except excav.)	6.00	5.10	6.00	5.70	5.10	6.50
76 lin. ft. 30-in. bitu. coated corru. metal pipe (CIP except excav.)	6.60	5.65	6.50	6.60	5.65	7.00
240 lin. ft. 36-in. corru. metal pipe (CIP except excav.)	7.80	7.90	8.50	9.00	7.90	10.00
160 lin. ft. 36-in. bitu. coated corru. metal pipe (CIP except excav.)	9.60	8.40	10.00	10.00	8.40	10.00
144 lin. ft. 42-in. corru. metal pipe (CIP except excav.)	11.00	9.60	10.50	11.00	9.60	11.00
102 lin. ft. 54-in. corru. metal pipe (CIP except excav.)	15.00	12.50	12.00	15.00	12.50	16.00
144 lin. ft. 72-in. corru. metal pipe (8 gauge) (CIP except excav.)	29.00	24.00	26.00	29.00	24.00	29.00
60 lin. ft. 50-in. x 31-in. arch type corru. metal pipe (CIP except excav.)	11.30	11.00	10.00	13.00	11.00	13.00
233 cu. yd. plain riprap (Std. C-23) (Type E) (CIP)	3.00	6.00	8.00	7.00	10.00	6.00
50 ea. r/w markers (Std. C-1) (Type B or C) (CIP)	5.00	6.00	5.00	6.00	6.00	7.00
1 ea. survey monument and cover (Std. C-1) (CIP)	35.00	30.00	30.00	50.00	30.00	100.00

Clearing, Grading and Asphaltic Surfacing

New Mexico—Bernalillo County—State. Skousen-Hise Contracting Co., Albuquerque, with a low bid of $1,594,387.75, was awarded contract by the New Mexico State Highway Department for constructing 7.95 miles of U. S. 66 from Albuquerque through Tijeras Canyon. Unit bids were as follows:

(1)	Skousen-Hise Contra. Co.	$1,594,387.75	
(2)	W. T. Bookout Co.	1,598,131.30	
(3)	G. I. Martin, O. D. Cowart, Brown Contr. Co.	1,838,075.90	
(4)	Lowdermilk Bros.	$1,954,305.00	
(5)	Engineer's Estimate	1,734,213.70	

	(1)	(2)	(3)	(4)	(5)
Lump sum, clearing and grubbing	$2,000	$14,000	$2,000	$1,000	$2,000
Lump sum, removal of old structs.	$20,000	$9,000	$12,700	$20,000	$18,400
Lump sum, removal of obstructions	200.00	700.00	500.00	250.00	500.00
952,760 cu. yd. excav., unclassified	.68	.73	.76	1.00	.70
8,220 cu. yd. excav. for structs.	2.00	4.00	2.00	2.50	2.50
6,050 cu. yd. excav. for pipe culverts	2.00	4.00	3.00	2.50	2.50
35,130 cu. yd. borrow	.65	.70	.60	.50	.35
2,233,800 sta. yd. overhaul	.018	.005	.03	.01	.02
637,000 ¼ mi. yd. haul	.07	.05	.08	.05	.05
115,300 ton mi. haul	.10	.10	.09	.06	.05
2,950 hr. mechanical tamping	5.00	3.00	4.00	5.00	5.00
3,085 hr. rolling—sheepsfoot roller	4.00	3.00	4.00	4.50	4.00
1,240 hr. rolling—steel tired roller	6.00	4.00	6.00	6.00	5.00
2,886 hr. rolling—pneumatic tired roller	4.00	3.00	4.00	4.25	5.00
58,050 ton ballast	.48	.45	.65	.58	.55

(Continued on next page)

53,220	ton leveling course	.72	.60	.90	.70	.65
18,535	M. gal. watering	.40	1.00	.50	1.00	2.00
5,605	cu. yd. Class "AE AR" concrete	37.00	40.00	46.00	40.00	50.00
703,000	lb. reinforcing steel	.11	.11	.12	.12	.13
16,106	lb. structural steel	.25	.40	.30	.20	.25
3,478	lin. ft. std. reinf. conc. pipe, 24-in. diam.	5.25	5.20	6.00	5.30	5.00
1,634	lin. ft. std. reinf. conc. pipe, 30-in. diam.	6.65	6.65	9.00	7.85	6.50
2,168	lin. ft. std. reinf. conc. pipe, 36-in. diam.	8.50	8.55	11.00	10.00	8.50
768	lin. ft. std. reinf. conc. pipe, 42-in. diam.	11.50	11.75	14.00	12.00	11.00
1,008	lin. ft. std. reinf. conc. pipe, 48-in. diam.	13.00	13.50	16.00	15.25	12.50
270	lin. ft. corr. galv. metal culv. pipe, 18-in. diam.	5.00	3.75	4.00	3.25	3.00
1,727	sq. yd. grouted rubble gutter	2.00	4.75	7.00	5.00	3.00
3	ea. cattle guards (18-ft. roadway)	$1,500	$1,500	$1,500	$1,600	$1,500
1	ea. monuments and markers	100.00	100.00	50.00	50.00	50.00
14,250	lin. ft. galv. barbed wire fence	.20	.17	.15	.20	.15
10	ea. gates, Texas type	10.00	10.00	10.00	20.00	7.50
104	ea. bracing	6.00	6.00	5.00	7.50	7.00
2,481	ea. tr. tmbr. warn. posts. refl. (6-in. diam.)	5.50	6.00	5.00	4.75	7.00
204	ea. right-of-way markers	6.00	8.00	7.00	6.50	6.00
3,000	lin. ft. removing and rebuilding fence	.15	.20	.12	.15	.12
91	ea. new posts for rebuilding fence	1.00	1.25	1.00	1.00	1.00
1.7	mi. obliterating old road	300.00	200.00	500.00	350.00	200.00
1,425	lin. ft. contour ditches	.25	.20	.40	.15	.20
600	bbl. cutback asphalt Type RC-2	7.00	8.00	5.80	6.75	6.50
1,700	bbl. cutback asphalt Type MC-1	7.00	6.00	5.80	6.55	6.50
1,495	bbl. cutback asphalt Type RC-4	6.50	6.00	6.80	7.40	6.50
2,765	ton aggregate for seal coat	4.00	4.50	5.00	4.50	5.00
28,750	ton hot plant asphaltic surfacing	3.15	2.50	3.80	3.50	4.50
16,600	bbl. 85-100 asph. for hot plant surfacing	5.20	5.50	5.70	5.70	6.50
7.954	mi. asphalt processed base	$6,700	$2,500	$8,000	$7,500	$1,300
800	ft. std. galv. pipe, 4-in. diam.	3.00	2.50	3.00	4.50	3.00

Rip-rap for Mountain Highway

Washington—Clallam County—State. J. P. Surace Construction Co., Seattle, was low bidder for rip-rap for state highway 9 at Lake Crescent. Unit bids were received as follows:

(1) J. P. Surace Construction Co. $18,370
(2) Hugh Govan 19,015
(3) Port Construction Co. $19,062
(4) Osberg Construction Co. 28,800

		(1)	(2)	(3)	(4)
3,960	cu. yd. unclassified borrow including haul	.75	1.00	1.15	2.00
2,980	cu. yd. loose rip-rap Class A in place	5.00	4.75	4.60	6.00
	Lump sum, removing debris	500.00	900.00	800.00	$3,000

Miscellaneous . . .

Replacing Concrete Fords with Concrete Box Culverts

Arizona—Pinal County—State. Reliance Truck Co. & A. L. Snuffer, Phoenix, with a bid of $64,891.50, was low before the Arizona State Highway Department for replacing three concrete fords with concrete box culverts and approach roadway. The work is located on two short sections of highway, one near Florence Junction and the other north of Florence. Unit bids were as follows:

(1) Reliance Truck Co. & A. L. Snuffer $64,891.50
(2) Larsen Contracting Co. 66,099.25
(3) Wallace & Wallace 67,999.00
(4) Vinnell Company, Inc. 69,447.00
— Arizona Sand & Rock Co. 69,693.45
— Tanner Construction Co. $69,960.00
— Martin Construction Co. 73,385.75
— Johnson Construction Co. 74,362.60
— Western Constructors, Inc. 80,594.75

		(1)	(2)	(3)	(4)
200	cu. yd. roadway excav.	.50	.50	.50	.26
5,675	cu. yd. drainage excav.	.20	.25	.30	.23
2,400	lin. ft. grader ditches	.05	.05	.05	.05
1,665	cu. yd. structural excav.	.95	1.00	1.30	.90
11,650	cu. yd. borrow (CIP)	.25	.25	.30	.25
600	M. gal. watering (CIP)	2.20	2.00	2.00	2.50
200	hr. rolling	5.50	6.00	6.00	6.00
6,150	cu. yd. select material (CIP)	.25	.50	.40	.28
250	ton cover matl. for seal coat (Type B) (CIP)	4.00	4.00	5.00	5.00
2,000	ton bitum. mix (Cl. I—Road Mix) (CIP except cost of liquid asphalt)	1.00	.80	1.60	1.50
115	ton liquid asphalt for prime coat, tack coat and bitum. mix (Grade MC-2 or MC-3) (CIP)	31.00	32.00	33.00	35.00
25	ton emuls. asph. for seal coat (Grade A) (CIP)	34.00	35.00	35.00	38.00
876	cu. yd. Class A conc. (including cement)	35.00	34.00	34.00	35.00
110,750	lb. reinf. steel (bars) (CIP)	.105	.10	.10	.105
156	lin. ft. 24-in. corr. metal pipe (CIP except excav.)	4.50	4.00	4.00	5.00
2	cu. yd. removal of struct. conc.	20.00	20.00	20.00	35.00
8	ea. place dowels	2.00	4.00	2.00	1.00
8	ea. guide posts (std. C-8) (Type B) (CIP)	6.00	6.00	6.00	5.00
400	lin. ft. bank protection (Std. C-23) (Type A) (CIP)	8.00	10.00	8.00	12.00
275	lin. ft. bank protection (Std. C-23) (Type B) (CIP)	5.00	6.00	6.00	7.00

Main Line and Shoofly Railroad

Oregon—Lane County—Corps of Engineers. Lookout Point Constructors, Portland, a joint venture of Wm. A. Smith Contracting Co. of Missouri and Wm. A. Smith Contracting Co. of California, with a bid of $1,992,362.40, was low before the Corps of Engineers, Portland, for railroad construction near Lowell. The job consists of construction of approximately 16 miles of track on Southern Pacific Company's relocated main line and a shoofly track, including furnishing roadbed topping, ballast, ties, rail and turnouts, and appurtenances. Unit bids were as follows:

(1) Lookout Point Constructors $1,992,362.40
(2) Guy F. Atkinson Co. 2,044,453.40
(3) Utah Construction Co. $2,063,476.90
(4) Contracting Officers' Estimate 1,687,455.70

		(1)	(2)	(3)	(4)
200	cu. yd. excav. for reshaping subgrade	2.00	5.00	1.15	.70
250	cu. yd. borrow for embank.	2.00	2.50	.60	.75
10,000	cu. yd. roadbed topping matl.	1.50	3.00	3.00	1.75
7,000	cu. yd. ballast material	6.75	4.50	6.60	4.45
100	lin. ft. 4-in. clay tile or 4-in. perf. pipe, in place	1.50	2.50	1.60	1.00
4,725	track ft. track laying, new, 132-lb. rail	17.00	18.40	17.00	14.40
2,490	track ft. track laying, shoofly track, using 131- or 132-lb. Govt.-furnished rail	5.00	8.75	8.50	5.75
1,374	track ft. track laying, shoofly track, using 110-lb. Govt.-furnished rail	5.00	7.75	7.50	5.60

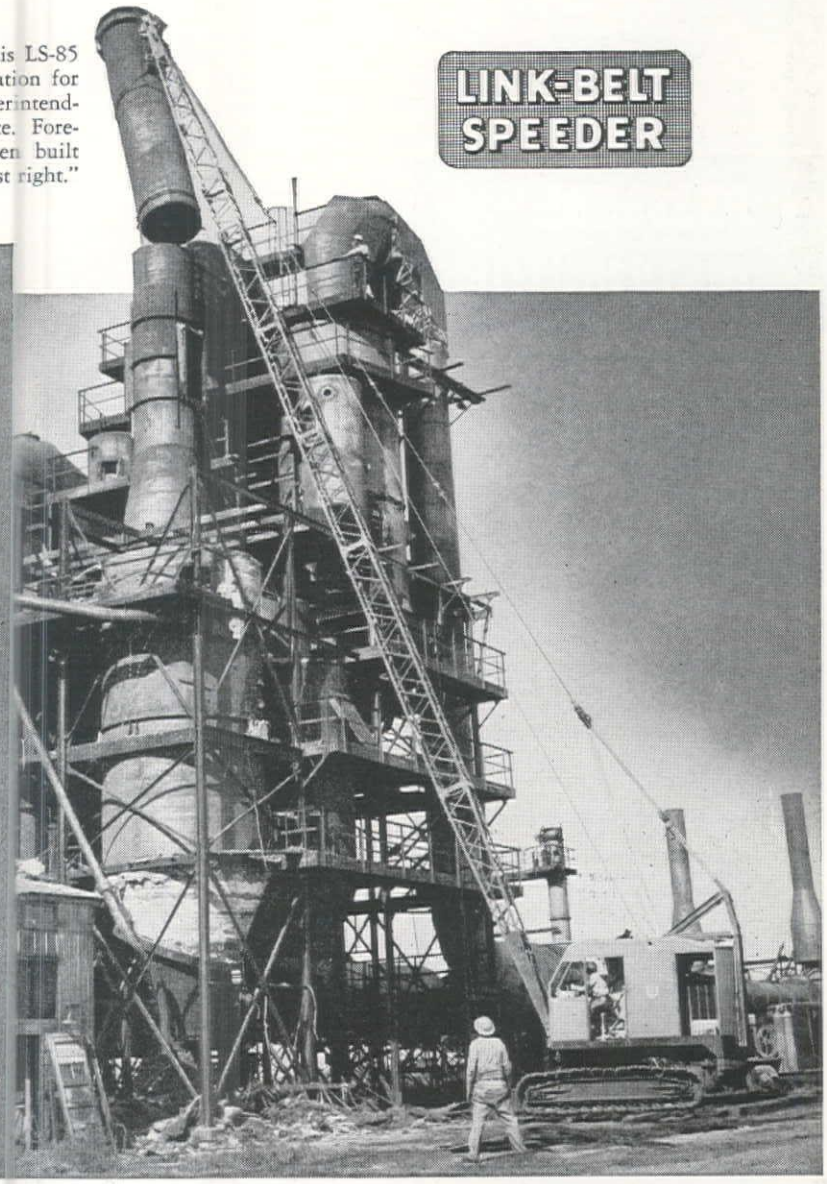
(Continued on next page)

Here's why operators call the LS-85 the

SUPER SHOVEL-CRANE!

- Heavy-duty, all-welded construction..
- Designed to assure short, positive turns in steering
- Wide, long frame for ground-hugging stability
- 13″ ground clearance — nothing to snag or foul..
- Fully convertible for all attachments
- Service and repair parts stocked by your local distributor

5,000 lbs. on the end of a 90 ft. boom! Yet this LS-85 handles the job easily in a plant dismantling operation for Cabot Carbon Co. L. M. Salmon, construction superintendent, is enthusiastic about the LS-85's performance. Foreman Olin Duke says, "The LS-85 must have been built especially for a steel rigger . . . it does everything just right."



FROM its safety type independent rapid boom hoist to its massive crawler base . . . the big, husky LS-85 has what it takes to stand up under heavy digging and lifting operations — year in and year out.

And when it comes to work—the LS-85 asks for it! Quickly convertible, you can use the LS-85 on big or small jobs . . . keep it working, making profits all the time.

The LS-85 Shovel-Crane is the machine with the *speed* for high output, the *stamina* for low upkeep, the *stability* for extraordinary digging and lifting.

LINK-BELT SPEEDER
CORPORATION

Builders of the most complete line of shovels, cranes and draglines
CEDAR RAPIDS, IOWA

12,300

1	ea. No. 12 turnout, 132-lb. new, shoofly to relocated main track, in place	$5,750	$8,000	$7,200	$5,270
14	joint ins. jts. and abrasion plates, new, for 132-lb. rail, in place	50.00	45.00	50.00	46.00
1	ea. derail switch, 132-lb. new, in place	700.00	$2,000	$1,300	606.00
3	ea. track car, turnout, complete, in place	175.00	150.00	120.00	105.00
200	cu. yd. excav. for reshaping subgrade	2.00	5.00	1.10	.70
2,500	cu. yd. borrow for embankment	2.00	2.50	.60	.60
25,000	cu. yd. roadbed topping material	1.50	2.50	3.25	1.75
56,000	cu. yd. ballast material	6.35	3.90	2.75	4.00
600	lin. ft. 4-in. clay tile, or 4-in. perf. pipe, in place	1.50	2.50	1.50	1.00
73,417	track ft. track laying main track, new, 132-lb. rail	15.00	15.80	16.50	13.35
1,033	track ft. track laying, siding, new, 132-lb. rail	15.00	15.80	16.50	13.15
17,281	track ft. track laying, siding and spur track, used 110-lb. Govt.-furn. rail	5.10	7.40	7.00	4.70
2,561	track ft. track laying, spur track used, 90-lb. Govt.-furn. rail	4.30	6.00	6.10	4.20
1,300	track ft. track laying, bridge guard rail, used, 90-lb. or heavier Govt.-furn. rail	2.00	2.30	.70	1.05
6	ea. No. 12 turnout, spring switch, 132-lb. new, main line to siding, in place (to be converted by others to mechanical switchman)	$6,000	$7,500	$7,325	$5,600
1	ea. No. 12 turnout, split switch, 132-lb. new, main line to siding, in place (located at Portland end of Siding No. 4, to be converted by others to power switch)	$6,000	$7,500	$7,280	$5,400
4	ea. No. 10 turnout, 110-lb. used, Govt.-furn. siding to spur, in place	$1,200	$1,250	$1,300	990.00
68	joint insulated jts. and abrasion plates, new, for 132-lb. rail, replacing angle bars and tie plates, Sta. 847+62 to Sta. 1274+00, in place	60.00	51.00	50.00	52.00
13	joint insulated jts. and abrasion plates, new, for 110-lb. rail, replacing angle bars and tie plates, Sta. 847+62 to Sta. 1274+00, in place	60.00	50.00	50.00	44.50
110	joint insulated jts. and abrasion plates, new, for 132-lb. rail, in place, between Sta. 1274+00 and 2020+00	50.00	44.00	47.50	45.00
16	joint insulated jts. and abrasion plates, new, for 110-lb. rail, in place, betw. Sta. 1274+00 and 2020+00	50.00	44.00	47.50	42.50
4	ea. derail switch, 90-lb. new, spur track, in place	550.00	$1,000	$1,150	560.00
2	ea. car buffer, complete	150.00	125.00	105.00	100.00
3	ea. rail rack, includ. new rail, in place	250.00	260.00	260.00	235.00
27	ea. track car turnout, complete, in place	175.00	125.00	115.00	98.00
1,408	sq. yd. 1-in. asphaltic protection course for bridge deck plate, in place	1.50	1.25	1.60	1.00
1	job waterproofing, conc. deck on hwy. underpass	$1,000	$1,500	$1,275	415.00
80	lin. ft. private rd. crossing, complete	20.00	15.00	13.50	13.00
160,000	cu. yd. removal of slides	.70	.70	.95	.60
200	rod reconst. of fences	6.00	7.00	9.50	6.00
10	ac. clearing slide area	$1,000	$1,500	$1,000	590.00
100,000	cu. yd. mi. overhaul	.10	.30	.18	.20

Railroad Spur and Siding

Idaho—Butte County—Atomic Energy Commission. Vern H. Beaver, Kemmerer, Wyo., with a low bid of $50,521, was awarded a contract by the Atomic Energy Commission for construction of a railroad spur and siding in the Central facilities area, Arco. Unit bids were as follows:

(1) Vern H. Beaver $50,521
(2) Morrison-Knudsen Co., Inc. 56,936
(3) Bergman & Lampson 62,660
(4) Wm. A. Smith Contracting Co. $68,685
(5) A. D. Schader Co. 78,685

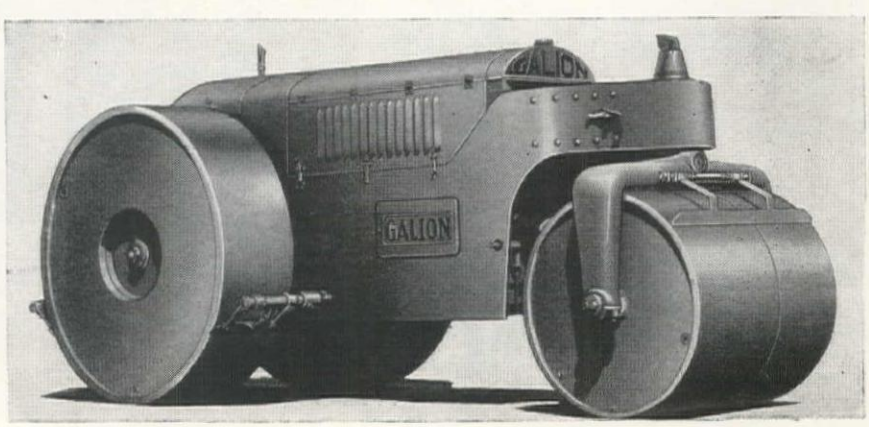
		(1)	(2)	(3)	(4)	(5)
2,500	cu. yd. ballast, per cu. yd. in place	1.50	2.60	1.25	2.00	4.00
2,600	ea. cross ties, each in place	5.10	5.30	5.25	6.00	7.50
60	ea. cross ties, in stockpile for maint.	4.35	4.60	5.00	5.25	7.50
2	sets switch ties, in place for No. 10 turnout	525.00	520.00	500.00	600.00	660.00
1	set switch ties, in place for No. 9 turnout	450.00	480.00	500.00	450.00	600.00
2	ea. turnouts, No. 10, complete in place (w/rail, spike, tie plates, etc.)	$1,050	$1,050	$1,200	$2,500	$1,100
1	ea. turnouts, No. 9, complete in place (w/rail, spike, tie plates, etc.)	$1,000	950.00	$1,200	$2,200	$1,100
2	ea. 28 ft. Type No. 2 crossings, complete in place (incl. planking shims, etc.)	185.00	300.00	250.00	200.00	370.00
5,460	lin. ft. track, complete, in place, which includes two No. 10 and one No. 9 turnouts	5.12	.....	7.25	7.00	7.75
1	ea. bumpers, complete, in place	325.00	300.00	400.00	300.00	400.00

300

Galion "Chief" roller in 6 to 12-ton weights

Features claimed: With the addition of their variable weight "Chief" Three-Wheel Roller, Galion now offers this type of roller in a complete range of sizes from 6 to 12-ton weights inclusive. This new type weight roller is available in 10 and 12-ton (unballasted) weights, either of which can be equipped with 20 or 24-in. width rear rolls. The steel drum rolls can be filled with water ballast to obtain a wide range of compression weights varying from two to three additional tons, depending on the size of roller.

Manufacturer: Galion Iron Works & Mfg. Co., Galion, Ohio.



LESS 'SHUT-DOWN TIME' DUE TO ADVERSE WEATHER WITH THE SEAMAN MIXER

When a sudden rain sends your road crew to shelter — you can start up your mixing operations again hours sooner if you have a SEAMAN.

Why? Because the SEAMAN'S aerating action quickly removes excess moisture by accelerating evaporation. Wet aggregates are readily dehydrated and a mix affected by adverse weather can be easily re-processed.

Mixing can be continued through colder weather, too, for even though the binder is sluggish in flow, a few additional low cost passes with the SEAMAN will bring the mix to the required standard. And, even in normal processing the SEAMAN is invaluable for reduction of solvents in a bituminous mix.

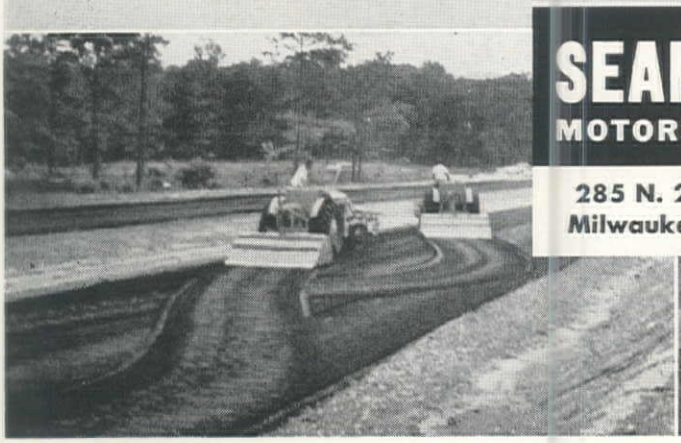
Those are just some of the advantages of a multiple pass machine. You *can* operate — you *can* complete the job even when conditions are unfavorable. That means a lot in terms of profit and the avoidance of costly shut-downs.

Spring and autumn months are notorious for bad weather. Protect yourself — with a SEAMAN.

The 1951 edition of "Soil Stabilization Methods" — completely revised. Up-to-the-minute information for the road-builder. Send for it now. Ask for Bulletin 25.

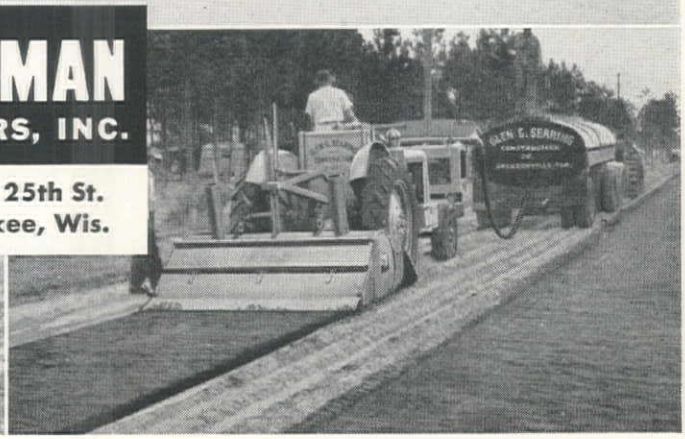
The SEAMAN multiple pass method protects against processing failure when, due to bad weather or soils which resist pulverization, additional trips are needed. Further, multiple passes permit cross-mixing to blend out "lean" and "fat" spots.

The SEAMAN TRAV-L-PLANT is a complete processing unit for bituminous construction, soil-cement or any stabilization where water is employed. In addition to spray bar, pump, pump tachometer, fifth wheel and intake hose, all standard equipment—the SEAMAN TRAV-L-PLANT can be equipped with a meter to record total gallonage used.



SEAMAN MOTORS, INC.

285 N. 25th St.
Milwaukee, Wis.



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.

****

301

Special aluminum paint has high heat resistance

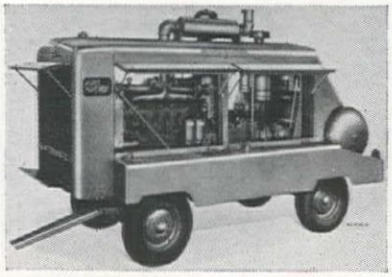
Features claimed: Capable of withstanding temperatures up to 1700 deg. F., the new paint Heat-Rem H-170 utilizes a silicone base and fuses with surface metal immediately upon application. It is reputed to form a bright, elastic finish resistant to moisture, corrosion, mild acids, alkalis and industrial fumes. It is recommended for use on heat lines, condensers, compressors, ovens, engine heads and other places where heat is intense.

Manufacturer: Speco, Inc., 7308 Associate Ave., Cleveland, Ohio.

302

Portable air compressor of a new type

Features claimed: This unit is designated as the Gyro-Flow 600. It delivers 600 actual cfm. free air at 100 psi. Total weight is only 9,500 pounds ready for use. Chief advantages are simplicity and low cost of operation and maintenance, greater reliability, lighter weight and a discharge temperature at 100 deg. F. lower than that of conventional portables. The compressor itself is an advanced-design, two-stage, oil-cooled



rotating-vane type. It eliminates pistons, con rods, valves and the need for a clutch. The Gyro-Flow 600 is driven by the nationally known General Motors Series 71 diesel engine. It is a thoroughly proven 6-cylinder, 2-cycle engine with 12-volt battery starting and a fast-starting ether system for cold weather operation.

Manufacturer: Ingersoll-Rand Co., 11 Broadway, New York, N. Y

303

New arc welder driven by gas engine

Features claimed: This arc welder and power generator is a self-contained unit, powered by a 6-cylinder self-starting Chrysler Industrial Engine directly connected to the welding generator and mounted on a welded steel frame. An auxiliary 3-KW power generator provides for lights and such tools as a lathe, grinders, drills, brake reliner, valve refacer, chipping hammers, power wrenches and paint sprayers. The unit is completely enclosed by a sheet metal canopy that is bolted directly to the frame. Hinged side doors provide access to the control panels, the engine, the welding generator and other parts within the canopy.

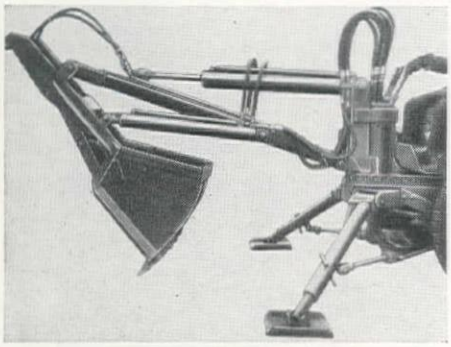
Manufacturer: Hobart Brothers Co., Troy, Ohio.

304

Greater trencher reach increases digging depth

Features claimed: The improved Oliver-Ware Hydro-Trencher with an increased reach of 16 feet makes it possible to dig to a depth of 8 ft. to 10 ft. and load to a height of 5 ft. 6 in. with the standard trencher bucket. The new model features the Forced Ejection Bucket, which is available as optional equipment. It can be used with equal ease for both trenching and swing loading.

Simply reversing the bucket and dipper stick converts it to a swing loader. The bucket does not have controlled pitch; instead, the control cylinder is used to hydraulically force the bucket gate all the way through the bucket itself, forcing out all material and assuring complete discharge even where clay, gumbo, or sticky soil is involved. The 1951 Hydro-Trencher has an



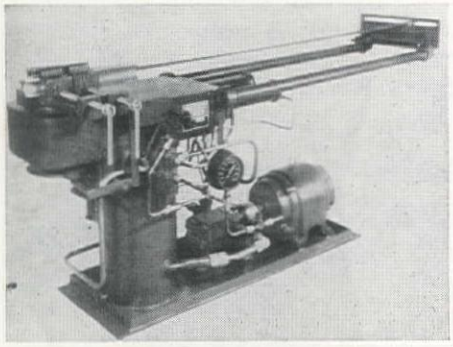
improved counterweight design, and is more ruggedly built with a weight increase of approximately 2000 pounds. It is available for mounting exclusively on Oliver Industrial Wheel Tractors, Model '77' or Model '88.'

Manufacturer: The Oliver Corp., 19300 Euclid Ave., Cleveland, Ohio.

305

Compact bending machine is real space saver

Features claimed: A small compact bending machine only 21 in. wide by 34 in. high, and 78 in. long for space saving is now available. It has power well beyond its capacity of 1¼-in. O.D. by #16 B.W.G. steel tubing. The unit is powered by a standard 2-hp., 220/440 volts, 3-phase, 60-cycle motor furnished with the machine. It is oper-



ated by a single lever which when pushed down causes the bending arm to swing around to the degree of bend selected, remain there until the operator has removed the bent part, then when the lever is moved up the arm swings back to its original position.

Manufacturer: Wallace Supplies Mfg. Co., 1300 Diversey Parkway, Chicago, Ill.

306

Portable brick conveyor with gas engine drive

Features claimed: The portable Bricktoter has now been made more adaptable by the addition of a gasoline engine drive for use where electricity is not available. The gas engine is a Briggs & Stratton Model NPR-6, 4-cycle air-cooled model with 6 to 1 gear reduction and supplied with rope starter and other standard equipment. It is mounted below the conveyor belt level to allow handling of materials wider than

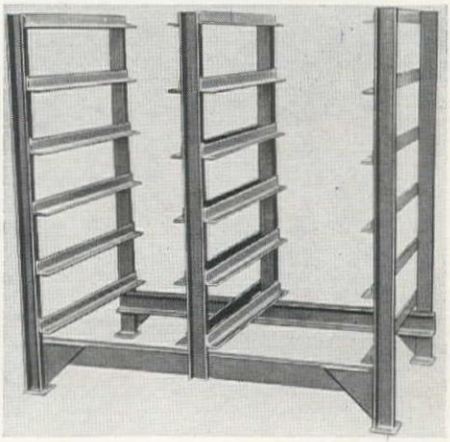
the 12-in. belt width. Total weight of conveyor with gas engine drive is only 384 lb.

Manufacturer: Mar-Rail Conveyor Co., 560 York Ave., Pawtucket, R. I.

307

Cement block handling simplified by new rack

Features claimed: This rack is designed to eliminate individual block handling and make multiple handling practical in drying and during storing and shipping to the jobs. It is of welded structural steel con-



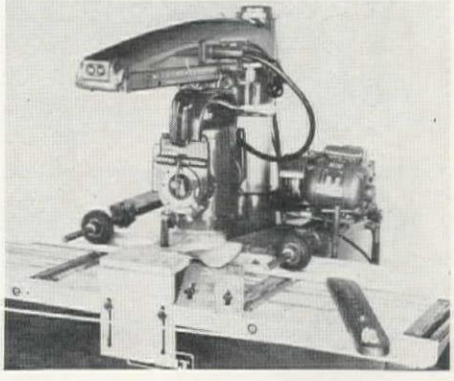
struction and holds 12 steel or wood pallets of the size used for casting 4 blocks, a total of 48 blocks. The bottom level is raised from floor to permit lifting and transporting by fork truck or platform from casting to storage. Spacing of the levels permits free circulation of air for drying. Racks holding 48 blocks can be loaded on trucks for movement to job or dealer without being removed from the casting pallet.

Manufacturer: Equipment Manufacturing, Inc., 21550 Hoover Rd., Detroit, Mich.

308

Woodworking machinery for finished materials

Features claimed: Models GE 400 and GR 400 in power machinery by DeWalt Inc. feature ideas that meet the demands of



today's market by permitting builders, lumber yards and others to produce scarce finished materials such as finished flooring, window stripping and moulding. The Custom Table of the DeWalt Models 400 has a pressure arm, a spring hold-in and a spring tensioned hold-down. The Custom Table Top permits the operator to run moulding, shape, rip, bevel rip, tongue and groove, rabbet and plough on the power feed machine. Each power feed operation can be run continuously and without fear of material being scarred or chipped by the cutter head, because the material is always

held against the cutting tool by a constant pressure. The DeWalt Safety Power Feed unit can be easily swung out of position when not required.

Manufacturer: DeWalt Inc., Lancaster, Pa.

309

Elevating endgate raises loads of 2,000 pounds

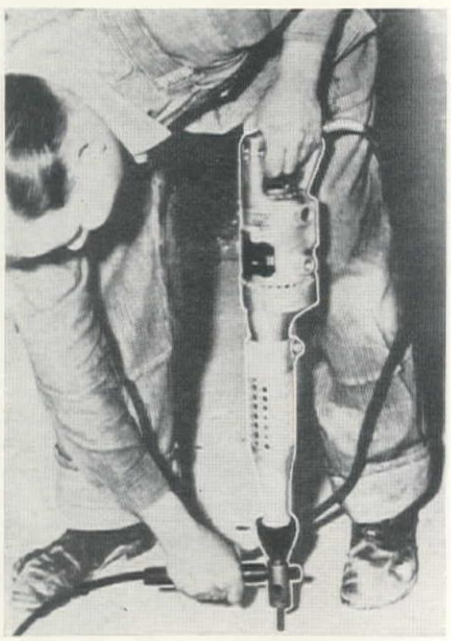
Features claimed: The Frate-Gate, an elevating endgate that fits all van, platform or stake body trucks, will raise loads of 2,000 lb. from ground to body level or lower them in a few seconds. Safety to personnel, security to cargo, and savings in time and labor costs are stated benefits for the owner of the device.

Manufacturer: Gar Wood Industries, Inc., St. Paul Division, 2207 University Ave., Minneapolis, Minn.

310

Electric hammer-and-drill saves time and cost

Features claimed: Three different types of work can be accomplished by the new electric portable hammer-and-drill. It can be used for drilling concrete and masonry, metal and wood and driving, grinding, buffing and wire wheels. The Do-All is fully



equipped with ball-bearings with sealed lubrication, and is built for hard continuous usage. It is operated by a powerful universal motor with fan ventilation and has the switch located in the handle. Any lamp socket runs it, and it weighs only 15 lb.

Manufacturer: Wodack Electric Tool Corp., 4627 W. Huron St., Chicago 44, Ill.

311

Mixer and plant design for better concrete production

Features claimed: Essential parts of the SuPremix plant have a preferred arrangement. The operator's floor, scales and loading funnel are situated in front of the discharge end of the 3 cubic yard mixer. Streamlined aggregate and cement batchers are located above and on the charging side. A double gated bottom bin section designed to lessen segregation feeds the aggregate batcher. The cement feed is directly above the operator's floor and has automatic, quick acting cut-off gate located

at the cement batcher. These elements can be arranged in various patterns to best suit the owner's needs. Bin details and structural steel are designed individually or stock plans are available.

Manufacturer: SuPremix, Inc., 401 Grace Street, Adrian, Mich.

312

Hidden arc welding limitations removed

Features claimed: A new process now makes it possible to utilize hidden arc welding even where the joint to be welded is not in position for downhand welding. New procedures and equipment are required wherein the previous difficulties of directing the electrode and retaining flux and molten metal in a joint not lying flat are overcome. With this process the plate being welded may be positioned anywhere from flat to vertical, the joint being horizontal. The procedure greatly reduces the cost of welding and expands the possibilities for the application of hidden arc techniques.

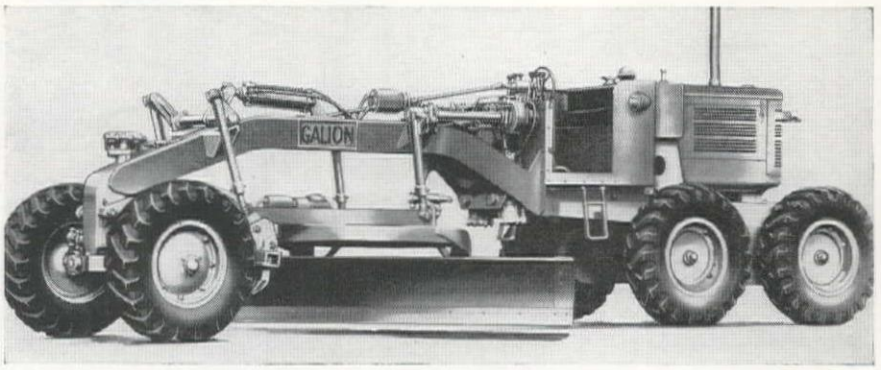
Manufacturer: The Lincoln Electric Co., Cleveland 1, Ohio.

313

New GMC trucks stress more strength and power

Features claimed: Important engineering changes have added extra horsepower to both the 228 and 248-cu. in. engines found on the new GMC line. Both front and rear axles on models from the GMC 280 on up have been strengthened to take heavier loads, while the entire brake design has been changed to provide more powerful performance and longer wear. Features taken from the heavy duty line include new "show job" paint colors, controlled ventilation windows for driver comfort, and horsepower has been stepped up from 96 to 100 on the 228 engine and from 110 to 114 on the 248 engine. Fuel economy, pre-heating controls, and valve adjustments permit greater all-round efficiency.

Manufacturer: General Motors Corp., 660 South Blvd., East Pontiac 11, Mich.



314

New Galion motor grader for heavy duty operation

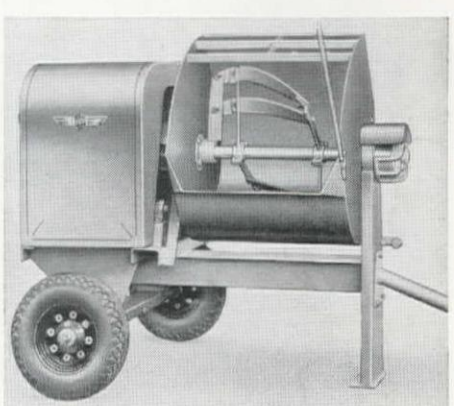
Features claimed: An important feature of this grader is the new transmission. It is of the constant mesh type and is claimed to be designed for the specific and complete needs of heavy-duty operation. This compact, sturdy transmission is said to permit smooth, easy gear shifting without clashing of gears. One lever is needed for all shifting —either forward or reverse. Six overlapping forward speeds provide a range of 1.1 to 20.1 mph. Two reverse speeds are provided. The extreme high reverse of 8.4 mph. permits fast operation from one end of the job to the other without turning the machine around. It is especially desirable where space is narrow and limited.

Manufacturer: Galion Iron Works & Mfg. Co., Galion, Ohio.

315

Contest to name new plaster and mortar mixer

Features claimed: Contractors, their families, employees and employees' families are urged to compete in the contest to name this new 3½-cu. ft. batch mixer, ruggedly built for practical usage. The winner will



receive one of the units free of charge, delivered freight prepaid anywhere in the United States or Canada. The contest starts March 1 and ends April 31, 1951. Every Essick dealer has specification sheets on this new mixer and official entry blanks which must be used in submitting names. If no Essick dealer is nearby contractors may write directly to the manufacturer.

Manufacturer: Essick Manufacturing Co., 1950 Santa Fe Ave., Los Angeles, Calif.

316

Improved traffic line spreader lays fractional-inch lines

Features claimed: This new spreader makes it possible to lay down lines in fractional widths from two to eight inches. It is particularly adapted to line street cross-

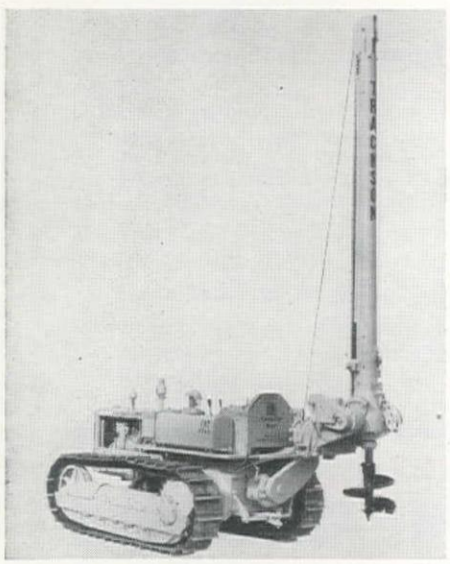
ings, roads, highways, construction projects and traffic safety zones. Gravity-fed and requiring no power unit, the machine has no hose to blow out, no jets to clean, no pressure tank to worry about, no brush or felt band to maintain or replace and no gas engine or compressor to complicate its operation. The markers are equally effective in lining outdoor areas and indoor installations as well as hard surface parking lots. The sled-type paint spreader accommodates striping zone paint of any standard manufacturer.

Manufacturer: Universal Marine & Mfg. Corp., 137 Alexander St., Yonkers 2, N. Y.

317

Useful earth auger available for Caterpillar D4 tractor

Features claimed: A fast, dependable, earth boring and pole setting machine, the earth auger assures construction firms, telephone, telegraph and power companies; railroads, and highway departments a full



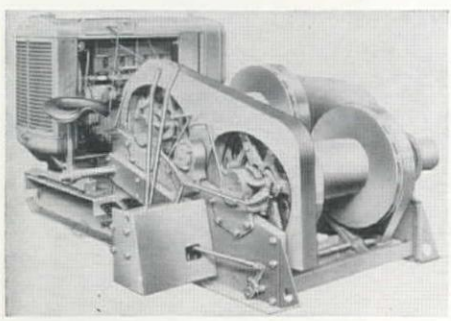
range of boring positions for drilling holes vertically or at any usable angle. The Model EA4 will drill holes 9 inches to 24 inches in diameter, to a depth of 8 ft. with the standard 13-ft. bar or to a depth of 11 ft. with the optional 16-ft. bar. The solid auger bar is square, permitting full bearing contact through the driving head. It has a 5,000-lb. capacity which handles poles up to 50 ft. in length.

Manufacturer: Caterpillar Tractor Co., San Leandro, Calif.

318

Line pull hoist with 8,000-lb. capacity

Features claimed: Perfected band friction clutches enable the operator of this



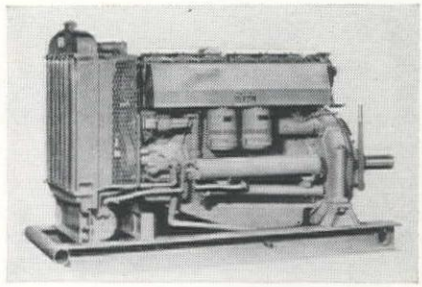
new line pull hoist to handle full capacity loads with exceptional ease. Equalized linkage gives smooth and even friction engagement and release. Outside friction surface affords better heat dissipation, and large diameter brakes permit safe and accurate load control by merely "toeing" the brake lever. Shafts rotate on ball bearings to provide a higher degree of hoist efficiency and economy with longer, trouble free service.

Manufacturer: Clyde Iron Works, Inc., Duluth 1, Minn.

319

Heavy duty diesel engines, 145 to 220 hp.

Features claimed: This new heavy duty diesel engine line consists of six models from 145 hp. to 220 hp., and is designed to operate at continuous speeds up to 1400 rpm. This higher operating speed will make



possible the application of Murphy Diesels in many new services including those requiring torque converter power transmission.

Manufacturer: Murphy Diesel Co., 5317 W. Burnham St., Milwaukee, Wisc.

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.
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320

Pipe for all needs

A new 16-page booklet entitled "Armco Corrugated Metal Pipe—A Type for Every Need" has been published by **Armco Drainage & Metal Products, Inc.**, Middletown, Ohio. It lists the types of full-round pipe and Pipe-Arch available to meet specific requirements for various types of sewers, culverts, conduits or irrigation systems. The booklet also contains reference data for assistance in selecting the most suitable structure.

321

Offset pipeline tractor

"The 'Caterpillar' Offset D8 Pipeline Tractor" is the title of a new illustrated specifications booklet published by the **Caterpillar Tractor Co.**, Peoria, Ill. Specifications are given for the tractor and engine, for the Trackson MDW8 Pipe Layer, and for the "Caterpillar" No. 46 Hydraulic Control arranged for use with the Pipe Layer. Travel speeds, lifting capacities, as they vary with the overhang of the Pipe Layer, and details on the offset track arrangement and the No. 46 Hydraulic Control are also included.

322

Lightweight plaster aggregate

A new brochure featuring an actual short form specification for use by architects in specifying Permalite lightweight plaster for general base coat (scratch and brown) plaster applications has been published by the **Great Lakes Carbon Corporation, Building Products Division**, 18 East 48th Street, New York, N. Y. It includes recommended mixes and applications based on American Standards Associations Specification A42.1, and a concise chart lists the materials required (gypsum and Permalite) for various plaster bases: gypsum lath, metal lath and masonry.

323

Sheepsfoot tamping rollers

A new catalog on its line of sheepsfoot tamping rollers has been released by the **Baker Manufacturing Company** of Springfield, Ill. The booklet describes the specially Baker-designed feet, shaped to compact soil without disturbing it on pullout. The Baker rollers are made in single, double and triple drum models, with tandem hitches available for 3-2-1 or 2-1 operation.

324

All Nordberg machinery

A fully illustrated 28-page two-color bulletin published by **Nordberg Manufacturing Co.**, Milwaukee, Wis., contains information about all types of Nordberg machinery. It gives design data on two and four-cycle stationary and marine diesel engines, gasoline marine engines, Symons cone crushers and screens, mine hoists, machinery for the basic processing of ores and minerals, air and gas compressors and railway track maintenance equipment.

325

All-welded clamshell buckets

The details of capacity, weight, dimensions, sheave and cable data of Johnson clamshell buckets are described in a colorful 8-page catalog released by **C. S. Johnson Co.**, of Champaign, Ill.

326

New clearing equipment

The new, larger engine-mounted hydraulic Baker Bulldozers, Grade-builders, and Root Rippers manufactured by the **Baker Manufacturing Co.** of Springfield, Ill., are described in a new engineering bulletin. Complete descriptions of the new design and performance features engineered into the earthmoving attachments are contained in the booklet.

327

Finds wood moisture content

The Tag midget moisture meter, designed to instantly determine the moisture content of wood, lumber, plaster, and wood products, is described in a new 6-page bulletin issued by the **Tagliabue Instruments Division, Weston Electrical Instrument Corp.**, Newark, N. J.

328

Installing acoustical tile

Short form specifications and comparative cost data for the fast, sag-proof method of installing acoustical tile and board with

Nelson Quick-Clips are included in a 4-page bulletin on this new technique issued by the **Nelson Stud Welding Division of Morton Gregory Corporation,** Lorain, Ohio.

329

Road machinery described

Rear-dump Euclid trucks of 15-ton capacity are featured in an 8-page catalog released by the **Euclid Road Machinery Co.** of Cleveland, Ohio. The various features of the off-highway hauling units designed and built for moving earth, rock, ore and other heavy excavation are discussed.

330

New crawler tractor

Two 16-page catalogs—each telling the story of a new A-C crawler tractor—have been issued by **Allis-Chalmers Tractor Division,** Milwaukee, Wis. One catalog describes the Model HD-9—weighing 18,500 lb., and developing 70.0 drawbar horsepower. The other covers the Model HD-15 which weighs 27,500 lb., and develops 102.0 horsepower at the drawbar. Both catalogs use large illustrations.

331

Concrete-mix water mixers

Auto-Stop water meters, which automatically control the amount of water delivered to ready-mix concrete batches, are explained in a new bulletin released by **Neptune Meter Co.,** 50 W. 50th St., New York, N. Y. The booklet describes the operation of the meters, and gives complete specifications and prices covering 1, 1½ and 2-in. meters for cold, warm or hot water.

332

Steel scaffolding equipment

A bulletin describing their line of steel scaffolding and allied equipment for building contractors, has been issued by **Automatic Devices, Inc.,** 1260 Hodiamont Avenue, St. Louis, Mo. The 12-page folder describes the positive locking device which is unaffected by use, rust, mortar and wear.

333

Crane-excavators

Heavy-duty Wayne Crane ½-cu. yd. crane-excavators are illustrated and discussed in a 14-page catalog published by **Wayne Crane Division, American Steel Dredge Co., Inc.,** Fort Wayne, Indiana. Features such as the new deck machinery layout, self-leveling chassis, oversize 20-in. clutches, large modern cab and right angle drive mechanism are shown in the booklet.

334

Cleans and dries compressed air

A condensed catalog on the Logan Aridifier, which removes contamination from compressed air or gas lines by the use of centrifugal force and gravity pull, has been published by the **Logan Engineering Co.,** 4901 W. Lawrence Ave., Chicago, Ill.

335

Lumbermen's buying guide

West Coast Lumbermen's Association has issued its January 1, 1951 "Where to Buy." This directory of members of the Association is designed to aid buyers of Douglas fir, West Coast hemlock, Sitka spruce and Western red cedar. Detailed information is given on sawmills, remanufacturing plants, timber fabricators, a wood pipe and tank manufacturer, and wood treating plants in the Douglas fir region of western Washington, Oregon, and north-

ern California. New member mills total 66 since the 1950 edition and their listing along with the changes in the previous members will give lumber buyers the latest information on mill locations, officials and sales offices, capacities, facilities, and products manufactured.

336

Welding alloys

Containing complete specifications on about 100 different Eutectic Low Temperature welding alloys used in welding, brazing and hard surfacing of steel, alloy steels, stainless, cast iron, brass, bronze, copper, aluminum, magnesium, zinc die cast, etc., a new reference chart is now available from **Eutectic Welding Alloys Corp.,** 40 Worth Street, New York, N. Y.

337

Industrial power tools

Complete specifications of tools comprising the "Portable Tools for Industry" line are presented in a new condensed catalog prepared by **Cummins Portable Tools** of Chicago, Ill. Drills, saws, and disc sanders are described, and a list of accessories includes saw blades for various uses, abrasive wheels, grinding wheels, wire brushes, backing pads and a rotary planer head mountable on the sander spindle.

338

Installing drainage products

Armco Drainage & Metal Products, Inc., has published an illustrated 46-page manual which is intended to assist construction engineers, superintendents, and foremen in the proper methods of installing Armco drainage structures, culverts, sewers, or conduits. The manual first discusses the handling of metal drainage products, location, proper excavation and preparation of base in various types of foundation soils and rock. Detailed instructions for the assembly of corrugated metal pipe, coated or paved pipe, Pipe-Arches, Hel-Cor pipe, and Multi-Plate pipe and arches are also included. Graphic sketches are used throughout the manual to illustrate important installation recommendations.

339

Enduring lubricant

The Lubriplate Division of **Fiske Brothers Refining Co.,** 129 Lockwood St., Newark, N. J., has published a 54-page booklet, "Lubriplate—the modern lubricant." The booklet discusses the selection, uses, treatment and types of equipment for which Lubriplate is intended.

340

Bearing maintenance study

A continuing study of bearing maintenance techniques and successful maintenance, installation and removal procedures has been published in pamphlet form by the **Anti-Friction Bearing Distributors Association,** 1900 Euclid Ave., Cleveland, Ohio. This is probably the first such attempt to publish in permanent form all available maintenance information on every type of bearing.

341

Answer to limited headroom

Armco Drainage & Metal Products, Inc., of Middletown, Ohio, has published a new folder entitled "An Economical Answer to Limited Headroom—Fast Runoff." It describes Armco Pipe-Arch and Multi-Plate Pipe Arch, which are said to carry more water than round pipe. Test data and case histories are included to show that these drainage products have more than sufficient strength to withstand both live and dead loads.

342

Timber bridge construction

In a folder entitled "Permanent Timber Bridges," published by **Timber Structures, Inc.,** Portland, Ore., the advantages of engineered timber construction are discussed with reference to the deck arch, girder, bowstring truss, composite deck and parallel chord bridges. Photographs and diagrams are included in the folder.

343

RLM units and manufacturers

A new, 4-page RLM bulletin containing a complete listing of all RLM manufacturers and RLM certified lighting equipment made by each, is offered by the **RLM Standards Institute,** 326 W. Madison St., Chicago, Ill. It is intended to be of great service to anyone who buys, sells, recommends or specifies industrial lighting equipment. Included in the folder is an easy-to-check chart which enables the reader to quickly see whether a lighting unit is RLM certified, which manufacturer makes it, and what lighting units are now in the process of being tested by the Electrical Testing Laboratories.

344

Aid to well-drilling

Strata-Seal, a lightweight additive to combat and prevent lost circulation of drill-

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.

ing mud, is the subject of a new folder in two colors made available by **Great Lakes Carbon Corporation,** 5845 Atlantic Avenue, Long Beach, Calif. The folder gives six important reasons why Strata-Seal will be preferred as a lost circulation material. Two examples showing actual savings through the use of Strata-Seal are listed.

345

Worthington air tools

Photographs and information about the full line of Worthington Blue Brute air tools are available in a 6-page bulletin released by the **Worthington Pump and Machinery Corp.** of Holyoke, Mass. The uses and features of the models are discussed, along with a list of small pneumatic tools that can be operated at 80-90-lb. pressure by the Worthington 30-cu. ft. portable air compressor.

346

Quality welding equipment

National Welding Equipment Co., San Francisco, has released a beautiful color catalog showing its line of heavy-duty welding equipment. The catalog shows various packaged outfits in addition to a full assortment of flame heads, torches, and other accessories.

347

New service ditcher model

The new Model 705-A "Runabout" Service Ditcher of **Barber-Greene Co.,** Aurora, Ill., is featured in an 8-page folder issued by the company. Most valuable feature of the folder is a table which describes six typical tile and pipe types and diameters, matching these specifications with the digging widths available with the "Runabout." There is also explanation of Barber-Greene's exclusive "Hydra-Crowd" hydraulic transmission which is said to provide an infinite range of digging speeds from 0 to 16 ft. per min., in conjunction with bucket line speeds of 380, 649, and 1,152 ft. per min.

348

Complete portable tool catalog

A 72-page illustrated catalog describing the entire line of SKIL portable tools for the manufacturing, construction and automotive service industries has been released by **Skilsaw Inc.,** 5033 Elston Ave., Chicago 30, Ill. The catalog includes specifications and illustrations of each tool, as well as general information regarding branch offices, distributors and prices.

349

Heavy-duty core drill

Joy Manufacturing Co., Oliver Bldg., Pittsburgh, Pa., releases a booklet describing in detail the Joy HD heavy-duty diamond core drill. The bulletin offers information and complete specifications on the drill, which has a 2,000-ft. capacity driven by gasoline, electric, or compressed air and mounted on truck, steel skids, or underground column.

350

Chemonite wood preservative

J. H. Baxter & Co., 200 Bush St., San Francisco, Calif., has issued a 12-page booklet in 2 colors which traces the history of the development of this copper-arsenite preservative. It includes facts and figures to show the efficiency of the wood treating compound, and indicates the correct uses for Chemonite-treated forest products. Illustrations are also included.

351

Bitumuls for airfield needs

A 20-page indexed booklet on the use of "Bitumuls for Airfields" has been released by **Stancal Asphalt & Bitumuls Co.** of San Francisco, Calif. The booklet has 36 photographs and discusses mixtures for low-cost yet durable construction, surface treatments and penetration pavements, surface paving mixtures, and CAA airport design standards and construction specification references.

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