

WESTERN

CONSTRUCTION

Volume 25

NOVEMBER 1950

Number 11

FEATURE ARTICLES

Cement-Mortar Lining for Old Steel Penstock	65
Records on Installing the "Super-Inch" Gas Line	68
Field Operations on the Des Chutes Project	73
By R. L. MOTTNER	
Problems for the Second Stage at Chief Joseph Dam	77
Construction of Hard-Surfaced Tennis Courts	80
By H. L. CURTISS	
Road-Mix Cement-Treated Base for La Cadena Freeway	83
By B. NELSON	
Payment Provisions in Corps of Engineers Specs	85
Unique Tunneling Operations at Fort Randall Dam	86
Features of Montgomery Freeway Construction	88
Placing Suspended Sewer Outfall at San Francisco	91
By W. J. TALBOT	

DEPARTMENTS

Editorial Comment	63
Reports from the Courts	93
By H. S. BURNSIDE	
Construction Design Chart	94
By J. R. GRIFFITH	
News of Western Construction	95
Personalities in Western Construction	100
Bids and Contracts	105
News of Distributors and Manufacturers	110
Unit Bid Summary	112
New Developments in Construction Equipment	128
Advertisers in This Issue	140

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Published Monthly by
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Subscription Rates

The annual subscription rate is \$4
in the United States and countries
in the Pan American Postal Union.
To Canada, England, Australia and
New Zealand, \$5 per year; all
other countries, \$11.00 per year.
Single Copies, 35c

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"... As Directed by the Engineer"

THE IMPLICATIONS behind those five words, so common in specifications for construction work, are vital to engineer-contractor relations. They even hold the key to serious effects on construction costs. To the engineer in charge of the project they mean one thing; to the contractor quite another. To one they imply a "tight specification" and to the other a "loose specification." For engineers of long experience in directing projects from the design stage, through specification writing to the final supervision of field operations the more subtle significance of "as directed by the engineer" will be appreciated and allowance made. For many younger engineers—to whom the following is addressed—the phrase deserves thoughtful consideration.

From the young engineer's point of view, it is important that he have complete control in translating his plans into reality on the job site. He is convinced that he must be in a flexible position to meet any possible field condition. He wants specifications which will put him in this position. Rather than phrase and write exact regulations for contractor's operations in the field he prefers to state general objectives and then depend on supervision.

But follow these specifications into the hands of a contractor, and the philosophy of the young engineer may get a reverse twist that could have an unexpected and marked effect on bid figures. For example, suppose two borrow pit areas were indicated for the source of fill, or two disposal areas shown for waste, and the specifications state that they will be used by the contractor "as directed by the engineer." A prudent contractor must consider the possibility that the most distant one, or the one which will entail his highest cost *may* be selected by the engineer for exclusive use. Of course, no contractor can afford to let such a pessimistic attitude prevail if he wants to get a job, but the flavor of uncertainty will have an effect on his prices. Any amount of "as directed" will tend to add conservatism to all bids which means adding to the cost of the work. Any bid reflects a combination of the cost of work as exactly described, plus the work which may be imposed.

Thus, in honest effort to maintain rather complete control over field operations the engineer may provide specifications and working rules that will tend to raise all bid prices, through their very lack of definition. What may have appeared to be tight for the engineer, providing him with desired control, may have seemed loose to the bidder, by placing the threat of interpretation at its worst. Of course, engineers must maintain all necessary powers of direction and control, but with the realization that such discretionary powers will be viewed by the bidder in their most costly aspect. Higher construction costs can result from such words "... as directed by the engineer."

Frank Banks—Master Construction Engineer

FRANK BANKS has retired. More than any other engineer, his name will remain associated with the development of the Columbia River for the advancement of the West. He has directed the building of structures that provide the triple benefits of controlling destructive floods, creating hydroelectric power and conserving water for the reclaiming of arid lands. From his first assignment at American Falls until his current work on the largest man-made structure of Grand Coulee Dam his engineering skill and administrative ability have provided the direction for the development of this great natural resource.

Many engineers have worked on the planning and design of the control structures, and many contractors have worked on their building. But Frank Banks has been a coordinating force of such prominence as to make his name live, in the future of Columbia River development, as the engineer who brought the river into its first useful stage. His record is a credit to the Bureau of Reclamation he so long served, and his career assures to him the well-earned title of Master Construction Engineer.

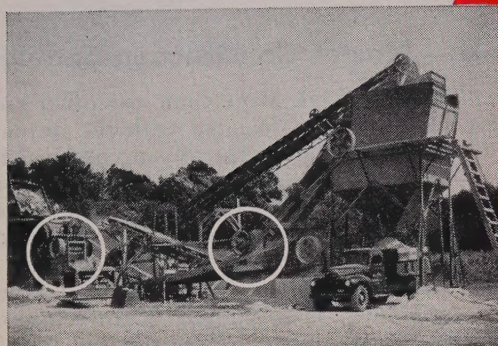
Based on Engineering Facts

WITH THE ADEQUACY of highways and streets falling farther and farther behind the demands of traffic and public safety, it becomes increasingly important that plans for reconditioning and improvement be carried forward according to factual information. In normal times the desirability of having an engineering approach to the scheduling of betterments was important; today it is absolutely essential. With public clamor putting pressure on all road expenditures, the engineers of states and municipalities must protect themselves and their plans with documentary evidence on where the greatest needs exist. Several issues ago the plan for rating the adequacy of state highways developed in Arizona was reviewed, and last issue contained an article describing the use of a roughometer to determine the priorities for the street improvement program of Berkeley, Calif. In both cases the plans are based on engineering facts. Too often, in the past, administrative officials in both state highway departments and city street departments have been subjected to pressure groups without adequate facts to back their opinions. Now priorities can be lifted out of the argument level and given a technical standing. Uniform application of the results of such engineering studies will add the necessary continuity and long-range value to any improvement program.

About a decade ago, traffic counts began to assume a major position in establishing the sequence of allotting funds for highway and street work. Today, these counts, which indicate the amount of traffic, are being supplemented by measuring the actual physical conditions of the existing facility. The two provide a combination of data which will maintain a semblance of order in a situation where uncontrolled pressure groups could bring chaos to the highway and street system of the West.

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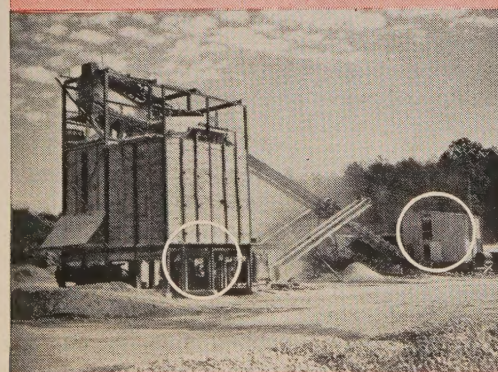
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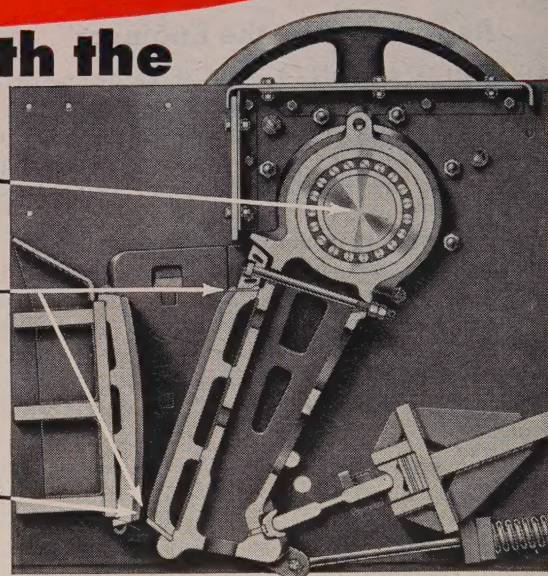
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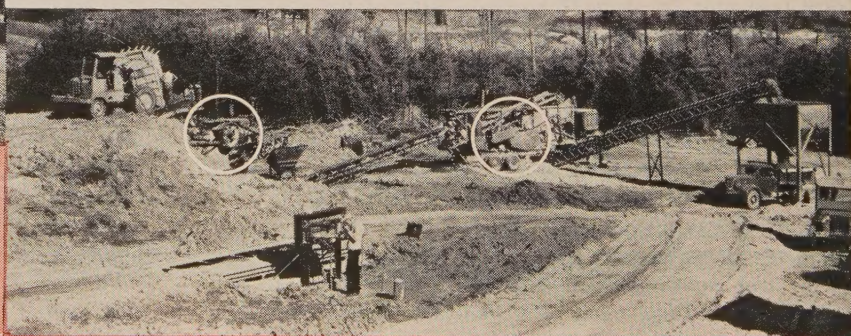
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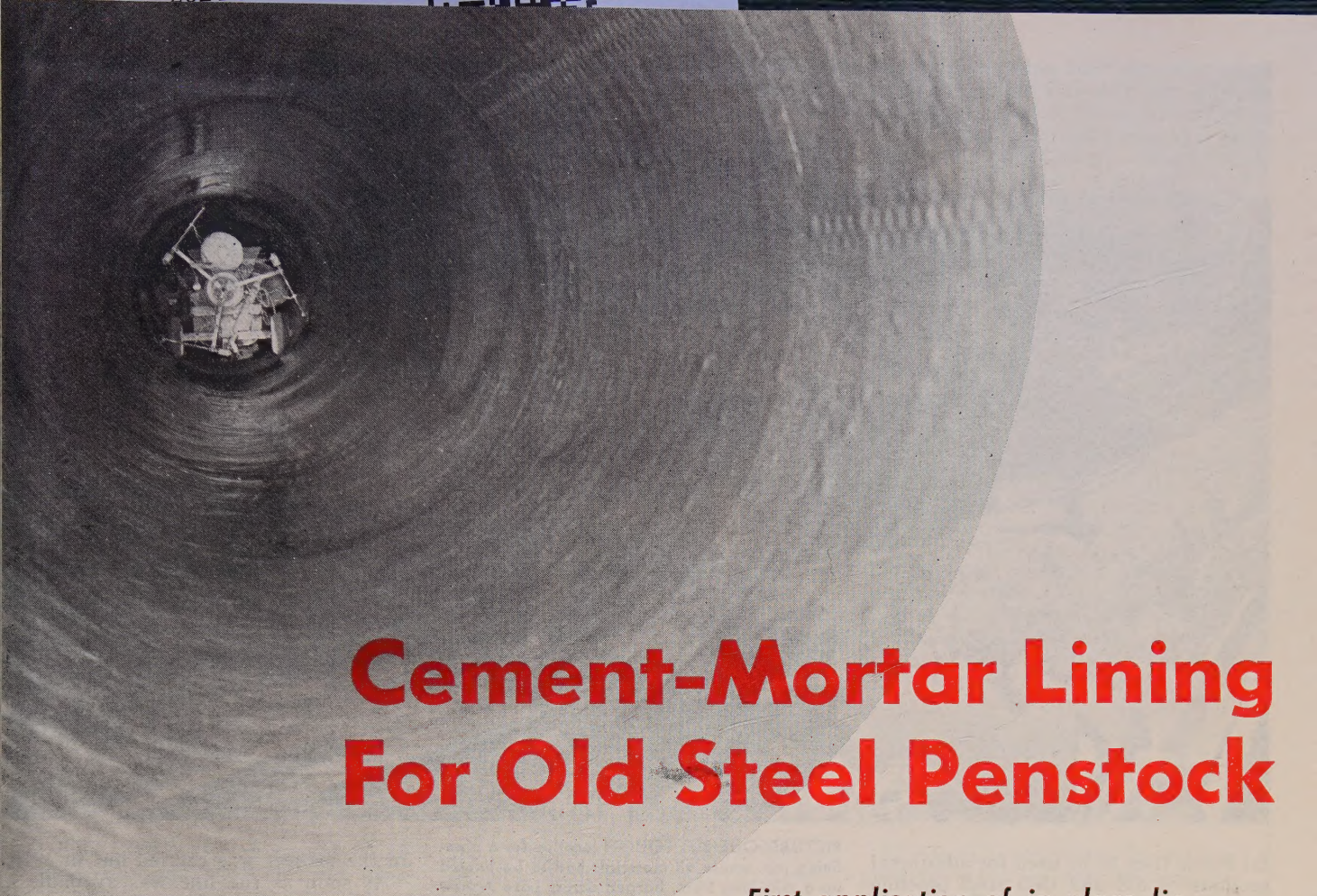
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Cement-Mortar Lining For Old Steel Penstock

First application of in-place lining process to 35-yr. old discharge pipe from Gem Dam—Coat of $\frac{3}{8}$ -in. thickness placed after mechanical cleaning—Access problem serious in delivering material to 9,000-ft. elevation in the Sierra Nevada of California

FOR THE FIRST TIME, a cement-mortar lining is being applied to recondition and improve the flow in the penstock line of an existing hydraulic power plant. The work is being carried out for the California Electric Power Co. on a 48-in. discharge line from the reservoir behind Gem Dam, above June Lake, Calif., by the Centrline Division of American Pipe & Construction Co. Present operations, as reviewed in this article, are part of an extensive field test instituted by the power company for reconditioning some of its old steel pipelines in its power system. The line is thirty-five years old and was built of $\frac{3}{8}$ -in. steel plate which was coated on both sides with a waterproof compound when installed as the outlet line from the reservoir.

The immediate program consists of placing a $\frac{3}{8}$ -in. cement-mortar lining in the first 1,490 ft. of the line. The pipe extends on a level grade for a distance of 1,140 ft. and then descends on about a 25-deg. slope to the end of the present lining work. This will place a head of about 185 ft. on the lower end of the lining under normal operating conditions (below reservoir spill).

A word of history

This historic power project is located at one of the most inaccessible sites on the eastern slope of the Sierra Nevada about 60 mi. north of Bishop, Calif. The Gem Dam is situated on the headwaters of Rush Creek at an elevation of 9,050 ft. (reservoir surface) and was con-

structed during the seasons of 1915 and 1916.

All material for construction of the multiple-arch dam and steel penstock was brought to the site under most difficult conditions of transportation. For example, cement was shipped about 350 mi. from the mill on standard railroad, trans-shipped about 85 mi. farther on a narrow-gage railroad and finally hauled for 70 mi. by tractor over a desert road to the powerhouse site. Here the material, including the steel pipe, was reloaded and hauled up an elevation of 1,250 ft. vertically on a tramway almost one mile long to Agnew Lake. At this point the material was again rehandled onto a barge, towed the length of the lake and reloaded onto another tramway for another lift of 550 ft. to the dam site.

All this transportation and the following construction work had to be carried out during a short season, with supplies for the crews coming in over the same route. Incidentally, Gem Dam has been extensively reviewed in technical literature, not only because of its original multiple-arch design but also its subsequent repair resulting from disintegration of the concrete under extreme weather conditions at 9,000-ft. elevation. The two major technical reviews appeared in "Transactions" of the American Society of Civil Engineers, 1917 and 1926.

The problem

The outlet pipe is of 48-in. diam. steel plate of riveted design. It was built in 1916 and when laid was given an inside and outside coating which was probably an asphaltic compound. Traces of this coating can be seen both inside and outside the pipe. Because of severe weather the pipe was placed in a trench excavated out of the side-hill rock and covered with a minimum thickness of about 6 in. of natural sand and rock material.

During its 35 years of service the line has developed the usual amount of tuberculation and corrosion on its inner surface. Within the last few years company engineers realized a major reconditioning job must be carried out or the line would have to be replaced. This was particularly true near the upper end where the steel was of the minimum $\frac{3}{8}$ -in. thickness. Extensive study was made of the problem, both as to reconditioning methods available and relative costs.

Final conclusion was to institute an extensive field test of the Centrline process. If this installation proved success-



ful it was then to be used for additional sections of old and thin steel pipeline being operated by the company. General features of the Centrline process are reviewed for the readers of *Western Construction* in a short separate item accompanying this article.

Field operations

The work of lining the test section of pipe had to be carried out when power-operating conditions enabled the company to drain the penstock and shut down the power plant. This occurs dur-

PICTURESQUE BUT TOUGH location for a pipeline job, where all materials had to be hauled up a mile-long tram, barged across Lake Agnew (shown) and up another tram to this mixer. Discharge of the mixed mortar is directly into car (bottom of page) in pipe.

ing the fall of the year when Gem Lake can be emptied, at the end of the run-off season.

Prior to the start of actual work on the line, materials for the new lining were delivered at the site using the tramways which had been kept in operating condition since the original construction

on the project was carried out in 1916.

As soon as the line was available a crew consisting of foreman and three operators began work on the job, assisted by about 8 laborers furnished by the power company.

With an expected output of 400 ft. per day on the line the program called for lining work to be completed in a 4-day period of actual operations.

Sequence of procedure

Access points not farther than 750 ft. apart were provided for lining work on a pipe of this general size. Where existing manholes were not available a 6-ft. section is cut from the top half of the pipe.

The first operation consisted of cleaning the interior of the line. This can be accomplished either by the usual type of hydraulically-operated cleaning device, or by a method consisting of spinning lengths of chain inside the pipe by means of a flexible shaft. These chains are mounted on a head which is held in the center of the pipe as the work advances. The flailing action of these chains knocks off accumulated tuberculation and scale. A small flow of water in the pipeline is used to remove the material as loosened.

This cleaning operation is carried out just prior to lining and the lining does not require a dry pipe to secure proper adhesion.

In the present case, the line was cleaned under a subcontract using the revolving-chain process in a period of about three days.

Applying the lining

Dried sand for the mortar was brought to the site in 100-lb. bags, screened to #16 size, which is standard for the pro-

TRANSPORT in the pipe from mixer to lining machine is by electrically-driven car consisting of trough for mortar and seat for driver. This buggy follows the curves of the 48-in. pipe without steering, and discharges at the placing machine for re-handling.



ss. The contractor preferred to bring his prepared sand from Los Angeles rather than to attempt to screen and dry local product, in spite of the distance and difficulties in transportation. Cement is standard type II and a pozzolanic admixture is used.

The mix used on this particular job had a proportion of 5 sacks of sand to 1 of cement and 1 of pozzolan. The pozzolan is used to increase workability and delay the setting time.

Mixer and placing

The ingredients were mixed in a small electrically-operated machine of the pug-mill type with water added at the discretion of the operator. In general, the water content provided a mixture having consistency similar to that which would be used in laying bricks or masonry block.

These small batches were dumped directly into an electrically-operated car in the pipe for transporting to the lining machine. This car is a rubber-tired unit (see illustration), which takes energy from an electric cord looped on the floor of the pipe.

The lining machine starts from a point at the end of the section and backs

slowly towards the point of access. It is electrically operated from a rubber covered cable stretching from the point of access to the machine.

The machine (see accompanying description) was fed by hand from the delivery car. The mortar is deposited on the pipe centrifugally from the head of the machine, which is maintained in the center of the line. The operator maintains the machine in this position by a simple steering lever as it backs through the pipe.

Thickness of the mortar is regulated by the speed of movement, which is adjusted by a speed reducer operating between the electric motor and the rubber-tired wheels. For the desired $\frac{3}{8}$ -in. thickness, the speed of the machine was approximately 2 ft. per min.

Directly behind the head throwing the mortar onto the pipe are two sets of revolving steel trowels and a final set of finishing trowels. These trowels revolve against the mortar as the machine is withdrawn and provide a smooth, even finish.

Work on slope

For the major part of this particular job, the machine operated under its own

power on the flow-line pipe which had a grade of from 2 to 4 ft. per 1,000. In the sloping section, the machine had to be pulled up the sloping pipe by a $\frac{3}{8}$ -in. steel cable pulled in by a hand winch. The machine operated around the vertical bend, placing the mortar in the pipe, but the trowels were not used, since they would have dug into the lining. The short section of lining in the bend was hand-trowelled after the mortar had taken its initial set.

At the end of each day the openings in the line were closed and moist conditions prevailed during the night for adequate curing of the lining.

Personnel

Operations of the California Electric Power Co. are under the direction of Paul H. Yelton, construction engineer at the company headquarters in Riverside, Calif. E. I. Bulpitt is superintendent of hydro generation with headquarters at Bishop.

Robert C. Sargent is manager of the Centrline Division, American Pipe & Construction Co. of Los Angeles. J. W. Thomson is general superintendent for this division, and Kieth Boatright is job superintendent.

General Features of the Centrline Process

DEVELOPED in the East about fifteen years ago, the Centrline process for placing cement-mortar linings in existing pipelines has only been used extensively in the Western region during the last few years. Briefly, the operation consists of centrifugally placing a pre-mixed mortar coating followed by steel troweling. The action is entirely mechanical without pneumatic aid and does not produce rebound as the machine is propelled slowly inside the pipeline. At the present time pipe sizes are from 22-in. diameter up to a maximum of about 12 ft.

The thickness of the coating is regulated by the rate of travel of the machine. Minimum thickness is usually considered about $\frac{1}{8}$ in., and $\frac{3}{8}$ in. is standard for most lines. In riveted pipe the mortar coat is designed to provide a thin covering over the rivet heads.

Access to the pipelines may be either through existing manholes or through cut-out sections large enough to introduce men and equipment.

Cleaning operation

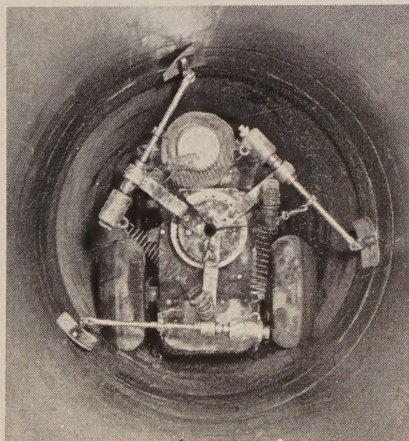
Preparation of the line after draining includes cleaning with one of the recognized types of machines. These usually consist of a series of scrapers pushed through the pipe as a unit by hydraulic pressure (National Water Main Cleaning Co. and Flexible Sewer Rod Co.). This cleaning operation is intended to remove tuberculation, scale and any loose materials resulting from corrosion. It does not have to expose fresh metal and the pipe does not have to be dried after clean-

ing. A small flow of water is introduced to flush out the material cleaned from the pipe.

Mortar materials

Aggregate used is carefully screened and well-graded dry sand passing a No. 16 sieve. The centrifugal unit of the liner is designed for sand of this size and no larger. Cement is standard and the usual practice is to add a pozzolanic material to improve workability and retard the set. Proportion varies from 1 part sand to 1 part cement plus admixture, to a leaner mix of $1\frac{1}{2}$ parts sand to 1 part of cement plus admixture. Water is added at the pug-mill type mixer to produce a consistency similar to a stiff mortar.

HEAD END of the lining machine shown receding in the pipe as the mortar is flung against the pipe by the revolving head.



Curing is accomplished by closing openings in the pipe and enclosing the natural moisture.

The machine is introduced into the pipe at the location of the mixer and moved to the length of the electric cable, which may represent a distance up to 1,200 ft. An electrically-driven car is then used to convey mortar from the mixer to the rear of the machine where it is transferred either mechanically or manually and fed into the lining unit.

The results obtained by this process include the stopping of corrosion on steel pipe, the strengthening of weak pipe or weakened sections of pipe and the improving of hydraulic characteristics.

Western significance

Of special significance to this Western region is the recent use of this process for reconditioning irrigation pipe installations. It is particularly applicable to the many miles of thin steel pipe used to convey irrigation supplies into areas where pipe was used in place of open ditches.

A large scale test has recently been made on a siphon on a Bureau of Reclamation project. The current lining being placed in the penstock of the California Electric Power Co. plant represents another Western innovation, being the first time the process has been used on a hydroelectric project.

The Centrline Corporation has its headquarters in New York City and is represented on the West Coast by American Pipe & Construction Co. of Los Angeles.

New Records Laying the "Super-Inch"

FAR EXCEEDING any comparable record, Bechtel-Price-Conyes placed 56 mi. of the "Super-Inch" gas pipeline during the month of August. During that month, one main line crew of the joint-venture firm lined up, welded, wrapped and coated, lowered in and covered this long stretch of the pipeline between Bakersfield and Kettleman, where few steep grades or other obstructions were encountered.

The "Super-Inch," a 34-in. diameter high pressure natural gas line, is being constructed as a joint undertaking of the Pacific Gas and Electric Company and the El Paso Natural Gas Co., at an estimated total cost of \$150,000,000. It will extend from natural gas producing fields in Texas and New Mexico to the San Francisco Bay Area where it will go into the P. G. and E. gas system. The El Paso company is building the line to the California-Arizona border near Needles where P. G. and E. will take delivery. The P. G. and E. section of the line, 501 mi. long and estimated to cost \$63,300,000, has been under construction by Bechtel-Price-Conyes since June 1949. (For more details about the "Super-Inch," see box on opposite page.)

Behind the record

Two practices of the contractor are responsible for the record established in August. First, careful thought was given to the plan for a construction schedule which could be accelerated as work progressed. Second, during the actual field operations, the contractor developed new methods and equipment which helped to maintain and even exceed an already fast schedule.

Laying 56 mi. of 34-in. diameter gas pipeline during August exceeds any comparable record—Major equipment innovations, carefully coordinated schedules and the hard-working crews of Bechtel-Price-Conyes responsible for the speed

In the field operations, the biggest single key to the phenomenal speed has been the use of more and bigger equipment. The first major innovation in this respect came near the start of the job when the contractor discovered that conventional side boom tractors were too small to handle the heavier, stiffer pipe during lowering operations. As the result, a new idea was born when the inboard track of some crawler tractors was extended 22 in. for more leverage (see box on page 70).

To maintain a full crew and full speed, the general superintendent for the contractor arranged major units of equipment in fleets in such a way that spare units are available at all times. Thus, the equipment has been kept in better-than-normal repair for maximum output, and down-time on any one piece has not hindered the output of the fleet. The superintendent states that on a job of this nature, with the heat on to get over 500 mi. of line placed within little more than fifteen months, the higher first cost of large fleets of equipment, kept in top

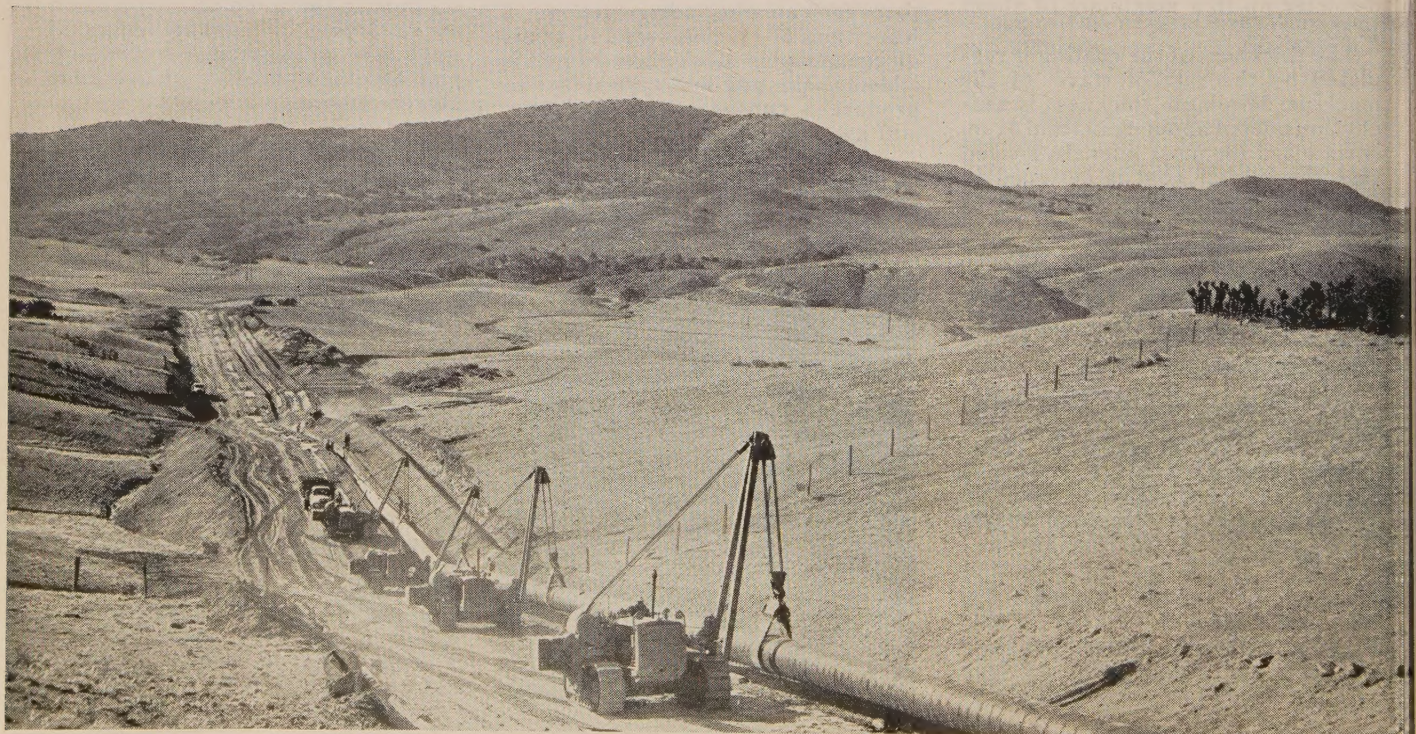
A NEW IDEA was born soon after the job started when the inboard tracks of a fleet of side-boom tractors were extended 22 in. for increased leverage during the laying-in process. Tipping capacity of each unit was increased by about 50%.

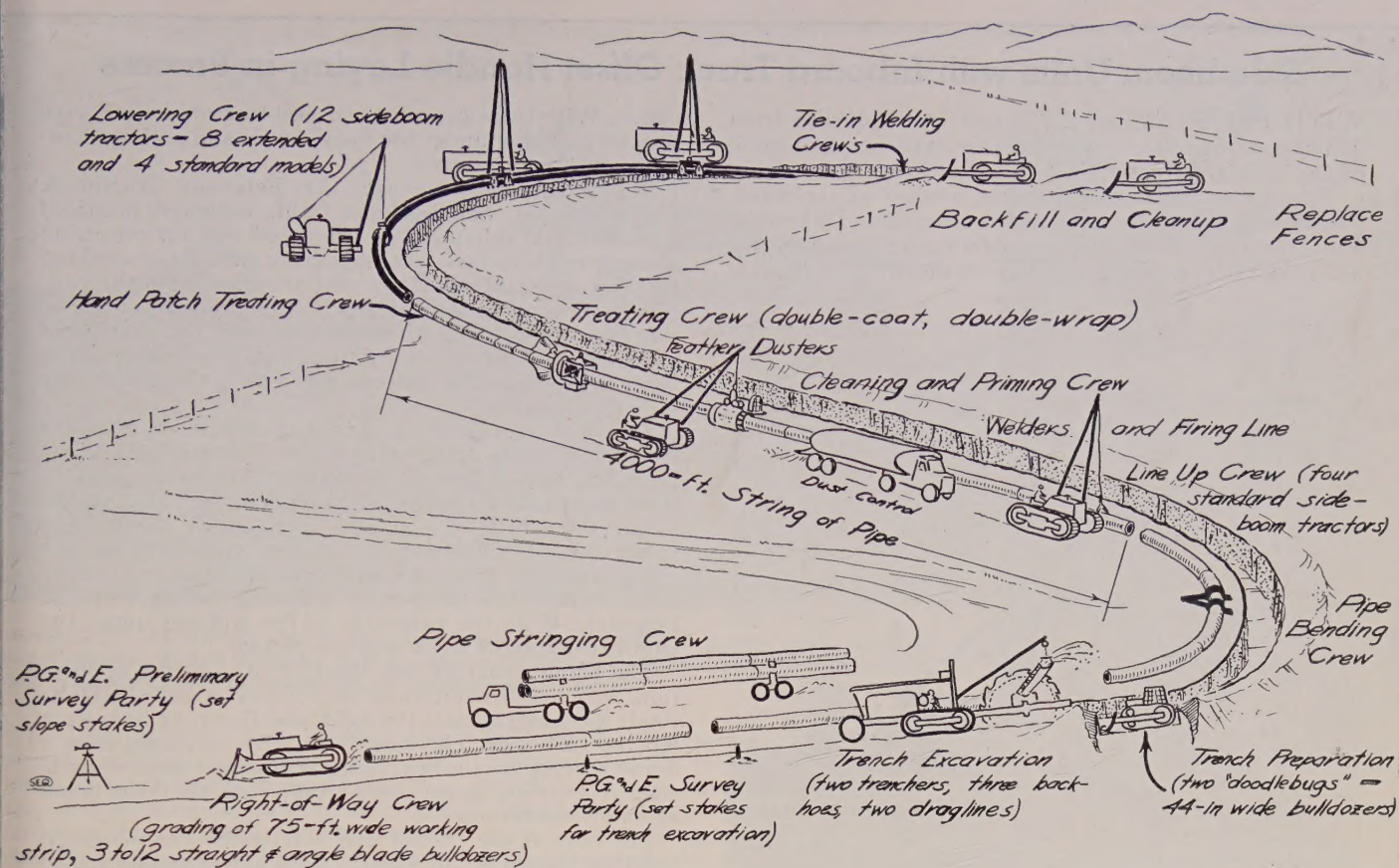
shape, is more than offset by savings from having the crews operating at full rated efficiency 100% of the time.

Bugs out early

Beginning at Llanada, Calif., and working northward for 80 mi. to Milpitas, on the southern tip of San Francisco Bay, the contractor ironed out most of the bugs in the production line before the crews got too far away from the home office. An early innovation was the use of two midget bulldozers exclusively for trench bottom work. Manufactured to order by the Cletrac Division of The Oliver Corp., the two bulldozers have an overall width of 44 in. Each is equipped with a drag, giving the trench bottom a smooth surface at grade consisting of soft, well-broken material. The short dozers, called "doodlebugs," were on the job before the line had progressed 15 mi.

A revised design of internal line clamp operating completely from the inside was used on the job. The clamp consists of an expandable "war head," backed up by a carriage mounted on wheels. Operated electrically, the clamp is inserted inside the new section of pipe and the power turned on so that it travels to the far end where the joint is





CONSECUTIVE MAJOR OPERATIONS by one main line crew on the "Super-Inch" are shown by schematic sketch (beginning at lower left). A minimum of slow-down for each of the operations resulted from precise planning before the job began.

to be welded. Push-button control is from a 100-ft. long cable. At the joint, the head protrudes enough to mate to the inside of the main line of pipe. After the new section of pipe has been spotted at the line, the power is turned on and the head expands, cinching both ends of the joint by means of pressure from within. The lineup welders then take over and complete the stringer bead. When the stringer is finished, the head is collapsed and the clamp run out the open end of the pipe under its own power. The head's expanding action comes from motors inside the carriage connected by worm gears to a lever arrangement.

Both reinforced standard lineup clamps and two inside lineup clamps, as designed and built by the contractor, are used on the job. They contain modifications made from the original model and have heavier duty heads and travel and expand motors. The extra power for the clamps is needed because occasionally the pipe ends are not perfectly round, an inherent trouble in extra large diameter pipe, and the ends have to be slightly rounded up by the lineup clamp in order to match concentrically. The expanding rings on the head are cinched in place when there is exactly a 1/16-in. separation between ends. The rings are also designed as narrow as possible, so that their contact with the pipe will not sap too much heat from the base metal during welding of the stringer bead.

The design of the "Super-Inch" pipeline has incorporated high unit stresses in the steel pipe. For this reason, P. G.

and E. has done an unusual thing in pipeline engineering. Throughout the 501 mi. of pipeline, grades were laid out on the right-of-way and trench. All vertical curves were calculated and staked before the trenchers cut the ditch, and the pipe is carefully bent using the wrinkle method before being lined up and welded. This is producing a strain-free line, without any sections flexed over hilltops.

Since the maximum wall thickness of the pipe (1/2 in.) occurs immediately after each compressor station, the con-

tractor found that conventional pipe benders would not handle this heavy steel. As a result, the bender used on the job was rebuilt with a heavier shoe and reinforced frame.

Double- and triple-ending plants

When the contractor originated his schedule, it called for the pipe to travel from the steel mill to a double-ending plant in the field and thence to the trench. Accordingly, the pipe was transported by truck from the Consolidated Western Steel Corp. South San Fran-

Some Details About the "Super-Inch"

TOTAL LENGTH of the natural gas transmission line from gas fields in Texas and New Mexico to the San Francisco Bay Area will be about 1,600 mi. The nickname for the pipeline refers to the record diameter of the steel pipe (34 in.).

The Pacific Gas and Electric Company section of the line will be about 501 mi. long, extending from the California-Arizona border and travelling through the Mojave Desert, across the Tehachapi Mountains, north across the floor of the San Joaquin Valley, over the Coast Range Mountains to Hollister, and thence to the key metering system of the company's gas system at Milpitas.

Bechtel-Price-Conyes, contractor for the P. G. and E. section of the line, is a joint-venture firm comprised of Bechtel Corporation, San Francisco; Conyes Construction Corporation, San Pablo, Calif., and H. C. Price Co., Oklahoma.

Ground on the P. G. and E. section

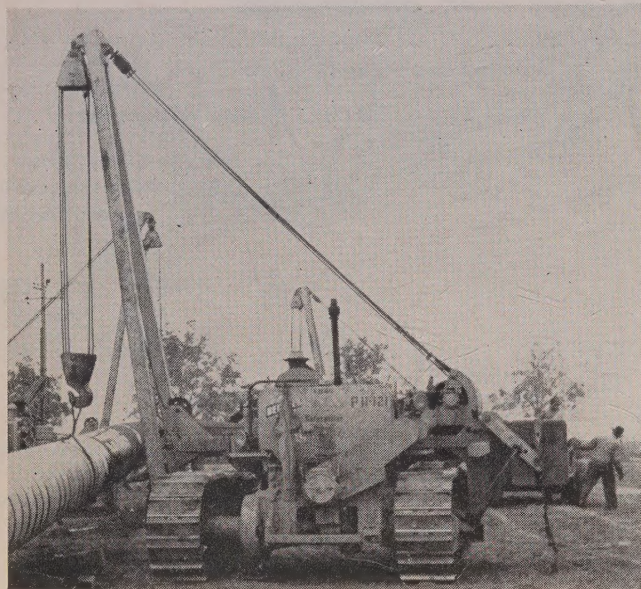
was broken June 1949 at Llanada, 80 mi. south of Milpitas. The line progressed north to Milpitas, and then was re-started at Topock to continue north to Llanada, with completion scheduled for the latter part of November 1950. Work also began last year on the 80-mi. section from Llanada north.

The first delivery of natural gas, about 150,000,000 cu. ft. per day, is scheduled in the contract to start January 1951. By 1952, it is anticipated that 400,000,000 cu. ft. per day will be delivered.

Three compressor stations, at Topock and Hinkley in San Bernardino County and Kettleman Hills in Kings County, are scheduled for completion in 1951. Inlet pressures at the compressors vary between 440 and 500 psi., and the maximum designed discharge pressure is 790 psi. The pipeline contains about fifty main line sectionalizing valves, making complete shutoff possible.

Side-boom Units with Inboard Track Offset Handle Laying-in Process

WITH THE START of the "Super-Inch" pipeline from Milpitas to Needles it soon became apparent that none of the standard tractors had enough lifting—or working—capacity to handle the laying-in process of the work. The tipping capacity of a standard Caterpillar D8 tractor and Trackson side-boom extended 4 ft., for example, was about 54,000 lb. with the heaviest counterweights feasible



to use. With these capacities several tractors in line were seriously tipping under the heavy loads and still not handling the work properly.

Seeing this performance, the Peterson Tractor & Equipment Co., San Leandro, Calif., designed, prepared drawings, and submitted an estimated cost for offsetting a single track to raise the tipping, or maximum working capacity, to 82,000 lb. Upon authorization from the contractor, one such machine was built and placed in operation two weeks later. After the first tests, the contractor authorized the Peterson firm to widen seven more of the contractor's own D8 tractors, and finally three more for a total of eleven.

The work in making the change over from the standard model consisted of machining a new final drive axle 22 in. longer for the left side of the tractor. This made necessary the fabrication of a longer sprocket drive hub and spacers to carry the bellows seal. The track-frame swing-brace was extended a like amount. A new structure was designed to brace from the main transmission case to the track frame, thus completely relieving the load on the long axle. With the extension of the stiff-bar under the engine the tractor work was completed.

The boom structure was lengthened to fit the application. A 12,500-lb. addition to the counterweight (16,000 lb. total) was hung against the right side. Boom-up lines were left the same size. The hoist lines were increased from a 3-line reeving to a 6-line, using the same standard cable size. A heavier, larger hook completed the side boom assembly modifications.

The cost of the tractor and side-boom was increased less than 9% for an increase in work power amounting to 29.6%.

cisco plant (*Western Construction*—May 1950, pg. 61) to a double-ending plant at Santa Clara.

Here the pipe was joined into lengths of 60 ft., stockpiled, and then trucked to the open trench. In order to speed up field operations, the next plant, established at Barstow for construction of the gas line northwest from Topock, was made into a triple-ending plant. Truck tractors with trailers then carried 96-ft. lengths of pipe to the trench, in the first recorded use of a triple-ending plant in this size range.

At the Santa Clara double-ending plant, and subsequently at the triple-ending plants at Barstow and Coalinga, the pipe was stockpiled on runways and handled in the yards by specially-built fork lift trucks. The runways, inclined so that pipes would roll into place, were fitted with stops at the incoming high end. The fork lift would deposit three 32-ft. lengths of pipe at a time on the

ramp; then, still holding the pipe, back up until the pipe touched the stops. The pipe would then roll into place, always in line and with negligible variation. These stops, an innovation of the subcontractor, allowed the pipe to be placed on ramps as long as 600 ft.

Temperature requirements

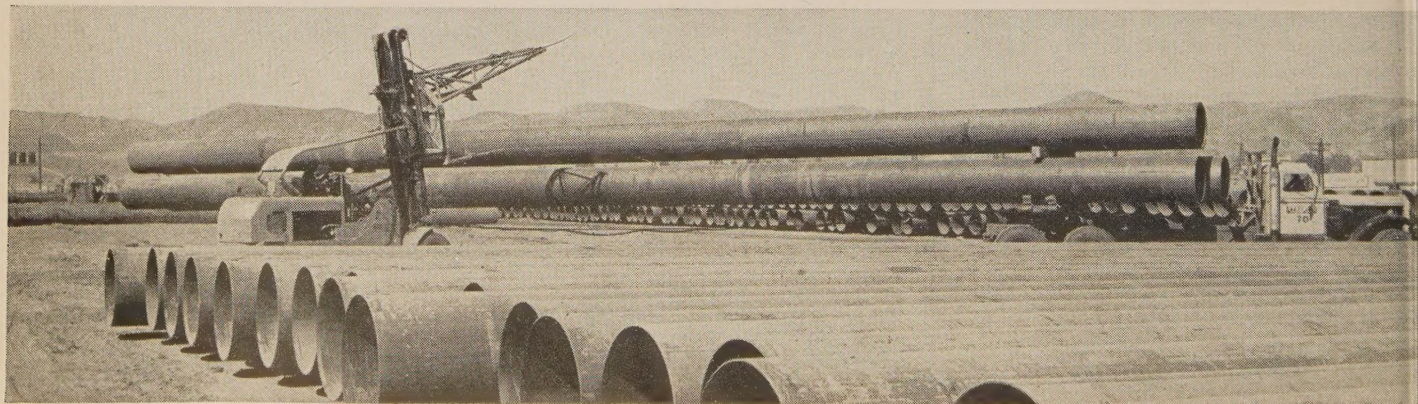
The entire length of line has been laid without the installation of any expansion joints. As a result, specifications state that the pipe cannot be lowered and covered until it is at 70 deg. F., or less, a tough qualification to meet in the desert, where the temperature at one time did not get below 80 deg. for twelve days (even at night). At this location

PIPE LENGTHS on truck are 96 ft. long, ready to be shipped from triple-ending plant to trench, where they are welded into lengths as long as 4,000 ft. for laying-in. Fork lift truck was specially equipped to handle the long, heavy lengths.

the length of each string was reduced to less than 3,000 ft., and the necessary slack was calculated. Under these conditions, the string of pipe was cut to size, held up at the ends and welded to the succeeding length, thereby forming a slack loop which was then lowered into the ditch and covered between the hours of 1:00 and 6:00 a. m. Before daylight hours, batteries of airport lights were used.

Welding procedures

As the job progressed, there were few changes in the welding procedure. Due to the high tensile strength steel resulting from the hydraulic expansion of the pipe during manufacture, a 70-10 welding electrode was specified. In the field, a 5/32-in. Fleet No. 5 (AWS 60-10) rod is used for the stringer pass. The second pass is with a 5/32-in. Shield Arc No. 85 (70-10) rod, and successive passes with a 3/16-in. Shield Arc No. 85 (E70-10).





WHEEL-TYPE TRENCHERS dug the 64-in. wide trench to depths of 8½ ft., greater depths requiring trench hoe work. Midget bulldozers, built to order for the job, were equipped with 44-in. wide blades and drags to work the trench bottom to a smooth surface at grade.

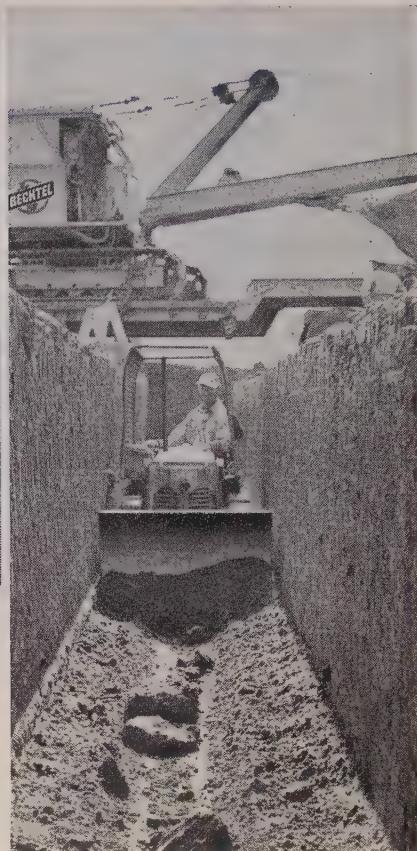
At the double- and triple-ending plants, the joint is made first with two hand passes, followed by the automatic set-up. Two hand passes were needed to build up the beveled ends because one stringer pass was not heavy enough to act as a back-up strip for the automatic machine.

The pipe is stressed at 64% of the yield point. Because of hydraulic stretching during the manufacture, with a corresponding cold working effect, there are three different yield points for the five different wall thicknesses of pipe. These vary from 46,000 psi. on the ½-in. steel (used only for safety factor in congested areas near highways and railroads and at discharge end of compressor stations) to 52,000 psi. on the thinner, more highly stretched steel.

The advance operation of this pipeline construction is grading of the 75-ft. working strip. This is followed by the

ditching machine cutting a 64-in. trench. The depth of the trench is determined by the minimum pipe cover of 24 in. in rock and 30 in. in earth. Where the easement extends through cultivated land, as it does through the fertile Santa Clara and San Joaquin Valleys, the minimum cover is greater, occasionally up to 5 ft. to avoid underground irrigation pipe. The trench is also dug deeper when traversing sharp ridges to avoid sharp changes in profile. The wheel type trenchers dig the first 8½ ft., and any additional depth is dug with a trench hoe, except for the use of a dragline under unstable conditions. Backfilling is done with a crew of bulldozers. The re-

PIPE BENDER, left, was rebuilt with heavier shoe and reinforced frame to handle the heavy pipe. Bending was by the wrinkle method. Coating and wrapping machine, right, is a 3-pump model, one pump discharging in the well and two pumps feeding distributors which flood asphalt around pipe.

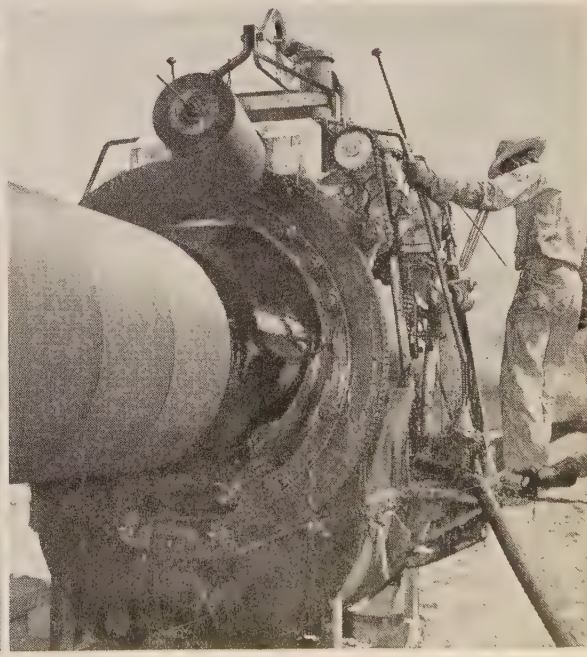
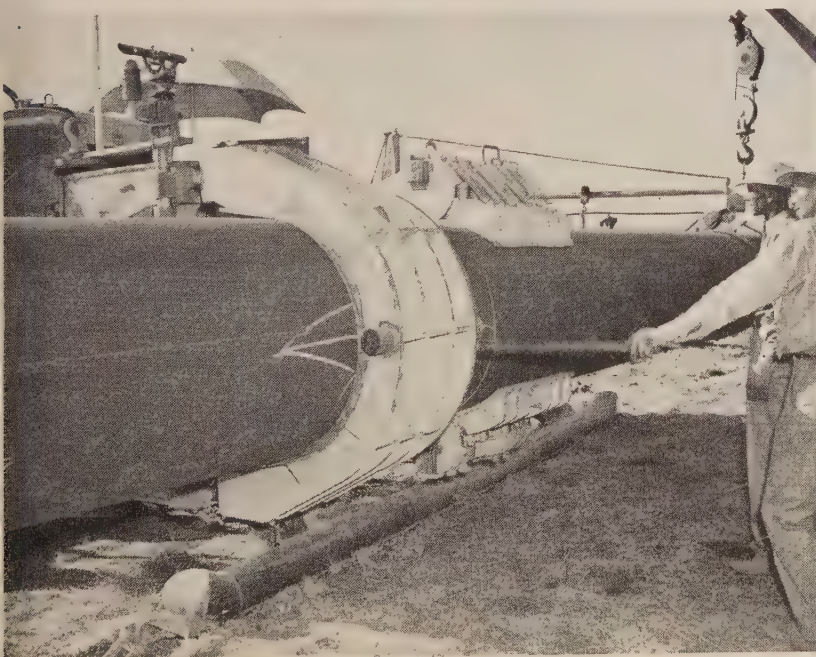


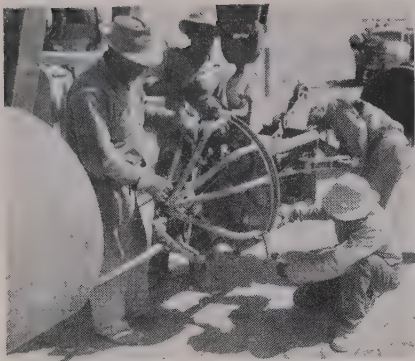
mainder of the spoil bank is leveled off on the right-of-way.

An electrolytic survey will be conducted by P. G. and E. to determine where cathodic protection may be necessary. Protection will be applied locally, where indicated.

Supporting structures

For a length of 5¼ mi. of line from Llanada to the north in the valley, a total of 7% of the pipeline is carried above ground on spans. Structures have been standardized according to span length. Unsupported spans up to 120 ft. carry their own weight; up to 160 ft., an





LINEUP CLAMP, designed and built by contractor, travels under own power by push-button control through pipe to joints where it expands to secure ends during welding.

A-frame support is provided in the middle; up to 200 ft., two A-frame supports are provided 60 ft. out from each end. A-frames consist of welded lengths of 4-, 6-, or 8-in. pipe, set on concrete foundations and capped with a pipe saddle. Exposed pipe is painted with aluminum paint and receives no wrapping.

Coating and wrapping

The coating and wrapping machine is finally used on the job is a 3-pump model made by Perrault Bros., Tulsa, Okla. One main pump has its discharge in the well, and two pumps feed a system of fishtail and shoe distributors which flood asphalt around the pipe. Principal field problem of the "dope" superintendent is to maintain constant and uniform distribution of asphalt around the pipe. The most recent record established on the job is the double-coat, double-wrap treatment of 17,400 ft. of pipe in an 11-hr. shift, a record made in September. In corrosive wet ground areas, the double coat-and-wrap machine is followed by a bobtail wrapping machine which applies the third coat of asphalt and wrap.

Mobile field camp

Field offices and shops of the contractor consist of eight 40-ft. trailers and three 30-ft. automobile trailers, housing all facilities of a warehouse, accounting, personnel, and expediting office. The trailers are moved in steps of 20 to 60 mi. along the line, and are set up so that moving requires only one day. A trailer is maintained in each nearest town, apart from each field office location, for telephone contact and materials delivery. The radio contact used has two main stations and twelve field units.

Powerful, dust laden winds hindered operations at times in the desert, and upon occasion the job was shut down. Under these conditions the pipe cannot be wrapped or welded, nor can automobiles be used without getting a sand-blasting. Most sand storms could be detected from the weather reports continually coming in from the P. G. and E. San Francisco office.

P. G. and E. engineers state that if another "Super-Inch" were being designed on the drafting boards today, almost no changes of any kind would be made. Perhaps, in light of recent developments in pipe bending techniques,

a smooth bend would be specified. However, wrinkle bends on large diameter pipe have proved entirely satisfactory on other lines.

From 5% to 10% of the circumferential field welds are checked by gamma ray photography, requiring the drilling of a small hole in the pipe wall for insertion of a radium pellet. On the latter part of the job, X-ray equipment supplemented the gamma ray method.

Personnel

O. W. Peterson is manager of general construction for the P. G. and E., J. A. Love is engineer of gas construction, and R. S. Fuller is manager of gas operation. A. D. Spratling is the project superintendent in the field.

Rapid Test Forecasts Attack by Sulfate Groundwaters on Concrete

A RAPID TEST for accurately measuring the susceptibility of Portland cements to attack by sulfate ground waters has been developed by W. C. Taylor and R. H. Bogue at the National Bureau of Standards. The new procedure, which determines the extent to which aluminates in the cement can react with the sulfate ions present, not only reduces the time required for the test from several weeks or months to one day, but also provides more valid results than methods previously used.

Some concrete structures deteriorate in the presence of ground waters containing soluble sulfates while others do not. Where deterioration occurs, it appears to be due principally to a reaction between the sulfate ions in the ground water and aluminate ions in the cement.

In the past, the sulfate resistivities of various types of cements have been evaluated by preparing bars or slabs of mortar and noting their change in length, strength, or appearance after storing in sulfate solutions for periods up to several months. This procedure has two notable disadvantages: the time required is excessive, and the physical character of the specimen may have a pronounced effect on the results. The test developed at the Bureau, on the other hand, is made directly on portions of the cement rather than on specimens of the paste. It thus makes it possible to evaluate correctly the inherent resistance of the cement to sulfate action as distinguished from the physical effects due to the nature of the specimen.

This test measures the amount of sulfate removed from solution in a definite time when a small sample of the cement (adjusted to a known sulfate content) is continuously shaken with a saturated lime-water solution. The sulfate in the cement dissolves quickly in the water-cement fluid mixture and reacts with the aluminates to form the difficultly soluble calcium sulfoaluminate. In the early period, which may be as long as two hours, the reaction proceeds rapidly, but after four hours it becomes much slower. After six hours, the concentration of sulfate in the solution changes so slowly that

HOW 34-in. pipe for the "Super-Inch" was fabricated and hydraulically expanded to finished diameter at the South San Francisco plant of Consolidated Western Steel Corp. was fully described in the May 1950 Western Construction on page 61.

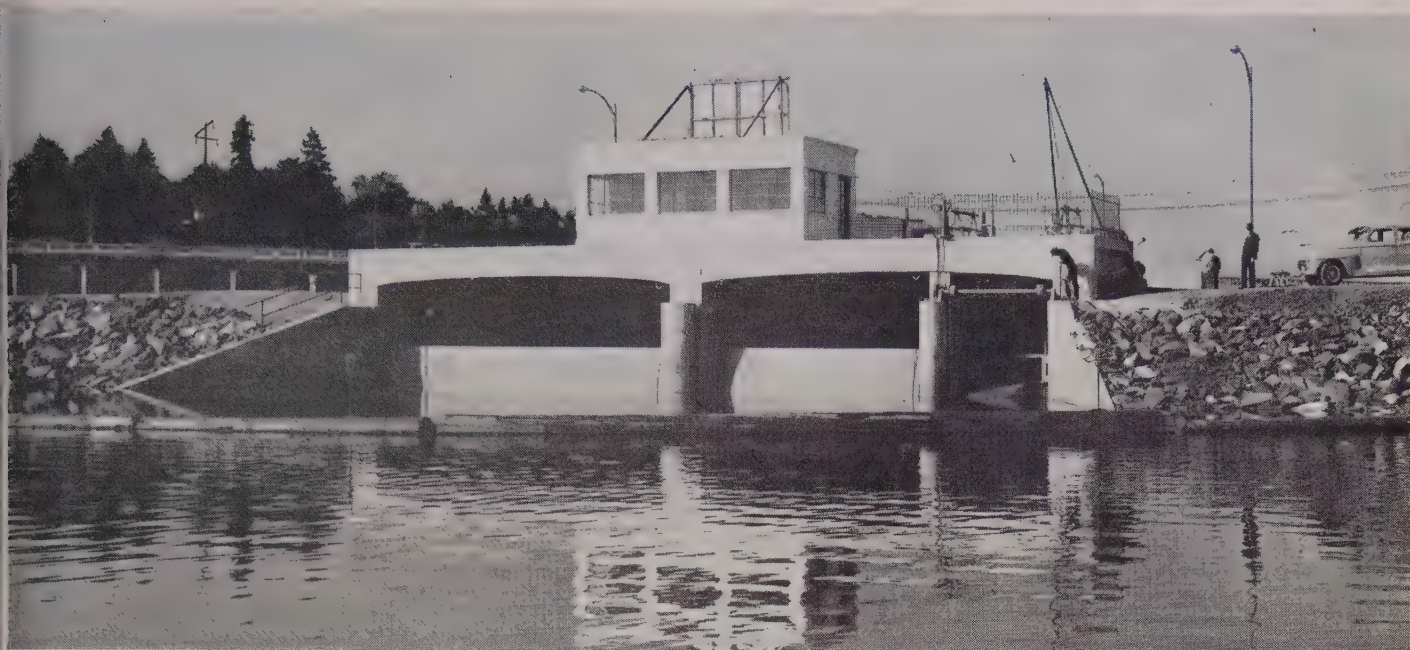
For the contractor, V. G. Hindmarsh is vice-president. R. L. Hamilton is pipeline consultant, R. L. Bowman is general superintendent, and S. J. Valline is office manager. Superintendents include S. D. Bechtel, Jr., W. B. Hanna, N. L. Barron, and Walter Gee. Russell Rhoades is welding consultant.

it can be measured with very little error. The difference between the original SO_3 content of the mixture and that of the liquid at six hours is then calculated as percentage of the SO_3 originally in the cement and is designated "sulfate reaction value." This value represents the amount of SO_3 that has been rendered insoluble by interaction with the aluminates and thus indicates the susceptibility of the cement to attack by sulfate waters.

Sulfate reaction values obtained for a large number of cements at the National Bureau of Standards have shown a high correlation with the behavior of concrete and mortar specimens of these cements that had been stored in sulfate solutions for some time. The rather striking results indicate that it is possible to separate cements into three groups with respect to their sulfate susceptibility. Thus, a cement having a sulfate reaction value up to 50 can be expected to have considerable resistance to sulfate attack. The lower the value the greater will be the restivity of the cement. Concrete or mortar structures made with such a cement will have satisfactory durability when exposed to sulfate waters except where disintegrative forces other than sulfate reaction may be involved.

At the other end of the scale, a cement having a sulfate reaction value above 65 can be considered relatively nonresistant to sulfate attack. Structures made with such a cement cannot be expected to last long when exposed to sulfate waters, regardless of the quality of the workmanship or the presence of beneficial agents.

Cements having sulfate reaction values between 50 and 65 are somewhat on the borderline. While they cannot in general be depended upon to resist sulfate attack, structures made of these cements may be durable in sulfate exposure if they are dense and impermeable and are free of other disintegrative agents. In this range of cements, good workmanship is absolutely necessary, and air entrainment would undoubtedly be beneficial.



Washington's Des Chutes Basin Project— Tide Flats Become Fresh Water Lake

Earthfill dam 800 ft. long across tidal basin creates 350-ac. lake to enhance beauty of Washington State capitol grounds—Concrete spillway supported on timber piling—Dam built in-the-wet but four cofferdams enclose work on spillway

THE FIRST PHASE of a unique project to transform an unsightly, odorous tide flat adjacent to the Washington State Capitol grounds into an attractive fresh water lake has been completed by Scheumann & Johnson, general contracting firm of Seattle. An 800-ft. long earthfill dam has been constructed across the Des Chutes tidal basin, which forms the southern tip of Puget Sound. Behind the dam, a fresh water lake covering an area of 350 ac. is being formed. This initial work was financed by the State of Washington under a \$1,000,000 bond issue.

Job sequence

Scheumann & Johnson began work on the dam in January 1949. By its nature, the job lent itself to the following sequence of operation: first, build the haul road and west half of the dam and construct the spillway and install the equipment below high tide level, and second, build the east half of the dam and finish installation of equipment in the spillway. The haul road and spillway, as separate units of work, were also started in January 1949.

As a dirt moving team an International HD-19 tractor with a 20-cu. yd. Gar Wood scraper were put into operation on a three-shift, five-day week basis. No other equipment was employed on the first phase of the haul road construc-

By
ROBERT L. MOTTNER
General Superintendent
and Engineer
Scheumann & Johnson
Seattle, Wash.



tion, and because the material was sandy, the tractor was able to load the scraper without the aid of a pusher. After dumping, the fill was dozed ahead and maintained by the same dozer. About 70,000 cu. yd. of dirt was moved by this method, at an average of 1,000 cu. yd. per day. In 70 working days about 2,300 ft. of 30-ft. wide haul road was completed.

During the tractor-scraper hauling period a conveyor belt was built across railroad tracks at the borrow pit. This consisted of a hopper and feeder, and a

30-in. wide elevated belt that dumped into a twin 15-cu. yd. compartment bunker. The reasons for switching to the conveyor belt-truck operation were (1) the distance became too great for practical operation of the tractor and scraper, (2) it eliminated possible costly delays due to logging trains blocking the crossing, and (3) the conveyor system reduced the haul by 1,000 ft. and kept the trucks out of the pit and onto hard road.

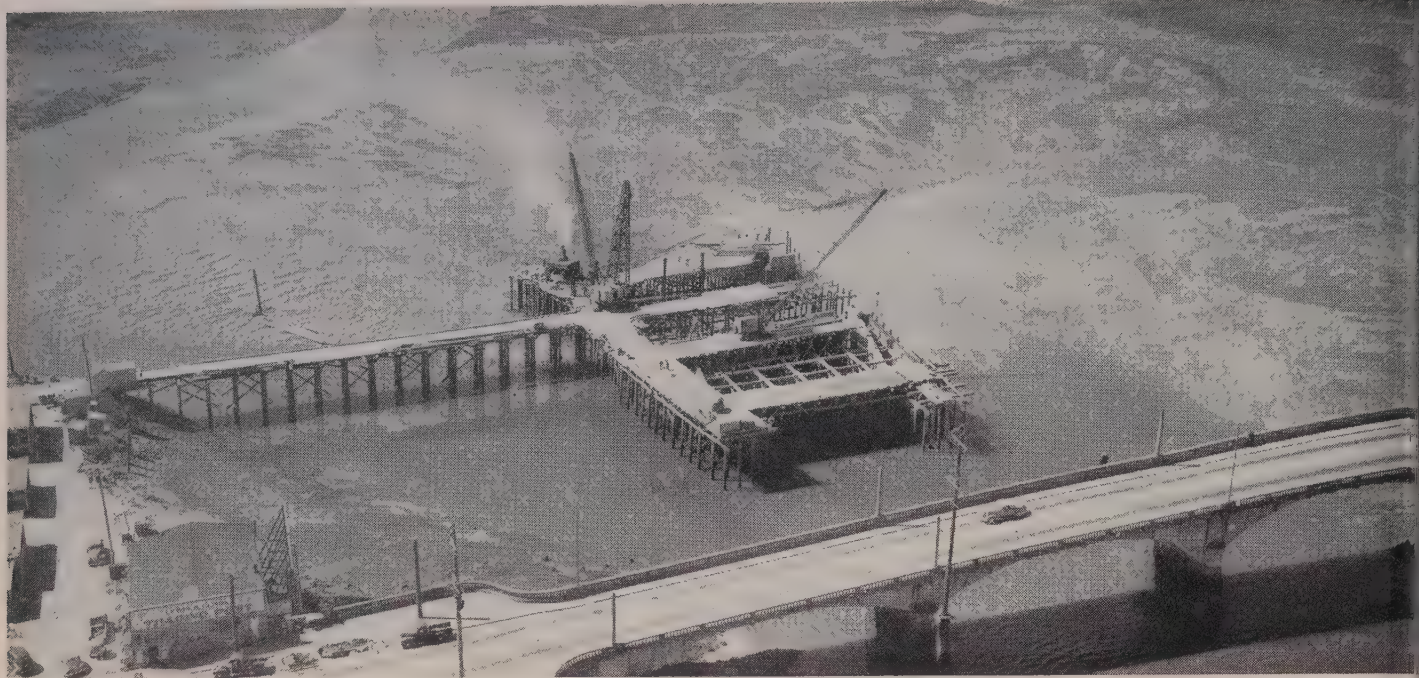
From this point the contractor commenced hauling with four dump trucks. Two HD-19s were used to feed the hopper. One pushed directly into the hopper, acting as the feeder bulldozer, while the other, with scraper, hauled the dirt down from the far end of the pit. It was necessary at times during the dam construction to double shift the two bulldozers to get enough dirt stockpiled for an 8-hr. shift of the trucks.

Four cofferdams for spillway

To build the reinforced concrete spillway and install radial gates and other operating equipment, the contractor set up four consecutive cofferdams and completed the unit of work enclosed by each. Construction joints in the structure permitted the isolation of each of the two upstream wing walls as separate units. The two downstream wing walls, including the spillway slab between, comprised the third unit. The fourth cofferdam enclosed the center section, walls of the 36- and 24-ft. gateways and fish ladder. Because of the uncertain conditions encountered on the bottom, the length of foundation piles required and potential trouble with leakage, the contractor decided to construct the two upstream wing walls first. Each required a cofferdam about 80 ft. long and 25 ft. wide. The other two cofferdams were to be

PICTURED ABOVE—

COMPLETED SPILLWAY of the Des Chutes Basin Dam. Two radial gates automatically maintain lake at constant level. Fish ladder allows spawning fish to head upstream.



much larger, 80 by 100 ft., and 100 by 100 ft.

The first order of work on the spillway structure was to build the trestles and falsework to reach the middle of the Des Chutes waterway, location of the spillway. An all steel skid rig with a Vulcan No. 1 steam hammer was used throughout the job to drive 1,500 fir bark piles in the falsework and structure foundation. The same hammer was also used to drive all cofferdam sheet piling. Guide piles were driven and several sheet piles were set up on each side of the cofferdam to act as guides for the crib as it floated up and down with the tide.

In the two upstream wing-wall cofferdams the crib frames were assembled in

SPILLWAY during early stages of construction. Both upstream and downstream wing walls had been poured and work was starting on cofferdam to enclose center of spillway, gateways and fish ladder. Tide is out. Notice unsightly tidal flats in the background.

two sections and lowered in place ready for bolting together. However, in the larger cofferdams, the crib was built up entirely in the water. Heavy 16 x 16-in. material was used for horizontal wall timbers, and 12 by 12-in. for struts and posts. Bethlehem AP-3 sheet piles, 40 ft. long, were used as sheeting.

Sheeting was driven down to top elev. of -1.5, thus the bottoms were at elev. -41.5. Cofferdams were excavated to -36.5, the City of Olympia datum which

corresponds to -18.5 USC&G Survey datum. Excavation from within the cofferdams was done using 1-cu. yd. clamshell bucket. Excavated material was hauled ashore and dumped in the waste area. Extreme caution was exercised in excavating only to the required depth, as this left just 5 ft. of sheet pile below the excavated bottom. If the excavation had been carried too deep, a blow-in would have occurred under the sheeting due to the pressure of an 18-ft. head of mud standing on the outside of the cofferdam.

Final excavation and fine grading were accomplished by using a 6-in. air siphon. The siphon functioned satisfactorily, sweeping across the bottom in a vacuum cleaner manner, sucking up any high dirt. It worked well with 240 cfm of air at 80 psi. pressure. Three high pressure water jets attached to the siphon were turned on when sucking in hard material.

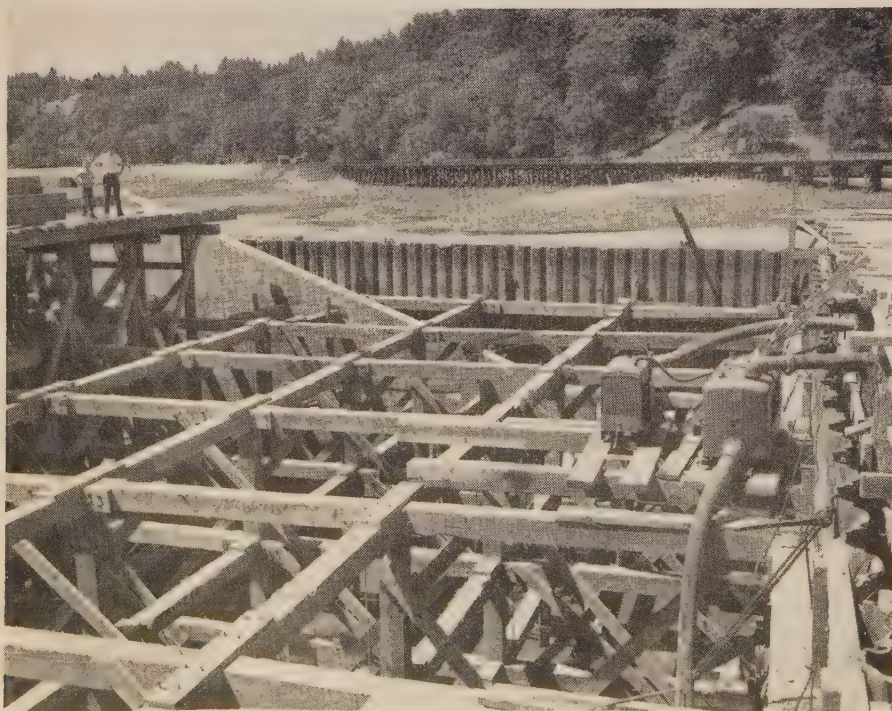
Considerable difficulty was experienced excavating the material next to the sheeting under the crib timbers. Often shear walls of clay would stand 10 ft. high without caving away. A high pressure water jet had to run down between the crib timbers and the sheeting to cut this material loose.

Spillway on timber piling

Foundation piling was driven in each cofferdam at center distances varying from 2 ft., 6 in. to 5 ft., depending upon the requirements of the structure. It was not practical to excavate to solid footing for the entire spillway structure, therefore it was designed to be set on timber piling. Piles were driven to a minimum of 40-tons bearing load. Pile driving in some areas of the cofferdam made the bottom come up as much as 6 in., and in other areas no perceptible change in elevation took place. Wherever it was necessary, the bottom was re-excavated with the siphon.

An average of 30-ft. penetration was required to reach the specified bearing

NORTH COFFERDAM enclosing discharge wing walls and spillway slab. Crib for this cofferdam was built up entirely in the water.



load per pile. Because piling cut-off was 29 ft. below high tide, 60-ft. piles were used. Actually it would have been possible to use piling of shorter length by using a follower on each pile.

Sealing cofferdam bottoms

A 6-ft. slab of 6-sack mix concrete was poured in the wet to seal off the bottom of the cofferdam. This thickness of seal was deemed sufficient when poured around the foundation piling to prevent a "blow-in." The concrete was allowed to set seven days before pumping out of the cofferdam was attempted. On the initial de-watering of the large cofferdams, pumping capacity up to 12,000 gpm. was required. However, as soon as the sheet pile leaks were sealed the required pumping capacity was cut to less than 6,000 gpm., even during high tide period. One electric 2,600-gpm. deep well type and two 6-in. gasoline, self-priming 1,500-gpm. pumps were the only pumps used after leaks had been sealed. Bay mud, which is a mixture of fine sand and clay, made an excellent leak sealer when mixed with a small amount of fine sawdust.

The last cofferdam was the only one in which the contractor experienced any difficulty with leaks. This was because the sheeting of this cofferdam had to be tied into the finished concrete of the upstream and downstream wing walls. Lugs were welded to sheet piles adjacent to the walls, and anchor bolts placed in the walls were used to pull the piles tight against the concrete. Any leakage was then caulked with wooden wedges and burlap.

All floor slabs were poured in continuous pours. The 32-ft. walls were brought up in two consecutive pours. Of primary importance was the installation of the radial gates and the details of the fish screen and fish ladder work that had to be accomplished behind the cofferdam. As soon as the radial gates were installed and tested the cofferdam was removed and the flow of water permitted through the spillway. Thus, with the spillway providing an avenue for the



TOP—Widening east half of the dam. Note how bed capacity of Euclid trucks was increased 3 cu. yd. by bolting timbers to sides.

BOTTOM—Dumping quarry rock so as to protect the leading edge of the fill while making the closure of the dam.

Des Chutes Basin Project Construction Data

Area of new lake.....	354 ac.
Length of haul road.....	2,700 ft.
Length of dam.....	800 ft.
Width of dam at the top.....	80 ft.
Earthfill in road and dam.....	300,000 cu. yd.
Rock rip-rap for spillway and dam.....	15,000 tons
Overall length of spillway incl. wing walls.....	239 ft.
Overall width of spillway.....	83 ft.
Concrete in spillway.....	10,000 cu. yd.
Foundation piling.....	36,000 lin. ft.
Width of gateways.....	36 and 24 ft.
Width of fish ladder.....	10 ft.
Elevation of roadway deck.....	6.5
Elevation of the crest of ogee section.....	—17.0
Elevation of spillway floor slab.....	—27.0
Elevation of fresh water lake.....	— 3.5
Approximate cost of project to date.....	\$1,000,000

flow of the tide and river water, the earthfill dam could be completed on the east side. Although bad weather delayed dirt moving for six months during the winter, this time was used to good advantage installing equipment and putting the finishing touches on the spillway.

On April 6, 1950, the contractor resumed dirt moving operations, this time dumping eastward from the spillway. Six "Eucs" hauled an average of 3,000 cu. yd. per day for this half of the dam. It was soon found to be imperative to timber a truck road across the dam wherever there was no existing trestle. Even small rainfalls caused the equipment to mire down badly in the newly built dam. A roadway was built by placing timber mats in the fill at 15-ft. intervals, then spanning the distance between mats with three 12 by 12-in. timbers for

each wheel of the trucks. The 12 by 12-in. stringers were drifted to the mats in the same manner as is done in trestle building. A 6-in. layer of sand was then spread over the timber for surfacing. This compacted into a hard-surfaced road that easily withstood the contractor's heaviest hauling.

Making the closure

In making the closure of the east portion of the dam one-half width of the dam was carried as far as possible without too great a loss of dirt, then quarry rock was hauled in and dumped so as to protect the opposite bank and the bottom from eroding as the dam closure was made. From this point, with about 100 ft. of raging tide to cut off, the contractor dumped dirt and rock together so that the leading edge of the dam was constantly protected from the eroding



DURING DIRT MOVING operation, a conveyor belt was built across railroad tracks at the borrow pit. The 30-in. wide belt dumped into a twin 15-cu. yd. compartment bunker. A bulldozer power take-off was used to trip and raise the bottom-dump doors of the bunker.

action of the water by the heavy rock being dumped down its face. The rock core was only 20 ft. wide. This method stabilized the fill against washing and no appreciable amount of dirt was lost in making the dam closure.

Rip-rap protects dam

The sides of the dam were dressed to a 3:1 slope. The lake side of the dam was protected from wave erosion by a 36-ft. blanket of rock, extending from +4 to -8, whereas the downstream side, to insure against tide erosion, was protected by a 72-ft. blanket extending from +4 to -20. The rock rip-rap blanket was 2 ft. thick. Rock was placed by dumping the 5-cu. yd. truck loads into a skip handled by a crane. The loaded skips were swung out over the slope and spot dumped at the rate of 1 ton per sq. yd. A second crane with a three-man crew followed up with hand placing and leveling the rock wherever necessary.

The spillway in the Des Chutes Basin Dam serves two purposes: it regulates the flow out of the lake so that the lake will be maintained at a constant level, and it provides a fish ladder for spawning fish heading up the Des Chutes River and Percival Creek. Installed in the spillway are two radial gates, one 36 ft. wide, 18 ft. high, and the other 24 ft. wide and 18 ft. high. These two gates are raised and lowered by electric hoisting equipment and automatically open and close as is necessary to maintain the lake at the constant elev. of -3.5. During the period when the tide is higher than the lake, the gates will close automatically so that no salt water can enter the barrier.

Revolving fish screen

Installed below the 24-ft. gate, which will, except in peak run-off, handle the flow of the Des Chutes River, is a revolving fish screen. This vertical screen pivots about a center axle to discharge trash accumulated against the upstream

side and prevents the fish from entering the lake under the open gate. The cycle of this screen may be set from a few minutes to several hours. A 10-ft. wide fish ladder was also included in the spillway structure. Ten sets of timber baffles

provide ten successive 1-ft. waterfalls for the spawning fish to jump on their journey from the bay to the fresh water lake. At the downstream end of the fishway is a sliding gate actuated by two hydraulic cylinders operating off the city water pressure. This gate automatically raises and lowers with the tide but is at all times 4 in. higher than the tide so that no salt water will enter the lake.

Across the spillway a 3-lane automobile bridge was built to accommodate the traffic of the scenic drive around the lake. Also, provisions were made for a railroad bridge across the spillway which is to be installed at some future date.

Personnel

The Des Chutes Basin Project is being built by the State of Washington under the direction of the State Capitol Committee, Governor Arthur B. Langlie, chairman. Cliff Yelle is state auditor, and Jack Taylor is state land commissioner.

Key personnel for the contractor include Robert L. Mottner, general superintendent and engineer; Harry H. Stillwell, assistant superintendent; and Howard Bilyeu, mechanic in charge of maintenance. James Cavelero is pile driver foreman.

Consulting engineers for the State are James W. Carey-H. W. Kramer & Associates, of Seattle. James H. Reid is the design engineer, and V. R. Rathbun is resident engineer.

Fixed Price Contract Awards Urged By AGC for Defense Construction

PROCEDURES for the guidance of the construction industry and the government to enable general contractors to efficiently carry out all national defense construction while at the same time performing the required civilian volume were recommended by the Governing and Advisory Boards of The Associated General Contractors of America at their recent meeting in Chattanooga, Tenn.

Based on the A.G.C.'s experience in expediting defense construction during World War II, and results of its recent survey of construction conditions which indicate rising prices and growing shortages in materials, manpower and equipment, the policy-making executives made the following recommendations:

That defense construction be performed through normal industry channels, with fixed price contract awards after competitive bidding wherever practicable in the United States and its territories.

That subcontractors and sellers of machinery and materials submit firm prices wherever possible.

That fair and just wages be paid to workmen, and all steps be taken for greater production, maintenance of wage rates for agreed upon periods of time, settlement of jurisdictional disputes without work stoppages, and for training of adequate numbers of apprentices.

That general contractors' organizations be kept intact and retain ownership and operation of their equipment

for most effective operations in emergency as well as peacetimes.

That government agencies adopt policies which cause least disruption of normal industry practices and procedures that have been time-proven as the most efficient methods of operating.

That, "in order to conserve funds now in use and to be made available for construction, and to make practical and feasible the awarding of fixed price contracts, steps should be taken immediately by government and industry to prevent further inflation."

The boards also recognized the need for establishment of war damage insurance provisions which were in effect during World War II, and for the provision of more equitable terms in anti-excess profits tax legislation as applicable to operations of the general contracting agency.

Glenway W. Maxon, Dayton, Ohio, 1950 vice president, was nominated for president in 1951, to succeed Walter J. Couse, Detroit, Mich. Gayle G. Armstrong, Roswell, New Mexico, was nominated for 1951 vice president.

Maxon is president of the Maxon Construction Company, Inc., Dayton, which specializes in heavy construction work. At present, his firm is engaged in work for the Atomic Energy Commission at Oak Ridge, Tenn., and for the Navy at Guantanamo. Armstrong heads the highway contracting firm of Armstrong & Armstrong, Roswell, New Mexico.

Solving the Second Stage Problems At Chief Joseph Dam

Concreting scheduled to begin next spring after diversion of Columbia River around first cofferdam — Second stage construction to proceed in well-defined steps as result of careful planning

CONSTRUCTION at Chief Joseph Dam and power project, which ultimately will have the second largest hydroelectric plant in the world, is continuing at an accelerated rate. Located $\frac{1}{2}$ mi. east of Bridgeport, Wash., the dam will be 220 ft. high and 2,260 ft. long, with a reservoir extending 51 mi. upstream to the tailrace of Grand Coulee Dam. Following a preview and outline of the project (*Western Construction*—March 1950, pg. 82), this article will bring the reader up to date on contracts currently executed in the area, and outline some of the thinking and problems in design encountered in the second stage construction work, for which bids will be opened early this month.

Excavating intake channel

The General Construction Co., Seattle, is engaged in the excavation of more than 3,500,000 cu. yd. of earth and rock for the powerhouse intake channel. This channel will carry impounded water from the reservoir around the south abutment of the dam and into the powerhouse intake structure, and will be about 80 ft. deep, 3,000 ft. long and have an average width of 1,000 ft. Its bed will be about 160 ft. above the present river bed on the left bank. The \$2,265,000 contract for this work was awarded in February 1950, and is scheduled for completion in May 1951. Excavation for the intake channel is currently at the rate of 12,000 cu. yd. of rock and earth per day on a 6-day week. Rock drilling is being pushed with 15 wagon drills working on a 3-shift basis. Four shovels, 12 trucks, and 6 Tournarockers are used to load and haul the excavated rock.

Studies of the damsite revealed that access by highway would be more economical than access by rail. Consequently plans were made for a 10½-mi. access highway extending from the damsite to a rail-head near Brewster. Integral parts of the access highway are a \$300,000 bridge across the Okanogan River near Brewster and a \$1,000,000 bridge across the Columbia River near Bridgeport.

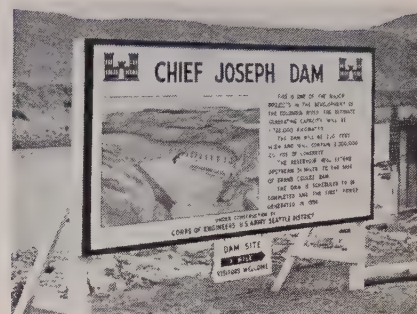
The government has not proposed to build a construction town near Chief Joseph Dam. A minimum amount of housing for government employees has been constructed within the town of Bridgeport, but it is hoped that additional housing and commercial facilities will be provided through the efforts of private enterprise. Bridgeport, a town of some 385 population when construction

at the dam started about 16 months ago, now has a population of over 2,000, a figure expected to double by 1951. Over 600 employees are now at work in the area.

The two stages

First stage construction is being done by Peter Kiewit Sons' Co., Longview, Wash., under a \$2,572,000 contract let June 28, 1950. Completion is scheduled for April 1951. The work involves over 1,250,000 cu. yd. of excavation for the right abutment of the dam, construction of 2,000 lin. ft. of cofferdam, and construction of about 2,000 lin. ft. of rolled impervious blanket upstream from the dam axis.

Second stage construction, estimated to cost between \$25,000,000 and \$40,000,000, will be awarded as a whole to one bidder after the bid opening early this month. Included in the contract will be all concrete work within the first cofferdam; construction of the second cofferdam enclosing the south half of the dam, and removal of the first cofferdam; concrete work within the second cofferdam; completion of the main dam; and excavation on the south bank for the powerhouse and intake structures. The period between the notice to proceed on the second stage construction and the April 1951 completion of the first stage cofferdam will be used to mobilize construction plant and equipment so that excavation and concreting operations within the first cofferdam can begin immediately upon completion of the first contract. All concrete work within the first cofferdam and rock fills, and slope pro-



tection on the right abutment, are scheduled for completion prior to the high water season of 1952.

All work within the second cofferdam is scheduled to be completed prior to the flood season of 1953, and removal of the second stage cofferdam will be accomplished prior to the high water season of 1954.

De-icing equipment

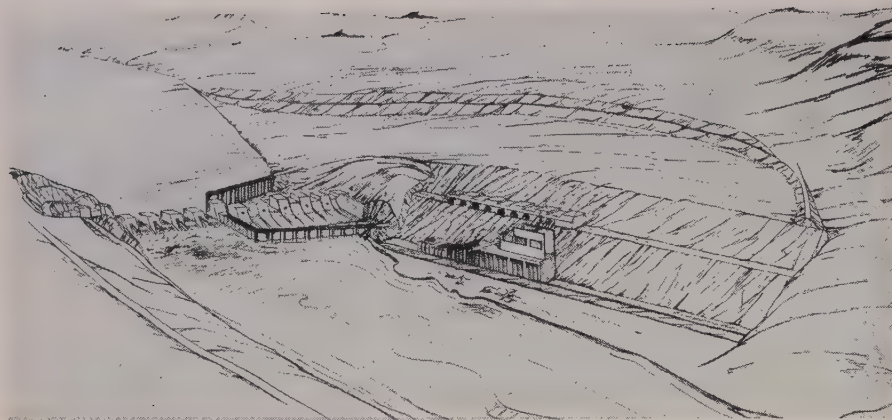
A feature of the second stage contract will be the installation of the de-icing equipment on the dam. It will include a compressed air system designed to force warm water from the lower reaches of the reservoir up to the surface to prevent ice formation in front of the crest gates. Electric heating units also will be installed behind the side seal plates on the tainter gates to prevent ice formation on the downstream side of the gates.

Steps in the construction

In the field, construction of Chief Joseph Dam will fall into well-defined steps. 1. Cofferdam the north half of river channel to divert flow to southern half. 2. Construct bottom portion of dam to maximum elev. 800 plus or minus within northern cofferdam, leaving five 49-ft. wide alternate monoliths low. 3. Remove north cofferdam and construct second stage cofferdam in southern half of channel, diverting flow over low monoliths constructed in first cofferdam. 4. Construct bottom portion of dam

FIRST STAGE, now about half completed by Peter Kiewit Sons' Co. under a \$2,572,000 contract, includes excavation of the right abutment and a cofferdam to occupy about 60% of the river channel. The cellular section of the cofferdam will contain 17 units of 63-ft. diameter.





IN THE SECOND STAGE, the south half of the low dam will be placed while flow of the river is carried over the north half and through temporary sluices. Work within the second cofferdam is scheduled to be completed before the flood season of 1953.

within second stage cofferdam, then remove cofferdam. 5. Close the five alternate low blocks, meanwhile diverting low flow through twenty-four 8 x 16-ft. temporary sluices through the structure. 6. Complete top of dam. 7. Close temporary sluices.

The first step cofferdam will occupy 55% to 60% of the river channel. Its width is fixed by the necessity of providing for five alternate low concrete blocks. The cofferdam will exclude a flow of 400,000 cfs., a flow exceeded 10 times in 36 years.

At the site of construction, granite walls rise abruptly on the left bank, and weathered slopes rise steeply over the right bank. On the right, a 0 to 20-ft. overburden covers irregular, pocketed granite. Fourteen axis sites were investigated over a length of 4 mi. In each case, the normal reservoir pool is confined to the narrow river canyon.

A thick, horizontal gravel stratum underlies the right abutment, providing a path for percolation of water from the reservoir around the dam and downstream. To cut off this water, an impervious earth blanket, 2,000 ft. long and extending from bedrock to an elevation above pool level will be constructed. The blanket will vary in thickness, according to hydraulic pressure, from 30 to 10 ft., and will involve excavation of 110,000 cu. yd., random fill of 135,000 cu. yd., and placing of 460,000 cu. yd. in embankment. It will be built in 12-in. lifts compacted at 500 psi. each, by six passes with a sheepsfoot roller at 6% to 10% moisture.

Innovation for cofferdam

The cellular section of the first step cofferdam will contain 17 cells of 63-ft. diam., and 8 cells of 51-ft. diam., with varying heights from 45 to 62 ft. Due to the great bursting stresses involved, connecting arcs between cells will intersect the cells at an angle of 45 deg., rather than at the more conventional angles of about 90 deg. This will be accomplished by means of a special section of sheet pile at the joint, formed by welding at the fabricating plant. The design of this type cell construction was analyzed in the Transactions for 1945, American Society of Civil Engineers, Vol. 110-1083, #2253.

Interior berms within the cofferdam

will be provided for access only, being 15 ft. high and 15 ft. wide at the top, with a back slope of $2\frac{1}{2}:1$.

The coefficient of lateral pressure as used in cell design is 0.4, rather than 0.31 provided from the usual formula, where the angle of internal friction equals 32 deg. Since the fill in the cell builds up in cones of material from the bottom, the maximum bursting pressure will be located one-quarter the height up in the cell.

The maximum interlock tension occurs during filling, therefore any cell resisting the filling operation may be considered safe against subsequent interlock failure. The maximum interlock stress is 12.1 kips, with corresponding web tensions of 32.2 kips per sq. in. For these reasons, piles are being furnished by the government with ultimate

strengths of 72 kips per sq. in. and an elastic limit of 38 kips per sq. in. These piles have a working interlock strength of 16 kips per lin. in. in comparison to the average working stresses used which vary from 8 to 12 kips.

Under the Chief Joseph site conditions, stability against sliding is not as important an item to consider as resistance against overturning and internal shear. Because of shear and overturning stresses, the cells must have a 4-ft. free-board on the upstream arm.

Design of spillway gates

First consideration was given to a spillway design using 25 tainter gates, each 40 ft. long, with a crest designed for a maximum head of 49.7 ft. Subsequent studies showed that it was more economical to reduce the number of gates from 25 to 21, meanwhile increasing the maximum design head to 53.5 ft. Still another study was made further to reduce the number of spillway gates. This design showed that the saving resulting from construction of a 19-gate spillway instead of one with 21 gates would be substantial. This is due to lower first cost, smaller excavation quantity in the right abutment for the spillway, and also from the excavation saved by moving the entire powerhouse 50 ft. riverward on the left bank. For these reasons the design engineers proceeded with the 19-gate design.

The final designs call for 19 gates, 40 ft. wide by 38.5 ft. high, separated by pier 9 ft. wide and with an overflow section occupying the full width of the river channel and an additional 50 ft. along the right bank. During the early stages of generating equipment installation, the

Status of Major Contract Work at Chief Joseph Dam

Description	% Complete	Amount of Contract	Contractor
Okanogan River Bridge on access highway to Chief Joseph Dam near Brewster, Wash.	84	\$ 299,838	Willett & Sons, Wenatchee, Wash.
Columbia River Bridge on access highway to Chief Joseph Dam near Bridgeport, Wash.	35	946,620	Guy F. Atkinson Co., Seattle, Wash.
Access highway between Chief Joseph Dam site and Brewster, Wash., Schedule "A"	95	612,215	Strong & McDonald, Inc., Tacoma, Wash.
Access highway paving, Schedule "B"	75	179,092	D-H Paving Co., Vancouver, Wash.
Excavation of intake channel and relocation of state highway.....	60	2,265,325	General Construction Co., Seattle, Wash.
Utilities for housing and administration facilities, Schedules "E", "F", and "G"	100	125,698	West Coast Plumbing & Heating Co., Seattle, Wash.
Housing, administration and maintenance facilities, Schedules "A", "B", and "C"	82	614,035	Dally Construction & Engineering Co., Seattle, Wash.
Sewage treatment plant.....	60	37,712	Dally Construction & Engineering Co., Seattle, Wash.
Concrete aggregate investigation, Terrace No. 2.....	100	11,900	Puget Sound Bridge & Dredging Co., Seattle, Wash.
Foundation exploration, Area "C".....	55	17,260	A. A. Durand & Son, Walla Walla, Wash.
First stage construction including cofferdam and bank seal.....	17	2,572,544	Peter Kiewit Sons' Co., Longview, Wash.



C. H. WAGNER, left, is resident engineer for the Corps of Engineers at Chief Joseph Dam. E. W. Elliott is superintendent for General Construction Co., Seattle, on excavation of the powerhouse intake channel.

gates will be operated on a nearly continuous basis in order to bypass flows normally used for power generation. After 20 power units are installed, taking their required 130,000 cfs., the gates will be operated for 3 to 5 months per year only during flood conditions. At the maximum spillway design discharge of 1,250,000 cfs., there will be a 3-ft. freeboard to the top of the non-overflow section of the spillway.

Stilling basin design

The design of flip bucket or ordinary hydraulic jump basin as energy dissipators was ruled out because the tailwater depth is inadequate at the site, and because construction of this nature may involve future maintenance problems. The inadequate tailwater depth would

result in excessive wave and surging action, a disturbance that could possibly affect generator action.

The plain hydraulic jump basin would have the advantage of minimum maintenance, but for large discharges the wave disturbances below the basin would be much greater. In addition, excavation would have had to be carried to an extra depth of 10 ft. to accommodate the jump.

By the process of elimination a baffle pier type basin was selected. Hydraulic model tests were run of the prototype basin selected. In the first test, an equivalent to a 265-ft. long basin was used, with two rows of baffles; however, negative pressures in the cavitation range could not be avoided in the second row under conditions of spillway design discharge. It was then found that the second baffle row and end sill contributed little toward energy dissipation, therefore the whole basin was shortened, moving in the end sill and eliminating the second baffle row. Continuing the experiment, the end sill was moved up to within 50 and 60 ft. from the first row of baffle piers. This effectively reduced the negative pressures. A basin 165 ft. in length was adopted for final design.

The height of baffles used will be about equal to the upstream depth of the hydraulic jump. The baffles will hold the jump on the apron and dampen the downstream surges. A stepped rather than a sloped end sill will be used be-

THE COVER

ROCK DRILLING for excavation of the powerhouse intake channel at Chief Joseph Dam is being hurried with 15 wagon drills working on a 3-shift basis. General Construction Co. holds a \$2,265,000 contract for this portion of the project.

cause of its more stable jump characteristics and reduction in velocity on the streambed downstream.

Questions arose during design procedure concerning the stilling basin's exit velocity, possible rip-rap erosion, and if back eddy currents would carry loose stream bed material over the end sill into the basin. Tests revealed that no rip-rap erosion could be expected, and that the high velocity of flow off the end sill will repel loose rock that might be carried by reverse roller immediately downstream. Tests also revealed that the basin is self-cleaning at the velocities expected from a 400,000-cfs. flow.

Personnel

Lt. Col. John P. Buehler is District Engineer, Seattle District, Corps of Engineers. F. S. Brown is chief of the engineering division, and R. F. Bracelin is project engineer. C. H. Wagner is resident engineer.

Drilling 180 Relief Wells to Collect Earth Dam Seepage

RELIEF WELLS and toe drainage system designed to collect normal seepage at the Canton Dam near the town of Canton, Okla., is under way under the supervision of the Corps of Engineers office of Tulsa. Gravel and sand strata under the earthen dam have carried a volume of seepage which was anticipated in the design of the structure. It was considered desirable to place the project in operation and observe the conditions as they developed before any provisions were made for taking care of the seepage. In order to take care of this condition, a series of 180 wells is being drilled in a line nearly $1\frac{3}{4}$ mi. long. Most of the wells have been completed. A Failing 1500S Holmaster is being used for the project and the average to date has been two completed wells each day. The wells are drilled 50 ft. apart. Each well is $1\frac{1}{2}$ ft. in diam., and they are gravel packed around a 6-in. I.D. slotted wood stave pipe.

A seepage collection channel has been constructed parallel to the dam and this collects and removes the seepage water. The wells are located in the center of the channel at 50-ft. intervals. The wells are drilled to a depth of 30 ft.

Drilling methods

The wells flow freely from the hydrostatic pressure and while one well is being drilled and completed, timbers are put in place for the next location so there is no lost motion. Since the wells are drilled in the running water in the

channel, no drilling mud is used. When the 18-in. casing is run it is to be excavated down only about half-way to the bottom of the hole. A jet is placed in it, operated by a big air compressor, and pressure is applied by the hydraulic system on the drill which forces the casing down to the bottom of the hole. By taking advantage of the full weight of the rear end of the drill, the casing is easily forced down into the hole.

After the 18-in. casing has been seated on the bottom, the 6-in. I.D. wood stave pipe is put into position and through the use of a surveying instrument it is set at the exact depth required. It is then packed with gravel and as the gravel is put into the hole the casing is gradually raised until it is completely removed.

Completion of the project will insure the safety of the structure and will decrease maintenance during its operation.

DRILL SETUP over the dewatering canal back of the dam. Timbers are placed ahead of drilling operations so there is no lost motion. Spillway can be seen at far left.



The Up-to-date Way to Build Hard-Surfaced Tennis Courts

An excellent illustration of the latest design and construction techniques is provided by courts recently completed at San Diego, Calif.

IN AN EFFORT to keep abreast of the demand for more and better tennis courts, public officials are constantly on the lookout for the latest improved design and construction methods. They have come to realize in recent years that few recreational facilities require as little upkeep as do hard-surfaced tennis courts, with consequently lower maintenance costs.

The popularity of tennis is emphasized by the fact that tennis ranked third in a list of 46 park and recreation activities reported by some 800 cities in the 1940 report of the National Recreation Association, "Municipal and County Parks in the United States." In the same survey it was found that there were a greater number of tennis courts than any other recreational facility.

Two reinforced concrete tennis courts built and opened to play recently in the La Jolla section of San Diego, Calif., provide an excellent illustration of up-to-date methods for such construction. This article includes the following: (1) a general discussion of important factors in the design and construction of hard-surfaced tennis courts; (2) design of the courts at La Jolla; (3) special provisions in the specifications adopted for construction of the La Jolla courts, presented in summary form.

Generally speaking

One of the chief factors in reducing maintenance costs for tennis courts is the adoption of a uniform hard-surface type of construction such as asphalt,

By
HAROLD L. CURTISS

Assistant
Superintendent
of Public Parks,
City of San Diego,
Calif.



asphaltic patented compounds or concrete.

The number and location of tennis courts needed by any community is of course dependent on the size and character of the individual neighborhood. Generally speaking the national standard is one court per two thousand population. The arrangement and orientation of the courts on the park or playground or on the military reservation, as the case may be, is an important factor in their use by the players. In designing the layout plan, space should be allocated for walks outside the fences leading to the gates. If the courts are intended for championship play provision should be made for a space on the west or east side for either temporary portable bleachers

or permanent ones. This would require from 16 to 25 ft. of width and 16 to 50 ft. of length, depending on the size of the bleacher units.

A planting screen of evergreen material of, say, 15-ft. minimum width along the outside of the fences will enable the large expanse of concrete to "fit into the neighborhood" in a better manner than if the courts are left unscreened. No shade trees should be planted close enough to the fence to throw their shadows onto the courts, which must be kept free from interfering shadows.

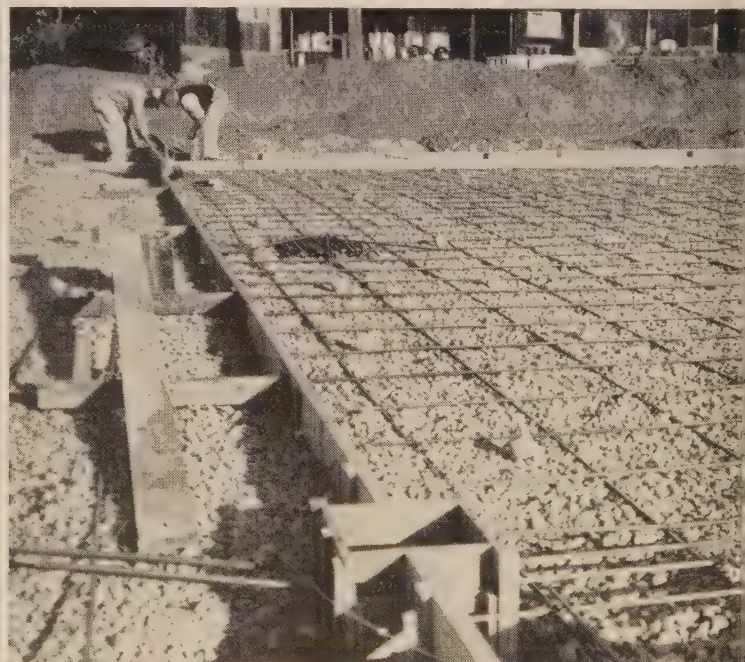
Important factors

In addition to orientation and size standards three other important factors in the design and construction of tennis courts are drainage, grading, and surfacing. Unless there is natural drainage, special provision must be made. Low, swampy places or areas where there is a tendency for adjacent ground to drain onto the court should be avoided. The question of sub-drainage should be given special attention. If the ground drains readily the amount of excavation will be greatly reduced. Along the Pacific Coast and in the Southwest the subsoil frequently contains adobe and it will often be necessary to excavate to some depth and backfill with imported borrow or with crushed rock in order to reduce the heaving and displacement characteristic of adobe soils when alternately wet and dried.

There are several ways of grading tennis courts but in all of them uniformity

LEFT—Following grading, header board between courts is placed, sleeve inserts set for fence posts and crushed rock dumped to 4-in. depth.

RIGHT—Ready for the concrete pour. Each slab is poured separately. Note steel dowels extending through header board to tie slabs together.



of graded surface is essential. For a court constructed alone some authorities recommend the gable roof type with the drainage from the long axis of the court running to both sides. For courts in batteries, which are preferably placed side by side, our experience has been that the best drainage is that of the end-to-end pitch with but one plane surface. One-foot slope in the 128-ft. length of the courts has proven entirely satisfactory, and has been in use for the past eighteen years for San Diego's tennis courts.

The La Jolla courts

When the La Jolla Tennis Club members decided that there was urgent need for an additional battery of two tennis courts at the La Jolla Community Center they went out and raised by popular subscription the sum of \$8,000 for this much needed public tennis court facility. This together with assistance from the City Council insured construction of the courts. The City then prepared the plans and specifications, bids were called for and the low bid of just under \$10,000 was accepted. This ten thousand-dollar project included a reinforced concrete retaining wall some 110 ft. long, concrete steps, two concrete walks along the outside of the courts and the necessary fencing.

Dimensions of the courts, 108 ft. by 128 ft., provide a greater length in the backcourt than the standard 120 ft. used in some parts of the country. This is because they are intended to be used by all classes of players, including those engaged in tournament and championship play.

The two La Jolla courts were placed side by side. The longest dimension runs north and south so that the morning or late afternoon sun is not in the eyes of the players.

Excerpts from the more important of the special provisions in the plans and specifications adopted in the construction of the La Jolla tennis courts are presented below in summary form.

Subgrade. Where grading is done on natural or cut ground the earth shall be scarified to a depth of 6 in. and then compacted. The entire area under the courts is to be covered with 4 in. of crusher-run rock or gravel of maximum size of $1\frac{1}{2}$ in. Rock sub-base shall be compacted to finish sub-grade with an 8-ton roller or equivalent. The finish sub-grade shall be thoroughly drenched with water about 12 hr. before any concrete is placed, in addition to sprinkling immediately before placing the concrete.

Reinforcing Steel in Slabs. All slabs shall be reinforced with $\frac{1}{2}$ -in. round bars 18 in. on center each way throughout. The steel shall be supported by means of pre-molded cylindrical concrete blocks of 6-in. diameter placed under the steel on the sub-grade. All reinforcing steel shall be bent and placed as indicated on the drawings and in accordance with sound engineering practice.

Concrete Work requires that all cement, sand and rock be accurately measured. Cement to be of a $1:2\frac{1}{2}:3\frac{1}{2}$ mix of aggregates and 6 gal. of water per sack of cement. The measured quantity of



TOP—Concrete delivered by transit-mix truck is delivered into a gasoline buggy which rides over plywood panels to dumping location. BOTTOM—Tamping and floating the last batch of concrete delivered from buggy before applying lampblack to surface.

water and no more shall be added to each batch, which shall be thoroughly mixed in a batch mixing machine. All concrete shall be deposited in its final position immediately after mixing. Transit-mixed concrete may be used. During and immediately after depositing, all concrete shall be thoroughly compacted by means of rods, spades or vibrators. Before any concrete is placed, reinforcing steel including dowels shall be permanently fixed in place and approved by the inspector and the forms thoroughly wet.

Cement Finish. Unless conditions make it impracticable, all concrete slabs shall be finished monolithic. The surface of the tennis court supporting concrete shall be struck to the proper level. It shall then be sufficiently tamped for monolithic finishing. After compacting to the proper grade as shown in the plans, it shall be further compacted with a wooden float and the surface tested with a straight edge and level to detect high and low spots and to check for proper drainage. Finish cement surface shall not deviate more than $\frac{1}{8}$ in. when tested with a 10-ft. straight edge held in any direction. High and low spots shall be eliminated, and the surface brought

to the proper single plane pitch. Floating shall be followed by a rotary motion steel trowel sweat finish with a dense uniform brush texture after the concrete has hardened sufficiently to prevent fine material from working to the surface and to create a smooth finish free from defects and blemishes. Three samples measuring 2 ft. by 2 ft. shall be submitted by the contractor for conclusion as to color and texture by the inspector. The sample meeting approval shall be retained for comparative purposes.

Color Treatment work includes the entire paved area under this contract, but not sidewalks and steps and walls. Valentine's or equal dry lampblack shall be incorporated in the surface by the mixing dry at the rate of one pound of lampblack per sack of cement with dry fine sand and spreading uniformly over the entire area to be troweled in during finishing work.

Curing. Exposed surfaces of concrete shall be covered to protect from injury and shall be kept continuously wet by sprinkling for a period of at least 14 days after being deposited. No surface curing compounds shall be used. All protective coverings shall then be removed and the cement finish shall be thoroughly washed



ERECTION of 12-ft. high wire fence. Fabric is #11 gauge, $1\frac{3}{4}$ mesh, stretched taut and hung with stretcher bands. Maximum post spacing is 10 ft. Provision is made for expansion in the top fence rail.

until clean, to the satisfaction of the inspector.

Tennis Court Fence and Gates. All sleeves for pipe post openings and all required cast-in units of other work shall be installed in the forms at the locations shown on the plans prior to placing of concrete. Precautions need to be taken to make sure that these fence post and net post sleeve inserts are absolutely

plumb and true, in order that the fence and net posts will be vertical and in a uniform line with the other posts.

Fences shall be 12 ft. in height and posts shall have a maximum spacing of 10 ft. Fabric shall be 12 ft. high #11 gauge $1\frac{3}{4}$ mesh, hot-dipped galvanized after fabrication with top and bottom selvages knuckled. Wire shall be Armco ingot iron wire or approved equal. Fabric shall meet with the ASTM specifications for this type of fencing and shall be stretched taut and hung with stretcher bands. Posts and rails shall be connected with appropriate malleable galvanizing iron fittings (welding will not be acceptable). Wire shall be fitted with necessary clips and stretcher bars. Provision shall be made for expansion in top fence rail.

The size or diameter of fence and net posts and gate frames shall be as follows: line posts shall be 2-in. I.D. standard G.I. pipe; corner posts $2\frac{1}{2}$ -in. I.D. Top rail $1\frac{1}{4}$ -in.; bottom shall be secured on #9 gauge G.I. tension wire; bracing shall be $1\frac{1}{4}$ -in. pipe extending from corner post to adjacent line post with return truss to base of corner post. Gates (3 ft., 6 in., by 7 ft.) shall be $1\frac{1}{4}$ -in. I.D. standard G.I. pipe cross-braced with heavy truss rods with closing device with hasp for padlock. Gate posts shall be $2\frac{1}{2}$ -in. I.D. standard G.I. pipe. Gates shall open through 180 deg.

The newly completed courts of the La Jolla Community Center completely satisfy the tennis playing public of San Diego and the members of the La Jolla Tennis Club. Unlike the clay and dirt courts of older days this new recreational facility has proven to be low in maintenance cost. Yet they carry an equally fundamental lesson, a lesson that good construction and low upkeep cost can only spring from careful design and good workmanship.

Special Oils Keep Power Equipment "In Mothballs" During Idle Spells

CONTRACTORS, municipalities and highway departments can put their power equipment engines "in mothballs" during idle spells by methods developed for protection of military vehicles in storage. N. T. Brenner, chief fuels and lubricants engineer, tractor section, Gulf Oil Corporation, advises.

Trucks, bulldozers, snowplows, fire engines, ambulances and other gasoline- or diesel-driven vehicles in intermittent use will benefit from these fully proven lay-up procedures, Brenner asserts. Life is lengthened, operation improved, and cleanliness of internal parts guarded. The necessity of overhaul caused by temporary lay-up is eliminated.

This protective lay-away is made possible by special oils created for military use in the past 10 years but now commercially available. Application is simple and requires no special equipment.

Here are directions outlined for best results with gasoline and diesel engines:

Gasoline engines: drain crankcase when warm, fill to normal operating

level with the protective oil, run engine 20 to 30 minutes at $\frac{1}{3}$ to $\frac{1}{2}$ normal operating speed. To protect cylinder walls, piston rings and valves, shut off the ignition, spray two ounces of the oil into each cylinder through the spark plug hole while rotating engine by hand or by the starter (at least five complete revolutions of the crankshaft). Apply oil to metal parts of spark plugs including points and threads.

Diesel engines: follow same procedure for crankcase as with gasoline engines. Remove fuel injectors where possible, and spray at least two ounces of no-rust oil into each cylinder to protect piston heads and valves. Rotate engine as recommended for gasoline engine. Apply oil to threads and bodies of injectors.

Fuel system of all engines: remove as much fuel as possible from the tank and run the engine without load until it stops for lack of fuel. No fuel should be left in the fuel system during storage.

Spray inside of tank and filler cap threads with protective oil. In addition, thoroughly lubricate engine accessories.

Completely drain cooling system.

The special no-rust oils meet U. S. Army requirements which include: ability to protect against high humidity and moisture condensation, to neutralize acidic products of combustion, and to be a satisfactory lubricant for spark ignition and diesel internal combustion engines. In addition these oils must have no harmful effect on metals used in engine construction.

Since the no-rust oils are formulated to serve for a considerable time in the place of regular lubricants, the engine may be run on the no-rust oil without drainage when it is taken out of storage, until convenient to change.

Protective oils should also be applied to exposed engine metal, such as water pump shafts or places where paint has cracked off, to provide an anti-rust coating.

The oil serves as an excellent general engine oil and as a protective lubricant for all tools and equipment subject to rust. Surfaces should be dried and the oil applied after use.

Bureau Plans Power Plant At Alcova Dam in Wyoming

A BUREAU OF RECLAMATION plan to install a hydroelectric power plant with 33,000 kw. rated capacity at Alcova Dam on the Kendrick Project near Casper, Wyo., has been authorized on a finding of feasibility, Secretary of the Interior Oscar L. Chapman has advised the Congress. The plant would provide 92,000,000 kilowatt-hours of electric energy annually for irrigation pumping, rural electrification, municipalities, and industries in Wyoming, Colorado, and Nebraska.

The Alcova plant and its appurtenances, including two generating units of 16,500 kw. each, is estimated to cost \$6,377,000. Revenue to the Government from the sale of power generated at the proposed plant, totalling \$380,100 annually, would be sufficient to pay operation, maintenance, and replacement charges, and to retire the estimated construction costs in 50 years at 3% interest.

Submission of the formal report on the project for the information of the Congress was accompanied by a letter from the Bureau of the Budget, stating that the proposal was in conformity with the President's fiscal program.

The Alcova power plant would require a three-year construction period. The initial operation of the Alcova plant would find a market within the North Platte River district area, which extends into the northeastern section of Colorado, where considerable present and potential irrigation pumping loads exist. Although the agricultural economy is predominant, the oil industry with its associated pumping and refining loads is becoming increasingly important.

At the present time water released from Seminole Dam on the Kendrick Project is used to generate hydroelectric power at that point but so far releases through a gross head of 165 ft. at the Alcova Dam have not been utilized.



Freeway Job Near Riverside, Calif., Features— Mixing Cement-Treated Base in Place

Windrows of borrow material formed accurately by spreader box on rear of dump truck—Aggregate, cement and water mixed by machines in one pass over windrow, each machine averaging 5,300 lin. ft. per day

MIXING-IN-PLACE of cement-treated base at a fast rate featured the recent construction of a freeway near Riverside, Calif. Purpose of the project was to incorporate La Cadena Drive, a two-lane road, into a full freeway on U. S. Highway 395. Beginning of the project was on Russell St. in Riverside and it extended 2.6 mi. north-erly joining an existing four-lane divided highway.

The work consisted in general of constructing a full freeway, 230 ft. wide, utilizing existing La Cadena Drive for Outer Highway Left, and constructing the freeway lanes and Outer Highway Right on new alignment and grade.

This portion of Highway 395 traverses a gently rolling country, the major area of which is used for citrus culture. The soil is of a clayey type, has a low bearing value and was difficult to compact. Specified compaction was obtained only by spreading soil in 4-in. layers with optimum moisture and complete rolling with sheepsfoot rollers and rubber-tired rollers.

Subgrade material of 100% California Bearing Ratio was obtained from a nearby granite ridge and cement treatment of this for a subgrade together with an imported subbase of the same material resulted in an economical section. Cement treatment of subgrade material for Outer Highway Right was not required, 2 in. of bituminous surfacing over 12 in. of imported borrow being sufficient.

To obtain the imported borrow mate-

By **BERNDT NELSON**
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rial it was necessary for the contractor to develop a new pit and build a 0.6-mi. long haul road. Prior to removal from the pit, the material (decomposed granite) was scarified with heavy-duty rooters and any unbroken material was further pulverized by passing a tractor over it. The material was then conveyed to a centrally-located bunker at the pit from which point it was hauled by dump truck to point of use, spread with a dozer and compacted with sheepsfoot rollers pulled with a tractor and with a pneumatic roller pulled with a truck. Water was applied to the material by sprinkling with water-tank trucks. Grade was prepared for bottom of cement-treated base for the freeway lanes and for bottom of bituminous surfacing for the Outer Highway on which were placed sized windrows of imported borrow material for further treatment.

Results of 43 compaction tests taken after placing and compacting of im-

ported borrow showed an average relative compaction of 96.5%.

Following is the average grading analysis of the imported borrow:

	% Passing
3/8-in. Sieve.....	100
No. 4 ".....	96
No. 8 ".....	78
No. 16 ".....	56
No. 30 ".....	37
No. 50 ".....	23
No. 200 ".....	9

The material was non-plastic.

Although this article primarily deals with cement treatment of base material used in the main roadways it was thought desirable to mention the Outer Highway Right due to the similarity of the construction methods used.

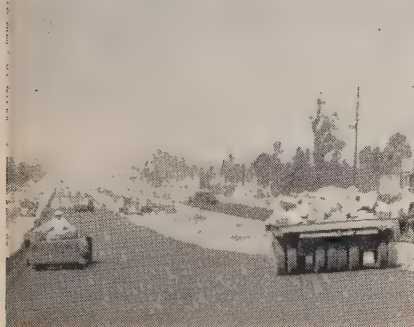
Preparing the windrows

After the grade for the bottom of cement-treated base for the freeway lanes was prepared for the specified width of 26 ft. for each lane, the required amount of import material for cement treatment was placed on the grade in two windrows of equal size. The windrows were formed by means of a spreader box readily attached to and operating behind the material trucks. The material was handled on a unit weight basis to insure that sufficient material would be placed in the two windrows, which after mixing, spreading and compaction would equal the required thickness.

Tests of the material in place in the subbase indicated the weight per cubic foot to be expected of the cement-treated base. The weight per lineal foot in the windrows was checked when thought necessary by the simple method of blocking off one foot of the windrow with steel plates firmly held one foot apart and weighing the enclosed material, due allowance being made for mois-

PICTURED ABOVE—

TWO WINDROWS were mixed simultaneously by two Wood Roadmixers making a single pass. Tank trucks operating alongside metered water in correct amount to mixers.



TOP—Spreader box with strike-off plate was accurate, economical way to form windrow.

CENTER—Gardner distributors with special metering device spread cement on windrows.

BOTTOM—Compacting cement-treated base with pneumatic-tired rollers pulled by tractors.

ture in the material. After the original setting of the strike-off plate in the spreader box, only slight adjustments were necessary. This proved to be an accurate and economical method of preparing the windrows.

Immediately prior to start of mixing operations, bulk cement was spread in a trench in the top of windrows by Gardner Cement Distributor trucks equipped with a cement metering device.

The specifications required that with the mineral aggregate mixed with cement in the amount between 4% and 7% by weight of the dry aggregate and compacted with optimum moisture content, the compressive strength of a sample of the compacted mixture should not be less than 650 psi.

The exact amount of cement to be used was determined by casting cylinders of the material containing various percentages of cement and noting the results of the seven day compressive strength tests. The material varied slightly, and cement in the amount between 4% and 5% by weight of the dry aggregate was used.

To check the operation of the cement metering device, short runs were made on building paper and the cement was picked up and weighed. After a few adjustments good results were obtained.

The wide dual tires of the trucks altered the shape of the windrows by flattening the sides, and a motor grader bladed the displaced material into the windrow before mixing started.

Mixing in place

Mixing was accomplished with two Wood Roadmixer units, one to each windrow. Each unit consisted of a Caterpillar D-8 tractor and Wood mixer with a water truck operating alongside. The units worked reasonably close together in order that the spreading and compacting of the material might start immediately after mixing.

One pass with the Wood mixer was sufficient to mix the aggregate, cement and water. Wide wings at the front of the mixer assisted in picking up all the material from the grade and the entire windrow was thoroughly mixed by means of the revolving paddles within the mixer. The average daily run was 5,300 lin. ft. (see box).

The control of water was excellent and was applied by pumping through a meter on the mixer during the mixing operation. Water was added until the moisture content was 8% of the dry weight of material.

Immediately after mixing, about half the material was spread on the subgrade by means of two motor graders and compacted with two pneumatic-tired rollers propelled by Fordson tractors, also rubber-tired. The remainder of the material was left in windrows on each side until the preliminary rolling was completed. This first rolling with pneumatic-tired equipment was accomplished in the least possible time in order to conserve moisture in the material and to avoid a condition of lamination. The remainder of the material was then spread to a uniform grade and surface contour free from irregularities both transverse and longitudinal.

Compaction was then obtained with two pneumatic-tired rollers with an operating weight of 1,400 lb. for each tire and a three-wheeled, 12-ton roller.

Immediately after rolling with the three-wheeled roller the surface was

Rate of Mixing the Cement-Treated Base

THE AVERAGE rate of progress for each of the two Wood roadmixing machines on the La Cadena freeway project was 5,300 lin. ft. per day, as stated in the article. This was equivalent to about 1,900 tons of mix per machine. Average time of mixing per day was about 6 hours, allowing lay-down crews to complete finishing of the roadway behind the mixers without excessive overtime work. Therefore, average daily production for each machine exceeded 300 tons per hour.—Editor



BERNDT NELSON, left, is district construction engineer at San Bernardino for the California Division of Highways. With him is W. H. Crawford, resident engineer on the project.

trimmed with a motor grader and the material cut away was bladed onto the shoulders. Very little trimming was necessary. However, it was done by a highly skilled operator and the quality of the subgrade was thereby materially improved.

To complete the surface compaction a pneumatic-tired roller was used immediately after trimming.

A water truck was on hand at all times to apply a light spray of water to the surface of the material if it appeared necessary during spreading and compacting operations. The surface of the finished cement-treated base was kept moist until the bituminous curing seal was applied.

As soon as possible after the spreading and compacting operations were completed the surface of the cement-treated base was covered with an asphaltic emulsion curing seal applied by means of a 550-gal. distributor truck. Application was at the rate of 0.15 gal. per sq. yd.

Surfacing

Plant-mixed surfacing operations were well under way before the results of the seven day compressive strength samples of the cement-treated base were received. These samples of the mixed material taken from the windrow behind the Wood mixer were cast daily in cylindrical form at the field laboratory. A small hydraulic press was used to compact the material in the test cylinders to a density comparable to that obtained of the material on the street. After fabrication the samples were placed in airtight tins and shipped to the Division of Highways laboratory at Sacramento for breaking.

Results of eleven seven-day breaks showed an average compressive strength of 661 psi. The desired results indicated the engineer had selected the proper percentages of cement and water to use and that the contractor had turned out a uniform mix.

This work was performed under authority of a State of California, Division of Highways contract awarded to J. A. Payton of Riverside, Calif. The road mixing of the cement-treated base including mixing, spreading and compacting, was subcontracted to Clyde W. Wood, North Hollywood, Calif.

W. H. Crawford, resident engineer, ably represented the State of California on this project working under the direction of E. Q. Sullivan, district engineer, District VIII of the California Division of Highways.

Two Innovations for Excavation Volume and Payments in Specs

SPECIFICATIONS for excavation volume and payments for Detroit Dam and Lookout Point Dam contain features which are of interest and significance to contractors as well as engineers. These two projects are being carried out in Oregon by the U. S. Corps of Engineers under the direction of the Portland, Ore., District. (*Western Construction*—September 1950, pg. 74, and October 1950, pg. 65.)

"Risk" and "guarantee"

These specifications represent another chapter in the gradual evolution of engineers' requirements in providing working conditions and rules for contractors for the ultimate purpose of reducing construction costs. Two key words in the approach to this problem are "risk" and "guarantee." Both of these two words and their implications are of serious concern to the contractors and engineers. Following a short background statement, the sections of the specifications are quoted directly.

For the engineer, any reduction in the element of contractor's risk will generally result in lower bids, as contractors can establish a firmer basis for estimating costs. On the other hand, as risk is reduced the specifications may come closer and closer to implying a guarantee of payment which is far beyond legal permission on public works. The result might require payment by the public agency for work which was not actually done.

The process of providing data for bidding, including information on site exploration, can go only so far with mutual advantage without approaching fixed figures. Thus the element of risk remains inherent in any set of specifications.

Significance to contractors

For the contractor, the factor of risk must be considered common to all private enterprise, although generally expected to be in greater magnitude in many types of business. The lower the risk, the more the contractor becomes a businessman able to fix firm values on the cost of his operations. The development of "unit bid prices" as compared to lump sum bids many years ago was a major step in this direction. Complete elimination of risk would result in changing the function of bidding into a fierce competition since it would reduce the features of daring, initiative and ingenuity. Lastly, contractors are aware that the word "guarantee" can never become part of any public works contract.

On the specific item of excavation, the item of risk revolves around the estimated quantity and how close the actual yardage will tally with the engineer's estimate. Disregarding any unbalance in the bid, in the interest of increasing payments during early stages of the project, the cost of carrying out the excavation work is a study in costs. Investments

IN THE LONG HISTORY of specifications for construction projects, sections relating to excavation quantities and payments at Detroit Dam and Lookout Point Dam provide interesting additions to the record. The pertinent sections are quoted. Background comment is presented to point out some of the problems involved in writing specifications for this type of construction operation, without in any way attempting to interpret the position or intentions of the Corps of Engineers—Editor.

must be made in plant, access features, overhead, etc., and these must be allocated to the excavation bid item. In turn, these allocated costs must be reflected in the "price per yard." Then, if developments at the site result in a substantial reduction in yardage, the allocated charge and resulting cost accounting has been seriously upset. Risk of this eventuality must be considered by responsible contractors. Hence, a fixed minimum of yardage would permit allocation of these general costs to such volume and allow any additional excavation to be added to the bid for the cost of only labor and materials.

However, from the engineer's point of view, this possibility of variation in excavation volume has been taken into consideration in the requirement of asking the contractor for the unit price in carrying out a predicted volume of work. Anything further would tend to be edging toward the word "guarantee."

Detroit Dam specs

With this brief review of a few of the many angles involved, a paragraph from the Detroit Dam specifications is quoted in the following:

"MEASUREMENT AND PAYMENT. a. Excavation.—(1) Payment will be made at the contract price per cubic yard for Item No. 3, entitled, 'Excavation, common,' Item No. 3A, entitled, 'Excavation, common, in excess of 400,000 cubic yards,' Item No. 4, entitled, 'Excavation, solid rock,' and Item No. 4A, entitled, 'Excavation, solid rock, in excess of 300,000 cubic yards,' which price and payment shall be in full compensation for furnishing all labor, equipment, materials and supplies, and performing all work necessary to complete the excavation, including the removal and disposal of stumps, roots, snags and other objectionable wood materials, as hereinbefore specified, and the construction of embankments, spoil banks, backfills or otherwise disposing of the excavated materials, as directed, all in accordance with the drawings and specifications. Excavation necessary to construct the access road downstream from the damsite will be measured and paid for separately at the contract price for Item No. 4.3, 'Excavation for access

road, common,' and Item No. 4.4, 'Excavation for access road, solid rock.' Line drilling, where required, will be measured and paid for separately under Item No. 4.9, 'Line drilling.' The quantity to be paid for will be the number of square feet of properly controlled vertical face resulting from such line drilling." (Section TP-3, paragraph 3-14.)

Contract for Detroit Dam was awarded to Consolidated Builders, Inc., and work started at the site in March 1949. Complete unit bids, including figures bid under the above specification, appeared in *Western Construction*, April 1949, pg. 144. This project is a mass concrete gravity structure and the construction plant was reviewed in the issue of October 1950. The site is a steep canyon involving important costs in access and construction plant.

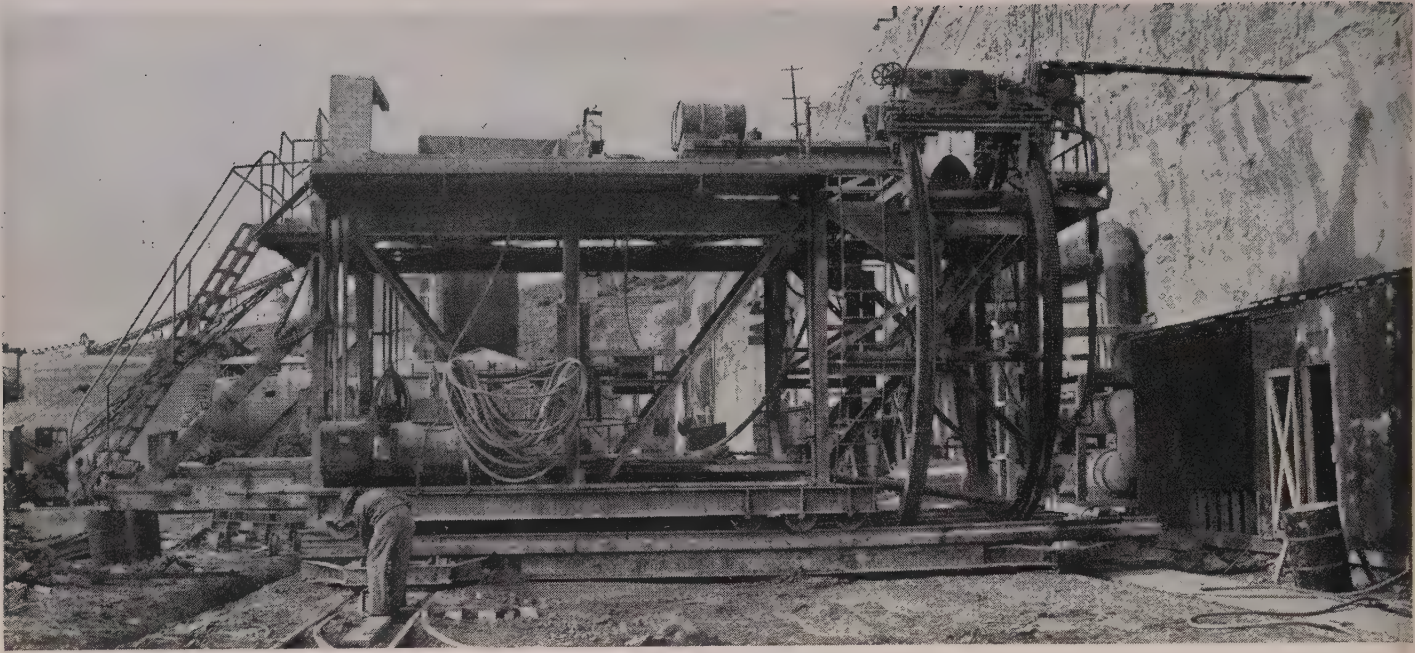
Lookout Point Dam specs

Lookout Point Dam is a rolled earth-fill structure located on the middle fork of the Willamette River, near Eugene. Contract was awarded in May 1950, and complete unit bids were published in the issue of June 1950, pg. 134.

The corresponding section of the specifications relating to the estimated quantities and repayment for excavation is as follows:

"ESTIMATED QUANTITIES.—

The quantities listed below are estimates only. Within the limit of available funds the Contractor will be required to complete the work specified herein in accordance with the contract and at the contract price or prices whether it involved quantities greater or less than the following estimates, provided, that should the actual quantity of work performed under Item No. 5, 'Common excavation for embankment foundation,' or Item No. 18, 'Solid rock excavation for spillway structure,' vary from the estimated quantity for the item by more than 25 per cent, an adjustment in the unit price for the item be made on the following basis. Where the actual quantities of work for Item No. 5 or Item No. 18 exceed by more than 25 per cent the estimated quantities stated in this contract for such item either party to this contract may make a demand for negotiation for a new unit price for the actual quantity of work that is in excess of the estimated quantity plus 25 per cent thereof. If the actual final quantity of work for Item No. 5 or Item No. 18 is less than the estimated quantity stated in the contract by more than 25 per cent the Contractor will be paid at the contract unit price for that item for the actual quantities of work performed and, in addition, may request compensation in an amount sufficient to provide a reasonable allowance for the loss of indirect costs on the quantity of work represented by the difference between the actual quantity and the estimated quantity of work less 25 per cent thereof. In the event of a dispute as to the amount of any adjustment under this paragraph the matter shall be treated as a question of fact to be determined in accordance with the 'Disputes' article of this contract." (Paragraph SC-3 of Special Conditions.)



Slabbing Saw Speeds Drilling

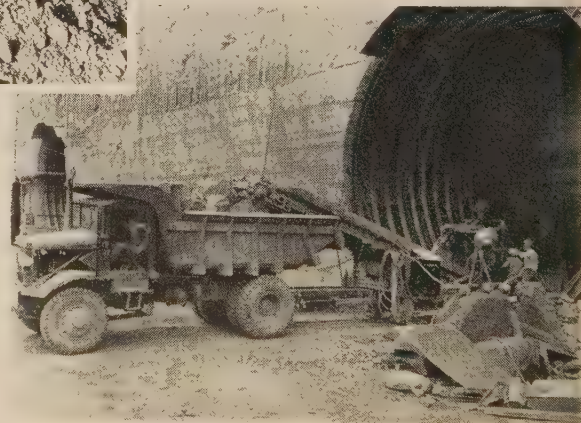


1. FIRST CUT at the portal, above, after completion to 8-ft. depth. Main power on the saw is a 75-hp. electric motor. Auxiliary power moves the saw slowly around the bull gear ring. Two methods were used to make vertical cut on the face—above the saw, the cut was made by closely-spaced drill holes; below this, a conventional slab saw completed the cut (note tooth marks).



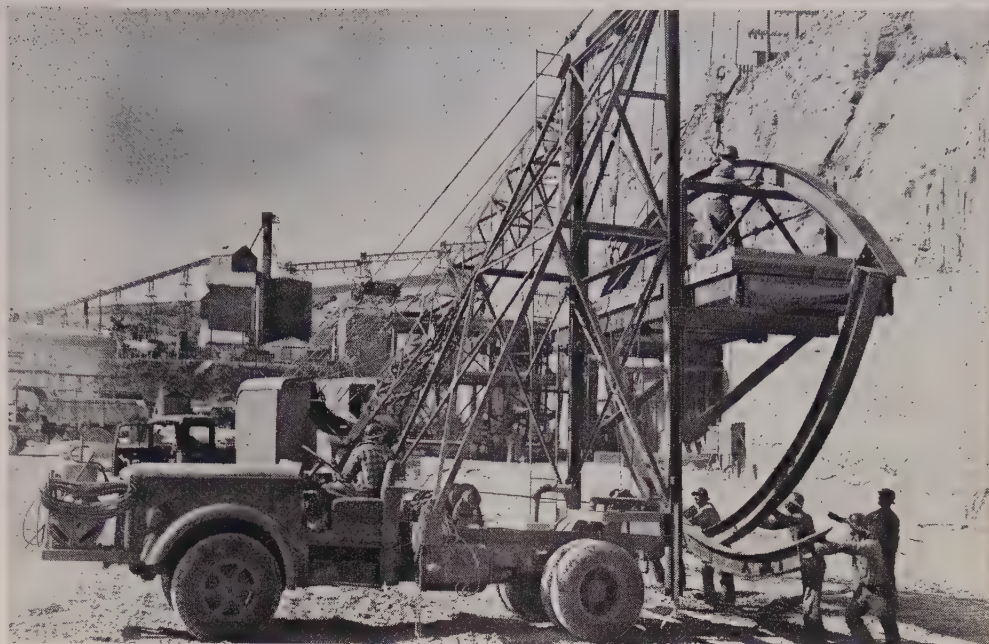
2. THE CHALK ROCK is quite readily broken, center, as indicated by the condition of the muck pile immediately after blast. Quantity of powder required to produce the clean break shown varied between 0.6 and 0.75 lb. per cu. yd. of rock. About 17 cu. yd. was blasted in a typical round. Blast holes were spaced at 4-ft. centers to 8-ft. depth.

3. AFTER HEADING BLAST, electric-driven mucking machines loaded 10-cu. yd. trucks, right. The diesel-powered trucks were connected to the mucking machine with drawbars adjustable in length to completely fill the trucks. The drawbars were also designed so that the truck power was utilized to push mucker into muck pile.



SPECIALY DESIGNED equipment has paid big dividends to the Silas Mason Company on its \$8,585,000 contract for construction of outlet works tunnels for the Fort Randall reservoir project near Yankton, South Dakota. Specifications required that the entire periphery of twelve circular tunnels, each 873 ft. long through fine-grained Niobrara chalk, be line-drilled or sawed before any blasting was done. The first two tunnels were line-drilled, but it was found difficult to keep 10-ft. deep holes parallel around the periphery. So the firm developed a slabbing saw mounted on a special jumbo which permitted cutting to nearly the exact circumference of the 33-ft. diameter tunnels. The saw is mounted on the front of the jumbo and geared to a large diameter ring gear. It cuts a 6½-in. kerf to an average depth of 8½ ft. The jumbo is moved forward and backward to adjust the depth of cut by means of cables and air motors and the jumbo is moved from tunnel to tunnel along the downstream portal bench on a special track dolly (picture at top of page). A drilling platform on the jumbo does not conflict with operation of the saw.

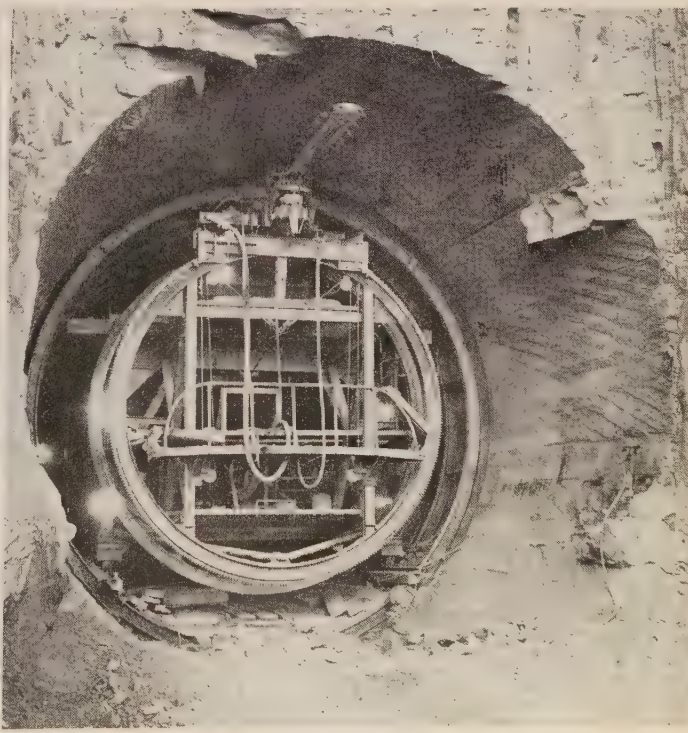
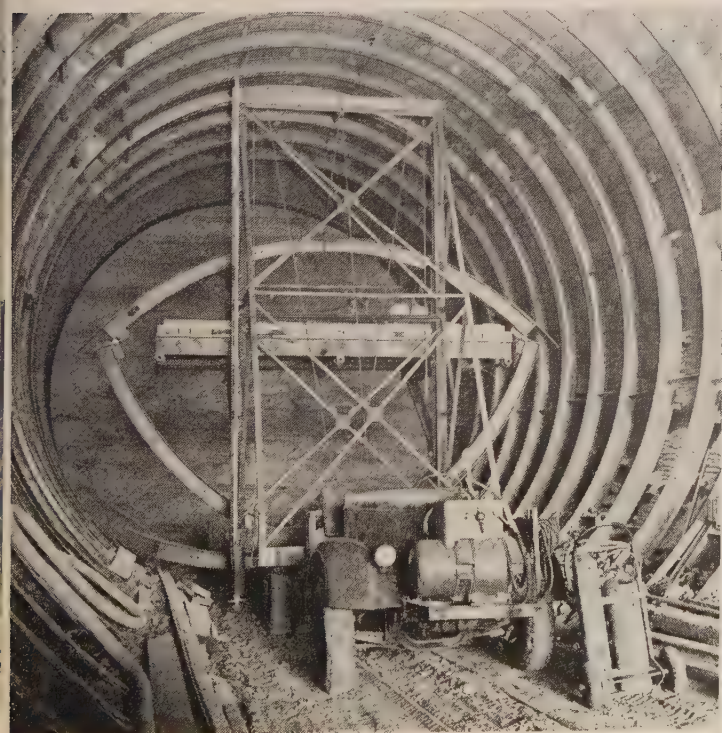
4. ANOTHER special piece of equipment was devised to install supporting ring beams. At first, the beams were placed almost entirely by hand, one quadrant at a time. With the truck-mounted rigging and elevating platform shown at left, two invert quadrants could be carried and set in one operation. Three upper quadrants of a ring are then moved into place and set in one operation. The two side quadrants are temporarily fastened to the upper section by specially-designed hinge brackets. They permit folding the side sections into the closed position as shown. This permits ample clearance for the loaded rig to back into the tunnel.



of Circular Tunnels in Chalk

5. UPON REACHING the placing position, the erection jumbo tower and elevating platform are steadied by the use of outriggers, as seen near the rear wheel. The elevating platform carrying the steel ring beam is raised with a power winch driven from the truck motor. As the top quadrant is raised into position, the side quadrants are pushed outward and their lower ends are then seated on the ends of the invert section. Butt joints are then bolted. Rings are then wedge-locked against the chalk around the circumference on 4-ft. centers to transfer the loading around the chalk rock and the ring beams. Later, quadrant joints are joined with lap-type splice plates.

6. HOLING THROUGH at the upstream end of one of the tunnels after boring 873 ft. through the chalk rock. The last cut is made holding the saw just slightly short of the portal face at close intervals, together with three or four support blocks placed around the periphery. The blocks are formed by withdrawing the saw from the heading and skipping about 2 ft. of the circle before sumping the saw into the rock again. By this method, sufficient support is provided to the rock core to enable the dynamite to break up the rock without scattering the pieces into the construction area upstream. Best progress was 311 ft. of advance at 3 headings in an 18-shift week.



Subsurface Water Complicates Freeway Project Along Coast

EXTENDING southward from Harbor Boulevard in San Diego is the new Montgomery Freeway, which will be approximately 11 mi. in length when completed and will accelerate the movement of traffic in the South Bay area. Construction of the freeway was started on November 4, 1949, with the award of a contract to the Charles MacClosky Co., R. E. Hazard Contracting Co., and C. G. Willis & Sons, as joint-venturers, for the construction of 3 mi. of freeway, including structures, between 14th Street in National City and "H" Street in Chula Vista. A contract to improve the section between 14th Street and 7th Street in National City was awarded to the R. E. Hazard Contracting Co., and is now nearing completion. A third contract for the construction of undercrossings at "H" Street in Chula Vista and Main Street near Palm City has been awarded to the Charles MacClosky Co., and is now under construction.

In general, the centerline of the new four-lane freeway is located approximately 125 ft. west of the existing Bay Boulevard. However, in order to utilize existing bridges at the north and south Sweetwater River channels, the north-bound traffic lanes are being constructed over a portion of the Bay Boulevard.

Unsuitable material excavated

In construction of the south-bound roadway for a distance of approximately one mile across Sweetwater Slough, it was necessary to remove unsuitable material underwater to a depth of approximately 8 ft., and to backfill the areas excavated with a coarse sandy material selected from the roadway cut south of the slough. The removal of the unsuitable material and the backfilling operation were carried on simultaneously. Result was that test holes dug in the completed fill showed a well-compacted fill completely free of pockets of wet or unsuitable material.

NEW BRIDGE across South Sweetwater channel carries south-bound lanes of the freeway. Earth dikes controlled high tide and doubled as access roads during its construction.



Cofferdams to control groundwater and earthfill dikes to keep out tides necessary during construction of the new Montgomery Freeway at San Diego, Calif.

Two 1½-cu. yd. draglines and six 14-cu. yd. Tournapulls are being utilized by the C. G. Willis firm to excavate the 400,000 cu. yd. required to complete the grading for the twin roadway sections, each 30 ft. wide, plus outer highways, ramps and access roads.

To stabilize the selected base course material by cement treatment the R. E. Hazard Contracting Co. constructed a special plant on the job which has a capacity of 2,500 tons of stabilized material per day. Bituminous plant-mix for the pavement is hauled from the Hazard Company's Mission Valley plant.

A major portion of the freeway project is the construction of bridges and grade separations. Two double highway undercrossings, three overcrossings, three railroad underpasses and four river bridges are under construction.

Access to the industrial areas located west of the freeway in National City is provided for by the construction of undercrossings at 18th and 24th Streets. The separations are identical, each being a double bridge approximately 30 ft. wide and 103 ft. long. Identical railroad underpasses are under construction at 18th and 24th Streets which provide for the separation of the mainline San Diego and Arizona Eastern railroad tracks. These underpasses are structural steel, plate girder bridges supported on reinforced concrete abutments. When completed a subway section will carry the vehicular and pedestrian traffic through the underpasses and undercrossings at a grade below sea level. An elaborate system of membrane waterproofing, corrugated metal drains, and permanent pump installations will keep the subway sections dry at all times.

Between 24th Street, National City, and "D" Street, Chula Vista, the freeway crosses the Sweetwater Slough and the North and South channels of the Sweetwater River. The south-bound roadway crosses the North Sweetwater channel on a new deck slab bridge, 170 ft. long, supported on Raymond concrete pile bents. The north-bound roadway utilizes an existing concrete pile bent bridge which is extended under this contract to approximately the same length as the new structure. At the South Sweetwater channel a new bridge is provided to carry the south-bound roadway, whereas the north-bound roadway will again utilize an existing bridge built in 1945. The existing bridge will be lengthened approximately 230 ft. by constructing ten additional reinforced concrete deck spans supported on concrete pile bents. The new bridge carrying the south-bound traffic is 333 ft. long, fifteen spans, reinforced concrete slab, supported on concrete pile bents.

At "E" Street in Chula Vista a two-span reinforced concrete overcrossing, approximately 105 ft. long by 34 ft. wide, supported on concrete abutments and a center pier, carries the traffic from Chula Vista to the west side of the freeway.

At "F" Street in Chula Vista a structural steel plate girder bridge of two spans, approximately 102 ft. long with concrete abutments and piers, carries a branch line of the San Diego and Arizona Eastern railroad over the freeway.

At "H" Street in Chula Vista a two-span reinforced concrete slab overcrossing 105 ft. long by 34 ft. wide, supported on concrete piers and abutments, is being constructed. This bridge will carry traffic from Chula Vista over the freeway to the South Bay industrial area. A permanent pumping station is also being constructed in connection with this bridge.

At Main Street near Palm City a four-span reinforced concrete bridge 178 ft. long and 34 ft. wide is being constructed to carry the traffic from Otay over the freeway to the agricultural area west of the freeway.

Construction sequence

The construction of the 18th Street and 24th Street undercrossings and underpasses connected by means of a walled subway section presented the most difficult construction problem. These composite structures at each location were founded approximately 10 ft. below sea level in a coarse sand strata which provided no barrier to the existing high groundwater. A general plan for the construction at each location was set up as follows:

1. Construct railroad shoofly—removed necessary main line tracks.
2. Complete the underwater substructure of the undercrossing and underpasses.
3. Complete the superstructure of each undercrossing and underpass.
4. Backfill, pave and route traffic over the west undercrossing.
5. Close the existing Bay Boulevard to traffic and excavate the subway section, ramps and pump house.
6. Cofferdam and dewater to con-

struct the subway section connecting the underpass and undercrossing structure; construct pump house.

The specifications for these bridges required that all concrete be poured in the dry and that the bottom and exterior walls be completely coated with a double membrane waterproofing. Sixteen construction operations were performed in the dry including pouring all pile caps; bottom grading; pouring pier footings and membrane base slabs; waterproofing bottom; pouring weight slab, piers, and subway walls; waterproofing piers and walls; backfill piers and walls; placing drainage system; pouring concrete subway pavement and sidewalk.

Special dewatering system

To accomplish this a special dewatering system was devised to give complete control of groundwater within a large working area over a long period of time. Each composite undercrossing, underpass and subway was divided into three cofferdams. The average size of the cofferdams was 150 ft. by 50 ft. Three-inch T&G wood sheeting from 12 to 20 ft. long was driven and jetted into place forming the perimeter of the cofferdam. No. 2 McKiernan-Terry sheeting drivers were used and a 4-in. Gorman-Rupp centrifugal pressure pump furnished water for jetting.

A Northwest Model 6 dragline was used to excavate the interior of the cofferdam to grade, and pumping started with 4- and 6-in. Gorman-Rupp centrifugal pumps. Perforated metal casings were sunk to an elevation lower than the bottom of the footings and subway base, and 350-gal. per min. Pacific Electric turbine-type deep-well pumps were installed. Usually a battery of three of these pumps could control the water once it had been drawn down. The pumps were rigged up on a semi-permanent basis with direct hookup from existing power facilities. The discharge was piped to a storm drainage system previously constructed.

Continuous pumping

Each section of cofferdam as described above required about three months from the initial dewatering stage to the completed subway section. During this time pumping was continuous, twenty-four hours per day. Due to the fact that the section of the subway cutting through the existing Bay Boulevard is at a lower elevation than the adjacent sections, and that this low section is constructed last in order to allow for an uninterrupted flow of highway and rail traffic, it was necessary to leave in place a portion of each outer cofferdam to act as a cutoff wall which prevented movement of the coarse sand foundation from under the foundations and slabs already constructed in the outer sections at the time that the last section was dewatered and excavated. Dewatering operations were simplified by maintaining the electric pumps in one cofferdam in complete operation, until the adjoining cofferdam was dewatered.

The level of the existing groundwater varied considerably in the length of the job and brought about special problems.



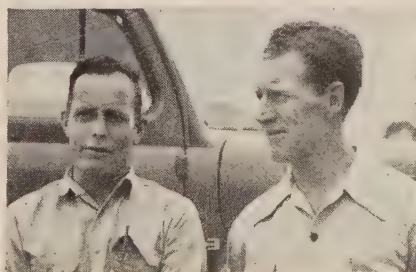
A SPECIAL dewatering system controlled excessive groundwater during construction of the 24th Street undercrossing. Foundation conditions before dewatering are shown at top. Bottom view is after excavation was sealed with membrane waterproofing and base slab.

At 18th Street, National City, salt water was encountered at elev. plus 3.0. At 24th Street, National City, salt water was encountered at elev. plus 2.0. At "F" Street, Chula Vista, the underground water appeared to be fresh at elev. plus 6.0. At "H" Street, Chula Vista, the groundwater appeared to be fresh water at elev. plus 7.0.

Dikes control high tide

The construction of the new Sweetwater bridges was expedited by constructing temporary earth fills to control the high tide and working the Raymond concrete pile rig in the bed of the channel, rather than from falsework. The temporary dikes were used as access and supply roads for the deck construction of these bridges, and permitted large sections of deck to be poured at one time using two cranes and ready-mix trucks operating across the channel.

JACK ADAMS, left, is bridge superintendent and Walter F. Maxwell, partner in the firm, is project manager for Charles MacClosky Co.



Some difficulty was encountered in excavating and dewatering the footing for the "F" Street pump house. The bottom of this footing was approximately 7 ft. below groundwater. At this point the groundwater appeared to be under some pressure in that it jetted into the excavated area with considerable force. A footing box was sunk in the excavation to a point considerably below the bottom of the footing and backfilled with crushed gravel. A 4-in. centrifugal gasoline pump, intake, was sunk in the gravel and the water controlled.

At Main Street cemented gravel formation was encountered, and in spite of the fact that the structure was located quite close to the ocean, the footing excavations were not affected by salt water.

All structure concrete was poured by crane. Three crawler cranes were kept busy. Construction joints in bridge decks were completely eliminated by using two cranes and double concrete crews for large pours.

The entire project is scheduled for completion in April 1951.

Personnel

W. T. Rhodes is the resident engineer for the California Division of Highways, and A. K. Gilbert is the Bridge Department representative on the job.

Walter F. Maxwell is project manager for the joint venture. Jack Adams is bridge superintendent. R. H. Hapgood is grading superintendent, and Al Dunbar is in charge of paving operations.

Sewer Outfall Hung in Place Through Maze of Wharf Piling

Four effluent lines of 48-in. cast-iron pipe from San Francisco treatment plant suspended under waterfront piers on framework bolted to piling

By

WILLIAM J. TALBOT

Superintendent
Ben C. Gerwick, Inc.
San Francisco, Calif.



piling. Large scale templates of the difficult sections of pipe were made and actually worked through the spaces on the scale layout drawing. Once this layout had been approved, the pipe was ordered. The contractor selected the 16-ft. lengths in order to reduce the number of pipe joints to be bolted and secured.

Trolleys deliver pipe

In addition, the contractor was required to make his own arrangements with the pier operators and the State Harbor Commission. Because the piers are under rental to the various shipping terminals for cargo handling, any loss of deck space involves costly interference with cargo operations. Accordingly, all construction work had to be carried on beneath the pier decks in such a way as to cause a minimum of interference with cargo movements. The only feasible way to meet these requirements was to run the pipe in from the outboard end, a distance of 800 ft. on one pier and 1,000 ft. on the other.

It was originally planned to float the pipe in place, in sections, by bulkheading the pipe ends. After the survey of existing piers was made it became evident that this would be very difficult, due to the limited clearances at pile

MONORAIL or dual-rail trolleys were used to run pipe into placing position. Pipe was brought in 4 ft. above final grade.

THE INSTALLATION of 3,500 lin. ft. of 48-in. diam. cast-iron pipe under particularly difficult circumstances is being carried out by Ben C. Gerwick, Inc., and Charles L. Harney, Inc., both of San Francisco, holders of a \$1,039,903 contract let by the San Francisco Department of Public Works. The pipe, among the largest diameter cast-iron pipe ever installed in the West, is being placed beneath piers 33 and 35 on San Francisco's Embarcadero to serve as the effluent outfall for the city's new sewage treatment plant at North Point (*Western Construction*—November 1949, pg. 74).

A total of four effluent lines, two on each pier, are to be installed under the piers from the bulkhead wall to the outboard end. The inboard 100 ft. of all four lines lies under the bulkhead wharf adjoining the piers. Under this bulkhead

MINIMUM of interference with wharf activities was provided by running pipe into place from deck holes at outboard end.

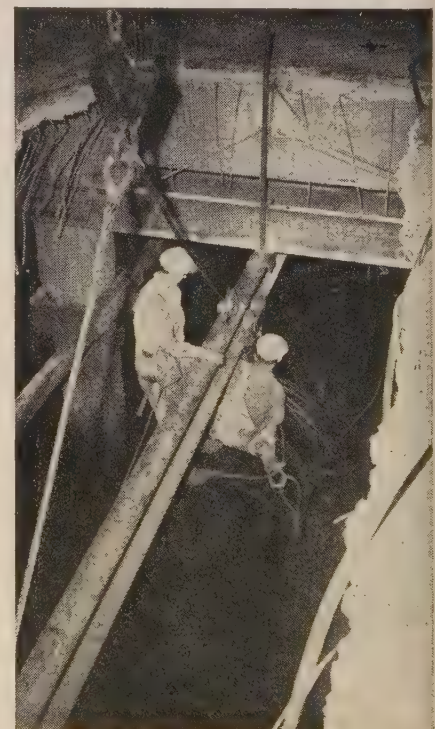
wharf, the pile bents are spaced with a high degree of irregularity. Many of the bents are rotated at an angle to the main pier, so that it was necessary to use a combination of bends and short lengths to fit the pipe between piles.

Both during construction and as part of final design the pipe is supported from the pier by means of an independent steel framework fastened directly to the piling. The supporting framework consists of cross channels bolted to the piles and longitudinal channels running parallel to the pipeline for its full length. The pipe itself is held in place by "U"-rods threaded vertically through the longitudinal channels. Concrete spacer blocks are fitted over the pipe at each "U"-rod and buck up against the longitudinal channels. All of the supporting steel channel frame is covered with wire mesh and coated with 2½ in. of gunite.

Survey locates piling

Specifications were written so that the contractor was held responsible for the correct layout and installation, including the selection of proper bends and lengths to be fitted in through the labyrinth of piles in the bulkhead wharf. The first operation on the job was to make a complete survey, locating every pile in both piers which influenced the layout of the pipe. This was done by engineers working for the contractor, who worked from floats beneath the docks. All measurements were taken in reference to the pier center line, and from the bulkhead wall to the outboard end of each pier. This survey required two weeks.

All piling was then plotted to large scale plan of the piers, and the pipelines laid out to scale. The proper bends and lengths were determined to fit the actual conditions. According to the survey, the most difficult portion of the line—the curved sections under the bulkhead wharf—were for the most part directly under the office buildings on the piers. This eliminated any possibility of opening the deck and placing the pipe from the top. It was therefore necessary to run all the pipe in from the pier's outer end and thread it through the maze of



bents, and because of piles being out of position in the bents. In addition, ground swell, tidal currents and wave action made this operation hazardous. The other alternative was to run the pipe in on trolleys supported on the steel framework. The contractor cut one hole at the end of each pipeline, at the outboard end of the pier, for the purpose of lowering the pipe through the deck. No structure could be built outside the pier since this would have interfered with navigation. Manholes were put through the pier deck over standard 20-in. cast iron seats, permanently installed as part of the pier deck.

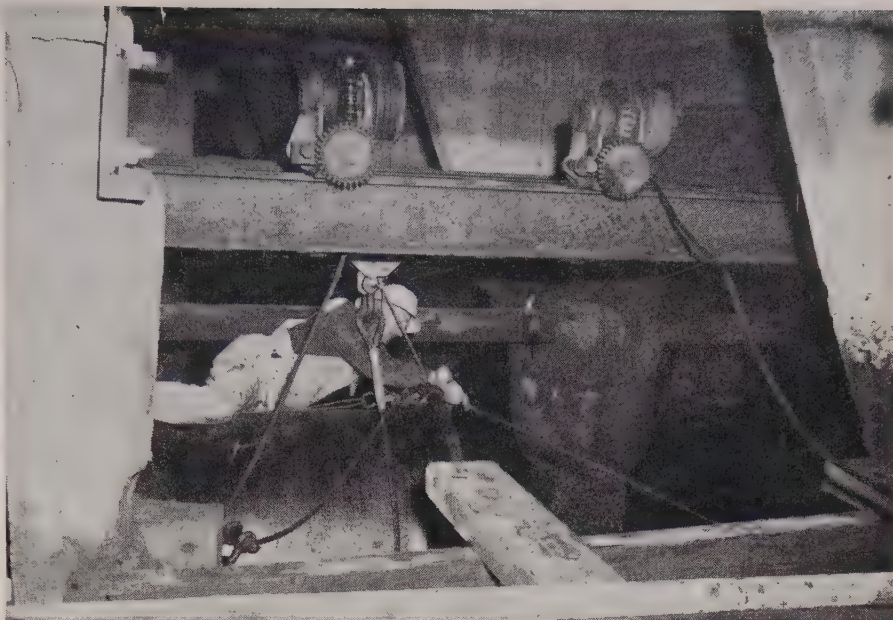
Preliminary work

After considerable planning, the contractor was ready to begin actual field work under the pier. The first construction step was to install temporary staging for each line beneath the docks. The staging was constructed of 4 by 8-in. timber, with collars bolted to the piles. The walkway itself was 4 ft. Staging for four lines required 100,000 fbm. of lumber. In addition to the staging, preliminary work involved a 110-volt lighting system and an air line extending the full length. All preliminary work was done from floats, and materials were floated in from the pier ends.

The cross channels are 12-in., 25-lb. on pier 33, and 15-in., 33.9-lb. on pier 35. Cross-section differences on the two piers are due to span length involved. These channels were fastened on the piles as cross girts, and were secured with eight 1 1/4-in. bolts each. In addition, each pile was notched down to its reinforcing steel in order to fit the channel and a gunite fillet was placed around the channel for bearing. Steel channels were lowered through the manholes and hand-trucked along the staging to the required spot. The bolts were tightened with Lowell socket wrenches, and correct tension was insured by the use of a torque wrench.

Installing channels

Longitudinal steel channels are 12-in., 20-lb., on pier 33, and 10-in., 15.3-lb. on pier 35. These channels were doubled with 4-in. clearance back to back for the length of each line, and set to a 4-ft. gage for the trolley. The longitudinal channels were both welded and bolted beneath the cross-channels. They were fabricated in lengths of 40 ft., with the required tie plates and splice plate in place, lowered through the deck, and carried to position on floats. They were raised to position by air hoists under the dock. The 4-in. space between the channels was designed to accommodate the "U"-bolt that went around the pipe and came up through the channels with a large plate washer on top of the channels. For the bends, the channels were bent to the exact radii and installed so that it was possible to run the trolleys carrying the pipe all the way through. Timber templates were set up so that the bent channels would conform exactly to the pipe bends and tangents. Because of the irregularity of the piling, particularly on pier 33, it was necessary to put quite a few reverse curves in the



PIPE SECTIONS were removed from trolleys by lifting with hand winches. The worm-drive winches, of 2-ton capacity, were built by the contractor specially for the job.

line, even in so-called straight portions, to make the pipe fit between the piles.

The cast-iron pipe is class B, 1.42-in. thick, lined with 1/4 in. of cement. The joints are the mechanical type known as the doublex-simplex fitting, consisting of a socketed end and a plain end with a loose gland. To make a joint, the plain end is entered in the socket end and a rubber gasket is forced into the recess provided by drawing up the loose gland with thirty-two 1 1/4-in. bolts. The bolts, resistant to corrosive conditions, are of high strength cast iron. Bolts were tightened, using a Lowell ratchet socket wrench, and torque was applied as recommended by the manufacturer.

Lowering pipe through deck

The pipe was installed by lowering one section at a time through the deck. The pipe was unloaded in a nearby storage yard, as received, painted with Inertol covering, and delivered to the opening in the pier by a lumber carrier. Specifications allowed the contractor to install pipe in either 12- or 16-ft. lengths. The standard pipe length was 16 ft., at 6 tons. Pipe was handled through the deck hole

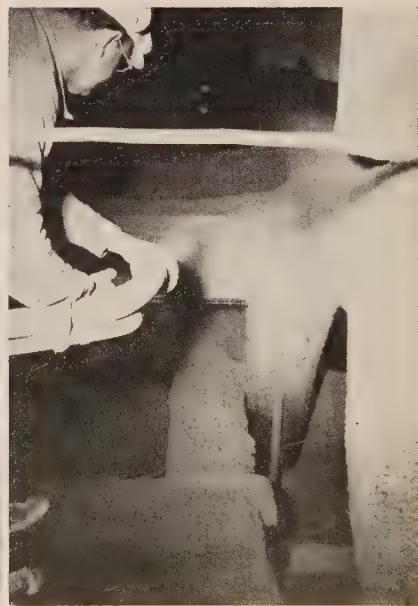
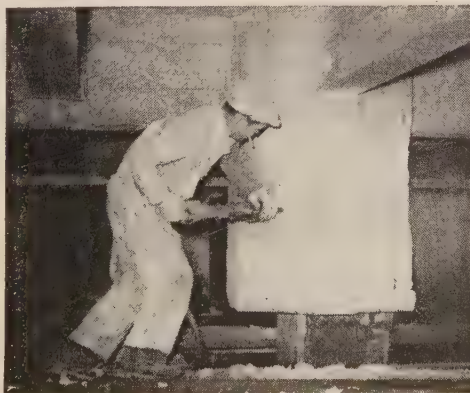
by a traveling overhead gantry. This rig was made in the contractor's shop in the form of a traveling carriage that could move over the piece of pipe, pick it up, and lower it through the hole. Lifting power was supplied by an air hoist rigged up through 9 parts of 1/2-in. line. A spreader frame was designed so that it would interlock with the existing longitudinal channel as it was being lowered. Before lowering, the pipe was hooked with a sling at each end to two 1 1/2-ton trolleys that were gaged to run on the longitudinal channels.

Running pipe to position

When the pipe and frame were lowered, the pipe could be run off on the trolleys to its position at the other end of the pier. The pipe sections were run in on the trolleys one at a time. Power to move the pipe was from another air hoist at the far end of the pier. A tail line was provided to return the trolleys. Time to run a section of pipe in the 1,000 ft.-

BELOW—Chipping concrete pier so that cross-channels could be placed and bolted.

RIGHT—Final step of construction was to gunite exposed steel supporting members.





LONGITUDINAL CHANNELS were welded together with 4-in. clearance so that Monel rods could penetrate up to be bolted. Spacer blocks shown are of lightweight concrete.

maximum was about 12 min. When the pipe reached its final position it was connected with the preceding section and the joints bolted up. The pipe, when in the position on the trolleys, was about 4 ft. above final grade and ready to be removed from the trolleys by lifting with hand winches. These hand winches are of two-ton capacity with worm drive. Two were used per length of pipe. To remove the pipe from the trolley slings, the line from the hand winch was simply put around the pipe and the load transferred to the winch sling. The worm drive winches were built specially for the job, since no piece of equipment on the construction market could be found to do the job. Once a number (6 to 8) of pipe joints had been bolted up and the hand winches connected, the pipe was lowered to its final grade.

Lowering pipe to grade

Lowering the pipe to grade required 12 to 16 men, depending upon the number of lengths involved, turning the hand winches in unison until the pipe was lowered to final position. Because the invert elevation of pipe varied from about tide elev. 0 to -1, it was not practical to make up all the pipe joints in the final position. For this reason the pipe was made up in strings of 6 to 8 pieces at the high elevation, brought in by the trolleys, and lowered as a unit to final grade where it is joined to the pipe already in place.

Because the sling from the hand winch is a continuous line that passes around the pipe (actually providing two parts of line), the pipe was rolled about one-quarter of a turn as it was lowered. This presented no problem since the joint could be made in any position due to the loose ring at the joint.

Maximum high tide was 4 ft. above the

top of the cast-iron pipe, which made it necessary to do all work at low tides, and much of it was under a few feet of water. The maximum progress has been twenty-eight 16-ft. lengths installed completely in one week of 4½ days. Progress was slow at the section under the bulkhead wharf where bends and short lengths had to be worked through the piling. It was necessary in many cases to use several sets of trolleys in order to transfer the pipe beyond certain piles that did not give sufficient clearance for the trolleys. Some piles in this area were so close that it was necessary to chip the pile down to its own reinforcing steel in order to get clearance. These piles were later repaired with gunite. It was necessary to take advantage of the flexibility of this type of joint in fitting the pipe through the reverse curves required for some sections of the lines. This type of joint can be made to deflect a maximum of 2 deg. without special fittings, a fact accounting for the only way the pipe could be threaded around several congested places. Pipe was supplied by American Cast Iron Pipe Co.

"U"-bolts and spacer blocks

The "U"-bolts supporting the pipe are of hot rolled Monel metal, 1½-in. diam., and with a threaded 2-in. upset end. Each pipe length is supported by two Monel rods placed near the joint at each end. Rods were about 7 ft. long from the center line of the pipe to the top of the threads, and are so bulky to handle that it takes four men to slip them over the pipe and thread them up through the channels. These were the largest diameter Monel rods ever to be upset and the largest diameter Monel nuts ever made.

The concrete spacer blocks are of lightweight concrete with weight-lightening holes in them. They are about 4 ft.

high and were made in the manner of a saddle to fit over the pipe and up tight under the channels. To install the spacer blocks, the contractor built an inside carriage that ran on the longitudinal channels completely clear of the rods and lines from the hand winches supporting the pipe. Thus while the pipe was still hung from the supporting winches the blocks could be brought into position without disturbing the rigging. The blocks were cast in the contractor's Petaluma, Calif., casting yards, and trucked to the site as needed. The blocks weigh 1,100 lb. each and are handled for the most part by a boom truck. The blocks were placed through the deck hole by the same rig that handled the pipe and trolleyed it to position by the inside carriage described above.

The pipeline had a grade of .001, so that the rods and blocks varied in length as the distance along the line increased. Blocks and rods were made in about 12 different lengths (1-in. variation) and the pipe was shimmed to exact grade by steel plates between the block and channels.

Framework gunited

The final step in the construction is to gunite all exposed framework of the steel supporting members. Specifications require a 2½-in. cover on all steel. This took about 800 cu. yd. of gunite for the job. The cover is reinforced by 2 by 2-in. No. 12 galvanized wire mesh, fastened with small studs to the steel by means of a Nelson stud welder. Two crews are employed to gunite with N-1 cement guns, with an average daily production of 12 cu. yd. per shift and a maximum of 16.

Personnel

Ralph G. Wadsworth is city engineer for San Francisco, and Fredrick Brown is chief construction engineer.

For the contractor, William J. Talbot is superintendent and S. M. "Duke" Fopp is assistant superintendent on the cast-iron pipe work underneath the piers. Included in the contract is construction of new sections of influent and effluent sewers in connection with the new North Point Treatment Plant, and modification of existing sewers in the area.

Drought in Arizona Continues Unabated

THE CRITICAL water situation in Arizona is continuing with run-off from all but two of the state's major streams during September at 50% of normal. (The Colorado River at the Grand Canyon was at 76% of normal, but is fed mostly by sources outside the state; Verde River was at 56%.) The drought has become more severe in southern Arizona, where the Gila River was at 31% of normal, Sabino Creek at 4%, and the Santa Cruz River, dry. The Salt River in central Arizona registered 46% of normal. The San Carlos reservoir at Coolidge Dam has been practically empty since the end of August. For the year as a whole, the Gila and Salt Rivers are running at their lowest ebb since 1914.

REPORTS

from the COURTS

By

HOWARD S.
BURNSIDE

Registered
Professional Engineer
Attorney at Law



Interpretation of Cost Plus Contract

"THE LANGUAGE of a contract is to govern its interpretation, if the language is clear and explicit, and does not involve an absurdity."¹

In *Jones v. Pollock*² the court examined the language of a contract to determine whether a maximum price had been stated. A building contractor had agreed to construct a building "in a good workmanlike and substantial manner, and within the estimated cost of \$13,100 and the contractor shall receive for his services 15% of cost of construction which is included in estimated cost." The "cost of construction *** shall be understood as an estimate only by the contractor, who, in no way shall be responsible for the fluctuation of prices of labor or materials."

The contractor completed the building at a cost to him of \$20,422. The increased cost was attributed to several causes including increases in the cost of labor and materials. The contractor contended that the figure \$13,100 was only an estimate and that the agreement was to build on cost plus. The owners agreed that it was a cost plus contract but contended that by the terms of the contract the maximum cost was to be \$13,100, (having in

mind perhaps the cost plus guaranteed maximum type of formula).

The Supreme Court upon interpreting this contract decided it to be a straight cost plus agreement. "Considering these provisions together, the conclusion is inescapable that \$13,100 was merely an estimate of the cost of the building and not a ceiling price. It is also of considerable significance that the word 'within' used in connection with the amount \$13,100 is limited by the term 'estimated' which immediately follows it."

The owners also argued that a provision in the contract for additional charges in the event an architect or engineer were engaged required an interpretation of the \$13,100 figure as a ceiling price. The court pointed out, however, that express reference to extras and to architects' and engineers' fees may have been intended to designate the scope of the contractor's authority or to authorize their inclusion as part of chargeable cost. "In the light of the express language to the contrary, those provisions do not justify an interpretation *** consistent with a ceiling price."

¹1638 California Civil Code.

²*Jones v. Pollock* 34 AC 946.

Suspension of Contractor's License Affirmed by Court

IT IS INTERESTING to note the penalty involved for a serious infraction of the license laws as well as the review by a court of law of the proceedings of an administrative body. A ruling of the Contractor's State License Board suspending plaintiff's license for one year was sustained upon a full hearing in the lower court.

One accusation of the Board charged a violation of the code providing that "aiding or abetting an unlicensed person to evade the provisions of this chapter or *** allowing one's license to be used by an unlicensed person ***" shall constitute "a cause for disciplinary action."¹

In reviewing and confirming the action of the lower court, the higher court said, "There was evidence that (the contractor) agreed with (the unlicensed person) that he would permit the latter to use his license on payment of \$250 or \$500 per house built ***. There was evidence that (the contractor) told a witness that he had a deal *** whereby (the unlicensed person) would build these houses and pay him a fixed commission for the use of his license. Evidence sufficient." Other accusations were based

on the code provisions against wilful or fraudulent acts and failure to exercise reasonable diligence in prosecution of the work.²

¹7114 California Business and Professions Code.

²*Penaat v. Zeiss* 97 ACA 1005; 219 P. 2d 60.

Jury Says Pipe Exploded From Water Hammer

AN INTERESTING aspect of the old familiar hydraulics problem of "water hammer" was recently illustrated. A broken 2-in. lead water pipe installed under plaintiff's basement floor and connected with the city main caused water damage for which reimbursement was sought against the insurance company. The break was 2½ inches in length along the axis of the pipe, the sides of the break being about ½ in. apart at the widest point. It had apparently occurred on a Sunday. The insurance policy provided coverage for damages resulting from the perils of windstorm, hail, explosions, riot, etc.

The main question was to determine whether there was an explosion of a type covered by the policy of insurance. The plaintiff offered proof that the break was caused by water hammer. One witness,

an expert in hydraulics, testified that in his opinion the pipe burst from "a sudden excessive pressure, far greater than the normal pressure in the main." The jury on being asked "Was there an explosion *** of the lead pipe ***" answered "Yes." Judgment for the plaintiff was affirmed on appeal.

The court said, "Defendant's argument that cold water does not explode is beside the point. It was the container, the pipe, that gave way with violence. And it should be kept in mind that the insurance policy did not give protection against big explosions only ***."

¹*L. L. Olds Seed Co. v. Commercial Union Assurance Co., Ltd.* 179 F. 2nd 472.

Contractor's Equipment Included in Overhead

IN *Michelson v. House*¹ the Supreme Court of New Mexico reversed the lower court and disallowed a sum of money claimed by the contractor as reimbursement on equipment owned and used in a construction project. The project involved building construction on a cost plus percentage fee basis. The contractor contended that he saved the owner additional expense by using various items of equipment.

The court said: "This contention is without merit. The contract is silent respecting reimbursements for personally owned equipment. In the absence of such stipulations, (the contractor) was required to furnish the necessary equipment for the work at hand. The claim was a part of the overhead and clearly falls within the provision *** of the contract which expressly excludes reimbursement for overhead and general expense."

Citing supporting authority the court continued: "So the tools used in the construction of the building were a part of the equipment of the contractor; a contractor, when he agrees to build, must, in the absence of a contrary agreement, furnish all the tools and necessary appliances for the work contracted to be done."²

¹*Michelson v. House* 218 P. 2nd 861.

²*Shaw v. G. B. Beaumont Co.* 88 N. J. Eq. 333; 102 A 151, 153.

REPORTS FROM THE COURTS by Mr. Burnside is presented this month for the first time. It will be a regular feature, appearing every other month.

CONSTRUCTION DESIGN CHART

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



CXXV...Joist and Rafter Spans for Deflection

THE CHART published in the July 1948 issue, gave the safe spans for joists and rafters based on a flexural stress of 1,200 p.s.i. The same chart will be found on page 206 of our booklet Construction Design Charts,¹ 1947 edition. The accompanying chart has been prepared for the same range of values as the one referred to above, except that this one is based on

a maximum deflection of $\frac{L}{360}$. This is the

maximum deflection usually considered advisable in order to prevent cracking of plastered ceilings.

The accompanying chart requires for a solution, two straight lines intersecting on the "SUPPORT." One solution line should be drawn between values on the (A) scales, and the other between values on the (B) scales. I have drawn solution lines on the accompanying chart for the same problem used to illustrate the former chart based on flexural stress. In the

former article, the following roof conditions were assumed:

Total unit uniform load = 50 p.s.f.

Rafter spacing = 18 in.

Rafter span = 19 ft.

In the previous problem it was found that for a flexural stress of $f = 1,200$ p.s.i., the choice of either a 4 x 8 or a 2 x 12 rafter would be satisfactory. The solution lines on the accompanying chart indicate that if the maximum deflection is limited

to $\frac{L}{360}$, the choice must be confined to the

2 x 12 size for even that is apparently slightly over the limit. It indicates that a 4 x 8 rafter, for the assumed conditions, would have a deflection considerably in

excess of $\frac{L}{360}$.

As a check on the results obtained from the accompanying chart, we have the following:

$$\text{Rafter loading, } w = \frac{18}{12} \times 50 = 75 \text{ lb. per lin. ft.}$$

$$\text{Maximum deflection} = \frac{5 w L^4}{384 E I} = \frac{5 \times 75 \times 19^4 \times 12^3}{384 \times 1,600,000 \times I} = \frac{137.5}{I}$$

From standard lumber tables, for S4S

$$2 \times 12, I = 206 \text{ in.}^4$$

$$4 \times 8, I = 127 \text{ in.}^4$$

The maximum deflections would therefore be

$$2 \times 12, \text{Deflection} = \frac{137.5}{206} = 0.668 \text{ in.}$$

$$4 \times 8, \text{Deflection} = \frac{137.5}{127} = 1.082 \text{ in.}$$

Maximum permissible deflection

$$\frac{L}{360} = \frac{19 \times 12}{360} = 0.634 \text{ in.}$$

This verifies the results obtained from the chart indicating that the deflection of the 2 x 12 was slightly in excess although it probably would be permitted, and that the 4 x 8 has an excessive deflection.

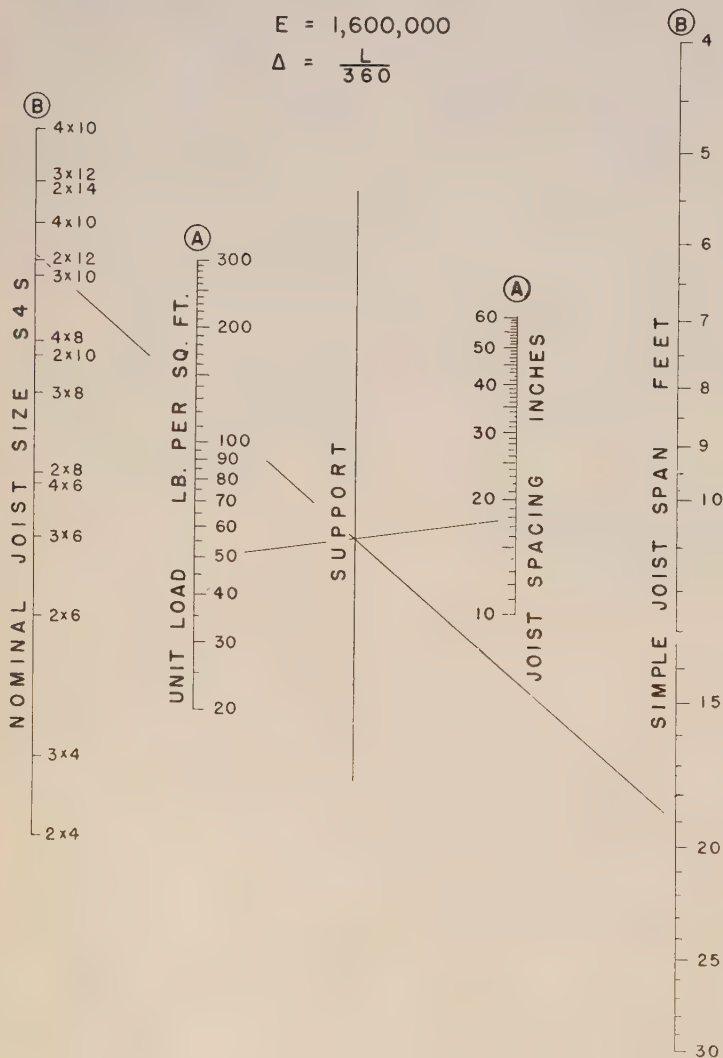
In many problems involving joists and rafters, the deflection is of little concern. The checking of the deflection is troublesome to many individuals due to its infrequent computation. So many digits are involved, the exact location of the decimal point is frequently a matter of uncertainty. It should also be remembered that the de-

Concluded on page 122

JOIST AND RAFTER SPANS FOR DEFLECTION

$$E = 1,600,000$$

$$\Delta = \frac{L}{360}$$



J. R. GRIFFITH

NEWS OF WESTERN CONSTRUCTION

NOVEMBER 1950

Bidders Urged to Visit Tunnel Site in Alaska

CALL FOR BIDS on construction of the Eklutna power tunnel in Alaska will be issued early next year and the Bureau of Reclamation is urging prospective bidders on the first phase of the estimated \$20,000,000 project to inspect the site before winter.

The work, approximately 30 mi. northeast of Anchorage, calls for building of a 22,000-ft. tunnel to divert the flow of water from Eklutna Creek to a power plant to be built north of the present Eklutna power plant. The tunnel will consist of a concrete-lined circular section, about 9 ft. in diameter, with the lining approximately 10 in. thick.

Lake inlet elevation to the tunnel is to be 830 ft., with the outlet to the penstock at elev. 802 ft.

A 78-in., exposed steel pipe to the powerhouse at elev. 22 is proposed for the penstock. An alternate proposal is an inclined tunnel, consisting of a 78-in. steel liner inside a 12-ft., 6-in. tunnel. Space between the liner and tunnel would be backfilled with concrete.

Other work to be advertised in the future includes the dam, power plant, penstock and transmission facilities.

Prospective bidders for the first phase of the project have been advised to contact Joseph Morgan at the Bureau of Reclamation office, Juneau, Alaska, to arrange trips to the work site.

\$40,000,000 Power Plant Planned in Northern Idaho

WASHINGTON Water Power Co. has filed an application with the Federal Power Commission for a preliminary permit to construct a \$40,000,000 power plant at Cabinet Gorge on the Clark Fork River, near the Montana state line in Bonner County, Idaho. According to the application 25,000 cu. ft. per sec. of water will be diverted to develop 200,000 kw. of new power.

Three 50,000-kw. generators attached to 70,000-hp. turbines will form the initial installation at the Cabinet Gorge hydroelectric site. According to engineering estimates initial expenditures for the power plant, including necessary installations to bring power to the interior, will total \$30,000,000. In addition to the power plant at Cabinet Gorge, construction plans call for a 150,000-v.-230,000-v. substation at each end of the line which will carry power to the

interior, with delivery terminal at Spokane, Wash. The line will run from Cabinet Gorge along the south boundary of Lake Pend Oreille to a point near Coeur d'Alene, Idaho, and west to the new Beacon substation northeast of Spokane.

Power from Cabinet Gorge is expected to be available by November 1, 1952, if the Federal Power Commission's approval is forthcoming early.

The new plant will have a total power output nearly equal to that of the WWP's six generating plants now on the Spokane River. Power from the proposed new hydroelectric plant will feed into the Northwest power pool. Considerable engineering studies have already been made of the Cabinet Gorge power-producing possibilities.

First Contract Awarded for Denver-Boulder Toll Road

CONSTRUCTION of the Denver-Boulder toll road in Colorado is starting with award of the first contract. The contract went to Peter Kiewit Sons' Co., Omaha, Neb., at \$1,066,767, and covers about 10½ mi. extending from the city

limits of Boulder to the town of Broomfield. The Kiewit firm's bid was considerably lower than the engineer's estimate of \$1,300,000. Contracts for the remaining 6.7 mi. of the project will be awarded within the next month.

A bond issue of \$6,300,000 was approved in late September for the entire project. The highway, about 22 mi. long, will consist of two 24-ft. wide roadways separated by a 30-ft. parkway. It will connect Boulder with Federal Boulevard in northwestern Denver and will have only one access point enroute.

Southern California Edison Plans Fontana Steam Plant

A PETITION for permission to construct a \$30,000,000 steam electric generating station adjacent to the Whittier Narrows flood control basin in Los Angeles County has been withdrawn by the Southern California Edison Company. Instead, the firm has made plans to build a similar plant at Fontana in San Bernardino County. The proposed project at Fontana, for which award of a design contract is now being made, will be located on a 200-ac. site west of Etiwanda

SIDE-HILL SLED PERMITS TRENCH HOE OPERATION ON STEEP SLOPES

A TRIANGULAR welded steel sled with a horizontal platform that enables a trench hoe to operate without interference on slopes as steep as 75% is used by American Pipe and Construction Co. on a pipeline job for the Bureau of Reclamation near Santa Barbara, Calif. The sled is lowered down right-of-way for trench as digging advances. The idea did not originate with American Pipe and Construction Co., and the firm points out it was previously used by Al Erikson of Erikson Construction Co., Oakland.



Ave. and south of Santa Fe Railway tracks. Under present plans, the first of two 100,000-kw. units would be completed in 1952. This would be the third steam station in the Edison system, the others being at Long Beach and Redondo Beach.

Interstate Commission Plans Compact for Columbia Basin

DRAFTING of a compact agreement to speed development of the Columbia Basin has been ordered by the interstate compact commission representing five northwestern states (Idaho, Oregon, Washington, Wyoming and Montana). Meeting October 10, the interstate commission appointed a legal committee to draft provisions of the proposed compact. Details of the compact will be worked out at a mid-December meeting of the commission at Portland.

Speeding Trucks Blamed for Shaking American Falls Dam

A REPORT that heavy trucks traveling at excess speeds are shaking the underlying structure of American Falls Dam across the Snake River in Idaho with the possibility of major damage last month caused Idaho Governor C. A. Robins to take quick action. State policemen will be posted at each entrance to the roadway across the top of the dam to enforce posted speed limits.

"PLUG" COMES OUT TO MAKE WAY FOR NEW HOOVER DAM GENERATOR

WORKMEN at Hoover Dam remove the Unit A-9 wheelpit plug in the Arizona wing of the power plant as the preliminary step toward installation of a new generator. The "plug," a concrete block of 18-ft. diam., 18 in. thick and weighing 57,000 lb., has served as a temporary covering for the wheelpit since completion of the dam and power plant in 1936. A 70,000-hp. turbine will be set below the opening to power a 60,000-kw. generator above. Two similar units, also being installed in the Arizona wing, will complete the wing, raising the plant's output to 1,249,300 kw.



Contractors Work on West Canada's Largest Railroad Job in 35 Years

LAYING of an 82.5-mi. extension of the Pacific Great Eastern Railway from Quesnel to Prince George in east central British Columbia is in progress and represents the largest railway construction job undertaken in western Canada in the past 35 years. Four different companies have crews busy clearing 100-ft. right-of-way and grading and graveling in prospect for laying of the track.

Major structure on the project is the Cottonwood Canyon bridge, contract for which was awarded to the Dominion Bridge Co., Ltd., on a bid of \$560,000. Steel is being laid on the 14-mi. stretch from Quesnel to Cottonwood Canyon by Dawson Hall and Co., and this will facilitate conveyance of construction materials to the site of the big span. It is expected that 25 mi. of the road from the Prince George end will also be completed before heavy snows suspend operations this winter. The B. C. government has allocated \$8,000,000 for the project, while the Canadian Government will pay a subsidy of \$15,000 per mile. Contracts have still to be let for 28 mi. of track and for a bridge over the Ahbau River.

Campbell-Bennett Ltd. is grading and graveling the first 30 mi. to Quesnel under a contract valued at \$1,850,000. Jamieson Construction Co. Ltd. has contracts for 15-mi. and 22.5-mi. stretches at a total cost of \$1,101,330. A section be-

tween the two Jamieson jobs, covering 15 mi. in length, is being carried out by the Emil Anderson Construction Co. Ltd. of Hope on a bid of \$522,300. The Jamieson Co. also holds a \$738,737 contract for laying 40 mi. of track southward from Prince George.

The Cottonwood Canyon bridge is considered one of the toughest jobs of railway bridge construction ever encountered. The engineers went 18 mi. up the Cottonwood valley to find a better crossing than that which had baffled the engineers 35 years ago and caused them to abandon the plan to build the railroad to Prince George at that time. The new crossing is at a point where the canyon is 100 ft. wide and has 100 ft. of dead drop between rock walls with steep earth slopes rising another 150 ft. It is estimated that this bridge and its approaches and subsidiary work alone will use up about \$1,000,000 of the extension costs. The steel deck of the bridge will be 225 ft. in height and 1,023 ft. in length. Two foundation piers will be 100 ft. in height and driven 75 ft. into solid rock. The central span will be 300 ft. in length. The steel bridge is of the continuous deck truss type with the truss 38 ft. deep.

Another problem encountered is what has become known as the bottomless pool at Mile 10. The Campbell-Bennett firm's contract called for the building of a right-of-way across a 100-yard wide pool, but this duck pond turned out to have a depth of 70 ft. and thousands of yards of material was eaten up before it was finally decided to divert the railway around the pool.

Soft glacial gumbo, silt and cutbanks are presenting major construction problems. The valleys are deep and slides are numerous. The engineers are seeking to maintain a 2% compensated grade and to do this have had to take over the nearby Cariboo Highway at several points. A new highway is being constructed around the four points so affected.

More Power Records At Grand Coulee Dam

NEW WORLD'S power production records are being set at Grand Coulee Dam in Washington. Latest record for a 24-hour period was set September 11 with a production of 40,340,000-kilowatt hours. The seasonal increase in load in the Pacific Northwest Power Pool and the seasonal drop in rivers all over the area is throwing an added load on the Grand Coulee plant. The installation of two new, 108,000-kilowatt generators at the dam this year has made it possible for the plant to carry heavier loads than ever before. Within the next few weeks another 108,000-kilowatt unit will be placed in service to increase the capacity and clear the way for even greater production records. Three additional units will be placed in service in 1951 to complete the installation of 18 large generators.

University Scholarships Sponsored by Bechtel

FIVE SCHOLARSHIPS for the academic year 1950-1951, three for students at the University of California and two for Stanford University students, have been established by the Board of Directors of Bechtel Corporation, well-known engineering and construction organization.

The three University of California scholarships, according to the Bechtel Corporation Board's request, will be given to students in the College of Engineering, preferably in the senior year; one each in the fields of study embracing civil, electrical and mechanical engineering. The awards are to be approved by the University's Committee on Undergraduate Scholarships upon nominations by the Dean of the College of Engineering.

At Stanford University, one scholarship will be awarded to a second year student in the Graduate School of Business who is specializing in Industrial Relations. The other Stanford scholarship, in the School of Engineering, according to the donor's suggestion would be given to a student specializing in civil, electrical or mechanical engineering, with preference to senior candidates.

New Facilities Planned For Airfield at Denver

CONSTRUCTION of new facilities to cost about \$3,000,000 at Stapleton airfield, Denver, Colo., has been recommended in view of a phenomenal increase in passenger and freight traffic at the field. A report submitted by James C. Buckley, Inc., terminal and transportation consultants of New York City is based on the field's air traffic forecast for 1951, 1955 and 1960. Traffic growth since 1940 was cited as nineteen times for passenger travel and ten times for freight tonnage. Included in the recommended construction are: a new wing for airline offices, a new control tower, new air mail and express freight unit, remodeling of terminal and changes and additions to utilities. The report notes that \$1,486,444 of Federal aid has been guaranteed to the city for the purposes outlined.

Labor Shortage Develops At Hungry Horse Project

THE FIRST cold weather failed to halt progress of concreting operations at Hungry Horse Dam in Montana. Concrete in place now totals more than 900,000 cu. yd., and the goal of General-Shea-Morrison crews is 1,000,000 cu. yd. before the winter shut-down, expected in mid-November. A labor shortage affecting the numerous contractors in the Hungry Horse area has set in as the draft call took additional reserves and others left for steady winter employment elsewhere. The shortage of labor at Hungry Horse is expected to become somewhat acute next spring.

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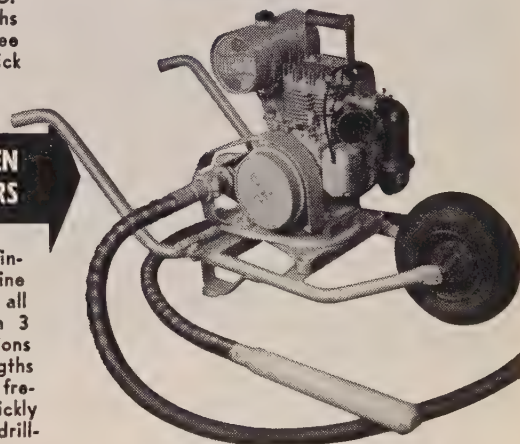
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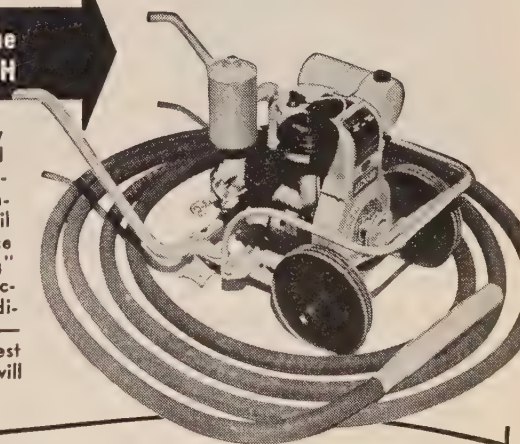
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PERSONALLY SPEAKING

In a top-flight personnel shift in the Bureau of Reclamation's Columbia River Basin Project, **Vaughn Downs** has been appointed acting supervising engineer of the Irrigation Division, succeeding **H. A. Parker**, who became acting district manager, filling the vacancy created by the retirement of **Frank A. Banks** (*Western Construction* — October 1950, pg. 96). **Ross C. Lovelace** has been appointed acting field engineer succeeding Downs. Downs joined the staff of the Bureau's chief engineer in Denver in 1931 and has

been a field engineer at Ephrata, Wash., since early in 1950. Lovelace joined the Bureau in 1933 on the Kendrick Project at Casper, Wyo.; he was transferred to Ephrata in 1940, served three years with the Corps of Engineers during the war, and returned to the Columbia Basin Project in 1945. Another announcement from the Columbia River Project noted the retirement recently of **Leslie R. Annett**, an engineering aide stationed at Quincy. Annett started his government career in 1902 as a surveyor with what

was then called the Reclamation Service. He has served 19½ years as a Federal employee, spent many years in private industry, and served as a Captain of Engineers during World War I.

George B. Thacher has recently become project engineer on the rock-fill dam which Pacific Gas and Electric Co. is constructing on the Bear River in Amador Co., Calif. A powerhouse and 13,600 feet of tunnel are included in the project.

Robert W. Jennings, formerly construction engineer for the Paonia Project of the Bureau of Reclamation, has been promoted to area engineer and will head a new Grand Junction, Colo., office. This office will supervise all activities in the Colorado, Gunnison, White and Yampa river basins of western Colorado. A native of Logan, Utah, Jennings has had wide construction experience, having directed large construction jobs in the South Pacific during the last war, participated in the \$130,000,000 Provo River Project, and carried on administrative as well as construction work at Paonia.

Frank W. McKenzie and **Lawrence J. Archer** have been named new assistants to the director of public works for the City of San Francisco. McKenzie, who was formerly in charge of the Bureau of Accounts and is a past president of the Civil Service Association of San Francisco, will assist in the administrative division. Archer, formerly senior engineer in the City's Water Department, will assist in maintenance and operation.

The selection of **Byron G. Felkner** as construction engineer on the Eklutna hydroelectric power project in Alaska was announced recently by **Oscar L. Chapman**, Secretary of the Interior. The Eklutna project will have a hydroelectric power plant with a 30,000-kw. capacity. Water will be supplied the plant by a 4½-mi. tunnel from Eklutna Lake. Felkner is particularly familiar with tunnel construction, having served as field engineer on a job which included a railroad tunnel under a portion of the reservoir site at Boysen Dam, Wyo. He has also served the Bureau of Reclamation on the Rio Grande, Altus and Parker projects.

Lawrence L. Lee, formerly assistant to the chief engineer of Salt River Valley Water Users' Assn., Phoenix, Ariz., is now water supply consultant to Iran with offices in Tehran.

J. P. Jones, assistant regional engineer, has been granted the Bureau of Reclamation's superior accomplishment reward. This reward, which carries an annual pay increase, is made very rarely.

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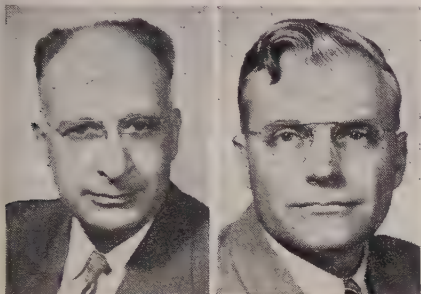
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and only in cases where recognition of exceptional merit is not immediately feasible under the Bureau's regular promotion system. Jones was commended for assuming responsibilities and completing duties over and above the normal demands of his position and for contributing materially to the promotion of working morale. He joined the Bureau in 1927, came to Boulder City in 1931—a few months before construction of Hoover Dam began—and except for 4 or 5 years has been connected with projects in the Southwest ever since.

Climaxing a quarter century of service as a Los Angeles water works engineer, **Burton S. Grant** has been elevated to the post of chief engineer of water works and deputy general manager of the Los Angeles Department of Water and Power. He succeeds **Laurance E. Goit**, who has held the post for five years



GRANT

NELSON

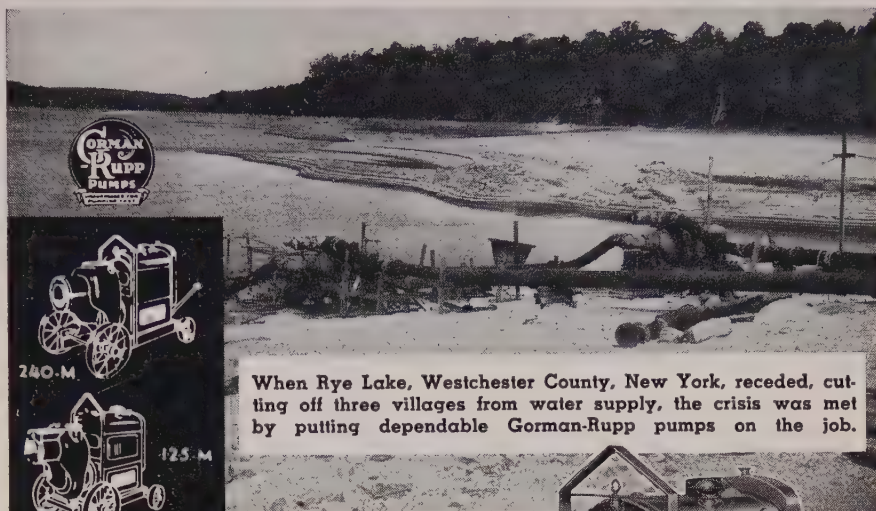
and who has requested an appointment to a lower position because of ill health. As executive head of the second largest water system in the United States, Grant will have the responsibility, under **Samuel B. Morris** and the Water and Power Commission, of supplying the water needs of more than 400,000 customers whose average daily demands are 351,000 gallons. Named assistant chief engineer under Grant was **Samuel B. Nelson**, who also has been with the Department for more than 25 years. Since 1949 he has been head of the Aqueduct Division; this post will be filled by Goit.

Keith Murdock, formerly City Manager of Claremont, Calif., has taken over an administrative job in Anaheim, Calif.

Washington Water Power Co. has announced that **George H. Pike** of Spokane will go to Greece as one of the builders of an \$83,000,000 power system there. Pike, who will be the project's rate director for five years, is one of 50 specialists assigned to the mission by Ebasco Services, Inc., New York City. He reported that Ebasco will erect four hydro and steam powered generating plants and nearly 1,000 miles of transmission lines. Funds for the project will be drawn from Marshall plan money, Italian reparations and British and Greek private capital.

At a recent meeting the American Society of Civil Engineers, Montana Section, elected **William J. Wenzel** of

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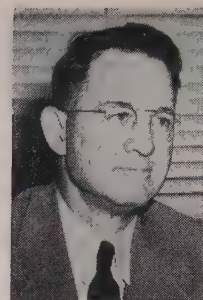


Great Falls as its president. Elected vice presidents were: Earl Parson, Helena; Reginald Hurdle, Billings; Emil Gehri, Hungry Horse; Thomas Smith, Great Falls. George Hoge of Great Falls was elected secretary-treasurer.

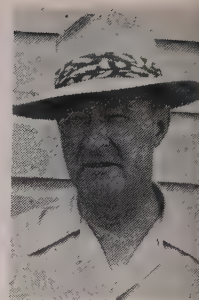
ate construction supervisor; H. A. Cox, associate electrical engineer; H. D. Pate, associate mechanical engineer; C. W. Hamilton, associate construction supervisor; L. S. Hannibal, senior mechanical engineer; L. L. Williams, senior electrical engineer.

Nate W. Downes heads the maintenance survey and repair section which was recently set up within the California State Division of Architecture. The new section will survey all State buildings and recommend steps for physical maintenance. On Downes' staff are the following engineers of the Division of Architecture: E. W. Anderson, associ-

Louis H. Oppenheim has recently been named assistant general manager of Kaiser Engineers, division of Kaiser Industries, Inc. He will continue to serve as assistant chief engineer in the division. Oppenheim, who joined the Kaiser organizations in 1938 as a plant engineer, has subsequently served as



NEFF



MANN

CORRECTION—

IN THE OCTOBER *Western Construction*, with the article describing plans for diverting the Columbia River at McNary Dam, a cut of George M. Mann was inadvertently substituted for that of Sam G. Neff. To straighten the record, pictures of both men are presented above. Neff is resident engineer at McNary Dam for the Corps of Engineers; Mann is project engineer for Winston-Salem, N.C., constructing the Soap Lake Shiplock of the Columbia Basin Project.

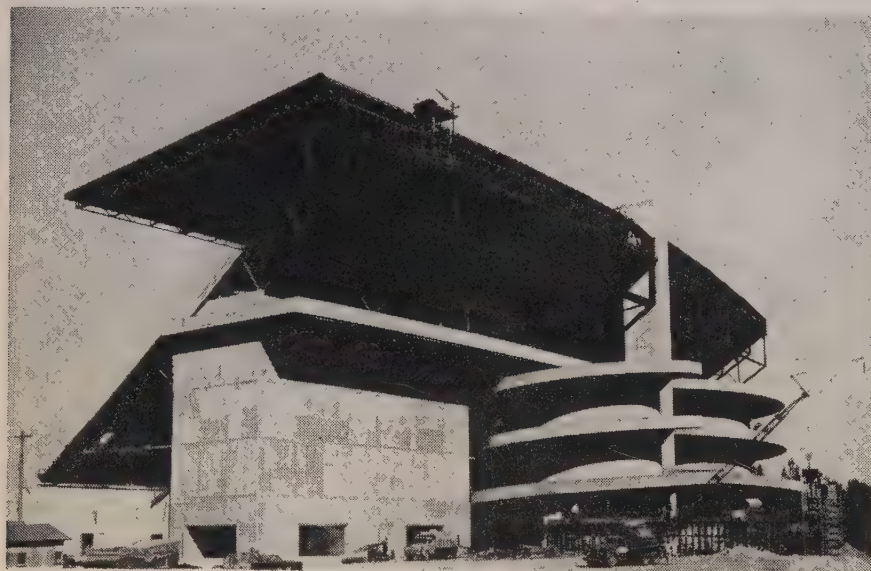
assistant chief engineer during the design and construction of the Fontana plant of Kaiser Steel and in the construction of ordnance plants at Fontana and Denver, and at Scranton, Pa.

W. A. Dexheimer of Denver, assistant chief construction engineer of the Bureau of Reclamation, left San Francisco Oct. 12 for Australia. He is on a 60-day loan to the Australian commonwealth to furnish specialized services on the big Snowy Mountains development, involving transbasin diversions for power and irrigation now in their beginning stages. He will also consult with the State Electricity Commission of Victoria, which is building the Kiewa tunnel.

Montana State Highway Engineer Troy Carmichael has recently appointed Henry C. Helland as principal assistant highway engineer. Helland has been with Canyon Constructors, the firm building Canyon Ferry dam. He fills the position made vacant by the resignation of George Poore, a department employee for 29 years.

Hans Bille has been appointed to the office of assistant state engineer of Montana at Billings to succeed Gerald J. Oravetz who died in August. Bille, who was head office engineer in Billings prior to this appointment, will be in charge of the statewide water resources survey now concerned with operations in the Yellowstone drainage basin.

Lt. Col. J. W. Miles, long-time veteran of the Corps of Engineers, returned to Salem, Ore., last month from his assignment in Okinawa. He is recovering from an illness contracted three months ago. Lt. Col. Miles, who was resident engineer for the Detroit dam until last March, was supervising construction of a huge air base on Okinawa.



South side of new addition to the University of Washington stadium, capacity 55,000. Architect, George Wellington Stoddard; General Contractor, Strand & Sons.

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OBITUARIES...

Edward A. Pullan, 45, chief electrical engineer of the Donald R. Warren Co., died recently at Los Angeles. He was responsible for the design of many large industrial and war-time projects, such as the Rough-and-Ready Island Naval Supply Depot, 155-mm. shell plant for the U. S. Army, the hospital at Fairfield-Suisun Army Air Base, and the Hazel-Atlas Glass Co. plant at Pomona, Calif.

Robert R. Bartlett, 74, retired Port of Astoria (Ore.) manager and builder of the Astoria port terminals, died recently. He was a member of the Oregon board of engineering examiners for 12 years.

Porter J. Preston, 79-year-old retired Bureau of Reclamation engineer who headed construction work on Colorado's Big Thompson project, died recently in St. Joseph's Hospital, Denver. Two of his biggest jobs were the Big Thompson and Uncompaghre reclamation projects.

Edward N. Whittemore, 54, senior right-of-way man for the Southern California section of the State Division of Highways and one-time city engineer of La Habra, Calif., died Oct. 2 in Whittier, Calif.

William Floyd Haynes, 48, Orem, Utah, and **Collis Nephi Thompson**, 46, Springville, Utah, were killed by lightning while working for the W. W. Clyde Construction Co., Springville, surfacing a new stretch of the airport highway near Price, Utah.

Ralph C. Myers, 58, California State Highway Department civil engineer for more than 25 years, died October 2 in Los Angeles.

Luman Albert Woodward, 54, road contractor of Missoula, Mont., died there recently.

Clinton C. Melarkey, 54, office engineer of the Nevada State Highway Department, died recently in a Reno, Nev., hospital.

Willis H. Mead, 76, president of the Whiting-Mead Co., a construction firm he helped found in 1898, died recently in Los Angeles.

McNary Dam took another life in September when **Ray Graham** of Umatilla, Ore., was crushed beneath a 12-yd. dump truck in the maintenance yard. Graham, an electrician working on the Oregon Shore, was instantly killed by the accidental fall.

M. L. Kobe, superintendent for Bates & Rogers Construction Corp., was accidentally electrocuted on the job October 3.

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SUPERVISING THE JOBS



RIGGERS S. J. Peterson and **S. H. Wallace** ride the load as Bureau of Reclamation and contractors' officials pose with the 305-ton rotor which is being installed in the first generating unit at Davis Dam power plant being built on the Colorado River 67 mi. downstream from Hoover Dam. Standing, left to right, are—**E. L. Curry**, sales manager of Star Iron & Steel Co., manufacturer of the 325-ton gantry crane moving the rotor; **F. S. Dallan**, acting field engineer, and **J. R. Walton**, construction engineer in charge, both for the Bureau; **C. B. Reese**, electrical superintendent, and **D. W. McKinney**, project superintendent, both for Donovan-James-Wismer & Becker, installation contractor; **H. R. Orr**, office engineer for the Bureau; **K. R. Myers**, assistant superintendent for the contractor; **J. H. Harvey**, turbine and electrical installation engineer for the Bureau, and **L. Pitcher**, rigger subforeman for the contractor.

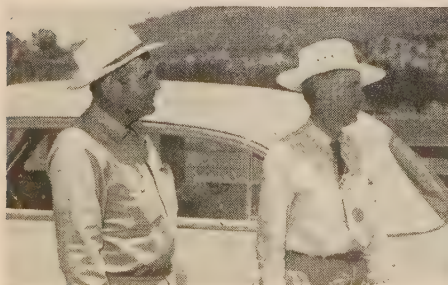
Supervising construction of the \$168,-473 San Jose Municipal Airport for **Leo F. Piazza Paving Co.**, San Jose, Calif., is **Earl G. Rhodes**.

J. E. "Ed" Tracy is job superintendent for **Claude T. Lindsay Co.**, San Francisco, and **Anderson-Rowe**, sponsors of the \$5,000,000 housing project at Hamilton Field, Calif.

A. B. Standard is general superintendent and **Clair Acker** is job superintendent for **C. L. Peck**, Los Angeles, con-

structing the three 12-story office and store buildings on Wilshire Blvd. in Los Angeles for an estimated \$12,000,000. **Art Letcher** is job engineer for the build-

KEY PERSONNEL on construction of the "Super-Inch" (see article, page 68). Left to right—**R. L. "Bob" Bowman**, general superintendent for **Bechtel-Price-Conyes**; **Russell Rhoades**, welding consultant; **Leo Hunolt**, pipe laying foreman; **Ronnie Cook**, assistant superintendent; **Ted Anthony**, wrapping and coating foreman; **"Al" D. Spratling**, engineer in charge for **P. G. and E.**, and **Charles Myers**, job engineer for the contractor.



ings and **George Paul** is steel superintendent.

Supervising a \$205,277 project for **Cannel & Losch**, Paramount, Calif., constructing additions to the fog dispersal system at Los Angeles International Airport, are **Guy Davis**, job superintendent, and **W. M. Chapman**, project engineer. **E. F. Hibberd** is purchasing agent.

Working on the \$1,000,000 addition to Montana State Tuberculosis Sanitarium at Galen, Mont., for **Carson Construction Co., Inc.**, Helena, are **E. L. Cox**, job superintendent, and **W. D. Foster**. **Cox** and **Foster** are also supervising construction of an \$817,161 powerplant, employees' dormitory and apartment building at the hospital for the company.

Michael H. Lichty is general superintendent and **John Lichty, Jr.**, is project superintendent for **Lichty Construction Co.**, Riverton, Wyo., on its \$162,713 contract for grading and surfacing 9.8 mi. of roadway between Rawlins and Sage Creek, Carbon County, Wyo.

S. L. Killion is general superintendent and **C. M. Stafford** is job superintendent for **R. J. Daum Construction Co.**, Inglewood, Calif., on a \$836,989 contract for constructing three reinforced concrete buildings and facilities, TA-18, at Los Alamos, N. Mex. **C. J. Frandsen** is general manager of the company.

Supervising construction of the \$1,885,000 Lincoln High School building at Portland, Ore., for **Donald M. Drake Co.**, Portland, are: **H. O. Prosser**, general superintendent; **Richard Huntington**, job superintendent; and **Webster Smith**, assistant job superintendent.

Walter Nordstrom is job superintendent for **Carl M. Halvorson, Inc.**, Portland, Ore., on the construction of a \$404,378 sewage treatment plant at Salem, which when completed will be the second largest in Oregon. **Fred C. Peters** is engineer and **John Helt, Jr.**, is labor foreman on the project.

Roy B. Olson is job superintendent for **Lalonde Construction Co.**, Sidney, Mont., on its \$415,915 contract for paving, curbing and gutter construction on 8.9 mi. of streets in Sidney.

L. F. de Stwolinski is superintendent for **A. Teichert & Son, Inc.**, on the con-



R. TRASK, SR., left, is superintendent, and **R. Trask, Jr.**, is foreman for Eaton & Smith of San Francisco on construction of the new Pacheco Pass road near Gilroy, Calif. The new road will eliminate many curves and reduce the grade over the pass.

struction of the Los Angeles River channel Sawtelle-Westwood system from Washington Place to Sharnock Road, near Culver City, Calif., a \$628,000 project.

Dean McPherson is supervising work for Stringfellow Construction Co. on its Whittier Narrows Dam rock job.

Harold D. Leppert has been placed in charge of all site work on the contract of William Radkovich Co., Los Angeles, for construction of Whittier College Memorial Stadium, Whittier, Calif.

Ted Brown, formerly superintendent for E. S. McKittrick Co. at Inyokern, Calif., is now superintendent for all work with D. M. Kitchen, cement contractor, at Bakersfield, Calif.

D. A. Flickinger is running the job for Tiffany Construction Co. on a highway project near Safford, Ariz., for the state highway department. The project is about 8 mi. long and the contract figure is \$280,000.

Clyde "Bud" Yates is job manager and **Bob Corr** job engineer for Guy F. Atkinson Co., constructing the Dominguez concrete conduit flood control channel from Inglewood Ave. to Los Angeles Airport.

Ray Anderson is job superintendent and **Wayne Cox** is chief engineer for James I. Barnes Construction Co., San Francisco, constructing eight one-story concrete buildings in San Anselmo, Marin County, Calif., for the \$1,799,708 Sir Francis Drake High School. **J. B. Allen** is purchasing agent for the project.

Earl Fizer is job superintendent for Perry McGlone Construction Co., Kansas City, Mo., on its \$2,346,141 contract for building earthwork and structures preparatory to the relocation of Chicago, Burlington & Quincy Railroad at Trenton Dam, Missouri River Basin Project, Neb. **Robert Baker** is office manager and **D. B. Leach** is construction engineer.

C. S. Muir is job superintendent for McLaughlin, Inc., Great Falls, Mont., on its \$213,873 contract for paving and curbing 40 blocks in Glasgow, Mont., using roll-type curbing. **William Stephenson** is field engineer and **D. C. Wingfield** is job office manager.

Milton Gerstenberger is job superintendent on the construction of the \$512,854 reinforced concrete box girder bridge on Harbor Freeway at Fourth St., Los Angeles, being contracted by W. J. Disteli, Los Angeles.

Frank Muren is superintendent and **Jeff Kasler** is assistant superintendent on a road construction project now nearing completion on Highways 99 and 60 near

Beaumont, Calif. **Fredericksen & Kasler** is the contractor.

Cuvier Greene is now superintendent for The Contracting Engineers, Los Angeles, constructing the \$250,000 New Carter Hardware building in Los Angeles.

Charles C. Braden is superintendent for the Process Construction Co., Los Angeles, constructing additions to the Norwalk Oil Co. plant at Bakersfield, Calif.

Louis A. Wilson is project manager and **Tom E. Moore** is general superintendent for Pioneer Constructors, Tucson, Ariz., contractor on a paving, water

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main, and sewer subcontract for the Walker Air Force Base housing project.

James Harris is project manager and **Tom E. Moore** is general superintendent for Pioneer Constructors on a \$91,000 highway project at Safford, Ariz.

E. E. Yaeger is supervising a \$270,000 street surfacing and widening job in Corona, Calif., for E. L. Yaeger Co., contractors.

Tom E. Moore is supervising the paving of streets, construction of sewers, gutters, and curbs in Jefferson Park Improvement District, Tucson, Ariz., for Pioneer Constructors, Tucson, a \$371,000 project.

A. H. Bauer is superintendent and **Al M. Clarke** is job engineer for A. Teichert & Son on its \$2,000,000 Ridge Route road construction project.

Benno Biesemeyer is supervising construction of a liberal arts building and a student union memorial building on the University of Arizona campus, a \$1,800,000 project, for M. M. Sundt Construction Co., Tucson, Ariz.

Milo Lubanco is project manager for Basich Bros. on its \$750,000 construction project on U. S. Hwy. 101 near Calabasas, Calif.

Monarch Materials Co., Inc., is the new name of the former Howard & Hos-

kins Material Co., Inc., located at Santee, Calif. **Irving P. Howard** is president; **C. Ray Silverthorn**, vice-president; **R. E. Clark**, office manager, and **Olly Stoffel**, master mechanic.

Earl L. Burrows is project manager and **A. J. Meyer** is general superintendent for Fern Meria Construction Co., Inc., on a large housing project near Albuquerque, N. Mex.

W. E. Orr, Jr., is project manager and **John Carey** is general superintendent for Orr & Orr Construction Co. on its \$75,000 contract for road construction on Cotton Lane, 30 mi. west of Phoenix, Ariz.

N. W. Axline is project manager and **L. D. Peterson** is assistant superintendent for Tiffany Construction Co. on its \$139,000 roadmix surfacing project for the Bureau of Public Roads at Idyllwild, Calif.

Arthur Rogers is superintendent for R. C. Tanner & Sons and Heuser & Garrett, Phoenix, Ariz., on its \$82,500 joint venture contract for highway construction on Christy Road, Phoenix.

E. W. Hoggan is superintendent for Manderbach Construction Co., Glendale, Calif., on a \$270,000 armory building at Burbank, Calif. He is also supervising construction on the \$260,000 Union High School at Fillmore, Calif., on which project **Art Shelton** is assistant superintendent.

Phil Britzius is job superintendent and **Kenneth Newton** is foreman for K. T. Henderson, Longview, Wash., general contractor for the \$1,167,370 junior high school building at Longview.

B. W. Goodenough is project manager and **A. J. May** is general superintendent for Utah Construction Co., engaged in shaft sinking at Carlsbad, N. Mex., for International Mineral & Chemical Co. and Duval Sulphur & Potash Co.

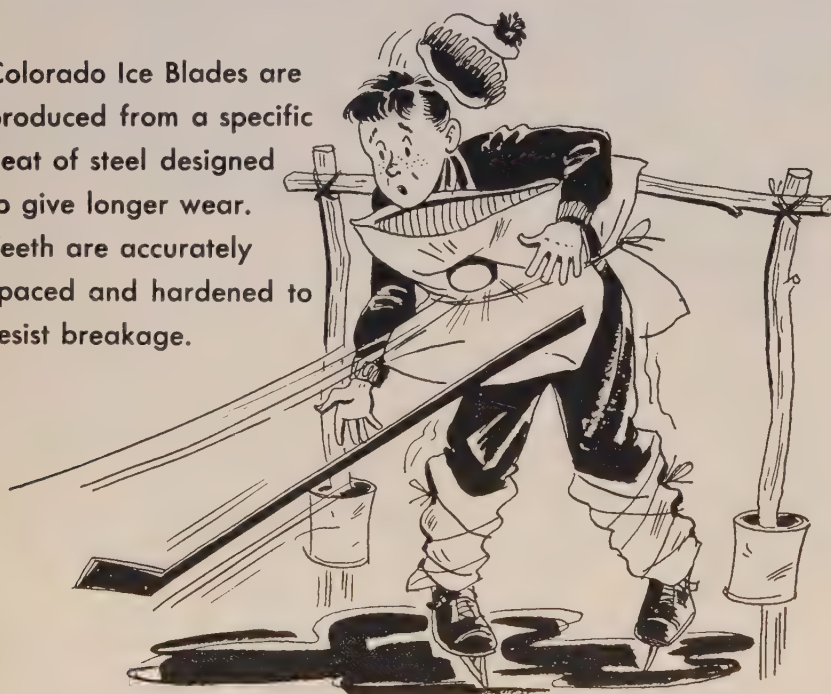
Murray Gray is general superintendent and **T. T. Word** is assistant engineer for Ivan Dement, Amarillo, Tex., for grading, and earthwork for a railroad embankment near Carlsbad, N. Mex., a project of Duval Sulphur & Potash Co.

Troy Jones is project manager and **Dewine Kelly** is general superintendent for San Xavier Construction Co., Tucson, Ariz., on its \$192,199 contract for realigning and surfacing 1.8 mi. of the Phoenix-Tucson highway in Pima County, Ariz.

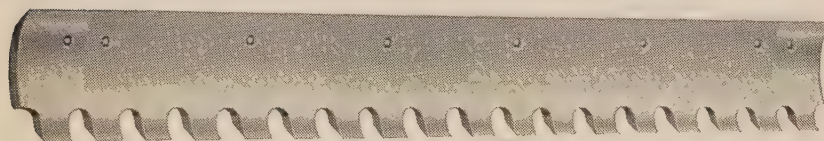
W. L. Johnson is project manager and **W. S. Dewlaney** is general superintendent for Johnson Construction Co. on a \$90,000 steel and concrete overpass project at Yuma, Ariz.

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Contracts . . .

A Summary of Bids and Awards For Major Projects in the West

Arizona

\$284,448—**Fisher Contracting Co.**, 2201 S. 19th Ave., Phoenix—Low bid for road improvement on a ½-mi. stretch of Miami-Superior highway.

\$262,152—**Phoenix-Tempe Stone Co.**, Box 1670, Phoenix—Contract for constructing 6 mi. of roadway over a new alignment on the new Topock-Kingman highway.

\$4,500,000 approx.—**Rubenstein Construction Co.**, 2518 N. Seventh Ave., Phoenix—Contract for building 1,300 dwelling units at Williams Air Force Base near Chandler, the first group of which is now under construction.

\$114,115—**J. H. Welsh & Son Contracting Co.**, 805 S. Central Ave., Phoenix—Contract for building a water supply system for Arcadia Improvement District on 2,400 ac. south of Camelback Mountain; by City of Phoenix.

California

\$895,800—**James I. Barnes Construction Co.**, 504 S. Lafayette Park Place, Los Angeles—Contract for construction of reinforced concrete cargo transit shed at Berths 9 and 10, Pier A, Long Beach Harbor; by Long Beach Board of Harbor Commissioners.

\$515,000—**Byerts & Sons**, 1110 S. Redondo Beach Blvd., Los Angeles—Contract for construction of a reinforced concrete bridge on San Gabriel River Parkway, Los Angeles County; by County Board of Supervisors.

\$1,298,254—**R. J. Daum Construction Co.**, 6803 West Blvd., Inglewood—Contract for constructing a 4-story reinforced concrete and brick wing on administration building at UCLA campus, Westwood; by Regents of University of California.

\$2,000,000 est.—**L. E. Dixon & Co.**, 409 S. California St., San Gabriel—Contract for construction of 11-story general office building on Wilshire Blvd., Los Angeles, excavation for which is already under way; by Gershon-Scott Corp.

\$333,843—**Eaton & Smith**, 715 Ocean Ave., San Francisco—Low bid for grading and surfacing with plantmix surfacing on crusher run base on 1.6 mi. of state highway at Hatchet Creek line change in Shasta County.

\$2,140,877—**Leo Epp**, 703 Market St., San Francisco—Low bid for construction of North Beach housing project, San Francisco; by Housing Authority of San Francisco.

\$8,000,000 approx.—**Fluor Corp., Ltd.**, 2500 S. Atlantic Blvd., Los Angeles—Contract for designing and constructing a steam electric generating plant on the outskirts of San Bernardino; by California Electric Power Co.

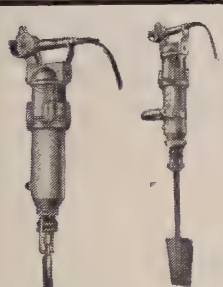
\$700,000 approx.—**Hongola & Elliott Construction Co.**, Box 157, El Centro—Low bid for construction of a power plant and appurtenances for Unit No. 2, El Centro Steam Station; by Imperial Irrigation District.

\$185,569—**M. J. B. Construction Co.**, 322 Elks' Building, Stockton—Low bid for grading and surfacing of 5.3 mi. of state highway between State Hwy. 4 and Jack Tone Road at Collegeville, San Joaquin County.

\$1,583,478—**Oberg Bros. Construction Co.**, 401 W. Florence Ave., Inglewood—Contract for construction of a 1,910-ft.-long subway on Sepulveda Blvd. under Los Angeles International Airport, between Century and Imperial Blvds.; by Los Angeles City Board of Public Works.

\$273,390—**W. H. O'Hair**, Box 278, Colusa—Low bid for grading and surfacing 12.8 mi. with roadmix surfacing on gravel base between Grasshopper Valley Ranch and Hayden Hill Road, Lassen County.

\$170,379—**Parish Bros.**, Box 6, Benicia—Low bid for construction of headworks and open channel near Lake Lagunitas and Bon Tempe Lake, vicinity of Fairfax, Marin County; by Marin Municipal Water District.



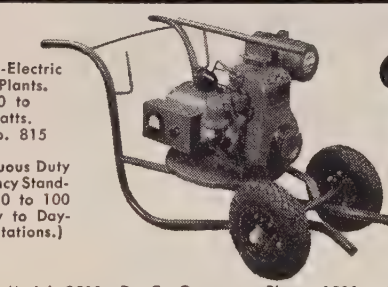
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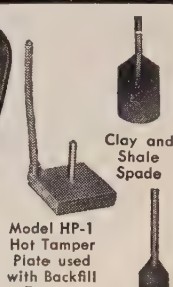
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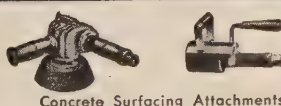


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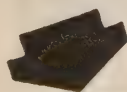
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\$548,439—**J. A. Payton**, Box 207, Riverside—Low bid for realignment of 4 mi. of State Hwy. 150 between Hot Springs and Tequepis Canyons near Cachuma Reservoir site, Santa Barbara County.

\$2,633,000—**Carl N. Swenson and Williams & Burrows**, 1095 Stockton Ave., San Jose—Contract for construction of 15 reinforced concrete high school buildings; by San Jose Board of Education.

\$1,645,114—**United Concrete Pipe Corp.**, Box 425, Baldwin Park, and **Ralph A. Bell**, 901 S. Primrose Ave., Monrovia—Joint venture contract for constructing three grade separation structures, two pedestrian overcrossings, grading and surfacing of 2.3 mi. on Santa Ana Freeway between Augusta Ave. and Rio Hondo, Los Angeles County.

\$895,579—**United Concrete Pipe Corp.**, Box 425, Baldwin Park—Low bid for constructing two bridges, grading and surfacing of 7.8 mi. with cement concrete pavement and plantmix surfacing between Tulare Airport and Tagus, Tulare County.

\$11,000,000—**Del E. Webb Construction Co.**, Box 4066, Phoenix—Contract for construction of 500-room, 8-story hotel on a 9-acre site in Beverly Hills, to be known as the Beverly-Hilton.

Colorado

\$741,740—**Adler Construction Co.**, Box 509, Dickinson, N. Dak.—Low bid for constructing the Pole Hill power plant and access road, Estes Park-Foothills Power Aqueduct, Colorado-Big Thompson Project; by Bureau of Reclamation.

\$232,392—**Gardner Construction Co.**, Box 360, Glenwood Springs—Low bid for constructing earthwork and structures, Schedules 1 and 2, for enlargement of Fire Mountain Canal, Paonia Project; by Bureau of Reclamation.

\$164,661—**L. J. Hesser**, Box 806, Greeley—Contract for grading structures and oil processing of 8.4 mi. between Lucerne and Barnesville, Weld County.

\$250,747—**M. F. Kemper Construction Co.**, 3701 Overland Ave., Los Angeles, Calif.—Contract for installing concrete lining in 2,240-ft.-long, 12-ft.-high horseshoe tunnel, on Colorado River, Grand Valley Project; by Bureau of Reclamation.

\$1,066,766—**Peter Kiewit Sons' Co.**, Box 4149, S. Denver Station, Denver—Contract for grading, ballast and minor structures on 10.7 mi. of Denver-Boulder Turnpike, extending from city limits of Boulder to town of Broomfield.

\$192,495—**Northwestern Construction Co.**, Denver—Low bid for stabilization structures and oiling of 6.6 mi. on U. S. Hwy. 287 between Lamar and Wiley; also channelization of an intersection with U. S. Hwy. 50.

\$314,698—**A. B. Reither Contracting Co.**, 602 Denham Building, Denver—Contract for constructing 348.2 mi. of transmission line by Morgan County Rural Electrification Administration, Fort Morgan.

\$202,106—**Robert B. Swaner**, 555 Thirteenth Ave., Salt Lake City, Utah—Contract for construction of 129.8 mi. of transmission line for Grand Valley Rural Power Lines, Inc., Grand Junction, Mesa County; by Rural Electrification Administration.

Idaho

\$1,018,000—**M. J. Brock & Sons, Inc.**, 2894 Rowena Ave., Los Angeles—Low bid for construction of the remaining buildings and other facilities for the naval reactor test plant where ship propulsion by atomic power will be studied; by Atomic Energy Commission and Westinghouse Electric Corp.

\$313,522—**Fonnesbeck Electrical Co.**, Idaho Falls—Contract for construction of four 138-kv. electrical substations at reactor testing station near Idaho Falls; by Atomic Energy Commission.

\$721,484—**Peter Kiewit Sons' Co.**, Box 875, Sheridan, Wyo.—Contract for construction of 38 mi. of highway between Idaho Falls and Twin Buttes reactor testing station area, one section in Bingham County, and another in eastern part of Bonneville County.

\$362,589—**Paul W. Larsen, Inc.**, 361 W. Fourth South, Salt Lake City, Utah—Contract for constructing a plant to generate process and heating steam at reactor testing station in southeastern Idaho; by Atomic Energy Commission.

\$543,931—**C. B. Lauch Construction Co.**, Box 2559, Boise—Contract for constructing two buildings, a refuse burner, and installation of water and sewage facilities at reactor testing station; by Atomic Energy Commission.

\$560,000—**Utah Power & Light Co.**, Kearns Building, Salt Lake City, Utah—Contract for constructing a 132-kv. transmission

line from Goshen to reactor testing station; by Atomic Energy Commission.

Montana

\$291,912—**Peter Kiewit Sons' Co.**, Box 875, Sheridan, Wyo.—Contract for grading, draining, and bituminous surfacing of 8.4 mi. between Conrad and Shelby in Pondera County.

\$533,517—**McKinnon-Decker Construction Co.**, 1520 Hauser Blvd., Helena—Low bid for general construction of new Catholic high school in Helena.

\$250,812—**McLaughlin, Inc.**, Box 1824, Great Falls—Contract for 10.3 mi. of grading, draining and bituminous surfacing between Great Falls and Fort Benton Road in Cascade and Chouteau Counties.

\$159,617—**Barry O'Leary**, Billings—Contract for grading and surfacing 1.37 mi. of state highway between Reed Point and Columbus Road in Stillwater County.

\$208,965—**Charles Shannon**, 502 S. Washington St., Butte—Contract for grading, gravel, and draining of 10.2 mi., and grading, draining, and roadmix oiling of 8 mi. on Malta-Loring road in Phillips County.

Nevada

\$1,777,241—**C. M. Elliott and John C. Gist**, Box 984, Redding, Calif.—Joint venture low bid for furnishing and installing turbines, transformers, construction of additional circuits and terminal facilities for Hoover Switchyard, Hoover Power Plant, Boulder Canyon Project, about 7 mi. northeast of Boulder City, Nev.; by Bureau of Reclamation.

\$136,484—**Isbell Construction Co.**, Box 2351, Reno—Contract for grading, draining, and surfacing of 9 mi. on Foothill Road between Scossa Ranch and Genoa, Douglas County.

New Mexico

\$192,921—**Brown Contracting Co.**, Box 1479, Albuquerque—Low bid for grading and paving of 12.5 mi. and timber bridge between Clovis and Texas state line in Curry County.

\$137,771—**Brown Contracting Co.**, Box 1479, Albuquerque—Low bid for grading and paving on crushed rock base for 7.6 mi. on Alamogordo-Cloudcroft Forest Highway in Otero County; by Bureau of Public Roads.

\$849,900—**Robert McKee**, Box 2848, Dallas, Tex.—Low bid for general construction on the new Bataan Memorial Methodist Hospital in Albuquerque.

\$1,125,000—**E. C. Pritchett Co.**, Box 8157, Houston, Tex.—Contract for construction of utilities and related services, to include roads, water mains, sewers, electric and gas mains, Area TA-16, Los Alamos.

Oregon

\$249,026—**American Bridge Co.**, Frick Bldg., Pittsburgh, Pa.—Low bid for erecting steel spans for Marion St. Bridge on Salem-Dallas Highway in Marion and Polk Counties.

\$284,020—**Cosmo Gilo**, Prineville—Low bid for grading 8.7 mi. of state highway between Stout Creek and Mill City on North Santiam secondary highway in Marion County.

\$498,415—**K. L. Goulter & Co.**, Box 37, Dexter—Low bid for clearing, grubbing, grading, draining, and surfacing 7.5 mi. of timber access road from Blowout Creek northeast to junction of North Santiam Highway, about 3 mi. east of Detroit, Linn County; by Corps of Engineers.

\$800,251—**Carl M. Halvorson, Inc.**, 218 Builders Exchange Bldg., Portland—Contract for reconstruction, grading, and surfacing of 2.8 mi. on Canyonville section of Oregon Pacific Highway; by Bureau of Public Roads.

\$208,370—**Hamilton & Thomas**—Box 726, Eugene—Contract for constructing a 751-ft. bridge over middle fork of Willamette River on Springfield-Creswell highway near Jasper, Lane County.

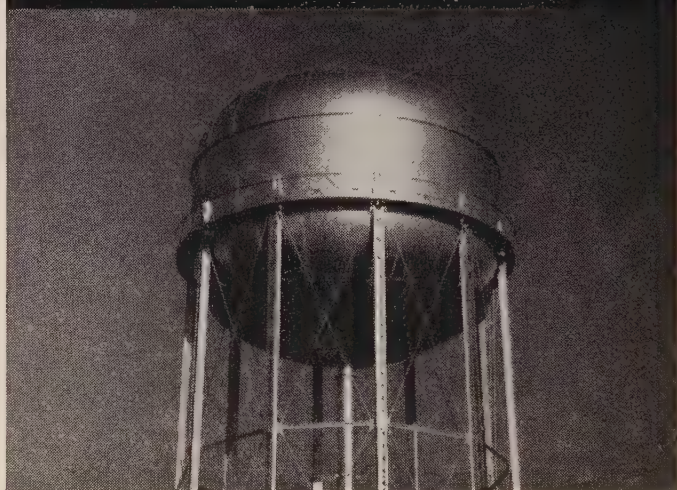
\$1,701,845—**Kuckenberg Construction Co.**, Box 7407, Parkrose Station, Portland—Low bid for construction of two-mile-long tunnel, the Grand Avenue sewage interceptor unit, to serve entire southeast district of Portland.

\$423,669—**Morrison-Knudsen Co., Inc.**, Box 450, Boise, Idaho—Low bid for construction of 30 mi. of Big Butte Springs Pipeline No. 2 to supplement water supply of city of Medford.

\$362,999—**Schutt Construction Co., Inc.**, Genoa, Wis.—Low bid for clearing areas F and G in the reservoir area $4\frac{1}{2}$ mi. above Detroit damsite, on south side of North Santiam River and on north and west sides of Breitenbush River; by Corps of Engineers.



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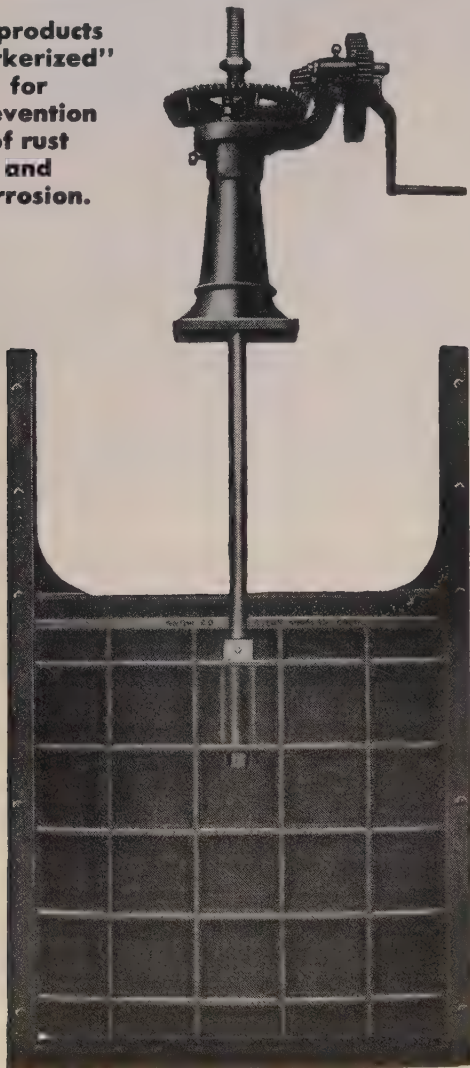
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\$199,463—**Utah Construction Co.**, Box 1549, Richmond, Calif.—Low bid for furnishing ballast, ties, rail and appurtenances, and constructing a shoofly track on existing Southern Pacific Co. railway, about 12 mi. upstream from Lowell, Lane County; by Corps of Engineers.

Utah

\$1,259,940—**Peter Kiewit Sons' Co.**, 345 Kieways Ave., Arcadia, Calif.—Contract for construction of earthwork and structures for Salt Lake Terminal Reservoir, Provo River Project; by Bureau of Reclamation.

\$1,194,916—**Olson Construction Co.**, Box 89, Salt Lake City—Low bid for construction of Southeast Junior High School in Salt Lake City; by Board of Education.

\$175,787—**Whiting & Haymond**, Springville—Low bid for construction of 2-in. roadmix bituminous surfaced road north and west of Cleveland in Emery County.

Washington

\$398,258—**Fiorito Bros.**, 1100 Leary Way, Seattle—Contract for grading and surfacing on 2.8 mi. of State Hwy. 1 in Cowlitz and Lewis Counties.

\$143,666—**Fiorito Bros.**, 1100 Leary Way, Seattle—Contract for 3.5 mi. of grading and paving with cement concrete on Old Military Road and South 188th St. in King County.

\$450,106—**Grant Construction Co.**, Box 351, Coeur d'Alene, Idaho—Contract for relocation, grading, draining and surfacing of 10.3 mi. of state highway between Pasco and Attalia in Franklin and Walla Walla Counties.

\$3,700,000—**Kaiser Engineers**, 1924 Broadway, Oakland, Calif.—Contract for constructing nine new factory buildings in addition to several new storage tanks, additions to power facilities—all for operation of the seventh potline—at Mead reduction works in Spokane; by Kaiser Aluminum & Chemical Corp.

\$1,352,345—**Peter Kiewit Sons' Co.**, Box 491, Longview—Low bid for construction of Cowlitz River Bridge at Kelso.

\$275,000—**Phil McInnis and Henry George & Sons**, Hutton Bldg., Spokane—Joint venture contract for raising from two stories to five stories the building of the Lincoln First Federal Savings & Loan Assn. in Spokane.

\$222,909—**Thomas Scalzo & Co.**, 3211 Airport Way, Seattle—Contract for construction of a permanent road, involving cutting and filling, grading and surfacing, exclusive of paving, to skirt west shore of new Deschutes Lake in Tumwater, Thurston County.

\$484,923—**J. A. Terteling & Sons**, Box 1428, Boise Idaho—Low bid for construction of 15 mi. of Columbia Basin West Canal, about 3 mi. of drain ditches, relocation of about $\frac{1}{3}$ mi. of road, and installation of one concrete bridge and five timber bridges; about 6 mi. south of Quincy; by Bureau of Reclamation.

\$167,336—**Valley Construction Co.**, 7722 Rainier Ave., Seattle—Low bid for construction of the Unit 1-C outfall line, involving construction of 2,400 ft. of 72-in. heavy reinforced concrete pipe, Lake City Sewer District, near Seattle.

Wyoming

\$319,045—**Boatwright & Smith Construction Co.**, Box 703, Rawlins—Contract for 4.5 mi. of highway construction between Sheridan and Montana state line in Sheridan County.



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426,427—**Peter Kiewit Sons' Co.**, 1024 Omaha National Bank Bldg., Omaha, Neb.—Contract for grading, draining, base course surfacing, base course stabilization, a bridge and four culverts on 1.4 mi. of roadway between Sheridan and Montana state line, Sheridan County.

373,228—**Sharrock & Pursel Construction Co.**, Box 316, Casper—Low bid for construction of a 12-mi. extension of the Wyoming canal and laterals, Riverton reclamation project; by Bureau of Reclamation.

Alaska

1,884,391—**Babler Bros. and Rogers Construction Co.**, 4617 S.E. Milwaukie St., Portland, Ore.—Joint venture low bid for grading and bituminous surfacing of 51.7 mi. of Alaska Highway from Big Delta to Sears Creek; by Alaska Road Commission.

3,790,141—**McLaughlin, Inc.**, Box 1824, Great Falls, Mont.—Low bid for grading, surfacing and bituminous surfacing of 34.6 mi. from Valdez to Mile 36 on Richardson Highway, Section H; by Alaska Road Commission.

327,668—**Stateside Construction Co.**, Securities Bldg., Seattle, Wash.—Sole bid submitted for installation of sewers, involving installation of 12- to 24-in. trunk line and 8- and 10-in. laterals, in western part of Fairbanks; by Alaska Board of Public Works.

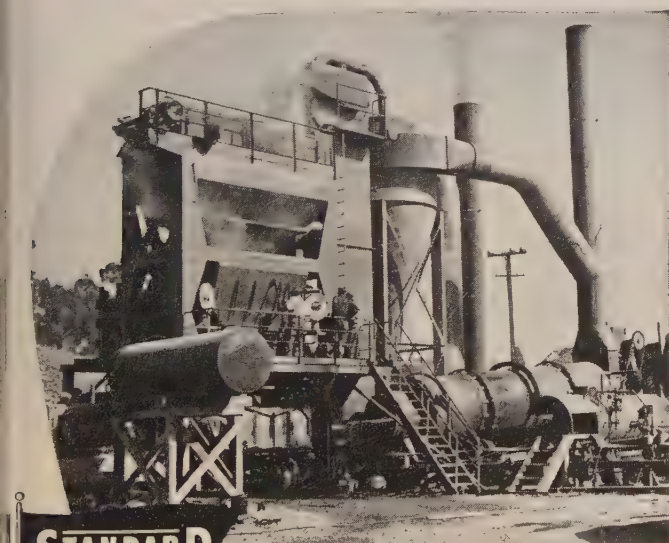
189,799—**Urban Plumbing & Heating Co.**, 103 S. 28th St., Tacoma, Wash.—Low bid for construction of outside utilities, involving installation of approximately 30,000 lin. ft. of sewer pipe ranging in size from 6 to 15 in. in diameter, at air depot area, Elmendorf Air Force Base; by Corps of Engineers.

Territory of Hawaii

1,000,000 est.—**Hawaiian Dredging Co.**, Honolulu—Contract for constructing the new Surf Rider Hotel at Waikiki Beach; by Matson Navigation Co.

British Columbia

3,500,000—**B. C. Bridge & Dredging Co., Ltd.**, Vancouver—Contract for modernization of the No. 1 generating plant of the B. C. Electric Co., to include installation of a single generating unit with capacity of 72,000 hp.



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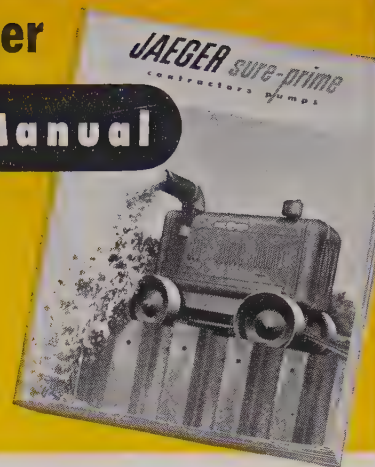
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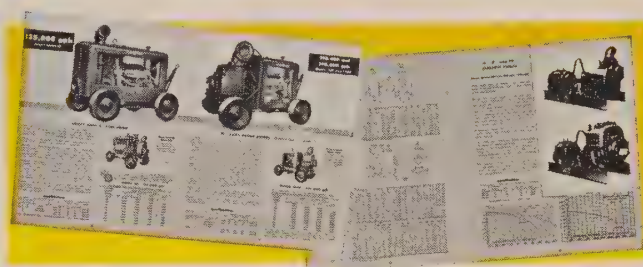
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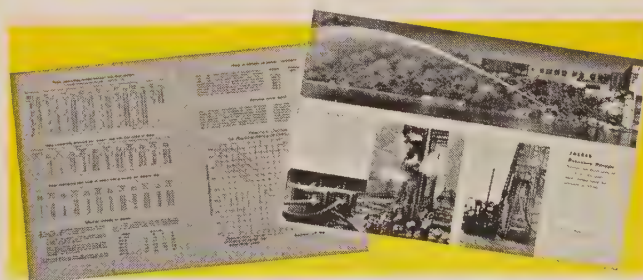
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EDWARD R. BACON CO.....	San Francisco 10
SMITH BOOTH USHER CO.....	Los Angeles 54
A. H. COX & CO.....	Seattle 4 and Wenatchee
NELSON EQUIPMENT CO.....	Portland 14
ANDREWS EQUIPMENT SERVICE OF WASHINGTON, INC.....	Spokane 9
WESTERN MACHINERY CO.....	Salt Lake City and Denver 2
CENTRAL MACHINERY CO.....	Great Falls and Havre
TRACTOR & EQUIPMENT CO.....	Sidney, Miles City, Glasgow
WORTHAM MACHINERY CO.....	Cheyenne and Billings
J. D. COGGINS & CO.....	Albuquerque
SCHRIVER MACHINERY CO.....	Phoenix
IDAHO MACHINERY CO.....	Boise

NEWS *of*

DISTRIBUTORS AND FACTORY BRANCHES

A \$3,000,000 factory-operated parts depot in Milwaukie, Ore., is planned by *International Harvester Co.*, to supply all the company's Northwest and Alaskan dealers with service parts. The nearest parts depots to these areas at the present time are at Richmond, Calif., and in Minneapolis, Minn.

★ ★ ★

J. E. CANNON was recently appointed manager of *Cummins Diesel Sales Corp.* of Seattle. Before joining that company, Cannon was employed for many years by the *Kenworth Motor Truck Corp.*, also of Seattle.

★ ★ ★

RAY KANESKI, branch manager of the *Tractor and Equipment Co.* in Glasgow, Mont., has announced that the company has begun preparations for use of a new industrial site it has purchased near the east limits of the city. The 5-acre site, which was purchased from the *Opheim Concrete Products Co.*, has a 450-ft. frontage on U. S. Hwy. 2 and is also accessible to the nearby Great Northern. The company, which has headquarters in Sidney, operates a tractor and heavy equipment business in the local branch to serve Valley, Phillips, Roosevelt and Daniels counties.

★ ★ ★

R. L. NICHOLSON and B. NEUSTADT, owners of the *Pacific Tractor & Implement Co.*, Richmond, Calif., distributors of Ford tractors and Dearborn farm implements in Northern California and Western Nevada, have announced the purchase of the Portland, Ore., office, inventory, and warehouse facilities of the *Dearborn Motors, Inc.* They have been granted the Ford-Dearborn franchise for the entire

Pacific Northwest territory, consisting of Washington, Oregon, Northern Idaho and Alaska. Renamed the *Columbia Tractor & Implement Co.*, the newly-acquired distributorship will serve 60 Ford tractor dealers in the Northwest. More details of the transaction will appear in this section next month.

★ ★ ★

The *Foulger Equipment Co.* of Salt Lake has named ARTHUR F. SMART as new parts manager. Smart was formerly purchasing agent for the Utah Construction Co., a position he held from 1944 to 1948. Before joining the Foulger Co. he was works manager of the Rico Argentine Mining Co. of Eureka, Colo.



GAR-BRO MANUFACTURING CO. has completed this new building in Los Angeles (see item)

Appointment of CLAUDE MULLEAGUE to the position of sales engineer in the Western Division sales department of *Caterpillar Tractor Co.* has been announced by B. L. HAGGLUND, Western sales manager. Mulleague will have headquarters in San Leandro, Calif., and he will serve as supervisor of engine installations for Caterpillar

distributors throughout the Western Division, including British Columbia and Alaska. He has been with Caterpillar since 1936, except for five years with the Johnson Tractor Co., a Caterpillar distributor.

★ ★ ★

C. E. BUCKNER, general sales manager of *Electric Steel Foundry Co.* of Portland, recently announced the promotion of ESCO Seattle branch manager, J. E. McQUAID, to the position of sales manager of the Contractor's Equipment Division in the Portland home office. McQuaid will go to Portland to assume his new duties in December. WILSON V. "BILL" LATIMER, for the past several years assistant manager at the Seattle office, was simultaneously promoted to managership of that branch succeeding McQuaid.

★ ★ ★

Gar-Bro Manufacturing Co., a division of Garlinghouse Brothers, has just completed a new building on recently acquired property adjoining the plant in Los Angeles. In announcing the new building, A. F. GARLINGHOUSE, president, explained that the organization has grown at such a rate since 1923 that enlarged facilities are very necessary to house the expanding sales, service and manufacturing department.

A TRUCK SPECIALLY DESIGNED to ship Mixermobile equipment is being used by Mixermobile Manufacturers, Portland, Oregon. The truck, which will carry four of the firm's Scoopmobiles, is designed and built to carry a 34,000-lb. payload at normal highway speeds. It is 45 ft. long and has 16 tires. The truck with its unusual features will facilitate delivery of Mixermobile equipment to distributors and customers throughout the country.



ments. 18,000 sq. ft. of additional area have been added. This includes 9,600 sq. ft. enclosed by an all steel building and 8,400 sq. ft. for parking. Plant facilities now total 48,000 sq. ft., and more extensive construction, which is planned for the near future, will include a modern office and display room.

★ ★ ★

G. W. JAMIESON, general manager of *Rhodes & Jamieson, Ltd.*, Oakland, Calif., announces a recently signed distributorship agreement with *Worthington Pump & Machinery Corp.*, Harrison, N. J., for handling Worthington-Ransome truck and big building cement mixers. Rhodes & Jamieson has been in business since 1900 and has been supplying readymix concrete plants and contractors in northern California with construction equipment since 1938.

★ ★ ★

WILLIAM N. SUNDAHL has been named factory representative in charge of a new branch of the *Maginniss Power Tool Co.* in Glendale, Calif. Sundahl has had long experience in the construction equipment field, specializing in portable electric and pneumatic tools. The Maginniss Co., with

headquarters in Mansfield, Ohio, manufactures the Hi-lectric line of concrete vibrators, saws, grinders and portable generators. A representative stock of complete units and parts will be maintained in the new location.

☆ ☆ ☆



JORGENSEN

LEE E. JORGENSEN, who has been active in the construction field since 1936 in positions ranging from sales to service, has been appointed district sales representative for R. G. LeTourneau, Inc., of Peoria, Ill. His territory will be Northern California, Idaho and Nevada, with headquarters in Sacramento.

Jorgenson has been with LeTourneau since 1945, serving with the Export Division in Mexico, Central America and Brazil. His previous experience has included work with the industrial engineering firm of Sanderson & Porter, Inc., the Douglas Aircraft Co., and the Corps of Engineers.

☆ ☆ ☆

According to F. A. EBELING, general sales manager, the W. W. Sly Manufacturing Co., of Cleveland, Ohio, has appointed the Horrell Co., Los Angeles, to act as sales engineers for the Sly industrial dust control and sandblast equipment. The Horrell Co. has served for a number of years in Southern California as consulting engineers and distributors of engineered products and equipment.

☆ ☆ ☆



LUNDAHL

JOHN LUNDAHL has been appointed to the newly-created position of sales representative-at-large by the Detroit Diesel Engine Division of General Motors Corp. Lundahl will be on special assignment, and on occasion will work with Western distributors. He will also be available to assist in the engineering on special GM Diesel engine installations.

☆ ☆ ☆

Appointment of ROBERT S. COOK as district manager of the Los Angeles office of the E. F. Hauserman Co. was announced recently by FRED M. HAUSERMAN, president. Cook succeeds ROBERT BROWN, manager of the Los Angeles office since 1947. Brown has been recalled to active duty in the Army. Cook, who was formerly manager of sales promotion for the company, has been on a special marketing assignment in the Philadelphia area since the early part of this year. Before joining the firm as a sales engineer in 1939, he spent a period of nine years designing buildings and exhibits for the Century of Progress, the Texas Centennial, and the New York World's Fair. He is also experienced in

Continued on page 112

An OWEN BUCKET

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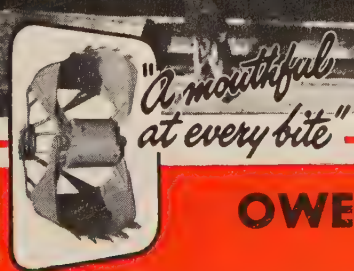
- In-built stamina through advanced, job-proved designs and the use of top-quality materials is characteristic of every bucket OWEN builds.

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NEWS of DISTRIBUTORS AND FACTORY BRANCHES

Continued from page 111

the design of porcelain enamel steel products for buildings.

☆☆☆

On a tour of *White Motor Company* branches and distributors in the U. S. and Canada, ROBERT F. BLACK, president of the company, and J. N. BAUMAN, vice president and general sales manager, headed more than twelve regional sales meetings. Main purpose of these meetings was to acquaint the personnel with the success of White's new 3000 series.

☆☆☆

According to R. S. NUTT, president, the *Northland Machinery Co.* of Sidney, Mont., has added to its industrial and farm equipment the *Calkins Manufacturing Co.* line of machinery. This line is used extensively in the semi-arid districts of Montana and Wyoming. Northland has also added a full line of sprinkler irrigation equipment whereby farms and ranches having reservoirs for water storage can irrigate small and large acreages.

NEWS of MANUFACTURERS

Cummins Engine Co., Inc., of Columbus, Ind., has announced the largest single expansion in its 30-year history. Construction of a new building, 200 ft. wide and 460 ft. long, will begin immediately, making available 2.1 ac. of land under one roof and adding 92,000 sq. ft. of floor space to the factory facilities. IRWIN MILLER, president of the company, said that by the time the new building is finished, Cummins will have spent more than \$5,000,000 since the end of World War II for additional manufacturing facilities and for modernizing the Columbus plant. In the same period production capacity has been increased by 60%. The company currently employs about 2,300 people. Cummins specializes in lightweight, high-speed diesels and has 84 models in the 50-550 hp. range.

☆☆☆

The National Supply Co., Pittsburgh, Pa., has recently broadened its sales and service facilities, as well as the horsepower range of its diesel engines, by purchasing the assets of the engine division of the *Atlas Imperial Diesel Engine Co.*, Oakland, Calif. The purchase included the name, patents, trademarks, designs, certain machinery and equipment, and sales and service outlets and inventories throughout the United States and Canada. The National Supply Co., the largest manufacturer and distributor of oil field machinery and equipment, is a major manufacturer of diesel, dual-fuel, and natural gas engines

Continued on page 114

UNIT BID SUMMARY

Water Supply . . .

Pipeline Using Lined and Coated Steel Pipe

California—San Joaquin Pipeline of Hetch Hetchy Aqueduct—San Francisco. P. & J. Artukovich, Los Angeles, with a low bid of \$1,663,710, was awarded a contract on Schedule III by the City and County of San Francisco for constructing the San Joaquin Pipeline No. 2, Section A, in the San Joaquin Division of the Hetch Hetchy Aqueduct. Unit bids presented below are for Schedule III, using lined and coated steel pipe.

(1) P. & J. Artukovitch.....	\$1,663,710	(4) Artukovitch Bros., Inc.....	\$1,778,233				
(2) Steve P. Rados, Inc.....	1,671,326	(5) M & K Corp. & Fredrickson & Watson.....	1,809,209				
(3) T. E. Connolly, Inc.....	1,766,715	(6) Winston Bros. Corp.....	1,887,999				
		(1)	(2)	(3)	(4)	(5)	(6)
975 lin. ft. furn. & lay. 62-in. steel pipe of 9/16-in. pl.	39.90	36.00	39.52	41.00	42.26	43.50	43.50
30,075 lin. ft. furn. & lay. 62-in. steel pipe of 1/2-in. pl.	32.60	29.70	32.98	34.80	35.70	35.70	35.70
5,530 lin. ft. furn. & lay. 62-in. steel pipe of 7/16-in. pl.	31.75	28.20	30.78	32.80	33.26	33.00	33.00
36,580 lin. ft. lining 62-in. steel pipe.....	4.30	5.00	4.70	4.10	4.70	4.50	4.50
36,580 lin. ft. coating 62-in. steel pipe.....	4.85	7.00	5.50	4.80	5.40	5.44	5.44
175 lin. ft. double mortar coating 62-in. steel plate	11.00	12.00	10.59	10.00	10.50	10.00	10.00
72,000 cu. yd. excavation in earth.....	.75	.85	.67	1.00	.60	1.00	1.00
5,000 cu. yd. excavation in rock.....	1.50	.85	2.85	3.00	.60	2.50	2.50
40,000 sta. yd. overhaul.....	.04	.12	.10	.10	.03	.00	.00
47,000 cu. yd. backfill.....	.35	.22	.50	.50	.54	.88	.88
150 cu. yd. concrete, Class A.....	45.00	52.50	70.00	80.00	40.00	95.00	95.00
10 cu. yd. concrete, Class B.....	38.00	47.50	70.00	50.00	20.00	23.00	23.00
250 cu. yd. concrete, Class C.....	37.00	30.00	70.00	50.00	20.00	42.00	42.00
bbl. Adjustment price for Portland cement.....	4.50	5.00		4.00	4.50	3.50	3.50
55,000 lb. steel reinforcing bars.....	.14	.12	.14	.10	.13	.11	.11
27 manholes, furn. and inst. manholes, 250-lb. std.	200.00	375.00	430.00	275.00	370.00	900.00	900.00
19 ea., furn. & inst. 6-in. air valve assem. 250-lb. std.	500.00	450.00	560.00	410.00	620.00	550.00	550.00
17 each, furnishing and inst. air release valve assem.	130.00	52.50	68.00	65.00	500.00	100.00	100.00
13 blowoffs, furn. & inst. 8-in. top bl'off, 250-lb. std.	400.00	450.00	580.00	400.00	510.00	800.00	800.00
2 blowoffs, fur. & inst. 12-in. top bl'off, 250-lb. std.	780.00	775.00	\$1,058	850.00	920.00	\$1,300	\$1,300
425 cu. yd. furnishing sand for backfill.....	2.75	4.00	5.00	4.50	5.00	2.00	2.00
18,000 lb. misc. metal work not attached to pipeline.....	.38	.49	.65	.41	.40	.58	.58
1 lump sum, removal of existing dished head.....	75.00	125.00	650.00	100.00	500.00	577.50	577.50
18,000 lb. galvanizing steel.....	.10	.87	.20	.07	.10	.11	.11
68 lin. ft. incasement for pipe at railroad crossings	100.00	60.00	200.00	60.00	71.00	140.00	140.00

Airport . . .

Municipal Airport at San Jose—Bituminous Surfacing for Runways, Installing Lighting, etc.

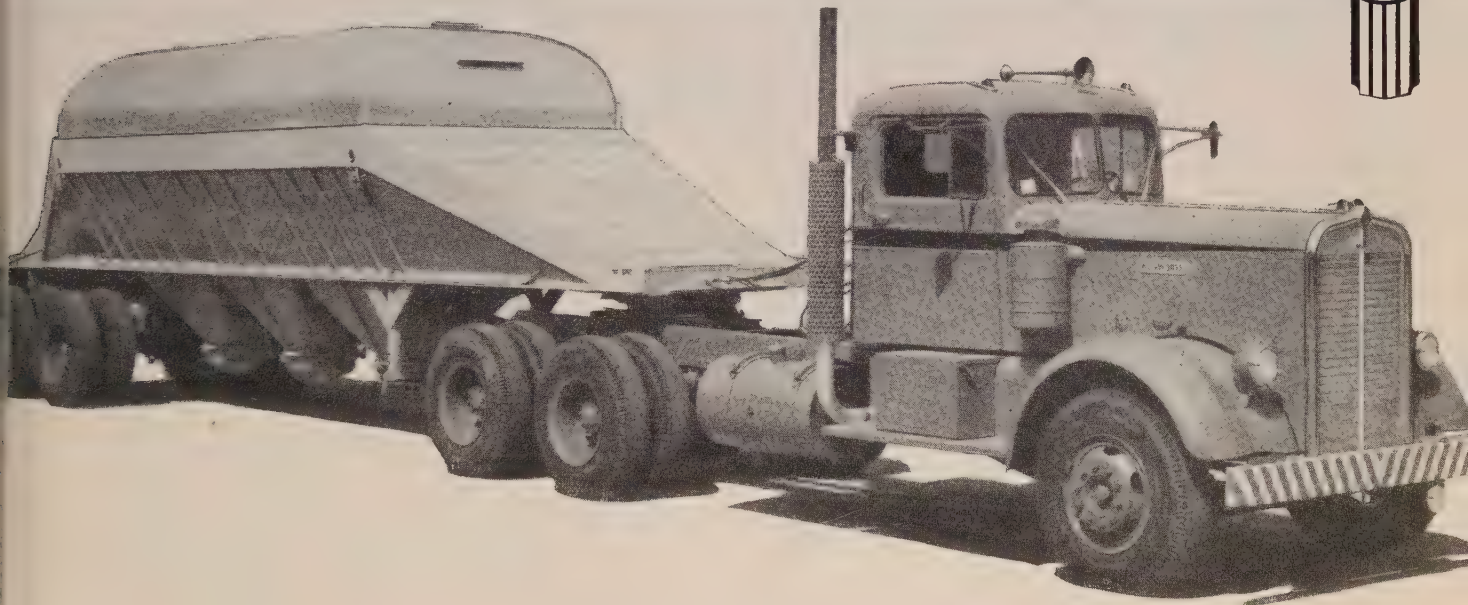
California—Santa Clara County—City. Leo F. Piazza Paving Co., San Jose, with a bid of \$168,473, was low before the Public Works Department of the City of San Jose for constructing the San Jose Municipal Airport. Unit bids were as follows:

(1) Leo F. Piazza Paving Co.....	\$168,473	(4) Edward Keeble.....	\$182,870			
(2) Covina Construction Co.....	173,309	(5) A. J. Raich Paving Co.....	211,163			
(3) John G. Mehren.....	176,240	(6) Engineer's estimate.....	175,629			
	(1)	(2)	(3)	(4)	(5)	(6)
Complete—lump sum, clearing and grubbing.....	\$1,500	\$2,500	\$2,000	\$1,500	\$1,450	\$2,500
Complete—lump sum, structure removal.....	300.00	\$2,500	750.00	\$1,000	\$1,275	500.00
21,750 cu. yd. unclassified excavation.....	.57	.89	.46	.40	.42	.41
3,270 cu. yd. shoulder excavation.....	.50	.90	.52	1.20	1.00	1.11
32,500 cu. yd. uncrushed aggregate base course.....	1.64	1.28	1.60	1.40	2.60	1.81
6,320 tons aggregate material for plant mix.....	3.68	5.15	4.25	4.58	4.00	3.00
400 tons bituminous material for plant mix.....	16.78	16.00	26.00	20.00	17.00	23.75
87 tons bituminous prime coat.....	32.33	30.00	31.00	30.00	30.00	36.00
57 tons bituminous material for seal coat.....	33.36	31.00	31.00	40.00	33.50	25.00
410 tons cover aggregate for seal coat.....	6.42	5.00	4.80	5.00	5.80	5.41
88 tons bituminous material for surface treatment.....	33.36	35.00	31.00	40.00	33.00	25.00
450 tons aggregate material for surface treatment.....	6.12	4.50	4.80	5.00	5.20	5.41
250 tons cover aggregate for surface treatment.....	6.42	6.00	5.10	5.00	5.50	5.41
1,067 lin. ft. 8-in. stand. non-reinforced conc. sew. pipe	2.35	2.00	2.20	2.67	2.65	2.11
695 lin. ft. 10-in. std. stgth. reinf. conc. culv. pipe	2.75	2.50	2.70	2.94	3.20	2.61
521 lin. ft. 12-in. std. stgth. reinf. conc. culv. pipe	3.30	2.80	3.25	3.68	3.85	2.81
390 lin. ft. 15-in. std. stgth. reinf. conc. culv. pipe	3.80	3.15	3.70	4.62	4.75	3.21
572 lin. ft. 18-in. std. stgth. reinf. conc. culv. pipe	4.50	3.70	5.00	5.35	5.65	3.21
1,351 lin. ft. 21-in. std. stgth. reinf. conc. culv. pipe	5.20	5.00	5.50	6.35	6.70	4.41
744 lin. ft. 24-in. std. stgth. reinf. conc. culv. pipe	7.00	5.10	6.60	7.64	8.00	5.21
4 lin. ft. 30-in. std. stgth reinf. conc. culv. pipe	10.00	25.00	10.00	16.00	17.00	6.41
30 lin. ft. 18-in. bituminous coated paved invert corrugated metal culvert pipe.....	7.50	10.00	20.00	21.00	22.00	4.21
1 ea. 8-in. automatic drainage gate.....	28.00	20.00	40.00	26.50	33.00	40.00
1 ea. 10-in. automatic drainage gate.....	34.00	22.50	60.00	36.85	55.00	50.00
1 ea. 12-in. automatic drainage gate.....	50.00	46.00	80.00	52.50	80.00	60.00
1 ea. 18-in. automatic drainage gate.....	75.00	36.50	200.00	68.00	220.00	75.00
133 lin. ft. 6-in. heavy cast iron culvert pipe.....	3.50	3.34	4.50	4.69	5.00	3.21
1 ea. brick manhole.....	200.00	315.00	200.00	210.00	330.00	150.00
18 ea. concrete inlet structure, Type A.....	145.00	140.00	185.00	224.00	190.00	115.00
6 ea. concrete inlet structure, Type B.....	157.00	160.00	290.00	295.00	275.00	135.00
1 ea. concrete headwall structure.....	400.00	145.00	350.00	880.00	550.00	300.00
565 lin. ft. underground electric duct, telephone and power service, 3 way section.....	2.37	2.34	2.36	2.50	2.60	3.11
80 lin. ft. underground electrical duct, 2-way section	1.85	1.68	1.70	2.24	2.00	2.11
100 lin. ft. underground electrical duct, 3 way section	2.65	2.25	2.30	2.50	2.95	3.11
1,260 lin. ft. underground electrical duct, 4 way section	2.68	2.44	2.46	4.25	2.95	3.11
330 lin. ft. underground electrical duct, 6 way section	4.55	2.75	2.75	6.30	5.00	6.41
73 lin. ft. installation of airport elevated marker lights, base-mounted type.....	104.85	120.00	121.00	114.68	125.00	111.41
52 ea., rebuilding of existing airport elevated marker lights to base-mounted type.....	25.38	38.00	39.00	27.41	29.00	41.00
1 ea., regulator for taxiway lights.....	\$1,048	970.00	\$1,000	\$1,277	\$1,175	800.00
1 ea., control for rotating beacon.....	131.92	117.70	122.00	160.75	150.00	150.00
5 ea., concrete electric pull box for underground duct—Type I.....	74.18	40.40	50.00	94.50	85.00	270.00

Continued on next page

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There's More Worth in KENWORTH



To build trucks which will haul more payload for a minimum of operating expense is the one basic purpose behind the Kenworth organization. From management through engineering in the field and on the drawing boards, and field observation after production by our skilled craftsmen, Kenworth trucks are built for the job. Therefore, the Kenworth trucks you operate will do your particular job with the utmost efficiency. Designed with you and built for you, Kenworth trucks mean profit for you.

Northwestern Portland Cement Company, specializing in the production of bulk cement, recently placed two Model 825 Kenworth trucks in service, and is now in a position to deliver from the plant at Grotto to any user of bulk cement in Central or Western Washington. Aluminum was used extensively in these engineered-for-the-job Kenworths. Gordon Tongue, president of this progressive firm, says: "Kenworth's lightweight construction enables us to haul 110 barrels, or nearly half a carload, of cement on each trip."



KENWORTH
TRUCKS ★ BUSES

SEATTLE, U.S.A. DISTRIBUTORS IN THE UNITED STATES AND MOST FOREIGN COUNTRIES

NEWS of MANUFACTURERS

Continued from page 112

at its plant in Springfield, Ohio. The manufacture of Atlas Imperial diesel engines and parts will be carried on at the Springfield plant, according to F. H. KILBERRY, head of National Supply's Engine Division. National's diesels have operated for many years in the municipal field and inland waterways marine service. Atlas diesels have served in the marine, work boat, fishing, and foreign fields.

☆ ☆ ☆



BERNER

LEO BERNER, well known designer and welding engineer, has recently returned to the *Atlas Scraper & Engineering Co.*, Bell, Calif., after an absence of 10 years. He will assume the position of chief engineer. He has been associated with Be-Ge Manufacturing Co. and Wooldridge Manufacturing Co., and

has lectured at Stanford University and Santa Clara University. During the last war he traveled from plant to plant as consulting engineer, inspecting and recommending welding procedures.

☆ ☆ ☆

PAUL JONES, president of *American Security (A.S.C. Corporation)*, Marion, Ind., and president of *Cummins Portable Tools Division*, Chicago, has announced the purchase of the assets of *Fred W. Wappat, Inc.*, of Mayville, N. Y. The newly-acquired property will be operated by Cummins as the *Fred W. Wappat Division*, and will continue to manufacture portable electric hand-saws for the industrial and heavy construction fields, a product which it has been making for the last 25 years. The entire Wappat personnel and the identity of the Wappat line will also be retained.

☆ ☆ ☆

THOMAS H. LUKE, distributor for *Caterpillar Tractor Co.* at Santa Maria, died September 22 at his home in Morro Bay, Calif. A pioneer in the West's tractor industry, Luke was widely known and respected. He joined the Holt Manufacturing Co. in Stockton, Calif., in 1890, and at the time that company combined with the C. L. Best Tractor Co. to form Caterpillar Tractor Co., he was serving as sales manager. He later became a distributor, a position which he held until his retirement in 1939.

☆ ☆ ☆

With the possibility of constructing a new plant in Oregon, the *Williams Form Engineering Corp.* of Grand Rapids, Mich., has opened an office in Portland, according to a recent announcement by C. I. WILLIAMS, president of the firm. The company manufactures and sells form hardware and other accessories to concrete manufac-

Continued on page 116

7 ea., concrete electric pull box for underground duct—Type II.....	55.31	80.80	90.00	84.00	60.00	250.00
1 ea., concrete electric pull box for underground duct—Type III.....	50.48	40.40	50.00	36.65	55.00	235.00
12,120 lin. ft. trench excavation and backfill for direct burial cable.....	.09	.17	.18	.245	.12	.15
10,100 lin. ft. underground cable—single conductor—No. 8, 3,000 volt in pl. in trench, duct or cond.	.15	.17	.18	.14	.165	.27
2,020 lin. ft. underground cable—single conductor—No. 10, 600 volt in pl. in trench, duct or cond.	.085	.14	.15	.11	.095	.15
Complete—lump sum, installation of primary underground service to administration building.....	108.00	244.00	270.00	\$1,207	120.00	400.00
Complete—lump sum, install. of auto parking area lights.....	452.00	453.00	470.00	453.00	500.00	\$1,035
Complete—lump sum, concrete transformer pad and primary service to hanger area.....	750.00	750.00	800.00	\$1,338	785.00	\$1,000
Complete—lump sum, installation of hanger area secondary serv. lighting panel and ramp lights.....	\$1,700	\$1,742	\$1,800	\$2,336	\$1,900	\$1,700
380 lin. ft. install. of 2-in. std. galv. steel wat. pipe.....	1.50	.80	1.25	1.85	1.65	1.50
911 lin. ft. install. of 8-in. spiral weld steel water pipe.....	3.00	1.50	3.00	4.30	3.30	4.00
2 ea., 8-in. gate valves.....	100.00	115.00	105.00	152.00	110.00	42.64
Complete—lump sum, taxiway painting.....	350.00	850.00	450.00	550.00	440.00	500.00

Sewerage . . .

Concrete Pipe Sanitary and Storm Sewers

Washington—Kitsap County—City. Lents, Bremerton, with a bid of \$145,735, was low before the Bremerton Department of Public Works for constructing the Snyder Ave. sanitary and storm sewers at Bremerton. Unit bids were as follows:

(1) Lents	\$145,735	(4) Utility Contractor	\$163,971				
(2) Valley Construction Co.....	151,743	(5) Superior Construction Co.....	166,325				
(3) Argentieri & Colarossi.....	155,629	(6) State Construction Co.....	196,779				
		(1)	(2)	(3)	(4)	(5)	(6)
510 lin. ft. 6-in. conc. sewer pipe.....	\$2.00	\$2.37	\$2.00	\$4.00	\$2.40	\$3.75	\$3.75
1,288 lin. ft. 6-in. conc. riser pipe.....	2.35	2.87	2.50	2.00	2.80	3.20	3.20
12,368 lin. ft. 6-in. conc. side sewers.....	2.00	2.12	2.20	2.50	2.35	3.40	3.40
25,751 lin. ft. 8-in. conc. sewer pipe.....	2.40	2.61	2.70	2.65	2.75	2.95	2.95
2,842 lin. ft. 10-in. conc. sewer pipe.....	2.50	2.77	2.95	3.05	2.95	3.30	3.30
626 lin. ft. 12-in. conc. sewer pipe.....	2.65	3.36	3.20	3.25	3.30	4.00	4.00
108 lin. ft. 8-in. C. I. pipe.....	5.50	4.50	4.00	7.00	5.25	6.50	6.50
24 lin. ft. 12-in. C. I. pipe.....	9.00	7.00	6.00	7.50	8.50	12.00	12.00
(Lump sum), remove 306 ft. of 8-in. conc. sewer pipe and reshape manhole base.....	200.00	500.00	300.00	230.00	\$1,000	400.00	400.00
80 each, standard manholes.....	195.00	175.00	190.00	200.00	165.00	225.00	225.00
88 lin. ft., add'l for manholes over 10 ft. in depth.....	15.00	13.00	10.00	12.00	12.00	12.00	12.00
1 only, standard manholes, cov. & ring furn.....	151.00	125.00	175.00	150.00	130.00	200.00	200.00
1 only, removal of existing manholes.....	25.00	75.00	50.00	100.00	50.00	50.00	50.00
1 only, special manholes.....	225.00	300.00	250.00	100.00	210.00	450.00	450.00
11 each, drop manholes.....	260.00	225.00	225.00	275.00	275.00	350.00	350.00
46 lin. ft., add'l for drop manholes ov. 11 ft. in depth.....	12.00	13.00	10.00	15.00	12.00	15.00	15.00
19 each, lampholes.....	35.00	60.00	50.00	40.00	30.00	75.00	75.00
(Lump sum), clearing and grubbing.....	200.00	\$1,000	\$2,000	500.00	\$1,000	250.00	250.00
1,000 cu. yd. bank-run trench gravel.....	2.25	1.50	1.25	4.00	3.00	2.50	2.50
500 cu. yd. solid rock excavation.....	3.00	1.00	.50	3.50	8.00	20.00	20.00
100 cu. yd. trench concrete.....	20.00	20.00	20.00	25.00	30.00	20.00	20.00
2,000 b.f. (price per fbm) lumber left in trench.....	200.00	70.00	75.00	40.00	100.00	60.00	60.00
80 lin. ft. 6-in. conc. inlet pipe.....	1.95	1.62	1.25	2.00	2.00	3.30	3.30
70 lin. ft. 8-in. conc. sewer pipe.....	2.25	2.01	2.75	2.50	2.75	3.10	3.10
1,503 lin. ft. 12-in. conc. sewer pipe.....	2.65	3.25	3.50	3.00	3.30	3.70	3.70
6 each, standard manholes.....	195.00	175.00	165.00	175.00	165.00	175.00	175.00
4 each, standard inlets, Type "G".....	95.00	80.00	50.00	60.00	100.00	100.00	100.00
4 each, special inlets.....	125.00	125.00	75.00	50.00	130.00	125.00	125.00
2,564 lin. ft. 8-in. C. I. Class 100 pressure and by-pass sewer pipe.....	4.40	4.00	4.00	4.40	4.75	4.25	4.25
2,564 lin. ft. 8-in. cement-asbestos class 100 pressure and by-pass sewer pipe.....	4.00	3.50	4.00	3.25	4.00	3.70	3.70

Dam . . .

Three Earthfill Dams to Form Carter Lake Reservoir

Colorado—Larimer County—Bureau of Reclamation. Winston Bros. Co., Monrovia, Calif., with a bid of \$2,389,350, was low before the Bureau of Reclamation for constructing the Carter Lake Reservoir, Colorado-Big Thompson Project, Larimer County, Colorado. The 2-mi. long reservoir will be formed by the construction of three earth-fill dams across the gaps in the eastern rim of the basin. The embankments of the three dams will consist of an impervious core of clay, sand, and gravel, compacted

in 6-in. layers and protected and stabilized on upstream and downstream slopes by rock fill, increasing in coarseness toward the outer surface of the slopes, placed on a thick blanket of rock fines, compacted in 12-in. layers by crawler-type tractors. Included in the schedule: relocation of 1.7 mi. of county road at the south end of the reservoir, requiring earthwork, structures, and surfacing; construction of an access road to Carter Lake Reservoir, approximately 4.5 mi. in length. Unit bids were as follows:

(1) Winston Bros. Co.	\$2,389,350	(5) C. F. Lytle Co., Inc. & Amis Construction Co.	\$2,832,790				
(2) Utah Construction Co.	2,396,536	(6) Engineer's estimate	3,748,119				
(3) Adler Construction Co.	2,573,942						
(4) Vinnell Co., Inc.	2,674,905						
		(1)	(2)	(3)	(4)	(5)	(6)
10,000 M. gal. furn. water for const. purposes, first 10,000,000 gal.	2.50	1.05	3.30	1.00	2.27	7.50	
40,000 M. gal. furn. water for const. purposes, over 10,000,000 gal.	.45	.30	.50	.06	.41	.75	
73,000 cu. yd. excav., all classes, for foundtns. of dams, first 73,000 cu. yd.	.85	.30	.55	.60	.59	.85	
73,000 cu. yd. excav., all classes, for foundtns. of dam, over 73,000 cu. yd.	.45	.30	.52	.45	.59	.70	
1,180 cu. yd. excav., all classes, for grout caps, dams Nos. 1 and 2 and for cut-off wall, dam No. 3.....	20.00	5.70	18.00	16.00	11.50	20.00	
8,600 cu. yd. excav., all cl., in open cut for outlet wks.	1.50	.40	1.10	1.20	.99	1.20	
580 cu. yd. excav., all classes, in upstream tunnel....	27.00	26.75	20.00	23.00	35.00	32.00	
400 cu. yd. excav., all cl., in gate chamber and access shaft	45.00	26.75	22.00	30.00	42.00	40.00	
30,000 lb. furn. and placing perm. structl.-steel tunnel supports, steel tunnel liner plates, and steel lagging	.21	.20	.18	.20	.27	.20	

Continued on next page

THE FIRST CARRYALL WAS A

FRUEHAUF CARRYALL!

... AND THEY'RE STILL THE BEST

FRUEHAUF CARRYALL
Model C40L



**BUILT TO CARRY YOUR LOADS
... CAPACITIES TO 74 TONS!**

YES, the first Carryall was a Fruehauf, built to specifications for a particular hauling job. Today, there are *seventeen standard* models and a host of "specials", designed to fit the requirements of most heavy-equipment users.

Ever mindful of the changing needs in heavy equipment hauling, and always keeping ahead in Trailer engineering and design, Fruehauf is ready to supply you with a modern Carryall to fit your particular hauling job — with either a "standard" or a "special".

For complete information, blueprints or specifications on the Fruehauf Carryall for *your* job, write —

World's Largest Builders of Truck-Trailers

FRUEHAUF TRAILER COMPANY

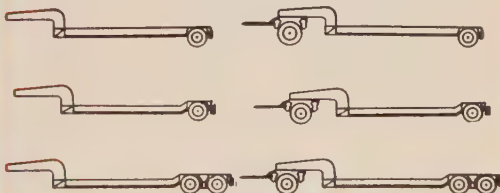
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Sales and Service: Los Angeles • San Francisco • Portland
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Fruehauf Carryalls are available in capacities from 10 to 74 tons in the standard models . . . to 110 tons in "specials". Frame designs as single- or double-drop "Semi" or full Trailers. No matter what your hauling problem may be, there's a Fruehauf Carryall to fit your job.

DESIGNED TO YOUR SPECIFICATIONS



WORLD'S LARGEST BUILDERS OF TRUCK-TRAILERS

NEWS of MANUFACTURERS

Continued from page 114

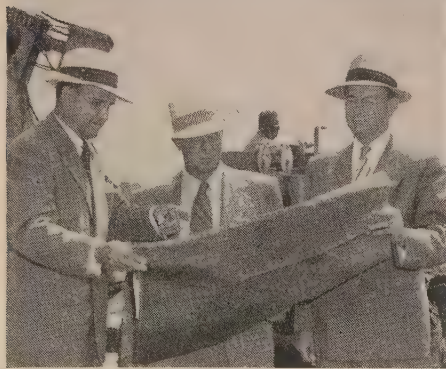
turers. Sales manager in the West will be S. D. WILLIAMS.

☆☆☆

Appointment of two new vice presidents of *Kaiser Steel Corp.*, Oakland, Calif., has been announced by JACK L. ASHBY, vice president and general manager. The new officers are: ATWOOD AUSTIN, formerly financial consultant for several of the Kaiser companies, appointed vice president and treasurer; C. F. BORDEN, general sales manager of Kaiser Steel since 1947, named vice president in charge of sales.

☆☆☆

Challenge Manufacturing Co., of Los Angeles, has begun grading operations for the construction of its new plant. Work on the new factory and office buildings, which will start immediately upon completion of the grading, should be finished by December 1st. The new buildings will comprise 32,000 sq. ft. of an ultimate 80,000 sq. ft.



OPERATIONS at Challenge's new plant (see accompanying item) are checked with interest by Howard Cook, left, president of Cook Bros. Equipment Co.; Ross Castendyck, center, president of Challenge, and J. E. Hall, sales manager of Cook Bros.

of floor area. The Challenge Manufacturing Co., under the guidance of Ross CASTENDYCK, president, entered the truck mixer field three years ago. The company featured a new type ready-mixed unit which combined light weight with more payload at less investment and operating cost. Acceptance of its product has made necessary the present expansion, more than doubling the existing facilities. *Cook Bros. Equipment Co.*—HOWARD COOK, president, and J. E. HALL, sales manager—is exclusive national distributor for Challenge mixers.

☆☆☆

Kaiser Steel Corp., at a recent meeting of its Board of Directors, set machinery in motion for a \$125,000,000 financing program and expansion of its plant at Fontana, Calif., into the manufacture of tin plate and additional steel production. The following new directors were elected to the board: J. L. ASHBY, Oakland, vice presi-

Continued on page 118

1,500 cu. yd. excav., all cl., in downstream tunnel.....	27.00	22.75	18.00	23.00	28.20	28.00
400 cu. yd. excav., all classes, for drainage trench.....	12.00	2.40	1.00	3.00	3.95	12.00
215,000 cu. yd. excav., stripping borrow areas, first						
215,000 cu. yd.	.20	.17	.23	.25	.233	.30
215,000 cu. yd. excav., stripping borrow areas, over						
215,000 cu. yd.	.20	.17	.17	.16	.233	.25
1,180,000 cu. yd. excav. in borrow area and transpnt. to dam embkts., first 1,180,000 cu. yd.	.26	.28	.26	.27	.289	.38
1,180,000 cu. yd. excav. in borrow area and transpnt. to dam embankmts., over 1,180,000 cu. yd.	.20	.20	.24	.23	.289	.35
1,900 cu. yd. backfill	.50	.15	.40	.50	.49	1.00
961,000 cu. yd. earth fill in dam embank., Zone 1, first 961,000 cu. yd.	.12	.22	.12	.15	.134	.17
961,000 cu. yd. earth fill in dam embank. Zone 1, over 961,000 cu. yd.	.10	.15	.10	.13	.134	.16
7,750 cu. yd. special compaction of earth fill in dam embankments	2.50	2.60	3.70	2.50	3.50	3.50
174,000 cu. yd. rock fines fill in dam embankmts, Zone 3, first 174,000 cu. yd.	.90	1.29	1.05	1.15	1.10	1.75
174,000 cu. yd. rock fines fill in dam embankmts., Zone 3, over 174,000 cu. yd.	.70	.84	1.00	.95	1.10	1.70
335,000 cu. yd. rock fill in dam embankmts., Zone 4, first 335,000 cu. yd.	.90	.74	1.00	1.15	1.00	1.45
335,000 cu. yd. rock fill in dam embankmts., Zone 4, over 335,000 cu. yd.	.70	.50	.95	.95	1.00	1.40
2,000 lin. ft. furn. sewer pipe and const. 8-in. diam. embank. toe drains with uncem. jts., Dam Nos 1 and 2	4.00	1.60	2.50	2.30	2.80	3.00
210 lin. ft. furn. sewer pipe and const. 4-in. diam. drains with uncem. jts., for outlet wks. stilling basin	1.50	1.40	1.50	1.75	1.60	2.00
350 lin. ft. furn. and laying 4-in. diam. sewer pipe with cemented jts. for outlet wks.	2.00	1.40	1.60	1.00	1.20	1.80
680 lin. ft. drilling drainage holes not over 25 ft. deep	1.60	1.96	2.50	3.00	1.80	4.00
7,600 lin. ft. drilling grout holes in stage betw. depths of 0 ft. and 35 ft., dams Nos. 1, 2, and 3	1.60	1.96	2.00	2.00	1.80	2.50
3,000 lin. ft. drilling grout holes in stage betw. depths of 35 ft. and 60 ft., dams Nos. 1 and 2	1.60	1.96	2.25	2.00	1.80	2.75
2,000 lin. ft. drilling grout holes in stage betw. depths of 60 ft. and 110 ft., dams Nos. 1 and 2	1.60	1.96	2.50	2.00	1.80	3.00
4,700 lb. furn. and placing std. black pipe and fittings for grouting	.22	.63	.60	.60	.30	.70
13,000 cu. ft. pressure grouting	1.25	2.23	1.80	1.30	1.50	2.00
8,000 cu. ft. pressure grouting with packe.s.	2.00	2.23	2.20	2.40	2.25	2.50
335,000 lb. furn. and placing reinf. bars	.12	.13	.12	.12	.137	.13
1,200 cu. yd. conc. in grout caps, dams Nos. 1 and 2, and in cut-off wall footing, dam No. 3	25.00	13.75	20.00	15.00	15.05	25.00
200 cu. yd. conc. in cut-off wall, except footing, dam No. 3	65.00	56.95	40.00	40.00	78.60	45.00
120 cu. yd. conc. in inlet struct.	45.00	34.00	60.00	50.00	61.40	80.00
360 cu. yd. conc. in conduit	45.00	31.70	37.00	35.00	62.30	60.00
390 cu. yd. conc. in upstream tunnel lining	52.00	35.30	38.00	50.00	41.50	35.00
830 cu. yd. conc. in downstream tunnel lining	52.00	37.75	35.00	37.50	41.80	35.00
150 cu. yd. conc. in gate chamber	52.00	31.90	60.00	75.00	56.60	75.00
75 cu. yd. conc. in gate chamber, second stage	52.00	18.50	42.00	50.00	33.00	35.00
210 cu. yd. conc. in access shaft	60.00	56.35	55.00	65.00	59.80	60.00
25 cu. yd. conc. in hoist house	70.00	100.00	120.00	95.00	125.00	90.00
73 cu. yd. conc. in stilling basin floor	60.00	17.50	34.00	25.00	23.00	25.00
125 cu. yd. conc. in stilling basin walls	60.00	62.50	50.00	40.00	78.60	60.00
40 sq. ft. furn. and placing resilient-type joint filler	3.00	.70	2.00	2.30	2.10	2.00
100 lin. ft. placing rubber water stops	2.00	2.80	1.00	2.00	2.10	2.00
570 lin. ft. furn. and placing metal seals, Type N1	1.00	3.00	1.50	1.20	1.50	1.70
165 lin. ft. furn. and placing metal seals, Type M1	1.60	3.90	2.00	1.50	1.80	2.00
44,800 lb. installing regulating and emergency gates and conduit liners	.08	.07	.10	.10	.07	.10
4,000 lb. installing control apparatus and piping for regulating and emergency gates	.35	.15	.25	.35	.50	.30
12,000 lb. installing trashracks	.10	.07	.10	.07	.10	.10
4,800 lb. installing air inlet pipe	.16	.28	.20	.25	.26	.20
1,525 lb. installing ventilating system	.40	.38	.40	.30	.45	.40
3,300 lb. installing reservoir level gage piping	.35	.38	.40	.40	.40	.40
6,515 lb. installing metal pipe, fittings, and valves	.20	.38	.20	.35	.22	.20
7,000 lb. installing miscel. metalwork	.35	.22	.20	.35	.31	.30
25 sq. ft. furn. and installing metal door	10.00	4.40	8.00	10.00	8.50	8.00
30 sq. ft. furn. and installing metal-sash windows	5.00	4.00	4.00	5.00	5.00	6.00
250 sq. ft. furn. and placing roofing	2.00	1.90	.60	1.20	.80	.80
200 lin. ft. furn. and installing elect. conduits, 1 in. or less in diameter	1.50	2.00	1.50	1.80	1.40	1.50
30 lb. furn. and installing elect. conductors and grounding materials	2.00	1.00	3.00	2.20	2.80	2.50
170 lin. ft. drilling 1½-in. min. diam. holes for piezometer apparatus, dam No. 1	3.00	3.50	3.00	2.80	3.80	3.00
35 lin. ft. drilling 4-in. min. diam. holes for settlement apparatus, dams Nos. 1 and 2	8.00	1.50	5.00	5.00	4.20	4.00
3,150 cu. yd. trenches for test apparatus, dams Nos. 1 and 2	4.00	7.90	5.00	4.50	10.00	7.00
51,500 lin. ft. installing piezometer tubing in dam emb., dam No. 1	.13	.10	.12	.12	.14	.20
3,200 lb. installing settlement apparatus in dams Nos. 1 and 2	1.30	.28	1.00	.85	.38	.20
11 cu. yd. conc. in terminal wall	110.00	148.00	135.00	80.00	125.00	80.00
Lump sum, installing test apparatus in terminal well	\$1,500	450.00	\$1,000	\$1,200	\$1,115	500.00
75 point installing surfi. settlement points on dam embankments	12.00	1.00	6.00	6.00	7.00	10.00
42,900 cu. yd. excav., common, for roadway	.75	.90	.35	.55	.423	.40
59,000 cu. yd. excav., rock, for roadway	.75	.90	1.15	1.25	1.00	1.75
74,000 sta. cu. yd. overhaul of excav. for roadway	.02	.02	.02	.025	.017	.02
290 cu. yd. excav., common, for roadway strcuts.	2.00	1.70	2.00	3.00	3.00	1.60
290 cu. yd. excav., rock, for roadway strcuts.	4.00	3.90	5.00	6.50	10.00	3.00
100 roller hr. rolling roadway embankments	10.00	7.50	10.00	5.50	15.00	5.00
400 M. gal. watering roadway embankments	3.00	3.00	2.00	2.50	3.00	3.00
1,150 cu. yd. backfill for roadway strcuts.	.60	.50	.50	.60	.44	1.00
1,150 cu. yd. compacting backfill for roadway strcuts.	2.50	2.40	4.00	4.00	4.50	3.50
2,000 sq. yd. drydock paving	6.00	4.70	2.00	5.50	4.25	4.00
150 lin. ft. furn. and laying 14-gage, 24-in. diam., corrugated-metal pipe	4.00	4.50	5.00	5.00	6.10	5.25
254 lin. ft. furn. and laying 14-gage, 30-in. diam., corrugated-metal pipe	5.00	6.00	6.50	6.00	7.50	6.50
252 lin. ft. furn. and laying 12-gage, 36-in. diam., corrugated-metal pipe	7.50	9.60	10.00	10.00	10.50	9.65
274 lin. ft. furn. and laying 12-gage, 42-in. diam., corrugated-metal pipe	8.50	11.50	12.00	11.50	12.50	11.25
208 lin. ft. furn. and laying 12-gage, 48-in. diam., corrugated-metal pipe	11.00	13.50	14.00	13.50	14.50	12.90

Continued on next page

Lorain 820

HAS *PLENTY*
of WHAT IT TAKES for ROCK!



• Lorain-820's, in the 2-yd. class, are built for the toughest rock! From shovel dipper to crawler treads, they are a rock machine. No other shovel can match "820" features. No other shovel can match the shock-busting performance of the hydraulic coupled Lorain-820. Check these features at the right . . . and then ask your Thew-Lorain Distributor to point them out on a machine in action—right in your neighborhood. There are *plenty* of reasons you'll want big Lorain-820's for those rough, tough jobs!

THE THEW SHOVEL COMPANY, LORAIN, OHIO

820 HAS PLENTY OF TURNABLE ADVANTAGES

Hydraulic coupling—no engine stall; no machinery shocks; no engine loafing ★ Double center drive pinion which applies power directly; (a) fully concentrated on any one operation or (b) spreads power for high-speed simultaneous operations ★ Extra wide clutches

820 HAS PLENTY OF CRAWLER FEATURES

Independent crawler travel ★ Chain drive ★ Two speeds in either direction ★ Steers either direction ★ 4-way ratchet and pawl travel and tread lock ★ Propelling mechanism runs in oil bath ★ Wider treads—extra strong, heat-treated drop forgings

820 HAS PLENTY OF SHOVEL FEATURES

Positive chain crowd ★ All-welded, all-steel, torsion-resisting boom ★ All-steel dipper stick ★ Drop forged crowd rack ★ Power dipper trip—saves time and operator's energy ★ Automatic crowd brake to hold stick extended

820 HAS PLENTY OF CRANE, DRAG, CLAM FEATURES

Interchangeable to Cranes, Clams or Drags ★ Simultaneous hoist, swing and travel (or boom derricking) ★ Worm driven high speed boom hoist ★ All-purpose Crane Boom head—6 part line ★ High gantry available (power lowered) ★ "Cable-Miser" fairlead ★ Large diameter boom head sheave for Draglines

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Continued from page 116

dent and general manager of Kaiser Steel; GEORGE W. BURPEE, New York; SAM H. HUSBANDS, San Francisco, president of Transamerica Corp.; EDGAR F. KAISER, Willow Run, Michigan, president, Kaiser-Frazer Corp.; HENRY J. KAISER, JR., Los Angeles; GEORGE D. WOODS, New York. The new mill to supply tin plate to the West's concentration of tin can manufacturing plants will have a capacity of 200,000 tons of hot dipped and electrolytic tin plate a year. In explaining the need for the mill, HENRY J. KAISER pointed out that the West, with its large food canning industry, consumes approximately 700,000 tons of tin plate a year; yet there has been only one tin plate mill west of the Mississippi, and the West has been able to supply less than one-third of its own tin plate requirements. The expansion at Fontana will include an eighth 200-ton open hearth furnace to increase the plant's annual steel-making capacity from 1,200,000 tons to 1,380,000 tons. Additional soaking pits and blooming facilities will be built. Engineering work for the construction has advanced sufficiently so that plans call for completion of the expansion early in 1952.

☆☆☆

WATT FALLIS, purchasing agent of *Kenworth Motor Truck Corp.* of Seattle and well known in trucking circles, will head the American Legion in the state of Washington for the 1950-51 term. He was elected department commander at the 32nd annual American Legion convention held recently in Bellingham.

☆☆☆

RALPH L. ROBINSON and EDWARD R. ANDERSON have received new executive appointments, according to an announcement by MAURICE N. TRAINER, president of *American Brake Shoe Co.* Robinson will become vice president of the Brake Shoe & Castings and Southern Wheel Divisions, with offices in Chicago. He joined the company in 1928 and since 1947 has been serving as assistant vice president of his division in St. Louis. Anderson will become vice president of the Brake Shoe and Castings Division. He joined the company as an engineering apprentice in 1930. Later, he became sales manager of the Pacific Coast district and vice president of the Kellogg Division. He will continue to be located in San Francisco.

☆☆☆

The overall production of Douglas fir plywood in 1950 will approach 2,300,000,000 sq. ft., according to O. HARRY SCHRADER, JR., managing director of the *Douglas Fir Plywood Association*. This association represents the 58-factory fir plywood industry of Washington, Oregon and California. After conferences in Washington, D. C., Schrader also noted that in spite of the prediction that the military needs of the nation may amount to about 15% of the Douglas fir plywood produced

Continued on page 120

80 lin. ft. furn. and laying 12-gage, 54-in. diam., corrugated-metal pipe	12.50	15.70	16.00	16.00	17.00	14.70
44 lin. ft. furn. and laying 10-gage, 60-in. diam., corrugated-metal pipe	17.00	21.25	22.00	20.00	22.00	19.50
96 lin. ft. furn. and laying 14-gage, 36-in. by 22-in. corrugated-metal pipe arch	6.00	6.25	7.00	7.00	8.00	6.60
216 lin. ft. furn. and laying 12-gage, 43-in. by 27-in. corrugated-metal pipe arch	8.50	10.00	11.00	10.50	11.50	9.90
112 lin. ft. furn. and laying 12-gage, 50-in. by 31-in. corrugated-metal pipe arch	11.00	12.00	12.00	13.00	13.50	11.60
114 lin. ft. furn. and laying 12-gage, 58-in. by 36-in. corrugated-metal pipe arch	12.00	14.00	15.00	17.00	15.00	13.25
138 lin. ft. furn. and erecting 10-gage, 66-in. diam., multiple-plate, corrugated-metal pipe	26.00	39.00	33.00	33.00	41.50	37.75
289 post furnishing and setting guard posts	6.00	5.60	8.00	6.00	6.00	8.00
900 lin. ft. furn. and erecting wire-cable guard fence	2.80	3.30	2.50	3.00	3.70	3.00
1 cattle guard furn. and const. cattle guards	\$1,000	800.00	700.00	\$1,200	\$1,410	\$1,600
9,500 cu. yd. selected roadway surfacing	1.20	1.49	.75	.70	1.42	1.25
47,500 yd. mi. overhaul of selected roadway surfacing	.20	.16	.10	.20	.07	.20

Big Sandy Creek Earthfill Dam and Dike, Outlet Works, Concrete Spillway Channel and Concrete Slab Deck I-Beam Bridge

Wyoming—Sweetwater County—Bureau of Reclamation, S. J. Groves & Sons Co., Minneapolis, Minn., with a bid of \$1,011,772, was awarded the contract by the Bureau of Reclamation for completion of Big Sandy Dam and dike near Eden, Wyo. Principal features are an earth-fill dam across the Big Sandy Creek, a concrete lined, open channel spillway on the right abutment, and an outlet works through the embankment on the left abutment, and an earth-fill dike beginning about 3,000 ft. north of the left end of the dam and extending northward approximately 8,100 ft. The dam will be approximately 2,300 ft. long at the crest and will have a maximum height of about 80 ft. above the lowest foundation.

The central or impervious portion of the dam embankment will consist of moistened and rolled earth-fill embankment of selected clay, sand, and gravel. A zone of selected sand and gravel will be placed adjacent to the impervious portion of the dam on the upstream and downstream slopes. A cut-off trench is to be excavated to a suitable foundation for the full

length of the dam embankment. The cut-off trench will have a maximum width of 80 ft. and foundation rock will be grouted along its center line.

The outlet works will consist of a trashrack structure, a 5-ft. 6-in. diameter horseshoe conduit, a gate chamber and shaft, control house, and a stilling basin. Two 3-ft. 6-in. by 3-ft. 6-in. high-pressure slide gates will be installed in the gate chamber.

The spillway will be of the slide channel type having a total length of about 500 ft. and a crest length of 170 ft. A concrete slab deck I-beam bridge will span the spillway channel. Pressure grouting will be required for the rock foundation of the spillway crest structure.

The earth-fill dike will consist of a moistened and rolled embankment of selected clay, sand, and gravel. To provide an outlet channel for the outlet works, a section of the Means Canal about 335 ft. long, and a diversion channel to Big Sandy Creek will be constructed.

Unit bids were submitted as follows:

	(1)	(2)	(3)	(4)	(5)	(6)
(1) S. J. Groves & Sons Co.	\$1,011,772					
(2) Long Construction Co.	1,053,329					
(3) Gibbons and Reed Co.	1,108,567					
(4) Sharrock and Pursel		\$1,137,148				
(5) Colorado Constructors, Inc.		1,154,458				
(6) Engineer's estimate		1,131,883				
Lump sum, diversion and care of river during const. and unwatering foundations	\$22,000	\$25,000	\$41,000	\$30,000	\$20,000	\$40,000
75,000 cu. yd. excav. com., for founda. of dam and dike	.28	.30	.45	.30	.60	.60
750 cu. yd. excav., all classes, for grout car	7.00	10.00	11.50	2.00	15.00	18.00
22,000 cu. yd. excav., com., for outlet works and spillway	.37	.30	1.68	1.50	2.00	.70
29,000 cu. yd. excav., rock, for outlet works and spillway	1.80	2.00	1.68	1.50	2.00	2.50
150 cu. yd. excav., rock for cut-off walls, for outlet works, and spillway	7.00	20.00	11.50	4.00	20.00	20.00
28,000 cu. yd. excav., stripping borrow areas	.25	.30	.18	.14	.50	.30
110,000 cu. yd. excav. in borrow area 1 and transportation to dam embank., Zone 1, first 110,000 yards	.265	.40	.27	.30	.26	.40
113,000 cu. yd. excav. in borrow Area 1 and transportation to dam embank., Zone 1, over 110,000 yards	.265	.30	.23	.30	.22	.25
62,000 cu. yd. excav. in borrow Area 4 and transportation to dam embank., Zone 1, first 62,000 yards	.265	.35	.25	.24	.24	.35
63,000 cu. yd. excav. in borrow Area 4 and transportation to dam embank., Zone 1, over 62,000 cu. yd.	.265	.25	.21	.24	.20	.20
347,000 cu. yd. excav., sand and gravel in borrow Area 1 and transportation to dam embank., Zone 2	.265	.35	.25	.30	.30	.30
90,000 cu. yd. excav. in dike borrow area and trans. to dike embank., Zone 1, first 90,000 cu. yd.	.19	.25	.22	.24	.22	.20
92,000 cu. yd. excav. in dike borrow area and trans. to dike embank., Zone 1, over 90,000 cu. yd.	.19	.25	.18	.24	.18	.15
237,000 cu. yd. earthfill in dam and dike embank., Zone 1, first 237,000 cu. yd.	.17	.15	.155	.10	.15	.16
237,000 cu. yd. earthfill in dam and dike embank., Zone 1, over 237,000 cu. yd.	.17	.15	.135	.10	.13	.12
156,000 cu. yd. sand and gravel fill in dam embank., Zone 2, first 156,000 cu. yd.	.17	.15	.13	.10	.09	.12
157,000 cu. yd. sand and gravel fill in dam embank., Zone 2, over 156,000 cu. yd.	.17	.12	.11	.10	.07	.10
17,000 cu. yd. rock fill in dam embank., Zone 3	.22	.25	.30	.20	1.00	.12
10,000 cu. yd. cr. rock or gravel blanket on upstream slope of dam embank.	3.90	5.00	4.18	7.00	5.00	6.50
30,000 cu. yd. riprap on upstream slope of dam embank.	6.00	5.00	4.20	8.00	6.00	6.00
1,500 cu. yd. backfill	.40	.50	.60	.25	.50	.70
3,000 cu. yd. special compaction of earth fill	3.60	2.50	3.35	3.00	4.00	2.50
200 cu. yd. dumped riprap for inlet channel of spillway	6.40	2.00	.90	8.00	2.00	2.00
400 cu. yd. dumped riprap for stilling basin left wing wall of spillway & outlet chan. of outlet wks.	6.40	5.00	5.50	8.00	7.00	6.50
19,000 cu. yd. topsoil for seeding	1.00	.50	.70	.25	.50	.60
57,000 sq. yd. seeding	.04	.05	.03	.04	.04	.05
1,280 M. gal. water for seeded areas	3.20	5.00	4.70	3.00	3.00	5.00
1,300 lin. ft. const. 8-in. diam. sewer-pipe toe drains uncemented joints	1.50	2.00	2.40	1.40	3.50	2.25
180 lin. ft. const. 10-in. diam. sewer-pipe toe drains with uncemented joints	1.85	2.00	2.40	1.75	4.00	2.65
900 lin. ft. const. 4-in. diam. sewer-pipe spillway drains with uncemented joints	.80	2.00	4.25	1.00	3.00	1.65
186 lin. ft. const. 6-in. diam. sewer-pipe spillway drains with uncemented joints	1.10	2.00	4.50	1.10	1.00	1.90
402 lin. ft. const. 8-in. diam. sewer-pipe spillway drains with uncemented joints	1.50	2.00	4.50	1.60	3.50	2.25
96 lin. ft. laying 8-in. diam. sewer-pipe drains with cemented joints	1.50	2.00	4.00	1.40	3.50	1.90
105 lin. ft. furn. and installing 4-in. diam. cast-iron soil pipe spillway drain	2.65	3.00	2.40	2.25	3.00	3.00
45 cu. yd. continuous gravel drains back of spillway walls	6.00	10.00	6.00	9.00	8.00	6.00
7 cu. yd. gravel drains under gravity walls	6.00	10.00	6.00	12.00	10.00	7.00
40 cu. yd. gravel backfill in trench under spillway floor	6.00	10.00	6.00	10.00	8.00	7.00

Continued on next page

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NEWS of MANUFACTURERS

Continued from page 118

during the remainder of 1950, the supply for civilian uses is greater than ever before. Production today is at the record volume of about 50,000,000 sq. ft. per week.

☆☆☆

A \$2,500,000 expansion program now under way will increase the productive space and capacity of the Los Angeles plant of *McCulloch Motors Corp.* by 300%, according to an announcement by ROBERT P. MCCULLOCH, president of the company. The firm is already the world's largest builder of power chain saws. The plant area, now 75,000 sq. ft., will be increased to 324,000 sq. ft. by the addition of eight new



manufacturing bays, a new recreation-cafeteria building, and additional engineering and warehousing facilities. These increased facilities will triple the present magnesium and aluminum die-casting capacity, will add an entirely new heat-treating department, and will expand the present gearmaking, grinding, machining, and assembly output. The new employee recreation center will include a 500-person cafeteria, auditorium, and gymnasium complete with 14 bowling alleys. The expansion will take place on the present site of the factory opposite the Los Angeles International Airport. Completion of the buildings, begun last June, is scheduled for June, 1951. At that time the number of employees will be increased to 1500.

☆☆☆

Two appointments in their West Coast plants have been announced recently by *General Electric*. L. M. LARKIN has been named Western regional sales manager of the company's Air Conditioning Department, according to H. M. BRUNDAGE, manager of the sales division. Larkin will direct the sales activities of his department's sales representatives in the states of California, Nevada, Washington, Utah, Wyoming, Oregon, Arizona and Idaho. Headquarters will be at 235 Montgomery St., San Francisco, and branch offices will be maintained in Seattle, Los Angeles and Salt Lake City. C. R. BENSON has been appointed manager of sales of General Electric's Oakland transformer plant, according to an announcement by R. R. HARTIG, plant manager. Benson has been with the company since 1926 when he joined its test course at Schenectady, N. Y., and he has since been connected with the Central Station Department and the San Francisco office.

Continued on page 121

80 cu. yd. furn. and placing screened gravel or crushed rock for filter under spillway floor	6.00	10.00	4.85	10.00	8.00	6.50
18 lin. ft. furn. and lay. 12-in. corrugated-metal pipe	3.25	3.00	5.00	4.00	5.00	3.50
26 lin. ft. furn. and lay. 18-in. corrugated-metal pipe	5.00	4.00	5.50	5.00	5.00	5.00
6,250 lin. ft. drilling grout holes in stage betw. depths of 0 foot and 35 feet	1.45	1.25	2.40	1.30	2.00	2.00
2,000 lin. ft. drilling grout holes in stage betw. depths of 35 feet and 60 feet	1.80	1.25	2.40	1.80	2.00	2.25
3,750 lb. furn. and placing std. black pipe and fittings for foundation grouting	.35	.80	.80	.75	.30	.60
13,500 cu. ft. pressure grouting	1.80	1.00	2.20	2.00	1.80	2.00
7,200 cu. ft. pressure grouting with rakers	2.15	1.25	2.25	2.25	1.90	2.50
4,600 lin. ft. drilling holes for anchor bars and grouting bars in place	2.15	3.00	2.10	1.00	1.50	2.00
750 cu. yd. concrete in grout cap	20.00	20.00	18.00	23.00	31.00	20.00
30 cu. yd. concrete in trashrack structure	76.00	50.00	130.00	90.00	100.00	65.00
225 cu. yd. concrete in gate chamber and gate chamber shaft	50.00	60.00	112.00	90.00	100.00	60.00
80 cu. yd. concrete in gate chamber control house	75.00	80.00	91.00	90.00	75.00	80.00
250 cu. yd. concrete in outlet works stilling basin	45.00	40.00	56.00	50.00	50.00	45.00
300 cu. yd. concrete in spillway side channel weir	32.00	30.00	48.00	50.00	60.00	30.00
1,650 cu. yd. concrete in spillway floor and side lining	30.00	40.00	42.00	40.00	40.00	25.00
1,700 cu. yd. concrete in spillway walls	33.00	40.00	65.00	45.00	55.00	50.00
120 cu. yd. concrete in spillway cut-off walls	20.00	30.00	70.00	45.00	35.00	25.00
21 cu. yd. concrete in spillway bridge	68.00	100.00	57.00	75.00	60.00	65.00
25 cu. yd. concrete in paved gutter	45.00	50.00	42.00	60.00	35.00	50.00
115,000 lb. furn. and placing reinf. bars	.14	.12	.13	.13	.13	.12
75,000 lb. placing reinf. bars	.05	.05	.06	.08	.075	.06
100 sq. ft. furn. and placing bitum.-type joint filler	.80	1.00	1.00	1.20	2.00	1.50
250 lin. ft. furn. and placing metal seals	3.00	4.00	1.40	1.60	1.50	2.00
40,680 lb. installing high-pressure gates	.12	.07	.17	.11	.08	.10
1,500 lb. installing control apparatus and piping for high-pressure gates	.35	.25	.24	.40	.35	.40
10,885 lb. installing trashracks	.17	.10	.06	.10	.10	.10
465 lin. ft. erecting wire fence	.14	4.00	1.00	.50	1.00	1.00
3,800 lb. installing pipe handrailing	.28	.25	.60	.30	.25	.25
2,340 lb. installing metal pipe, fittings, and valves	.45	.25	.30	.40	.40	.30
800 lb. installing ventilating system	.45	.50	.25	.40	.40	.40
2,600 lb. installing air-inlet pipe	.35	.30	.30	.30	.30	.25
26,500 lb. erecting structural steel for spillway bridge	.12	.05	.06	.10	.06	.07
2,180 lb. installing misc. metalwork	.35	.30	.50	.75	.60	.30
25 sq. ft. furnishing and installing metal door	12.00	10.00	12.00	12.00	20.00	10.00
28 sq. ft. furn. and installing metal sash windows	3.50	5.00	4.00	8.00	5.00	6.00
160 sq. ft. furn. and placing roofing	.60	1.00	1.00	1.00	1.00	1.00
16 posts furn. and setting guard posts	5.00	5.00	6.00	3.00	6.00	6.00
14 points furn. and install. brass bolt settlement pts.	2.15	5.00	1.20	20.00	5.00	12.00
180 lin. ft. furn. and install. elect. metal conduits 1 in. or less in diam.	1.20	1.00	1.20	1.75	2.00	1.50
65 lb. furn. and install. elect. condctrs. and gd. wires	2.50	1.00	2.40	4.00	3.00	2.00
1,200 lb. installing elect. apparatus	.70	.30	1.20	.50	.50	1.00
8,000 cu. yd. excav., common, for canal and diver. chan.	.28	.25	.95	.75	.60	.30
2,250 cu. yd. excav., rock, for canal and diver. chan.	1.80	2.00	.95	.75	.60	2.00
1,150 cu. yd. earth canal lining	.45	.50	2.35	.50	.50	.80
850 cu. yd. compacting earth lining	.28	.50	2.40	.20	1.00	.80

Waterway Improvement . . .

Placing Stone for Breakwater

Oregon—Coos County—Corps of Engineers. Morgan Construction Co., Inc., Florence, Ore., with a bid of \$261,635, was low before the Corps of Engineers for construction of a stone breakwater in the South Slough, a tributary of Coos Bay, for small boat harbor at Charleston, Ore. Unit bids were as follows:

(1) Morgan Construction Co., Inc.....	\$261,635	(4) Miller & Strong, Inc.....	\$296,140			
(2) Macco Corp.	272,020	(5) C. J. Eldon, contractor.....	300,830			
(3) Coos Bay Dredging Co., Inc.....	289,440	(6) Engineer's estimate.....	241,200			
	(1)	(2)	(3)	(4)	(5)	(6)
67,000 tons stone, in place.....	\$3.905	\$4.06	\$4.32	\$4.42	\$4.49	\$3.60

Tunnel . . .

Excavation and Concrete Lining

Colorado—Larimer County—Bureau of Reclamation. Gibbons & Reed Co., Salt Lake City, with a bid of \$1,294,312, was low before the Bureau of Reclamation for constructing the Rattlesnake Tunnel, Estes Park-Foothills power aqueduct, Colorado-Big Thompson Project. Length of the tunnel will be approximately 1.6 mi. Work will include: tunnel excavation, including closed sections in ends of tunnel; open-cut excavation for the outlet portal, for an open transition, and a channel; concrete lining of the tunnel; construction of concrete structures, including closed sections in tunnel, outlet portal headwall, and an open transition. Work is situated approximately 13 mi. west of Loveland, Colo. Unit bids were received as follows:

(1) Gibbons & Reed Co.	\$1,294,312	(4) United Concrete Pipe Corp. & Ralph A. Bell	\$1,342,360			
(2) G. L. Tarlton Contracting Co.	1,325,775	(5) Winston Bros. Co.	1,346,821			
(3) The Arundel Corp. & L. E. Dixon Co.	1,340,880	(6) Engineer's estimate	1,297,730			
	(1)	(2)	(3)	(4)	(5)	(6)
4,800 cu. yd. excavation, all classes, in open cut.....	\$1.90	\$3.00	\$5.00	\$2.00	\$4.00	\$2.00
35,700 cu. yd. excavation, all classes, in tunnel.....	21.50	22.60	23.00	20.00	21.80	21.00
100 cu. yd. excavation, all classes, for tunnel enlarg.	50.00	22.60	22.00	30.00	30.00	45.00
50 cu. yd. backfill.....	5.00	1.00	1.00	1.00	3.00	1.00
30 cu. yd. compacting backfill.....	5.00	10.00	2.00	4.00	4.00	3.00
450,000 lb. furn. install perm. steel tunnel supports.....	.16	.11	.22	.15	.18	.15
195 M.b.m. furn. & erect. perm. timbering in tunnel.....	270.00	150.00	180.00	250.00	250.00	300.00
800 lin. ft. drilling feeler or pilot holes ahead of tunnel excavation.....	.85	.30	1.00	2.00	2.00	1.25
800 lin. ft. drill. grout holes through conc. tun. lining.....	.85	.50	1.60	2.00	2.50	2.00
800 lb. furnishing & placing grout pipes and conn.	.75	1.00	1.45	1.00	.70	.90
8,000 cu. ft. pressure grouting.....	2.25	2.50	1.65	1.75	2.50	2.50
65 cu. yd. concrete in structures.....	60.00	65.00	75.00	60.00	100.00	65.00
10,000 cu. yd. concrete in tunnel lining.....	28.40	27.00	27.00	39.00	31.00	30.00
12,000 lb. furnishing and placing reinforcement bars.....	.10	.15	.10	.14	.15	.14
130 lb. furnishing and placing metal water stop.....	.25	1.00	1.00	1.50	.70	.50
15,700 bbl. furnishing and handling cement.....	5.00	8.00	4.25	5.45	4.70	5.00

Continued on page 122

Continued from page 120

The Oakland plant is a unit of the G-E Transformer and Allied Products Divisions. It manufactures transformers ranging in size from 1½ to 1,000 kva.

General Electric has also announced two other appointments. JAMES M. CRAWFORD has been named manager of the apparatus department's Transformer and Allied Product Divisions at the Pittsfield, Mass., headquarters, according to J. W. BELANGER, assistant general manager. Crawford, who has been manager of the department's Large Motor Generator Divisions, succeeds ROBERT PAXTON, recently appointed manager of manufacturing policy for the company. At the G-E Fractional Horsepower Motor Division's plant in Fort Wayne, Ind., WILLIAM N. OBERLY has been appointed assistant to LISLE D. HODELL, manager of manufacturing. Oberly has been with G-E since 1940, when he attended the test course.

★ ★ ★

E. V. BRISCOE, of Kerman, Calif., is undertaking personal delivery of 100 tons of Briscoe ditchers to Greece. He is flying directly to Athens, timing his arrival with that of the machines. Following his stay in Athens, Briscoe is planning a trip through Africa—French West Africa, Dakar, Algiers, and possibly Madagascar. By delivering his equipment personally he hopes to supply dealers with full instructions on the correct operation of the ditchers and to teach them the rudiments of maintenance. The 26 ditchers going to Athens range in size from the smaller 1½-ton machines that will dig a 4-ft.-deep, 10-ft.-wide ditch to the 5-ton Briscoe giants that will cut 5 ft. underground, digging a ditch 17 ft. wide and moving 600 cu. ft. of dirt in an hour. These ditchers will be used by contractors, by irrigation and reclamation projects, and for agricultural purposes under the supervision of the U. S. Economic Cooperation Administration. Company executives in addition to E. V. Briscoe include MEL BRISCOE, assistant general manager, and H. D. WEAVER, sales manager.

★ ★ ★

Columbia Steel Co., through PAUL F. KOHLHASS, vice president-engineering, has announced the appointment of WORRELL F. PRUDEN as assistant chief engineer. Pruden comes to Columbia Steel from Consolidated Western Steel Corp., a sister USS subsidiary in Los Angeles, where he was chief engineer. He joined Consolidated Steel Corp. (a predecessor of Consolidated Western Steel Corp.) in 1934, as a structural designer and was appointed chief estimator in 1939. When Consolidated opened its shipyard at Orange, Texas, during World War II, Pruden was assigned to that operation as manager of purchases. In 1943 he returned to the Maywood offices of Consolidated as assistant manager and subsequently as manager of the naval ordinance division, the position he held until his appointment in 1945 as chief engineer for the company.



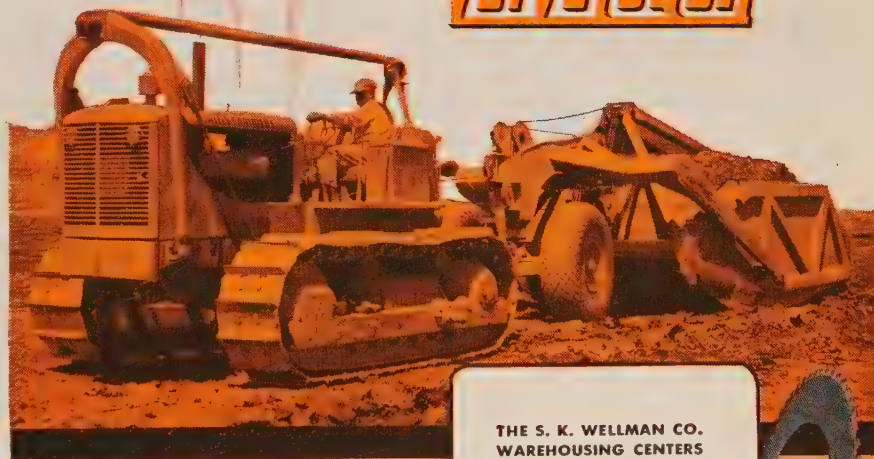
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flection of timber beams, under long time loading, will increase.

While working on this particular article, an electrical engineer came in to see me. He became interested in the chart due to the fact that he had been figuring on some remodeling of his home. He wanted to know why I had included joists and rafters on the same chart since to him they did not seem to be at all similar. It is true that in a pitched roof there seems to be little similarity, yet actually we figure them the same, taking the horizontal projection for load and span as in a stair beam. In a flat roof system, as utilized in southern California, the similarity is more apparent.

¹Western Construction.



STATEMENT OF THE OWNERSHIP, MANAGEMENT AND CIRCULATION REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) OF WESTERN CONSTRUCTION, PUBLISHED MONTHLY AT SAN FRANCISCO, CALIFORNIA, FOR OCTOBER 1, 1950.

1. The names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher: Arthur F. King, 609 Mission Street, San Francisco, Calif.

Editor: James I. Ballard, 609 Mission Street, San Francisco, Calif.

Managing Editor: John J. Timmer, 609 Mission St., San Francisco, Calif.

Business Manager: L. P. Vrettos, 609 Mission St., San Francisco, Calif.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of the total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.)

KING PUBLICATIONS, 609 MISSION ST., SAN FRANCISCO, CALIFORNIA. Arthur F. King, 609 Mission St., San Francisco, California; Louise B. King, 609 Mission St., San Francisco, California.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required from daily, weekly, semiweekly, and triweekly newspapers only.)

(signed) L. P. VRETOS
Business Manager

Sworn to and subscribed before me this 2nd day of October, 1950.

(Seal) CICELY M. DE PUY
Cicely M. DePuy, Notary Public in and for the City and County of San Francisco, State of California. My commission expires October 22, 1951.



Bridge and Grade Separation...

Treated Timber Bridge and Welded Girder Bridge

Wyoming—Fremont County—State. J. H. & N. M. Monaghan & Assoc. Cos., Derby Colo., with a low bid of \$168,262, was awarded a contract by the Wyoming Highway Department for constructing a reinforced concrete culvert, 23-ft. treated timber span bridge over Poison Creek and 100-ft. span welded girder bridge over Wind River on 5.1 mi. of the road between Shoshoni and Riverton. Unit bids were as follows:

(1) J. H. & N. M. Monaghan & Assoc. Cos.	\$168,262	(4) Chas. M. Smith	\$197,929
(2) N. A. Nelson Con. Co.	188,962	(5) Northwestern Engineering Co.	204,706
(3) Etlin E. Peterson	196,186	(6) Engineer's estimate	174,645

	(1)	(2)	(3)	(5)	(6)
60 cu. yd. structure excavation	\$1.50	\$3.50	\$2.50	\$3.00	\$2.00
70 hr. mechanical tamping	5.00	6.00	6.00	7.00	6.00
260 cu. yd. dry excavation for bridges	1.50	3.00	3.00	3.00	2.50
900 cu. yd. wet excavation for bridges	7.00	10.00	12.00	12.00	8.00
297.2 cu. yd. Class B concrete—superstructure	38.00	43.00	46.00	50.00	48.00
1,215.9 cu. yd. Class B Concrete—substructure	38.00	39.50	46.00	44.00	50.00
63.2 cu. yd. Class B concrete	38.00	39.00	45.00	44.00	48.00
91,160 lb. reinforcing steel	.09	.10	.115	.12	.122
379,550 lb. structural steel	155	.195	.175	.1775	.18
81,943 M.B.M. treated timber	250.00	240.00	260.00	275.00	300.00
3,062 lin. ft. treated timber piling	2.40	2.25	2.40	2.00	2.50
1,740 lin. ft. untreated timber piling	2.10	1.75	2.00	3.00	2.20
2 ea. test piles	200.00	100.00	250.00	150.00	200.00
517 lin. ft. metal plate guard rail	3.50	3.00	3.00	3.00	3.00
1 ea. prov. & maint. field test. lab. bldg.	500.00	800.00	500.00	500.00	600.00

Three-span Reinforced Concrete Bridge

Oregon—Marion County—Corps of Engineers. VaDare Construction Co., Portland, with a bid of \$46,645, was low before the Corps of Engineers for construction of a 26-ft. roadway, 3-span, reinforced concrete bridge over the North Santiam River on Blowout Creek-Idanha Road, Marion County. Unit bids were as follows:

(1) VaDare Construction Co.	\$46,645	(4) Port Construction Co.	\$57,060
(2) Lindstrom Bros., Inc.	48,540	(5) Lee Hoffman	63,845
(3) E. C. Hall Co.	51,138	(6) Engineer's estimate	53,675

	(1)	(2)	(3)	(4)	(5)	(6)
130 cu. yd. excavation for structure	\$20.00	\$12.00	\$30.00	\$35.00	\$50.00	\$21.00
512 cu. yd. concrete, in place	55.00	60.00	59.00	70.00	80.00	65.00
770 bbl. low alk. Portland cement, Type I or Type II	6.00	5.00	6.00	6.00	5.50	5.00
98,000 lb. steel reinforcement, in place	.105	.12	.12	.115	.12	.135
1,300 lb. structural steel and misc. metal, in place	.75	.50	.50	.60	.30	.45

Removing Existing Bridge and Superstructure for New Concrete Bridge

California—Shasta County—Bureau of Reclamation. John C. Gist, Sacramento, with a bid of \$288,911 was low before the Bureau of Reclamation for dismantling and removing an existing bridge; earthwork, foundations, and superstructure for a new Sacramento River bridge at Shasta Dam. Unit bids were as follows:

(1) John C. Gist	\$288,911	(3) Erickson, Phillips & Weisberg	\$322,175
(2) Fredrickson & Watson Construction Co.	316,401	(4) Ralph A. Bell	449,274
		(5) Engineer's estimate	270,985

	(1)	(2)	(3)	(4)	(5)
Lump sum, dismantling and removing existing bridge	\$27,400	\$29,000	\$35,000	\$30,000	\$23,000
5,700 cu. yd. excavation for channel improvement	3.30	2.50	3.75	9.00	2.00
900 cu. yd. excavation, rock, for structures	11.50	5.00	3.15	30.00	4.00
5,600 cu. yd. excavation, common, for structures	1.20	1.50	3.15	9.00	1.00
5,900 cu. yd. backfill	1.00	2.00	1.20	1.50	.75
4,000 cu. yd. compacting backfill	2.00	2.00	1.10	5.00	2.50
1,600 cu. yd. riprap	2.00	5.30	7.00	8.00	5.00
1,780 cu. yd. concrete in abutments, piers, and retaining walls	41.00	51.00	55.00	65.00	45.00
320 cu. yd. concrete in bridge slab	60.00	74.00	55.00	57.00	65.00
180,000 lb. placing reinforcement bars	.05	.05	.06	.06	.05
470,000 lb. furnishing and erecting structural steel	.17	.17	.16	.16	.15
22,500 lb. furnishing and installing metal railings	.34	.35	.30	.34	.40
Lump sum, maintaining and installing air and water lines	\$2,000	\$2,500	391.00	\$2,500	\$3,000
3,200 lb. furnishing and installing miscellaneous metal-work	.60	.50	.41	.50	.50
600 lin. ft. furn. and laying 4-in. diameter sewer-pipe drains	1.00	1.40	1.50	2.50	2.00
130 sq. ft. furn. and placing elastic filler material in joints	2.00	2.50	2.00	2.50	2.50
24 lin. ft. furn. and install. 6-in. rubber water stops in joints	4.00	4.00	3.00	3.00	2.50
3,150 bbl. furnishing and handling cement	5.50	5.30	4.40	5.25	4.50
240 tons credit to be allowed to the govt. for salvage steel	10.00	10.00	10.00	5.00	20.00

Reinforced Concrete Box Girder Bridge

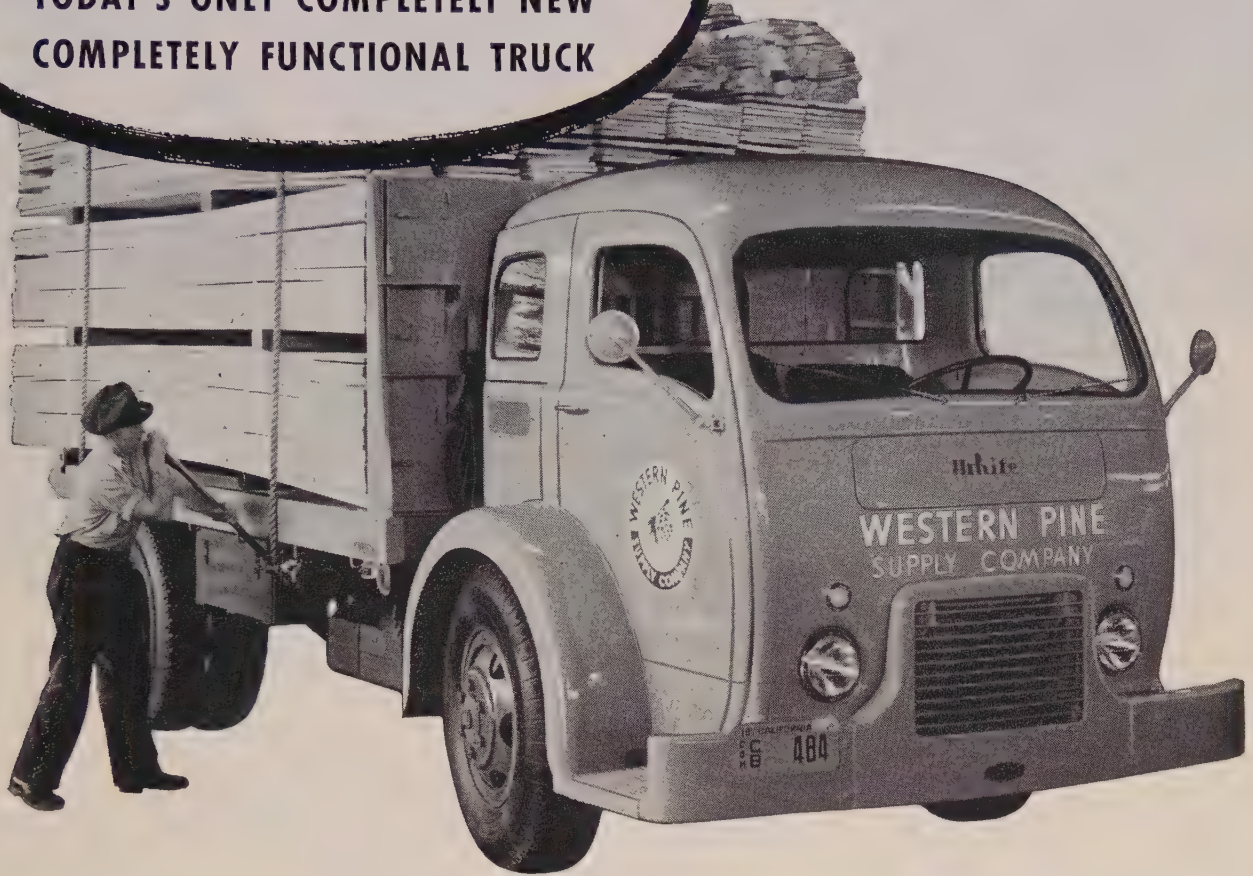
California—Los Angeles County—State. W. J. Disteli, Los Angeles, with a bid of \$512,854, was low before the California Division of Highways for constructing a reinforced concrete box girder bridge and grading and paving road connections over the Harbor Freeway at Fourth St. in Los Angeles. Unit bids were as follows:

(1) W. J. Disteli	\$512,854	(4) Webb & White	\$549,680
(2) K. B. Nicholas	529,140	(5) Oberg Bros. Construction Co.	560,978
(3) J. E. Haddock, Ltd.	539,784	(6) Winston Bros. Co.	565,083

	(1)	(2)	(3)	(4)	(5)	(6)
2,200 cu. yd. removing concrete	3.00	3.00	4.50	2.75	3.00	3.50
Lump sum, clearing and grubbing	800.00	500.00	\$3,000	\$1,000	\$2,000	750.00
104,000 cu. yd. roadway excavation	.61	.77	.75	.70	.66	.90
5,820 cu. yd. structure excav. (bridge)	1.75	.92	2.25	1.80	1.80	2.20
9,340 cu. yd. structure backfill (bridge)	2.00	1.75	2.25	2.20	2.00	1.70
1,100 cu. yd. structure excav.	2.50	3.00	4.00	3.50	4.00	3.00
3,850 ton imported base material	2.10	2.35	2.10	2.25	2.00	1.90
Lump sum, dev. wat. supp. and furn. wat. equip.	500.00	450.00	900.00	750.00	\$1,000	500.00
600 M. gal. applying water	1.90	2.30	1.75	2.00	2.00	1.90
Lump sum, finishing roadway	500.00	530.00	200.00	\$1,000	500.00	500.00
660 ton mineral aggregate (P.M.S.)	5.00	4.00	5.50	3.85	5.00	3.50
35 ton paving asphalt (P.M.S.)	18.00	17.00	5.50	17.00	20.00	15.00
2,400 ton asphalt concrete	5.50	4.90	4.75	4.70	6.00	4.20
200 cu. yd. Class "B" P.C.C. base	19.00	14.80	14.50	20.00	20.00	18.00
5,130 cu. yd. Class "A" P.C.C. (structures)	43.00	42.00	44.00	45.00	49.00	45.50
534 lin. ft. rubber waterstops	2.00	2.10	1.75	3.00	2.00	2.50
26,150 lb. miscellaneous iron and steel	.27	.28	.25	.30	.25	.28
500 cu. yd. Class "A" P.C.C. (curbs, gutters and sidewalks)	31.00	33.00	25.00	40.00	35.00	33.00

Continued on next page

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320 lin. ft. curb armor	3.00	2.60	2.50	2.75	4.00	2.50
340 lin. ft. curb bar	.70	.50	.42	.50	.60	.45
867,000 lb. bar reinforcing steel	.084	.085	.08	.08	.09	.09
114 lin. ft. 4-in. cast iron pipe	2.50	2.40	1.85	3.50	3.00	4.00
13 lin. ft. 8-in. cast iron pipe	7.00	5.60	12.00	5.50	10.00	7.00
1,450 lin. ft. chain link fence	2.00	2.00	1.90	1.70	1.50	1.80
2 ea. drive gates	75.00	88.00	75.00	70.00	60.00	70.00
1,794 lin. ft. steel railing	5.50	6.25	6.00	6.00	6.00	5.50
38 lin. ft. pipe handrail	6.50	7.00	6.80	7.00	7.00	6.50
350 lin. ft. temporary timber guard rail	2.00	2.30	1.75	2.00	2.00	1.86
180 lin. ft. portable timber guard rail	3.50	3.60	3.50	3.50	3.00	2.70
1,000 lin. ft. temporary timber curb	1.50	1.35	1.00	1.25	1.50	.55
550 lin. ft. 12-in. reinf. conc. pipe (std. strength)	4.75	4.25	2.90	4.50	5.00	3.00
95 lin. ft. 15-in. reinf. conc. pipe (std. strength)	5.15	5.00	4.00	5.00	6.00	4.00
300 lin. ft. 18-in. reinf. conc. pipe (std. strength)	6.15	5.65	4.70	6.00	7.00	4.50
57 lin. ft. 21-in. reinf. conc. pipe (std. strength)	6.25	6.50	5.30	7.00	8.00	5.00
160 lin. ft. 27-in. reinf. conc. pipe (1250-D)	7.60	8.75	6.70	9.00	9.00	7.50
24 lin. ft. 30-in. reinf. conc. pipe (1250-D)	8.40	9.60	8.00	10.00	10.00	8.50
240 lin. ft. 33-in. reinf. conc. pipe (2500-D)	10.75	14.00	10.50	15.00	11.00	11.00
230 lin. ft. 36-in. reinf. conc. pipe (2500-D)	11.50	17.00	11.70	18.00	12.00	12.50
210 lin. ft. 48-in. reinf. conc. pipe (1500-D)	14.00	18.25	15.30	19.00	20.00	16.00
18 lin. ft. pipe shaft manholes	10.50	16.00	15.00	17.00	15.00	15.00
30 lin. ft. 6-in. clay sewer pipe (std. strength)	6.00	9.00	10.00	10.00	10.00	12.00
600 lin. ft. 8-in. clay sewer pipe (std. strength)	9.50	17.50	18.50	18.00	16.00	15.00
1,000 lin. ft. 8-in. clay sewer pipe (extra strength)	10.85	12.50	9.20	13.00	10.00	10.00
7 ea. manholes (sanitary sewer)	275.00	350.00	500.00	400.00	450.00	800.00
1 ea. drop manhole (sanitary sewer)	550.00	750.00	\$1,200	800.00	700.00	\$1,300
3 ea. remodeling manholes (sanitary sewer)	75.00	50.00	85.00	60.00	100.00	270.00
2 ea. adjust. manholes to grade (sanitary sewer)	50.00	100.00	30.00	100.00	50.00	55.00
15 ea. house connection caps	15.00	5.00	15.00	6.00	10.00	17.00
Lump sum, electrical equipment	\$8,300	\$8,000	\$8,500	\$9,000	\$10,000	\$8,700
Lump sum, engineer's office	\$1,500	\$2,000	\$1,500	\$1,500	\$1,800	\$2,100

Highway and Street . . .

Application of Seal Coat

California—Santa Barbara County—State. Valley Paving & Construction Co., Inc., Pismo Beach, with a bid of \$15,509, was low before the Division of Highways for applying a Class C "Fine" seal coat to 8.9 mi. of state highway between Santa Maria and Orcutt Wye, Santa Barbara County. Unit bids were as follows:

(1) Valley Paving & Construction Co., Inc.			\$15,509
(2) Madonna Construction Co.			17,680
(3) E. S. & N. S. Johnson			19,126
	((1))	((2))	((3))
40 tons, location No. 1 V.-S.B.-2-F. asph. emuls. (sl. ct.)	\$30.00	\$39.00	\$31.10
450 tons screenings (sl. ct.)	6.40	6.84	8.90
59 tons, location No. 2 V.-S.B.-56-B, asph. emuls. (sl. ct.)	29.50	39.00	30.00
655 tons screenings (sl. ct.)	6.15	6.84	7.95
61 tons, location No. 3 V.-S.B.-2-L.A.), asph. emuls. (sl. ct.)	28.00	34.00	28.00
670 tons screenings (sl. ct.)	5.90	6.25	7.75

Bituminous Penetration Sealing

Utah—Summit County—State. W. W. Clyde & Co., Springville, with a bid of \$17,530, was low before the State Road Commission of Utah for sealing on a 5.5 mi. stretch of highway between Parley's Canyon Summit and Kimball's Junction. Unit bids were as follows:

(1) W. W. Clyde & Co.			\$17,530
(2) Gibbons & Reed Co.			22,430
(3) Engineer's estimate			16,710
	(1)	(2)	(3)
750 ton plant mixed bituminous surfacing	\$2.20	\$5.00	\$2.40
2,150 ton cover material	4.00	5.70	3.50
10,500 gal. bituminous material, Type 120-150 penetration	.12	.10	.13
43,000 gal. bituminous material, Type RC-4	.14	.125	.14

Grading and Bituminous Surfacing on Richardson Highway in Alaska

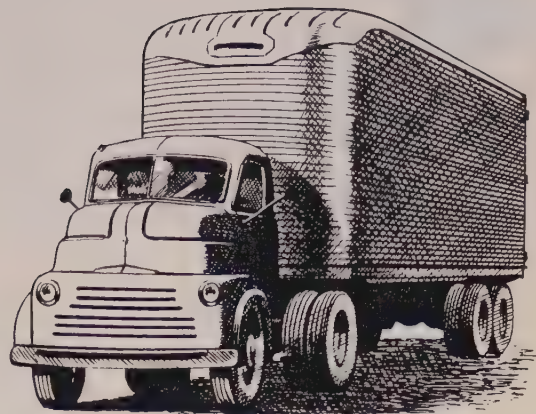
Alaska—Road Commission. McLaughlin, Inc., with a bid of \$3,790,141, was low before the Alaska Road Commission for grading, surfacing and bituminous surfacing of 34.6 mi. of Richardson Highway, Section H. Unit bids were as follows:

(1) McLaughlin, Inc.			\$3,790,141
(2) Morrison-Knudsen, Inc., Peter Kiewit & Sons Co., and S. Birch & Sons Co.			3,826,076
(3) C. F. Lytle Co. & Green Construction Co.			4,112,788
	(1)	(2)	(3)
Lump sum, extra & misc. force account work	\$4,000	\$4,000	\$4,000
85 acres clearing	500.00	660.00	1,800
70 acres grubbing	600.00	630.00	725.00
665,000 cu. yd. unclassified excavation	2.20	2.35	3.00
2,400 cu. yd. unclassified excavation for structures	9.00	7.65	23.00
430,000 cu. yd. unclassified excavation for borrow, Case 1	.80	.95	1.00
3,353,000 sta. yd. overhaul (1,000 ft. free haul)	.45	.03	.03
300,000 cu. yd. mi. special overhaul of borrow (1000 ft. freehaul)	.45	.35	.30
636 lin. ft. tunnel excavation	575.00	590.00	170.00
3,000 units watering of subgrade, Item 41	3.00	2.10	3.00
5,000 units watering of base course, Item 52A	3.00	2.10	3.00
All required lump sum, providing and maintaining water plant or plants	\$7,500	\$8,860	\$3,000
136,000 tons crushed gravel or crushed stone course (base)	2.00	2.37	2.00
540 tons MC-2 cut-back asphalt for prime coat	35.00	31.00	32.00
1,000 cu. yd. blotter material for prime coat	5.00	8.75	9.00
4,500 tons cover aggregate for Type 3 seal coat, grading B	10.50	9.90	9.80
440 tons RC-3 cut-back asphalt for seal coat	30.00	34.50	58.50
46,000 tons plant mixture, grading A-1 for Class F pavement, Type F-1	7.50	7.30	8.00
2,530 tons R-C cut-back asphalt, Grade 3, for Type F-1	10.00	4.20	6.30
3,000 tons dry plant mix aggregate, grading A-1, in stockpile	4.00	1.75	1.00
1,802 sq. yd. concrete pavement (air-entrained, low alkali cement)	25.00	14.00	12.00
360 cu. yd. concrete Class A (air-entrained, low alkali cement)	200.00	110.00	120.00
25,100 lb. reinforcing steel	.35	.20	.20
170 m ft. BM treated timber, cresote preservative	700.00	475.00	430.00
90 lin. ft. 18" std. strength reinforced concrete culvert pipe	No Bid	No Bid	No Bid
6,500 lin. ft. 24" std. strength reinforced concrete culvert pipe	No Bid	No Bid	No Bid
450 lin. ft. 36" std. strength reinforced concrete culvert pipe	No Bid	No Bid	No Bid
450 lin. ft. 18" corr. galv. sheet metal culvert pipe	6.00	8.00	6.80

Continued on next page

DOES ALL THREE JOBS

not just one!



CLEANS as it PROTECTS as it LUBRICATES

NEW TYDOL Heavy Duty Compounded Motor Oil

Trucks and busses, farm and construction equipment, marine and industrial engines—they all take a new lease on life when they're lubricated with great new Heavy Duty Tydols. These high detergency motor oils do more than merely lubricate. They keep engines whistle-clean; provide unmatched protection against wear. All three Heavy Duty Tydols—HD, HD S-1, HD S-2—are made from top quality, high V.I. paraffin base stocks, skillfully compounded with potent "additives." Every quart ... every drop cleans as it protects as it lubricates. Does *all three* vital jobs; not just one!

SAFEGUARDS ENGINES 10 VITAL WAYS

Each Heavy Duty Tydol remains stable, heat-resistant, non-corrosive • Assures positive lubrication; minimum oil consumption • Prevents clogged oil ducts • Banishes sludge and varnish deposits • Keeps rings from sticking • Insures free-acting valve stems • Permits easier starting • Reduces wear • Contains anti-foam agent • Keeps filter elements cleaner.

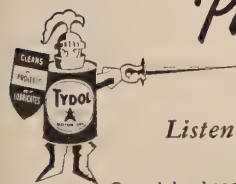
THERE'S A NEW TYDOL TO MEET YOUR NEEDS!

TYDOL HD. For high speed gasoline, butane, diesel-fueled engines in automobiles, busses, trucks, tractors, stationary units under normal Heavy Duty 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 cold starts, and to severe and continued overloading. SAE grades 20, 30, 40. Sold in drums.

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

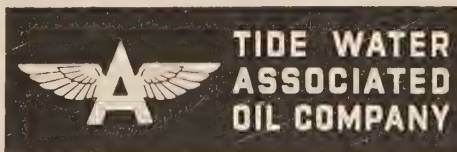
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for expert help on any lubrication problem.



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a

low-cost Inlet Gate



MARTIN Canal Gate-Type LC

**For Working Pressures
UP TO 20 ft.**

This new Martin Canal Gate has been designed to meet the demand for a sturdy, low-cost inlet gate for working pressures up to 20 feet. It is particularly adaptable to irrigation work, flood control systems, oil refineries, fish canneries, sewage disposal plants and other industrial applications.

Both the frame and slide on this gate have accurately machined or ground seats to insure an efficient cut-off. When closed, the slide is wedged tightly against the seat, and the full machine-cut threads on the stem assure a fast, easy operating slide.

Made in 6 different size openings from 16" to 36" with flat back for attachment to concrete head wall or spigot back for attachment to galvanized taper or section of corrugated iron pipe.

Write for catalog No. 49W.

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IRON
WORKS**

**1222 EAST 28TH ST.
LOS ANGELES 11, CAL.
SINCE 1900**

7,000 lin. ft. 24" corr. galv. sheet metal culvert pipe.....	8.50	11.10	9.50
450 lin. ft. 36" corr. galv. sheet metal culvert pipe.....	17.00	19.70	21.00
240 lin. ft. 48" corr. galv. sheet metal culvert pipe.....	20.00	27.00	28.00
210 lin. ft. 60" corr. galv. sheet metal culvert pipe.....	35.00	38.50	36.00
226 lin. ft. 72" corr. galv. sheet metal culvert pipe.....	42.00	48.00	49.00
1,862 lin. ft., remove, clean and stockpile salvaged culvert pipe.....	5.00	5.50	1.50
344 lin. ft., remove, clean and relay salvaged culvert pipe.....	6.00	10.00	7.00
300 lin. ft. 72" x 44" corrugated galv. sheet metal culvert pipe arch.....	40.00	40.00	44.00
1 lump sum, removal and disposal of existing bridge.....	\$7,000	\$1,400	\$1,000
sq. yd. dry rubble slope pavement, 2' thick.....	42.50	28.00	49.00
1,300 lin. ft. 8" concrete pipe underdrain.....	No Bid	No Bid	No Bid
1,300 lin. ft. 8" perforated corrugated galv. sheet metal pipe underdrain.....	11.00	4.30	3.00
2 pair castiron frames and steel gratings.....	350.00	90.00	225.00
300 cu. yd. rock packing.....	7.50	15.30	22.00
50 cords cordwood packing.....	40.00	140.00	105.00
5,000 hours rolling.....	12.00	10.50	11.00

Grading, Draining and Miscellaneous Work

Wyoming—Fremont County—State. J. H. & N. M. Monaghan & Assoc. Cos., Derby, Colo., with a bid of \$617,460, was awarded the contract for grading, draining, and miscellaneous work on 5.1 mi. of roadway between Shoshoni and Riverton. Unit bids were as follows:

(1) J. H. & N. M. Monaghan & Asso. Cos.	\$617,460	(4) Northwestern Engineering Co.	\$649,288
(2) Brown Con. Co.	619,846	(5) Lowdermilk Brothers	649,570
(3) Taggart Con. Co.	637,324	(6) Engineer's estimate	571,159

	(1)	(2)	(3)	(4)	(5)	(6)
903,000 cu. yd. excavation	.36	.32	.39	.35	.45	.25
1,913,000 cu. yd. sta. overhaul	.01	.01	.01	.01	.01	.01
154,000 cu. yd. mi. haul	.10	.12	.15	.12	.15	.12
11,800 M. gal. watering (emb.)	1.40	1.00	1.00	1.50	1.00	2.00
2,200 hr. sheepfoot roller operation	9.00	10.00	10.80	10.00	10.00	9.00
320 lin. ft. 12-in. std. R.C.P.	3.40	5.00	3.00	3.00	4.00	3.50
120 lin. ft. 18-in. std. R.C.P.	4.80	6.00	4.50	4.40	5.00	5.00
332 lin. ft. 24-in. std. R.C.P.	6.95	8.00	7.00	6.70	6.00	7.00
132 lin. ft. 30-in. std. R.C.P.	10.25	10.00	10.00	9.00	8.00	10.00
176 lin. ft. 36-in. std. R.C.P.	14.30	12.00	12.50	11.70	10.00	12.50
210.4 lin. ft. 30-in. siphon R.C.P.	18.50	14.00	12.50	11.70	11.00	13.00
510 cu. yd. excav. for pipe culverts	2.00	3.00	2.00	1.90	2.00	1.50
220 cu. yd. structure excav.	2.00	4.00	7.00	2.40	2.00	2.00
650 cu. yd. special backfill	1.75	2.00	2.00	2.40	2.00	1.75
160 hr. mechanical tamping	5.00	6.00	10.00	6.00	6.00	6.00
400 cu. yd. Class 1 riprap	5.00	6.00	5.85	10.00	4.00	7.50
28,400 cu. yd. special Class 1 riprap	6.00	7.00	5.25	7.00	4.25	7.50
1,440 cu. yd. Class 2 riprap	4.00	4.50	5.85	7.00	4.00	6.50
20 cu. yd. grouted riprap	15.00	15.00	10.00	20.00	20.00	12.00
6,400 lin. ft. metal plate guard fence Type B.....	2.50	3.50	3.15	2.65	2.15	2.15
48,000 std. r/w fence	.17	.18	.15	.17	.17	.16
70 ea. brace panels	10.00	8.00	7.50	10.00	8.00	12.00
40 ea. end panels	12.00	12.00	10.00	12.00	9.50	14.00
27.3 cu. yd. Class B concrete	60.00	70.00	60.00	60.00	55.00	45.00
1,420 lb. reinforcing steel	.10	.20	.15	.15	.14	.12
1,160 lb. structural steel	.15	.30	.50	.18	.30	.18
35 ea. r/w markers	7.00	10.00	10.00	10.00	10.00	10.00
1 ea. prov. and maint. field test. lab. bldg.	400.00	500.00	800.00	500.00	750.00	400.00

Miscellaneous ...

Actuated Traffic Signal System

California—San Mateo and Santa Clara Counties—State. A. J. Raisch Paving Co., San Jose, with a bid of \$27,677, was low before the Division of Highways for furnishing and installing a full traffic actuated signal system and highway lighting, constructing channelization, and removing existing electrical material. Unit bids were as follows:

(1) A. J. Raisch Paving Co.	\$27,677	(2) J. Henry Harris.....	\$28,008
----------------------------------	----------	--------------------------	----------

	(1)	(2)
550 lin. ft. remov. raised traffic bars.....	\$.25	\$.25
500 cu. yd. roadway excavation	2.30	2.60
Dev. water supply and furnish water equipment.....	\$1,300	\$1,148
40 M. gal., applying water.....	1.50	4.00
18 sta. finish roadway	12.00	12.00
690 tons min. aggregate (plant-mix. C.T.B.).....	3.75	3.30
130 bbl. Portland cement (plant-mix. C.T.B.).....	4.00	3.75
3 tons asphalt emulsion (pt. bdr., cur. sl., & sl. ct.).....	40.00	86.00
11 tons screenings (sl. ct.).....	6.00	6.85
3 tons sand (sl. ct.).....	6.00	12.00
320 ton min. aggregate (P.M.S.).....	7.80	7.15
16 tons paving asphalt (P.M.S.).....	19.00	23.00
730 lin. ft. raised traffic bars.....	1.10	1.20
59 cu. yd. cl. "B" P.C.C. (island surfacing).....	28.00	32.40
34 cu. yd. cl. "B" P.C.C. (curb).....	60.00	63.25
540 ea. Dowels (curb).....	.50	.45
6 ea. instal. metal guide posts.....	5.00	9.20
5 ea. horizontal refl. units	6.00	9.20
1,450 lb. bar reinforcing steel.....	.15	.15
Traffic signal system and highway lighting.....	\$13,660	\$13,757

Drilling, Casing and Testing Three Wells

Idaho—Arco—Atomic Energy Commission. R. S. Strasser, Portland, Ore., with a bid of \$43,467 on Schedule I and a bid of \$46,599 on Schedule II, was low before the Atomic Energy Commission for drilling, casing, and testing three wells at Arco, Idaho. Low bids were as follows:

	Schedule I	Schedule II
(1) R. S. Strasser	\$43,467	\$46,599
(2) A. J. Schoonover & Son.....	47,092	47,442
(3) Chas. P. Cope Drilling & Pump Co.	49,436	52,280
(4) A. A. Durand & Son.....	46,413	48,038
(5) Commons Drilling Co.	51,498	54,423

	(1)	(2)	(3)	(4)	(5)
Drilling three 16-in. wells up to 500 ft.....	\$18,600	\$22,500	\$26,250	\$20,625	\$27,750
Drilling from 500 to 700 ft.....	10.50	15.00	12.50	14.00	14.00
Plain casing to 500 ft.....	7.00	6.00	6.10	6.10	6.00
Perforated casing to 225 ft. total.....	11.00	6.50	7.50	7.50	8.00

Continued on next page

Plain casing from 500 to 700 ft.....	7.25	6.00	5.25	6.10	5.00
Expenses per hour of actual work.....	7.00	10.00	10.00	9.50	10.00
Equipment incidental for testing.....	\$1,800	\$1,500	\$1,500	\$2,250	\$1,725
Amount per hour of actual testing.....	4.00	5.00	5.00	8.00	3.00

SCHEDULE II

One 18-in. well and two 16-in. wells to 500 ft.....	\$20,100	\$22,500	\$28,250	\$21,250	\$29,750
16-in. wells between 500 and 700 ft.....	10.50	15.00	12.50	14.00	14.00
18-in. well between 500 and 700 ft.....	14.00	15.00	15.00	15.50	15.00
Plain casing 16-in. wells to 500 ft.....	7.00	6.00	6.10	6.10	6.00
Plain casing 18-in. well to 500 ft.....	8.25	6.50	6.50	7.10	7.00
16-in. perforated casing to 150 ft. total.....	11.00	6.50	7.50	7.50	8.00
18-in. perforated casing to 75 ft. total.....	13.00	7.00	8.50	8.50	9.00
Plain 16-in. casing from 500 to 700 ft.....	7.25	6.00	5.25	6.10	5.00
Plain 18-in. casing from 500 to 700 ft.....	8.50	6.50	5.80	7.10	6.00
Expenses per hour of actual work.....	7.00	10.00	10.00	9.50	10.00
Equipment incidental for testing.....	\$1,800	\$1,500	\$1,500	\$2,250	\$1,750
Amount per hour of actual testing.....	4.00	5.00	5.00	8.00	3.00

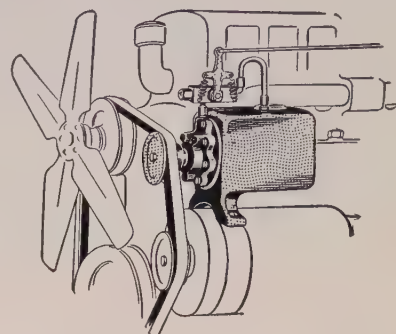
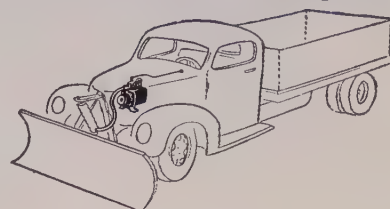
Surfacing Campus Athletic Courts

California—San Luis Obispo County—State. Madonna Construction Co., San Luis Obispo, with a bid of \$31,619, was low before the Division of Highways for grading and surfacing tennis courts with Portland cement concrete; grading and surfacing walkways, basketball and volleyball courts with plantmix surfacing at California State Polytechnic College campus. Unit bids were as follows:

(1) Madonna Construction Co.	\$31,619
(2) Tom C. Latham	32,143
(3) O. R. Ochs & Son	41,293

2 cu. yd. removing concrete.....	(1) \$ 5.00	(2) \$36.00	(3) \$50.00
1,600 cu. yd. roadway excavation	1.00	1.35	2.00
45 cu. yd. structure excavation	3.00	5.50	5.00
425 tons sandfill material	2.00	2.95	3.00
2,300 sq. yd. reshaping of existing ground.....	.10	.23	.80
1,200 tons imported base material.....	2.85	2.70	4.00
50 M gal. applying water.....	1.80	5.30	2.00
3 tons liquid asphalt, SC-2 (prime coat).....	25.00	40.00	60.00
225 tons mineral aggregate (P.M.S.).....	10.00	9.80	5.00
12 tons liquid asphalt SC-5 or SC-6 (P.M.S.).....	15.00	20.00	30.00
344 cu. yd. Cl. "B" P.C.C. (tennis courts).....	40.00	30.50	40.00
2 cu. yd. Cl. "A" P.C.C. (structures).....	75.00	80.00	80.00
3 cu. yd. Cl. "A" P.C.C. (curbs and gutters).....	40.00	80.00	80.00
2 each, entrance barriers.....	50.00	75.00	50.00
936 lin. ft. 12 ft. chain link fence (tennis courts).....	4.00	5.00	9.00
115 lin. ft. 8 ft. chain link fence.....	3.00	4.20	5.00
2 each, walk gates.....	20.00	67.00	25.00
1 each, double drive swing gate.....	60.00	190.00	75.00
242 lin. ft. remov. and reconstruct chain link fence.....	1.50	1.45	2.00
8 lin. ft. 12 ft. C.M.P. (16 gauge).....	2.00	7.00	5.00
1 each, cast steel frame and cover for drop inlet.....	25.00	67.00	50.00
365 lin. ft. 4-in. drain tile.....	1.25	.95	2.00
27,000 lb. bar reinforcing steel.....	.10	.12	.10
2 each, 60-in. C.M.P. tree wells (12 gauge).....	50.00	53.00	60.00
1 each, 42-in. C.M.P. tree well (12 gauge).....	60.00	60.00	80.00
Miscellaneous items of work.....	740.00	\$1,056	500.00

POWER HYDRAULICS for Snow Plows

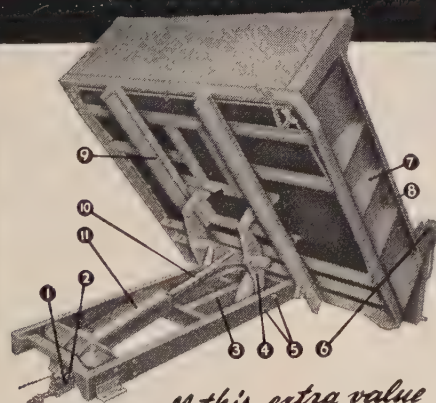


- Clutch operated models
- Thousands in use —
- Fit all trucks
- Fan belt or electrically driven

• Write Hydraulic Division
MONARCH ROAD MACH. CO.
 324 North Front Ave.
 GRAND RAPIDS 4, MICHIGAN

ONLY ANTHONY "Super" HOISTS give you all these DUMP BODY advantages!

1. "Non-thrust" Roller Bearing Pump patented design stops pump troubles.
2. "Balanced" Piston type control valve non binding, free action, creep proof.
3. Double "T" members supports lift mechanism—protects truck frame.
4. Double Arm "Power-Speed" Hoist—Super Power leverages changing to speed for faster dumping cycle.
5. Double shafts stabilizes lift, permits flexibility, adds life to hoist frame.
6. Massive rear body braces greater strength.
7. 3 Pyramid Braces on sides supports larger area.
8. Body rolls 3 1/4" wide—will stand a terrific beating.
9. Telescopic tipping frame gives full structural strength with 3" lower mounting height.
10. Extra large Piston Shaft gives added protection and strength needed for "Spreading" operations.
11. Cylinder, seamless steel, fitted with blow-out Proof Cylinder head.



and with all this extra value they are priced with the lowest

SEE YOUR TRUCK DEALER HE HAS VALUABLE LITERATURE FOR YOU

ARIZONA:
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CALIFORNIA:
 Los Angeles—Lambert Co., Ltd.
 Oakland—Commercial Sales Co.

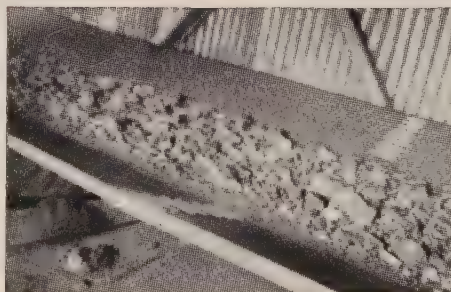
OREGON:
 Portland—Northwest Truckstell Sales, Inc.

WASHINGTON:
 Seattle—Nelson Truck Equipment Co.
 Spokane—Andrews Equipment Service



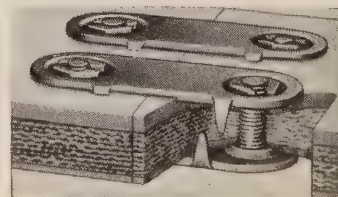
ANTHONY CO. • Streator, Illinois

FLEXCO BELT FASTENERS and RIP PLATES



FOR HEAVY CONVEYOR AND ELEVATOR BELTS OF ANY WIDTH

- ★ FLEXCO Fasteners make tight butt joints of great strength and durability.
- ★ Trough naturally, operate smoothly through take-up pulleys.
- ★ Distribute strain uniformly.
- ★ Made of Steel, "Monel," "Everdur." Also "Promal" top plates.
- ★ FLEXCO Rip Plates are for bridging soft spots and FLEXCO Fasteners for patching or joining clean straight rips.



Compression Grip distributes strain over whole plate area

Order From Your Supply House. Ask for Bulletin F-100

FLEXIBLE STEEL LACING CO.

4704 Lexington St., Chicago 44, Ill.

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.

Carbide Bits

1101

Manufacturer: Rock Bit Sales & Service Co., Philadelphia, Pa.

Equipment: Tungsten carbide bit of the conventional flat-top type.

Features claimed: Recommended where limited budgets are involved, this addition to the Rock Bit line gives the company a wide range of bit types for practically any application.

Maintenance Distributor

1102

Manufacturer: Rosco Manufacturing Co., Minneapolis.

Equipment: General purpose truck-mounted unit for handling all types of bituminous materials.

Features claimed: Maintains a constant

sprayline pressure to the tank, through use of a by-pass valve. All operating control levers are conveniently located. Model RHU is standard equipped with quick-detachable, non-folding, stationary spraybar in lengths governed by pump capacity. The machine includes such features as: load, transfer, spray, handspray, spraybar suck-back to clear spraylines, cleanout, and gravity draw-off.

Truck Mixer

1103

Manufacturer: The Concrete Transport Mixer Co., St. Louis, Mo.

Equipment: Hi-Lo truck and concrete mixer with visible mixing action.

Features claimed: This machine produces high quality concrete by the revolving blade, visible mixing action method. It

mixes thoroughly and assures uniform consistency from batch to batch. Action is obtained by means of a rotor that revolves on a horizontal steel shaft, parallel to the truck axle. Rotor appears to be a large spool that is split in the center and offset on the shaft. By offsetting in this manner, as that part of the rotor in the bottom of drum moves to the top, a cavity is created



into which material flows from the coned ends. Material is then carried to top of mixer by the spring-supported flaps which accomplishes both mixing and discharging. Barrel side of rotor provides a pocket into which concrete flows, and is folded and shoveled by the travel of the rotor. Rotor action produces a kneading, folding, and blading motion which provides a homogeneous mix and prevents segregation.

1104

All Plastic Goggle

Manufacturer: United States Safety Service Co., Kansas City, Mo.

Equipment: Safety goggle with interchangeable one-piece lens.

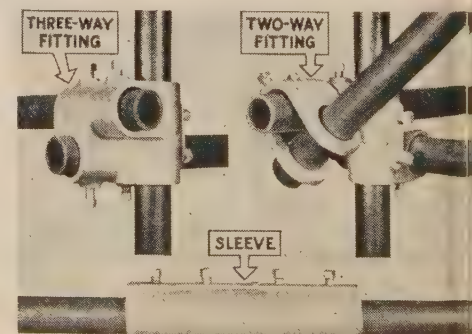
Features claimed: Lens is removable for use with either Saf-I-Duo goggle or Saf-I-Spec all-plastic safety spectacle. Lens is made from optilite; frame is of soft Vinyl.

1105

All-metal Scaffolding

Manufacturer: Amidon Sales Co., Elyria, Ohio.

Equipment: New system of all-metal scaffolding using standard pipe and patented fittings.



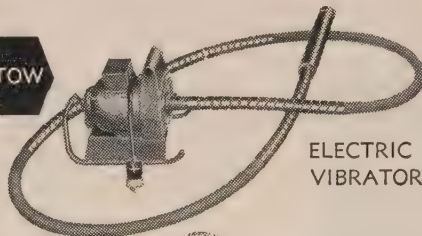
Features claimed: One or more of the following types of Amidon fittings are used in this system of scaffolding: (1) Three-way fitting, for connecting longitudinal, transverse, and vertical pipes into a single

Why
STOW
concrete
vibrators
do your
job
better!

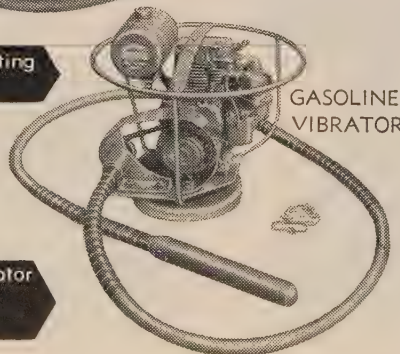
Equipped with
work-proved STOW
Flexible Shafts

Deliver high vibrating
frequency

Trouble-free Vibrator
head—lubricated
for life!



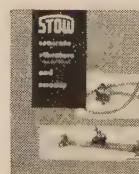
ELECTRIC
VIBRATOR



GASOLINE
VIBRATOR

STOW Vibrators — ruggedly constructed for long, efficient service, deliver up to 7000 vibrations per minute to the mix . . . place even stiff mixes uniformly. The high-speed motors (up to 9500 RPM) are protected by skid mountings . . . job-engineered, smooth running STOW FLEXIBLE SHAFTS guarantee longer, trouble-free performance. For better results, always specify STOW Vibrators!

WRITE FOR BULLETIN 507



STOW

MANUFACTURING CO.
56 Shear St. Binghamton, N. Y.

ugged corner joint, and for attaching one or two diagonal braces. (2) Two-way fitting, for fastening two pipes at right angles; these also permit building the scaffold to fit around circular structures and bends of any angle. (3) Sleeve, for joining lengths of pipe and for attaching casters.

1106

Canvas Housing

Manufacturer: Fort Dodge Tent & Awning Co., Fort Dodge, Ia.

Equipment: Heavy canvas housing for tractor and operator protection during cold weather.

Features claimed: Heat Houser Industrial is a compact, one-piece, heavy-duty, waterproof canvas housing. Permits operator freedom and does not interfere with most mounted equipment. Available for most models of industrial track type equipment.

1107

Truck-mounted Crane and Excavator

Manufacturer: Wayne Crane Division of American Steel Dredge Co., Fort Wayne, Ind.

Equipment: 12½-ton crane easily convertible to all crane and shovel attachments.

Features claimed: Model 40 has an increased swing speed of 6.4 rpm. Heavy-duty



carrier, which travels at truck speeds, is engineered and built especially for crane service. Equalizing beam-type suspension and a locking third differential make possible heavy, off-the-road work. Model 40 lifts, booms and swings either simultaneously or independently. Six-cylinder gasoline engine develops 105 hp. at 3,200 rpm. Auxiliary transmission provides ten forward and two reverse speeds.

1108

Work Glove

Manufacturer: Richmond Glove Corp., Richmond, Ind.

Equipment: Glove with one continuous seam on back of thumb for longer wear.

Features claimed: Seams on front of glove are eliminated, providing more usability at the point of greatest stress—where thumb meets palm. Palm is also seamless, assuring flexibility and wearability on primary work areas.

1109

Fastening Tool

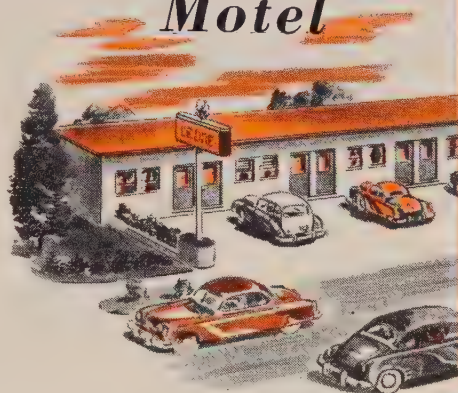
Manufacturer: Ramset Fasteners, Inc., Cleveland, O.

Equipment: Fastening system offering choice of either turn or tap operation for dual action.

Features claimed: Turn operation of this tool is designed for general working conditions. Tap operation is for use in confined quarters and for those who prefer it. Tap operation shortens tool by nearly 3 in. To



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use, simply insert a fastener and powder load in the tool, place it against the work. Instantly the drive pin or threaded stud is seated instantly in concrete, steel, masonry, or other building materials.

1110

Drive Pins

Manufacturer: Powder-Power Tool Corp., Portland, Ore.

Equipment: Special drive pin for powder driven fasteners.

Features claimed: Over 300,000 drive pins similar to the H-92 have been used to fasten a light perforated metal lath instantly



to a concrete ceiling on the Parklabrea housing project in Los Angeles. This metal lath, which is fastened, serves as the upper tie-strip for the rock lath sheet. A safety pad affords operators complete protection.

1111

Pile Driver Leads

Manufacturer: Lewis Welding & Engineering Corp., Bedford, O.

Equipment: Leads and equipment adaptable for use on crane booms of most standard manufacture machines.

Features claimed: Leads are of all-steel, welded construction. Complete machine



package consists of suitable adapter plates, one-piece 30-ft., channel-type leads with ladder, 2,500-lb. drop hammer, 14-in. driv-

ing plug and follower cap. Twenty-ft. extension leads available. Individual items available separately.

1112

Concrete Form

Manufacturer: Irvington Form & Tank Corp., New York.

Equipment: Square edge form with fastener permanently attached.

Features claimed: Waste motion due to extra handling and misplacing of parts is eliminated using the Atlas form and captive fastener. Especially designed for use on all structures where architectural concrete is required. These square edge forms can be crane handled in large panels or in light individual units for erection by one man. Can be used with wood or steel walers using any standard make wall ties. Basic units are 12 in. wide and are supplied in varying lengths of 4 ft. to 8 ft.

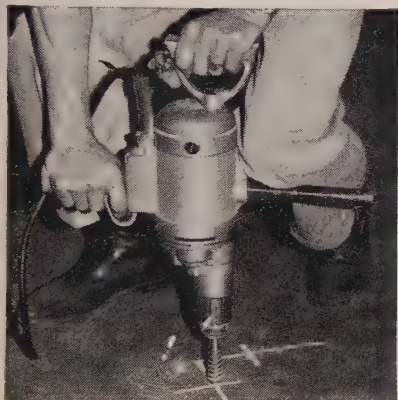
1113

Concrete Drill Bits

Manufacturer: Concrete Termite Drill Co., Pasadena, Calif.

Equipment: Bits designed for drilling holes for shields and anchors in concrete and masonry.

Features claimed: These Stubbies have overall length of 4 in., and are furnished in sizes for drilling holes from 1/4-in. diam. to 3/8-in. diam. in increments of 1/16 in. Bits



have shank diameters of 1/4 in. to 1/2 in. and may be used in electric drills, air motors or in a hand brace. Inserts and drill are of same diameter which assures use of more accurate holes.

1114

Clamshell Bucket

Manufacturer: George Haiss Mfg. Co., Inc., division of Pettibone-Mulliken Corp., New York.

Equipment: Narrow trenching clamshell bucket with 1/4-yd. capacity.

Features claimed: Bucket is only 16 in. wide. Furnished complete with set of four heat-treated, abrasion-resistant alloy steel digging teeth and 1 1/4 x 10-in. carbon steel digging jaws. Rated capacity 7 cu. ft., heaped capacity 10 cu. ft.

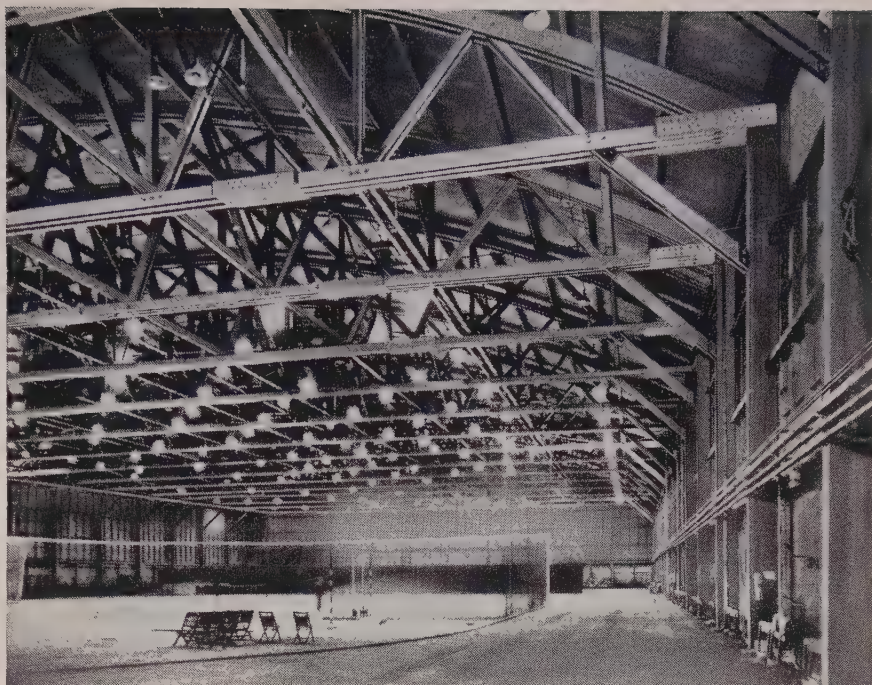
1115

Power Hydraulic Controls

Manufacturer: Hydraulics Division of Monarch Road Machinery Co., Grand Rapids, Mich.

Equipment: Truck attachment for automatic snow plow operation.

Features claimed: Fan-belt driven by Hy-Lo-Jack or storage-battery powered Dyna-Might can zip your equipment into



University of Minnesota Field House. Architects and Engineers, C. H. Johnson, Minneapolis.

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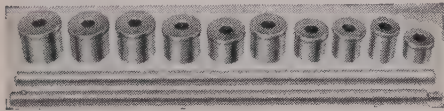
City _____ Zone _____ State _____

action with a flick of the finger on a conveniently located lever or button. Ten times faster than hand pumping. Has ample power, pressure, and capacity to lift snow plows, loaders, sweepers, hoists, and similar units.

1116

Bearing Set

Manufacturer: Owatonna Tool Co., Owatonna, Minn.



Equipment: Set of tools for removing and installing camshaft bearings in all International Industrial Tractors.

Features claimed: Set consists of 10 driving collars and a 53-in., two-section driving handle in a substantial metal case. Set is designed and engineered especially for these tractors (including the 14, 16, 18 and 24 Series diesels), and is recommended by the International Harvester Co.

1117

Cleaner-Polisher

Manufacturer: Cummins Portable Tools, Chicago, Ill.

Equipment: Cleaner-polisher that also does sanding, drilling in metal or wood, portable grinding and wire brushing, bench grinding and buffing, and rubbing.

Features claimed: Weighs only 4¼ lb. A patented swivel side-handle may be positioned at any point for greatest convenience. The no-load speed of 1,300 rpm. is said to

be ideal for cleaning and polishing. The tool is specially packaged with a complete set of accessories and wrenches for quick conversion.

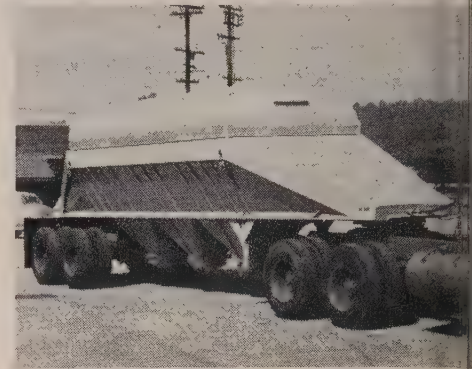
1118

Cement Haulers

Manufacturer: Kenworth Motor Truck Corp., Seattle, Wash.

Equipment: Two trucks and utility trailers, especially designed for transportation of bulk cement.

Features claimed: The utility trailers are gondola type dual axle semi's with a carrying capacity of 625 cu. ft. The sharply in-



clined hoppers are specially designed to facilitate rapid unloading. Loading time is 20 min.; complete unloading is possible in 20 min. to one hr. In addition to butterfly valves, the hoppers are also equipped with canvas boots to prevent loss on the highway or while unloading.

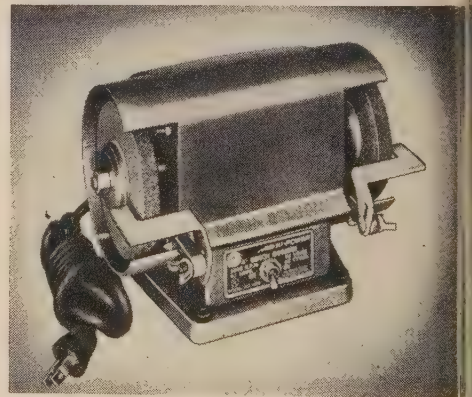
1119

Bench Grinder

Manufacturer: Portable Electric Tools Inc., Chicago, Ill.

Equipment: Portable fan-cooled grinders for grinding and sharpening jobs around shops and garages.

Features claimed: Model 400 incorporates these features and conveniences: single-phase, 60-cycle, 3,500 rpm. motor



with precision, dynamically balanced rotor for smoothest running; two fully adjustable tool rests; convenient on-off toggle switch built into front of motor housing; streamlined housing with wheel guards; and base with no-creep rubber feet.

1120

Tape Wiper

Manufacturer: L. S. Starrett Co., Athol, Mass.

Equipment: Attachment for frame-type tape designed for wiping clean tape line of oil, mud or other dirt when reeling it in.

Features claimed: Wiper is designed

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When construction projects call for a retaining wall experienced contractors know a ready answer. They can bid lower and make a good profit with an Armco Bin-Type Wall.

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either for permanent attachment or use only on dirty jobs. It is instantly mounted on the stud which secures the hand grip to the tape frame. Tape wiper with six extra pads priced at \$1.80.

1121

Concrete Finishing Material

Manufacturer: Irvington Form & Tank Corp., New York.

Equipment: Material which eliminates usual rubbing method of finishing concrete.

Features claimed: Speed Finish eliminates objectionable costly features of the rubbing method, and does not destroy any properties of the concrete. Develops a mechanical and chemical bond with the original concrete. Improves appearance and durability of surface, and acts as a barrier against the elements, abrasion, and spalling.

1122

Earth Drill

Manufacturer: The Buda Co., Harvey, Ill.

Equipment: Power operated, hydraulically controlled drill.

Features claimed: Model HBQ earth drill quickly drills 6-in. to 42-in. diam. holes to a maximum depth of 8 ft., 10 ft., 12 ft.,



14 ft., or 16 ft. Hydraulic finger tip controls quickly raise or lower the tower from traveling position, plumb the tower 15 deg. fore or aft, adjust the tower 45 deg. to right or left of vertical for drilling angle holes, feed the helix into the ground, and augment mechanical power for lifting dirt and helix from the hole. Powered by a 4-cylinder industrial heavy-duty gasoline engine, or a comparatively rated diesel engine.

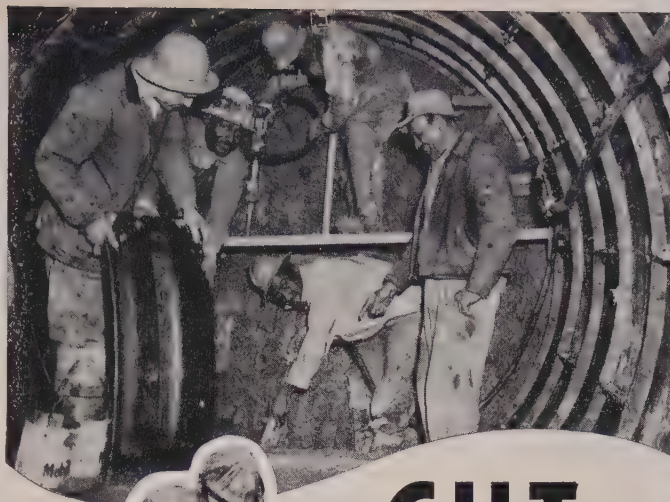
1123

Soldering and Splicing Set

Manufacturer: Tweco Products Co., Wichita, Kan.

Equipment: Lug-set block and punch for making easier the soldering of cable lugs and splicing of cables.

Features claimed: Tough manganese bronze block has three half-circle depressions to take the three sizes of lugs and splicers. To use this tool, the end of the cable is stripped and inserted in the correct size lug or splicer. It is then placed in the correct size saddle of the block. The barrel of the lug or splicer is then impacted into the cable strands using the special tool steel punch. Impacted copper to copper contact assures maximum conductivity and strength.



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with**

Thor

CLAY DIGGERS

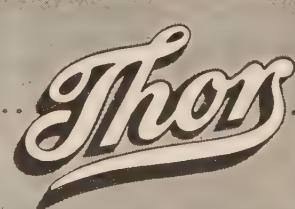
For construction digging where massive machines won't fit, for tunnelling, for trenching, here's the fast, economical way—THOR PNEUMATIC DIGGERS. Two sizes: a light weight machine for over-head work, a heavy duty tool for slashing through gravel, frozen ground or hard pan. Two styles: closed handle for spading, or extended "T" handle for trenching. Adaptable for light demolition, pin driving, timber and hitch cutting. Fast, powerful dependable under all conditions!

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PORTABLE POWER

TOOLS

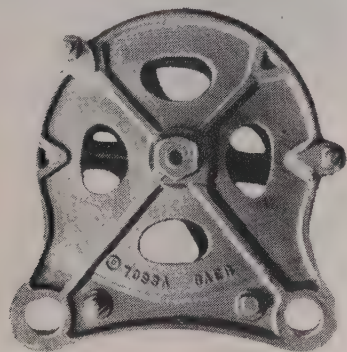
ELECTRIC • PNEUMATIC

Dragline Dump Block

Manufacturer: Baer Steel Products, Inc., Auburn, Wash.

Equipment: Free-running block that helps speed up the digging cycle of its machine.

Features claimed: The Baer block sheave turns on an oversize roller bearing to give full dumping force to the bucket load when its dragline is slacked off. To prevent foul-



ing or fraying of the fast moving dump line, the housing throat is faired into the sheave ropeway. Rope is confined and cradled to assure positive seating at any rope tension. Oversize, firmly locked retainers seal the Zerke-lubricated bearing to permit continuous use of the block in underwater digging if necessary.

Protective Masks

Manufacturer: General Scientific Equipment Co., Philadelphia, Pa.

Equipment: Masks consisting of an aluminum shield and replaceable laminated filters of extra thickness.

Features claimed: G-S masks protect throat, nose, and bronchial tubes from larger particles of non-toxic dusts that irritate these membranes, causing discomfort and increased susceptibility to infection. Masks weigh less than ½ oz. and are cooler and more comfortable than any other type.

Hard-to-get-at Bolt Tightener

Manufacturer: H. K. Porter, Inc., Somerville, Mass.

Equipment: Hand tool for tightening or loosening stubborn or hard-to-get-at screws, bolts, or nuts.

Features claimed: Simply twist in the desired direction and rap slightly with a hammer, and rusted or frozen fasteners are turned quickly and easily. Impakdriver is constructed on a very ingenious and efficient cam principle that translates the impact from a hammer's blow into an amazing amount of torque.

Brick Conveyor

Manufacturer: Mar-Rail Conveyor Co., Pawtucket, R. I.

Equipment: Conveyor belt that takes the hod work out of bricklaying.

Features claimed: Brik-Toter is extremely rugged, yet so light that two men

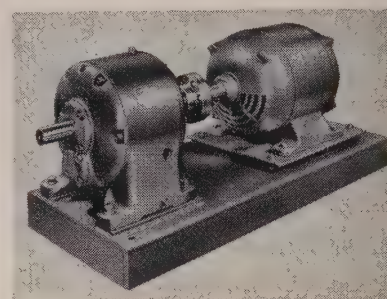
can move it into position. It is 20 ft. long, 14½ in. wide, and weighs only 385 lbs. Load capacity is over 1,200 lb. Bridge type trussed construction and torque frame eliminates all twist and sag. Enclosed ½-hp. gear motor furnishes drive for the conveyor and a flip of all-weather starting switch puts it into action.

Power Unit

Manufacturer: Link-Belt Co., Chicago.

Equipment: Helical gear drive with separate standard motor, flexibly coupled and mounted on one welded steel base plate.

Features claimed: Motogears are built in a variety of sizes, in double or triple reductions, and in a wide range of ratios and horsepowers. Input and output shafts are

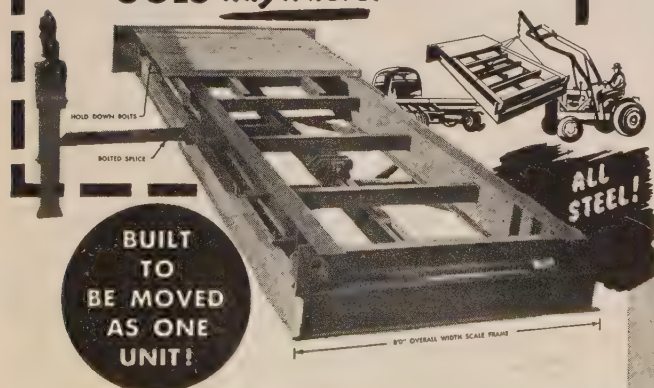


concentrically in line. A movable plate between motor feet and welded base plate provides for convenient adjustment, should shaft realignment be necessary for any reason. Helical gear drive available as separate unit without motor.

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NEW LITERATURE

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1129

CONCRETE MIXERS—Current models of Worthington-Ransome "Blue Brute" big concrete mixers are described in a booklet released by Worthington Pump and Machinery Corp. Redesigned to keep limitations, these mixers are for use in central mixing plants, large construction jobs and public works projects. The booklet illustrates how the big mixers, when installed in a central mixing plant, can be used in conjunction with truck mixers or agitators. Attachments and accessories, such as the hydraulic control system, are illustrated. Complete specifications and dimensions of the mixers are given.

1130

PERMALITE JOB DATA—A 50-pg. illustrated brochure has been made available by Great Lakes Carbon Corp., Building Products Division, New York, containing information on typical Permalite jobs throughout the country with such job data as the name of the architect, general contractor, sub-contractor, and the amount of Permalite and how it was used. Examples of the product's use in base coat plaster, plaster fireproofing of structural steel, acoustical plaster, and Permalite lightweight insulating concrete for roof decks, floor fills and curtain walls are included.

1131

HEAVY DUTY PORTABLE CONVEYOR—Bulletin describes the complete range of Barber-Greene Co. (Aurora, Ill.) Model 374 heavy duty portable conveyor. Lists fields of use and products handled. Series of sketches show applications in industry and construction. Accessories such as feeders, screens, hoppers, etc., are pictured and possible usage described. Construction features are illustrated and their operational advantages described. One page shows other materials handling equipment manufactured by the company.

1132

CORROSION-PROOF CEMENTS—Atlas Mineral Products Co., Mertztown, Pa., announces publication of its new bulletin on corrosion-proof cements. It describes the company's complete line of resin, sulfur, silicate, and asphaltic cements. Information on each cement is compiled in handy chart form which is helpful in the selection of the correct cement for a specific application. Included is information on Alkor 5E, claimed to be the nearest thing to a universal corrosion-resistant cement. It is inert to all solvents, alkalies and non-oxidizing acids.

1133

TREATMENT OF WATER SUPPLIES—Sodium aluminate treatment of industrial and municipal water supplies is described in a booklet issued by the Merriam Division of Monsanto Chemical Co., Everett, Mass. Booklet discusses the reaction of sodium aluminate as a water softener and clarifier. In addition, the pamphlet

MANUFACTURERS and SUPPLIERS for the CONSTRUCTION INDUSTRY . . .

BUILD WITH US

BY ADVERTISING IN OUR JANUARY, 1951 ISSUE

OUT JANUARY 1 — LAST FORMS CLOSE DECEMBER 5

In our January issue we propose to give you a report on Western construction which will broadly and specifically cover the subject "Building Tomorrow's West." At the mid-point in our century, it is time to take a look at the future of construction in the West, in terms of . . .

- (a) The 1950 census.
- (b) Construction statistics—growth in volume; forecast of the future.
- (c) A calendar of big Western jobs; who built what; problems encountered and how solved; cost data, etc.
- (d) History of A. G. C. in the West.
- (e) The equipment distributor's place in Western construction market.
- (f) Forecast of expenditures by States, Counties, Cities, and the Federal government.
- (g) Plus other important editorial material.

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This will be our Silver Anniversary number and it promises to be the finest issue we have produced in our 25 year history! Take advantage of this extra-interest packed issue, and begin your 1951 sales campaign with dominant space in WESTERN CONSTRUCTION's January Review and Forecast . . . and BUILD WITH US.

More contractors and engineers in the Western half of the U. S. read WESTERN CONSTRUCTION than any other construction magazine, national, regional or local. (Our June 30, 1950 ABC statement will show 12,648 net paid subscribers.)

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Composition—No charge.

DATA UNITS AVAILABLE

- WCN-1—Sales Presentation based on NIAA Outline for Publishers
- WCN-3—Description of Western construction market
- WCN-4—1949 Annual Index to Editorial which appeared in WESTERN CONSTRUCTION

Remember, "Building Tomorrow's West" will be published January 1—final forms close December 5—so send us your space reservation NOW, indicating size, color, and bleed.

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covers treatment of boiler feed water and internal boiler water treatment. Preparation of sodium aluminate solutions is also outlined.

1134

FLAMEPROOFING—In conjunction with new regulations concerning flameproofing of lumber and building boards in places of public assemblage (Article 55, California Health and Safety Code), **Flamort Chemical Co.**, San Francisco, has published a folder which photographically illustrates the protection given by Flamort fire retardants. Flamort retardants are approved by state fire marshals, local fire departments, the department of public works, division of forestry and others. Folder gives the easy instructions for flameproofing of wood, fiber boards, and paper.

1135
ASBESTOS-BONDED PIPE—"Here's The Drainage Structure With A One-Two Punch," a new, illustrated folder by **Armco Drainage & Metal Products, Inc.**, Middletown, O., tells how the company's asbestos-bonded pipe overcomes the problems of structural failure and corrosion. The folder describes how asbestos-bonded drainage structures are made and summarizes corrosion tests that demonstrate the exceptional durability of the material.

1136

METAL STUDS AND METAL LATH HOLLOW PARTITIONS—Assemblies of prefabricated metal studs and metal lath which speed up construction of building partitions are featured in the August issue

of **Metal Lath News**, publication of the **Metal Lath Manufacturers Assn.**, Cleveland. In all, eight combinations of steel studs and floor and ceiling track systems are shown for typical installations of hollow and double metal lath partitions. The 16-page booklet illustrates various installations.

1137

SPEED INDICATING & RECORDING INSTRUMENTS—Two color folders giving complete information on the **Tachometer** and the portable hand **Tachograph** have been published by **O. Zernickow Co.**, New York City. Without the need for timing or calculating, the tachometer indicates rpm. and fpm. speeds, speed fluctuations, belt slippage. Tachograph is a portable unit which can take the place of stationary equipment. It combines an adaptation of the tachometer with a precision recording mechanism.

1138

TRUCK MIXERS AND AGITATORS—A bulletin describing current models of **Hi-Up Worthington-Ransome** truck mixers and agitators is announced by **Worthington Pump & Machinery Corp.**, Harrison, N. J. For central mixing plants, the following mixers are described: an 84-S mixer which gives a capacity load for a 3-cu. yd. agitator; two 56-S (or one 126-S) giving correct load for a 4¼-cu. yd. agitator; and two 84-S mixers having the capacity to service a 6⅞-cu. yd. or 7⅞-cu. yd. agitator.

1139

BEAT BACK THE SNOW—City, county and state highway departments, and road commissions, as well as individual contractors responsible for snow removal operations within their area, will be inter-

\$5.22 a ton for Asphalt is worth saving!

The Foote Kinetic Asphalt Mixer will give you 8 to 10 more batches from a barrel of asphalt. One user* has reported savings of \$5.22 a ton. They used to buy their material for \$10.50 a ton. Now they make it with the Foote Kinetic Asphalt Mixer for \$5.28 a ton. \$5.22 a ton is worth saving! Such savings will soon pay for your Foote Kinetic Mixer.

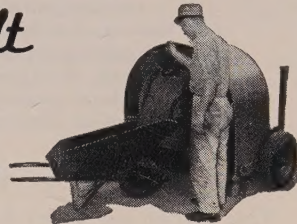
You cannot compare the Foote Mixer with an ordinary concrete mixer either from the standpoint of construction or the finished product. Let us send you complete details. Ask for Bulletin K-100. *Name on request.

- 3 cu. ft. in 30 seconds
- High output for low investment
- Handles any mix
- Fully portable
- New mixing principle gives you 8 to 10 more batches out of every barrel of asphalt

THE FOOTE CO., INC.

Subsidiary of Blaw-Knox Co.

1940 State St., Nunda, New York



White Heating Kettles Have Fire-Proof Tops

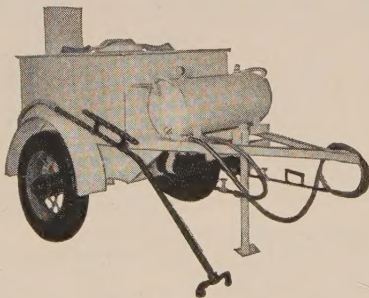
Cut-back and highly inflammable road repair material can be heated safely in White kettles. **FIRE-PROOF** top reduces fire hazard.

White asphalt and tar kettles are extensively used. They give long life and satisfaction.

Plain kettles or with hand or engine driven spray pumps for patching pavement. Thermometer, barrel hoist, warming hood extra. All oil burning, Semi-elliptic springs, pneumatic tires.

65, 110, 165, 220, 300 gallon capacities.

Model F-10 is oil jacketed, to heat elastic joint filler.



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CONCRETE VIBRATORS

Gasoline Engine and Electric Motor Driven Models

ASPHALT PLANTS

Portable—Stationary

FRONT END LOADERS

for Industrial Tractors

KEROSENE TORCHES

3 to 20 gal. Capacities

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White Mfg. Co.

Elkhart,

Indiana

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"THIS LUBRICANT reduces Service Calls!"



The sales director of the Lynch Corporation, manufacturers of the MORPAC forming and wrapping machine writes us, "Our Service Engineers can readily spot machines that have had other than LUBRIPLATE Lubrication, as these machines do not give the service they should."

1. LUBRIPLATE reduces friction and wear
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Write today for case histories of savings made through the use of LUBRIPLATE in your industry.

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Fiske Brothers Refining Co.
Newark 5, N.J. Toledo 5, Ohio

*The Different
LUBRICANT!*

DEALERS EVERYWHERE, consult your Classified Telephone Book

ested in a new 16-pg. booklet entitled "Beat Back the Snow with Caterpillar Equipment," published by **Caterpillar Tractor Co.**, Peoria, Ill. For the past two years the company has sent photographers into those areas where snowfall has been heavy and at times disastrous. Their photographic scenes taken under actual working conditions show how maintenance crews and snow removal equipment keep the nation's highways, roads, and streets open to traffic during the winter months.

1140

METALLIC COATED ROD FOR HARDFACING—A descriptive bulletin is available from **Rankin Manufacturing Co.**, Los Angeles, on its Ranite No. 4 Electric, which leaves a slag-free deposit. One of the features of this 18-in. electrode is that it can be gripped anywhere along the rod length. It is not necessary to grip the rod in the center or at the end.

1141

WORM GEAR DRIVES—Link-Belt Co. (Chicago) worm gear drives of three basic types, each available in 10 different sizes, for fractional or large horsepower, and in speed ratios of 35% to 1 up to 8,000 to 1, are illustrated, described and tabulated in an 80-pg. book released by the company. Features enumerated for these enclosed right-angle drives are: compact design; anti-friction bearings; automatic splash lubrication; high ratios in small space; operation at high input speeds; quiet performance; and their availability for vertical or horizontal driving. Pages 10 through 15 contain typical drive problems with their solutions and show the ease with which the proper drive may be selected for a specific duty.

1142

ALUMINUM ROLLING SCAFFOLDS—A bulletin on aluminum sectional rolling scaffolds has been made available by **Patent Scaffolding Co., Inc.**, Long Island City, N. Y. Bulletin includes photographs of scaffolds in actual use, and specifications, making it a valuable piece for any scaffolding file.

1143

METER ADAPTER FOR HORIZONTAL LINES—A catalog describing the use of an adapter for installing Flow-rator meters in horizontal process piping has been made available by **Fischer & Porter Co.**, Hatboro, Pa. This adapter eliminates the necessity for a vertical rise in a line where head room is at a premium. The horizontal line adapter is constructed of a number of corrosion-resistant materials, and may be supplied for use with all standard meters. Eye-level flow indication for accurate instrument reading is now made possible by this adapter, where necessity of vertical runs made it impossible before.

1144

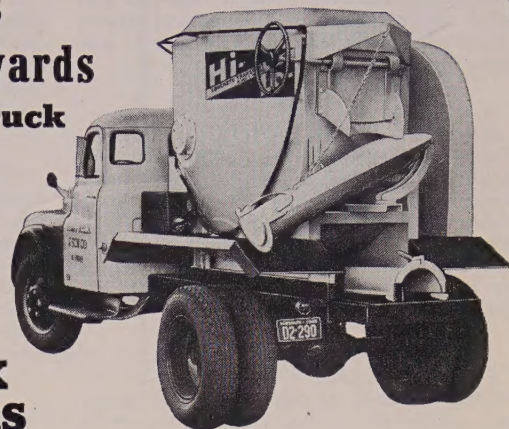
METAL SCAFFOLDING—All-metal scaffolding built up of standard steel pipe and patented fittings is described and illustrated in a bulletin announced by **Amidon Sales Co.**, Elyria, O. Bulletin explains how the Amidon three-way fitting, two-way fitting and sleeve are used to assemble pipe into fixed or rolling scaffolds of any height, size and shape required to fit the job.

1145

PROTECTIVE COATINGS AND TANK LININGS—**Nukem Products Corp.**, Buffalo, N. Y., has published an informative brochure on Nukemite, a synthetic resin-, acid-, and alkali-resistant coating. A chart for calculating the area of cylindrical tanks, a property chart, and an

Hi-Lo Jr. carries up to 3 cubic yards on a single axle Truck

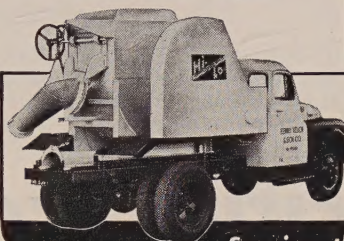
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single axle weight limitation
of 18,000 pounds
which prevails in many
States.



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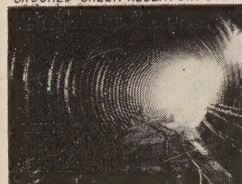
HIGHWAY TUNNEL
PENNSYLVANIA TURNPIKE



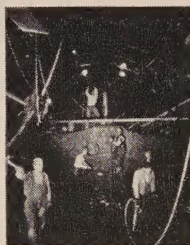
COLORADO RIVER AQUEDUCT
LOS ANGELES



WATER TUNNEL
CROOKED CREEK RESERVOIR DAM



SHIELD DRIVEN SECTION
CHICAGO SUBWAY

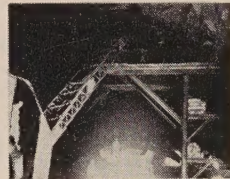


HAND MINED SECTION
CHICAGO SUBWAY

Tunnel Lining Supports



DELAWARE WATER
AQUEDUCT
NEW YORK CITY



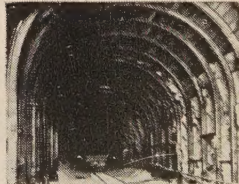
RAILROAD TUNNEL
CHESAPEAKE AND OHIO RAILWAY



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MIDTOWN HUDSON TUNNEL



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YOUNGSTOWN 4, OHIO

application chart are in the publication. Nukemite affords protection from severe corrosive conditions to metal, concrete and wood surfaces exposed to chemical attack. The resin film is leak-proof, odorless, and non-contaminating.

1146

MAINTENANCE PORTFOLIO—Maintenance problems of equipment and buildings are analyzed and recommendations made for economical upkeep in a maintenance portfolio, released by the **Wilbur & Williams Co.**, Boston, Mass. This portfolio features specialized paint coatings for resisting moisture, fire, mildew and chemicals.

1147

SWEETHEART OF THE HD-19—**Findlay Division of Gar Wood Industries, Inc.**, announces a large color folder on its new 625 scraper which attaches to the Allis-Chalmers HD-19 tractor. An immense cut-away drawing points out each feature of the scraper. Other cutaway drawings and actual photographs show the 625 scraper performing all its functions and in various positions.

1148

HARDFACING CATALOG—A hardfacing catalog has been announced by **Air Reduction Pacific Co.**, Emeryville, Calif., a division of **Air Reduction Co., Inc.** The 20-pg., illustrated catalog contains detailed information on the complete Airco line of

hardfacing alloys. Description of product, typical uses, mechanical properties, chemical analyses and a brief outline of recommended procedures are included. This datum is further supplemented by allied information such as a tabulation of recommended grinding wheels for dressing deposits of Airco hardfacing alloys.

1149

SNOW PLOW—A six-page bulletin, covering its complete line of snow plows has been announced by **Baker Manufacturing Co.**, Springfield, Ill. These snow plows are manufactured to fit all Allis-Chalmers tractors and motor graders. Construction details, application recommendations and complete specifications are contained in the bulletin.

1150

CONCRETE VIBRATORS—**Stow Manufacturing Co.**, Binghamton, N. Y., announces several data sheets on its concrete vibrators, both electric and gasoline powered. A catalog pictures the various models and accessories. It lists optional equipment. Also shown is a new screed which is available with parts and accessories in a unit package for the contractor who wishes to build his own.

1151

ALL-PURPOSE EXCAVATOR—A bulletin just released by **Marion Power Shovel Co.**, Marion, O., describes its Type 43-M machine, an all-purpose 1-cu. yd. ex-

cavator. Bulletin lists and illustrates the 43-M's varied applications as a shovel, dragline, clamshell, crane, backhoe, and pile driver. Machine designed for use in construction, bridge and road work, drainage and reclamation, quarrying, industries, coal and metal mining, and underground work.

1152

WELDING PROCESS—A reprint, "The Aircomatic R Welding Process," has been announced by **Air Reduction Pacific Co.**, Emeryville, Calif., a division of **Air Reduction Co., Inc.** This 26-pg. article, which originally appeared in "The Welding Journal," was written by A. Muller, G. J. Gibson, and E. H. Roper, and discusses the fundamentals of metal-arc transfer in inert gas-shielded arc welding. Methods of overcoming porosity in aluminum welding by automatic and manual welding as well as stainless steel, heat-resisting alloys, clad materials and aluminum bronze are covered.

1153

OIL MADE OF METAL—Technical bulletin published by **Lubricants Division of The Lockrey Co.**, College Point, N. Y., describes four new types of molybdenum base lubricant to meet especially severe conditions. It describes Liqui-Moly NV Regular and Grease, Liqui-Moly NV Thread Compound, and Moly-Wax-Stix. These lubricants permit the opening of new possibilities in machine design by providing safe lubrication at higher speeds, pressures and temperatures.

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Thanks to Seals, children today have a far greater chance of escaping TB than you did.

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Because of the importance of the above message this space has been contributed by

Western Construction
609 Mission Street
San Francisco 5, Calif.

New Zealand Tunnel Contract Wairarapa Railway Deviation

Tenders are being invited from firms in the United States and other countries for a contract involving the construction of approximately 5 miles 37.33 chains of single-track concrete-lined railway tunnel, together with approximately 1 mile 75 chains of approach formation. This project is known as the Rimutaka Tunnel Contract, for the Wellington-Wairarapa Railway Deviation in New Zealand.

Fencing, ballasting and platelaying of the permanent track, together with excavation of cuttings and construction of culverts outside the tunnel are not included in this contract.

Plans and specifications are available from the New Zealand Government Trade Commissioner, Dupont Circle Building, 1346 Connecticut Avenue, Washington 6, D. C.

Tenders close with the Ministry of Works in Wellington on 9th January, 1951, and may be submitted through the New Zealand Trade Commissioner in Washington.

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