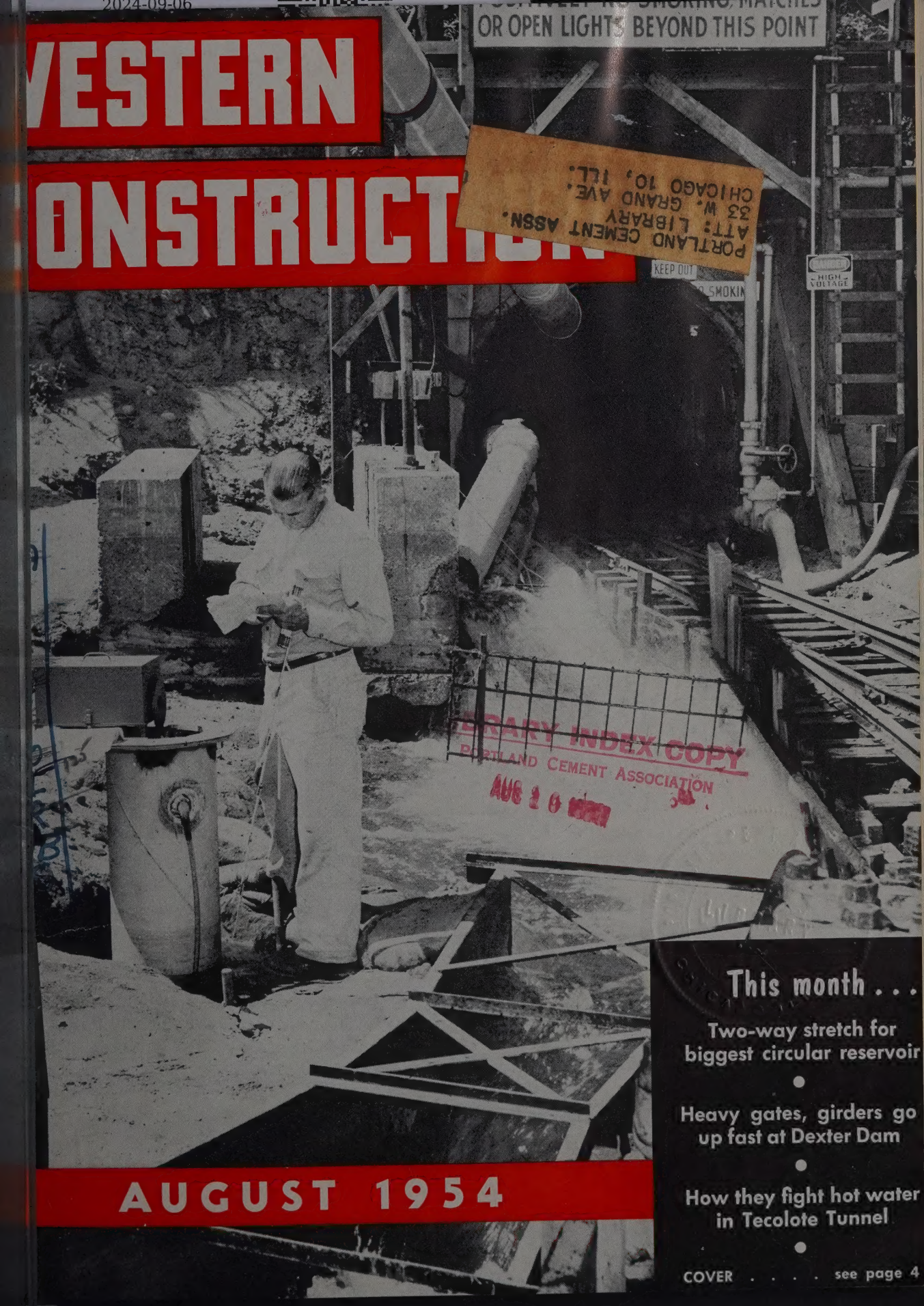
VESTERN
ONSTRUCTION



AUGUST 1954

This month . . .

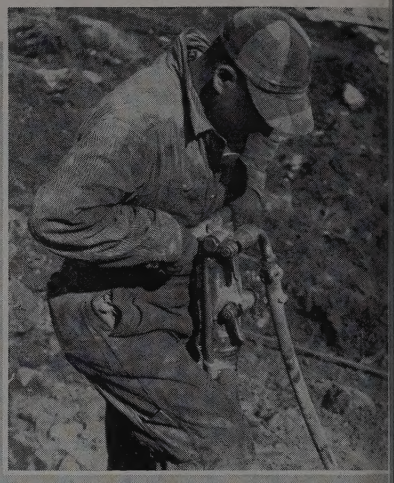
Two-way stretch for biggest circular reservoir

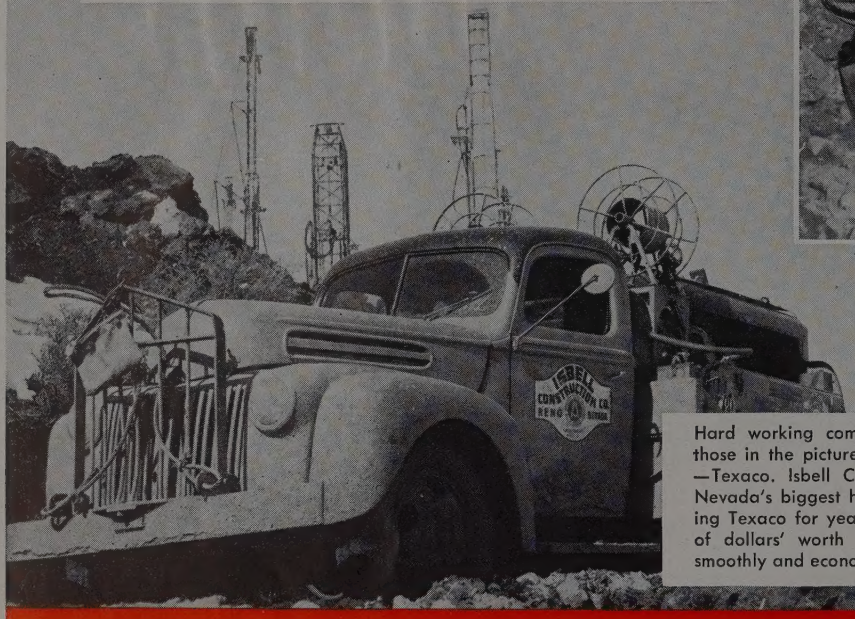
Heavy gates, girders go up fast at Dexter Dam

How they fight hot water in Tecolote Tunnel

COVER . . . . see page 4

TEXACO SIMPLIFIED LUBRICATION PLAN — With *not more than six* Texaco Lubricants you can handle *all* your major lubrication. The Plan saves time and money, reduces lubricant inventories, eliminates lubrication mistakes. Ask a Texaco Lubrication Engineer all about it.





Hard working compressors and rock drills, like those in the pictures, require effective lubrication —Texaco. Isbell Construction Company, one of Nevada's biggest highway builders, has been using Texaco for years to keep them—and millions of dollars' worth of other equipment—running smoothly and economically.

TEXACO HELPS ISBELL CUT COMPRESSOR UPKEEP COSTS

Like compressor operators everywhere, Isbell Construction Company, Reno, Nevada, uses Texaco air compressor oils to keep maintenance costs low and operating efficiency high. Choice of oil is determined by the size and type of compressor and the job's particular operating conditions.

Isbell is able to match oil to compressor because there is *a complete line* of Texaco air compressor oils—assuring fine performance whatever the type and size of compressor, whatever the operating conditions.

For rock drill lubrication, Isbell uses *Texaco Rock Drill Lubricant EP*. It gives outstanding protection against wear, guards against rust whether drills are running or idle, assures longer drill life, less maintenance expense.

Let a Texaco Lubrication Engineer help you increase equipment efficiency, lower maintenance costs. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Lubricants and Fuels

FOR ALL CONTRACTORS' EQUIPMENT

MAKING THE DRAGLINE JOBS

NORTHWESTS for James B. Kenney, Inc. Denver, Colo.

Here's the place to get the real story on the kind of performance you want in a dragline—from Northwest owners who have tried not one Northwest but several. Here is the fourth Northwest owned by James B. Kenney, Inc., of Denver, Colo. He is one of the many contractors in the Mountain Area that has approved Northwest performance by buying them again and again.

Northwests make the Dragline Jobs easy! They bring you a combination of advantages that lets you get the most out of a job. Northwest Crawler Mechanism with self-cleaning action stands up under the abuse of long travel. Travel gears are fully enclosed and run in oil. Adjustable Hook Rollers (most hook rollers are not adjustable) can be kept snug against the roller flange. Smooth swing, assured by Uniform Pressure Swing Clutches, makes spotting easier and reduces spillage at the truck. The "Feather-Touch" Clutch Control takes fatigue out of operation without resorting to complicated valves, pumps and tubing. Simplicity of design assures easy upkeep. The Northwest Cushion Clutch eliminates shock overloads *before* the overload reaches the machinery. These and other Northwest advantages combine to make one out of every three Northwests sold a repeat order in the hands of successful contractors. You can plan to have these advantages. Talk to a Northwest Man.

If you are interested in Rubber Tired Equipment be sure you learn about the greater advantages in the Northwest Truck Crane *before* you buy.

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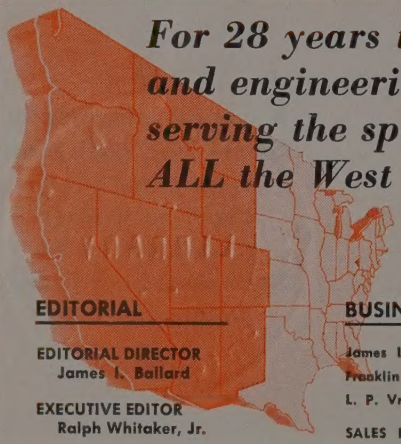
FRONT COVER

PROVING A POINT, Kiewit and Coker have installed this gaging station to record flow from Tecolote Tunnel outlet portal. *Ed Joswick*, USBR inspector, makes a daily check. To appreciate the 116-deg. heat you have to go underground—as reviewed in this issue, beginning page 59.



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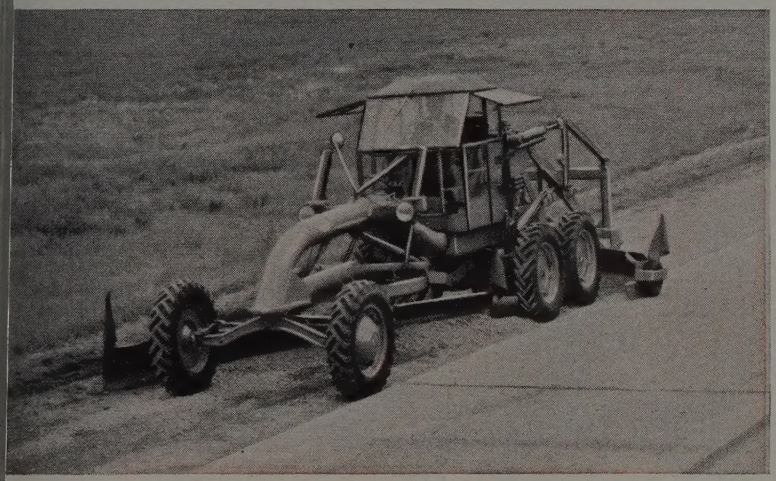
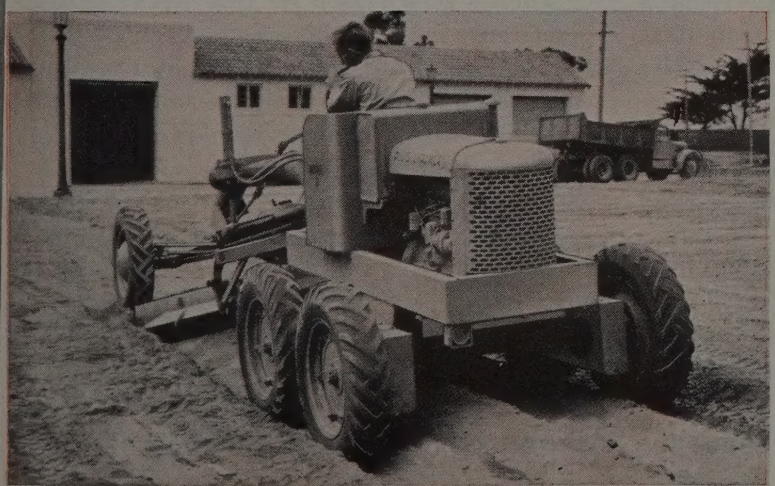
Cleans up, loads trucks with hydraulically operated rear-end loader . . . handles sand, gravel, dirt, any material with ⅝-yd bucket.



Keeps Shoulders Safe—Model D shapes shoulder, blading windrow next to edge of pavement where rear wheels compact gravel . . . rear-mounted blade feathers out windrow . . . to keep shoulder safe and well-drained, *all in one pass.*



Backfills fast, economically on trench or ditching projects. Can be kept busy on several jobs, travels from site to site at over 25 mph.

LETTERS from users —

Sirs:

We have been entirely satisfied with the Model D. It has proved to be a year 'round piece of equipment. We use it in the summer for grading and ditching and in the winter for plowing and it does both jobs well. Maintenance has been very moderate and your service excellent.

L. W. O'Connor
Town Manager
Bucksport, Maine

Sirs:

We purchased our first Model D in July, 1952. We are called on to do almost every kind of job known to the industry from paving small private driveways and parking areas to the larger street and road jobs. We also do a lot of paving inside buildings such as garages and warehouses. We find the Model D will deliver the goods in close places and on small jobs with a minimum amount of hand labor which is the difference between profit and loss on most small jobs.

The maneuverability, operator's vision, and mobility of the Model D make it a money-maker on any job, large or small. We find the Model D ideal for curb and gutter excavation, cutting sub grades, working intersections, laying down cold-mix materials, spreading base materials and finishing.

We purchased our second Model D in June, 1953, because our first machine had proved to be such a good investment. The Model D's do seventy percent of all our grader work, at our initial investment of about one-third that of the large machine. Our operating costs, fuel and repairs on the Model D's are less than one-third that of the large machine.

Hugh Hanley
Norris-Hanley-Norris
General Contractors

Sirs:

We are very pleased with our Allis-Chalmers Model D Motor Grader. This machine is being used to rough grade and finish grade streets and lots on our 75 acre development. Our area is exceptionally rocky, but we feel we have done big grader work with this machine. We believe this is the toughest machine for its size we have seen.

The "D" is outstanding in its ease of operation. Our operator says he has excellent visibility at all times. It is economical to operate and has worked very satisfactorily.

I. J. May, *President*
Southwest Development Co.

Sirs:

We find our Model D very economical considering the work it performs. Especially like the ROLL-AWAY moldboard and operating ease. Have done a lot of grading, ditching, and snow removal, and find it very satisfactory for a town our size.

Clyde Wood
Road Supervisor
Chester R. Johnson
Water Supervisor
Holden, Utah

Sirs:

I have operated heavy equipment of all kinds, makes and models for 22 years. I find that with this machine (the Model D) there is no job too large or too small. I clean streets, take dirt off streets, cut a 32-inch ditch for gas, water and sewer lines and backfill, break out asphalt, work base, spread asphalt, maintain all city streets, and build streets for new suburbs. With the rear-end loader I use it for laying 6-inch water lines, clean out sod on city streets, load base material, use it as a dozer blade, and dig and clean out drain ditches at sewer plant.

This machine has finger-tip control and very good visibility . . . it is very easy to do precision work. I highly recommend this machine for high performance and very low maintenance.

Curtis M. Sollock
Superintendent of Streets, Water Works,
Gas & Sewage of the City of Devine, Texas

ON THE OHIO TURNPIKE...

It's "Eucs" 4 to 1!

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From the Pennsylvania border to the Indiana line, 261 miles to the west, Euclid equipment is maintaining a fast pace on the 326 million dollar Ohio Turnpike. "Euc" Scrapers, Bottom-Dumps, Loaders and Rear-Dumps were first choice all the way—they outnumber all competitive rubber-tired earth moving equipment by better than 4 to 1!

There's good reason for this overwhelming preference by all of these leading contractors. They know from experience that they can depend on "Eucs" to get more work done on schedule—with little or no down time for repairs. Mighty important, too, is the ability of "Eucs" to take the toughest jobs in stride and move more payloads.

If you can't visit this big Ohio "Road Show" to see the wide range of work being done by "Eucs," have your nearby Euclid distributor give you helpful facts and figures on the complete line of Euclid equipment.

EUCLID DIVISION GENERAL MOTORS CORPORATION, Cleveland 17, Ohio

Euclid Equipment

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WESTERN CONSTRUCTION

Editorials

Progress vs. refinement in concrete

Progress in concrete construction is one thing. Technological advances in mix design and increased understanding of concrete chemistry have given us better durability and greater strength — generally a more flexible, more readily controlled construction material. These developments are of positive benefit.

Refinement in concrete construction is another thing. Prohibition of chuting, for instance, is good. But some finishing requirements are not. A striking example is furnished by reinforced concrete piers for two parallel barrels of a Western municipal water supply project.

Piers for the first pipe were poured 20 years ago. Their surfaces are textured by the characteristic grain pattern of form lumber. But the new piers, placed two years ago, embody the ultimate in what a cement mason can do (for a price) to memorialize the enraptured dedication of some nameless engineer to the reinforcd concrete ideal.

These piers are real smooth! The official reason for this occasion of refinement is increased durability. Winter temperatures fall below freezing, yet the new piers are not likely to spall. History, however, does not show that the old piers have spalled.

With these thoughts on refinements well in mind, it was refreshing to visit a new parking structure in a Western city recently. Form marks, and even honeycomb, were plainly evident in slab and beam soffits. To be sure, this is a building interior, well protected from weather extremes. But certainly—in the case of the stair well, for instance —it is not protected from the searching gaze of the concrete zealot!

Engineering practice, like almost any other, has its fads. In more dignified terms it may be said that the pendulum of practice swings between extremes. The present swing is welcome. Exemplified by the garage, it seems to be toward more realistic, economical and practical utilization of concrete.

A difference of professional opinion

Federal Power Commission hearings on plans for Snake River development in Idaho's Hells Canyon have recently spot-lighted a little-used but vital professional function of the civil engineer. Exploration of legal and political issues has required establishment of engineering facts. And to supply these facts civil engineers have appeared from various quarters to present expert testimony. From news accounts of the examination and cross-examination, the role of an "expert witness" is a difficult one.

Numerous Westerners have been on the stand—engineers of the FPC regional office, of the Bureau of Reclamation, of Idaho Power Co., and of Morrison-Knudsen Co., Inc. Their conduct has been commensurate with their professional position, both individually and collectively. And this is no small achievement when the efforts of attorneys (themselves professional men) have at times been attempts to destroy the witness' professional stature. Exploiting differences of engineering opinion, the attorneys have intruded upon the objectivity which alone marks expert testimony as professional in nature and therefore valuable in the case.

Should it surprise a lawyer to find two equally qualified engineers having different views of a situation? After all, the untold volumes of court decisions are replete, to the everlasting benefit of the legal profession, with contradictory interpretations of specific points.

But, if not surprised, the attorneys seem puzzled by divergent engineering opinion, and they have spent much time exhaustively reviewing the professional qualifications of witnesses called upon in the first place as experts in their field.

Much of the to-do has been concerned with the methods used, respectively, by the Bureau of Reclamation and the Federal Power Commission in evaluating Hells Canyon high dam power production, the principal paying benefit. It is sad, to be sure, that the hearings in a sense represent a fight between two agencies of the same federal governmnt. But it is ridiculous for attorneys of one "side" to attempt to discredit the expert testimony of a witness for the other. Insofar as the witnesses are government employees, they have met identical civil service requirements for engineering personnel. For the purpose of these hearings, their government positions are a partial measure of their equal professional competence.

We say again to the attorneys (themselves professional men): Is it odd that professional men of equal stature should differ on a professional question?

In a Single Mississippi County

An A-W Power Grader Finds Thes TEN DIFFERENT Things to Do

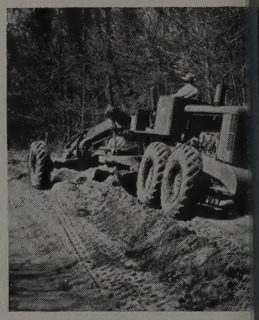
and does each superlatively well thanks to A-W's exclusive All-Wheel Drive and All-Wheel Steer

Whatever the problem . . . whatever the job . . . one of those pictured on this page, or dozens of others, you can do it better with an Austin-Western Power Grader.

All-Wheel Drive provides 30% more Power-at-the-Blade; keeps the front end of the grader under control at all times. All-Wheel Steer makes the grader twice as maneuverable. Rear Steer shifts the rear truck from side to side, for better traction and smoother operation.

The tougher the job, the more outstanding the performance of A-W "88" and "99" Power Graders in comparison with ordinary front steer, rear drive machines.

1 All-Wheel Steer carries continuous ditch cuts around corners.

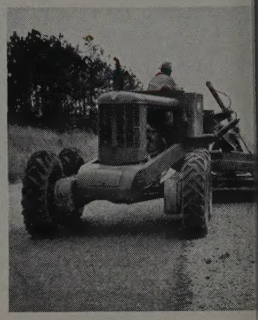


2 Six powerful driving provide maximum flot soft or sandy soils.

3 Blading in reverse is very much easier with All-Wheel Steer.

4 Fingertip hydraulic rear steer makes it easy to maneuver around obstructions.

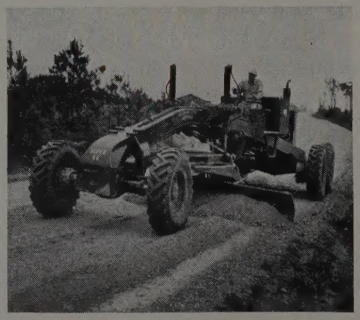
5 All-Wheel Drive holds machine and blade steady on rough, badly eroded banks.



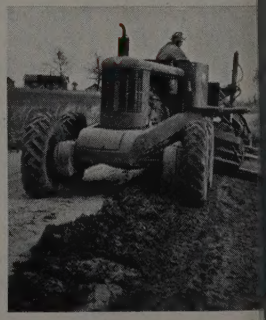
6 No tire marks on thi shoulder, thanks to rea

7 Controlled traction moves big windrows, farther and faster.

8 Live power in front drivers makes it easy to ride steep banks, when finishing.



9 Rear steer helps the blade do a fine job of gravel maintenance.



10 Rear truck remains on footing when pullin ditches, after a rain.

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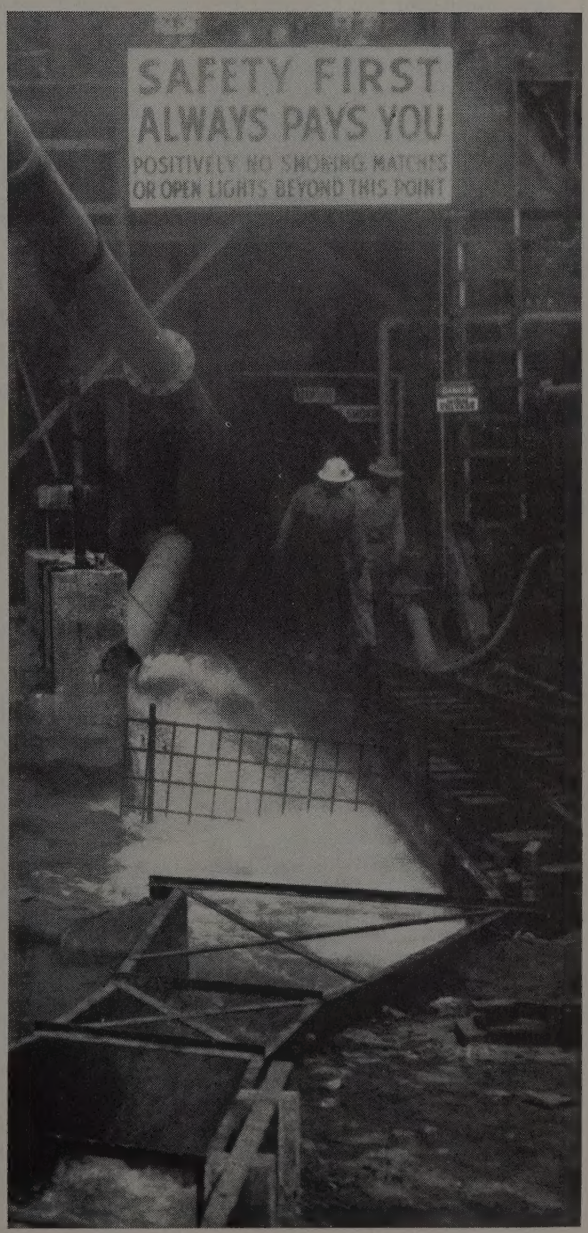
WESTERN CONSTRUCTION

AUGUST 1954

Coker and Kiewit have a job in Tecolote Tunnel—

Fighting 6,800-gpm. hot water flow

Bold measures mark renewed work in West's toughest tunnel—$447 per cu. yd. may prove a bargain price—568 ft. in 40 days this spring—4,148 ft. to go—and no peak yet for heat and water



THERE HAVE BEEN hot tunnel jobs. And wet ones. But Tecolote Tunnel in California, despite its small diameter (7 ft. 9 in. between horseshoe ribs) is really the large economy size when it comes to heat and water in one package. Figures for June 22 prove the point: 116 deg. F. and 6,800 gpm.

But Coker and Kiewit, joint venturing a completion subcontract for Halvorson Constructors, have read up on heating and ventilating practice and are now writing a few new chapters themselves.

(1) They have a line-up of 20 pumps pushing the hot water out, through one 14-in. and two 12-in. lines. Pumping is necessary for anything but a very small flow, since the tunnel gradient is slight. But it is extra important in Tecolote to cut down heat radiation and avoid further increase in the humidity (already 100% in spots).

(2) They have a 200-hp. Sutorbilt blower at the portal pushing about 5,000 cfm. of air in to the work. Some of this is tapped off at a pumping station 2 mi. inside, where three of the biggest pumps are located, their motors and transformers creating extra heat. But most of the air is picked up by a 125-hp. Sutorbilt booster and pushed on another mile to the heading. Even this air is pretty warm—as much as 100 deg.—but it is relatively dry. And it certainly takes a lot of the edge off the steam bath atmosphere.

(3) They have four Joy 2-stage compressors furnishing high pressure air for running equipment in the tunnel. Important to this installation are aftercoolers, which keep the temperature of the 116-psi. air below 80 deg. Also, the aftercoolers make it possible to condense and remove moisture from the compressed air.

Here's a neat trick: not all the high pressure air is used for tools. Some of it goes to run four Joy Turbinair motors up near the heading. The useful motor output turns the impellers of four 6-in. Jaeger pumps. More important to the miners, the air motor exhaust cools in its expansion through the motor and is cut in to the fan line, providing additional ventilation volume and cooling effect.

All this elaborate equipment is something you don't see every day on a tunnel job. And it has meant a sub-

stantial expense for the contractor. Put it this way: with more than 3,000-hp. connected load, Tecolote Tunnel is just about the biggest Southern California Edison Co. customer outside the Los Angeles metropolitan area.

But it takes a ride inside to appreciate Tecolote Tunnel from the point of view of the men who are driving it. These men are miners, operating engineers, and electricians. They're all under 40. They've all had rigorous physical exams. There are 3 shifts, and they work 6 days a week. Including change house time, it's a 9-hr. shift. Scale for miners is $2.42 an hour. The heat and water are worth a 13¢ hourly bonus. Sometimes there's a little overtime.

Going in to work a shift, or going

Here's a summary of four tough years . . . .

TECOLOTE is getting to be an old tunnel job, and with its age has come notoriety. It was bid in December 1949 at $4,750,455, and work commenced shortly after—the inlet leg (Sta. 0 + 50) on March 3, 1950, and the outlet leg (Sta. 336 + 07) on May 3, after construction of an access road. Early progress was good—average months for the first year being between 700 and 800 ft. in each heading. The work was reviewed twice in **Western Construction**—August 1950, p. 67; and September 1951, p. 78.

Trouble came first to the inlet leg. Methane, water, and sand slowed the work in February 1951, and only 223 ft. were driven in the following 3 months. Despite recurrent difficulties thereafter, fairly steady progress was made (average 532 ft. per month) until March 1952. Grouting the previous month had consumed over 1,000 sacks of cement. Most important, however, was consideration of progress on Cachuma Dam above the inlet. So as not to hamper schedules for its completion and storage of water, it was decided to stop driving in the inlet leg, and to line that 14,919-ft. portion. This lining was subsequently completed in January 1954, using special equipment. Procedures were reviewed in **Western Construction** in April of this year.

It is interesting to note the water temperature and volume last recorded at Sta. 149 + 69, end of the upstream leg toward which work is now proceeding from the other heading. Volume: 200 gpm. (at 190 psi.) Temperature: 78 deg. F.

Outlet leg worse

The outlet leg maintained its steady pace until August 1951. Temperatures by then had advanced slowly to about 87 deg. Water had first been encountered in appreciable quantity and under pressure about 6 months before. Now, with about 11,250 ft. of tunnel driven (Sta. 223 + 49), the water flow increased markedly. During the ensuing year it peaked above 4,000 gpm. as Halvorson laboriously inched ahead a total of about 250 ft. During this period also, pressure dropped a bit, from a previous high of 350 psi. to a little over 100 psi. It was this 250-ft. section of tunnel which was lined (in September and October 1952) before further tunneling, thereby reducing the total outflow to 1,500 gpm.

Resumption of aggressive driving operations late in 1952 took Halvorson into more water. The volume rose to 3,500 gpm., and it held at this figure for 3 months. Grouting was almost the rule and consumption in one spot went to 1,240 sacks of cement.

In February 1953 the water flow dropped again, and it was not consistent thereafter. Generally, however, the trend was up. The driving pattern, although continually hampered by the need for grouting, became somewhat consistent. An average monthly advance of over 340 ft. was maintained for 4 months, February through May 1953.

Engineering study

In June the situation became almost intolerable. The advance was only 80 ft. And in July it was necessary to grout in unprecedented quantities: 1,028 sacks in one spot, 2,981 at another. On July 21, 1953 (at Sta. 196 + 85), the job was shut down for appraisal and study by both the Bureau of Reclamation and the contractor. Water volume: 3,600 gpm. (at 230 psi.). Temperature: 112 deg. F.

A consulting board of engineers was retained by the Bureau and Tecolote Tunnel conditions were studied thoroughly during the remainder of 1953. The Board was composed of Rush Sill, consulting engineer of Los Angeles; Walker R. Young, former USBR chief engineer, of Denver; and Frank Purvis, also of Denver.

Following submittal of the Board's report, plans for resuming work were developed. During negotiations, Halvorson suggested that it would be to their advantage to subcontract tunnel completion. They proposed the firms of Coker Construction Co. and Peter Kiewit Sons' Co. Negotiations thereafter were carried on with Coker and Kiewit. The result was Order for Changes No. 14, dated January 8, 1954.

Contract items affected by this order all pertain to underground work. There are now just three pay items in connection with driving. Two of them are unchanged in price: steel support ($0.15 per lb.) and timber support ($232 per M.B.M.). The practical effect is to lump almost all work into the third item, tunnel excavation. The unit price establshed in the change order is $447 per cu. yd. The original figure had been $44!

For this price, however, the Bureau of Reclamation is buying everything necessary up to the point of holing through. (Excavation runs about 2 1/3 cu. yd. per lin. ft.) Lining and other later work remains as originally bid. Reason for the high price on excavation is that it includes all feeler and grout holes, grout pipe, and connections, grouting and cement for grouting, and weep holes (up to 500 of them, at 12 ft. per hole.)

The price adjustments of Order No. 14, carried into the extensions column, amount to a decrease of $850,450, but an increase of $5,026,800. The net increase is $4,176,360. Added to the original bid and payments made under earlier orders for changes and extra work, this means Tecolote is just about a $10,000,000 job!

No more changes?

Further adjustment of the contract will be contingent upon just two conditions: water or rock hotter than 130 deg. F., and/or water flowing in excess of 10,000 gpm. If the temperature tops 130 deg., the contractor will be paid for increased labor expenses due solely to that condition. In connection with water beyond 10,000 gpm., he will be compensated for labor costs incurred in handling and disposing of such excess water.

Under these conditions, Coker and Kiewit came on the job in January. Until April they worked at rehabilitation of the tunnel itself, and also the plant and equipment outside. Driving was begun on April 12 at Sta. 196 + 85 and continued until May 27. During that time 568 ft. were driven, to Sta. 191 + 17. The temperature rose to 116 deg., and with the last round on May 27 the water flow rose to 7,750 gpm.—all but about 1,100 gpm. coming from the last ½ mi. nearest the face. What the contractor has done about it is reviewed in the accompanying article.

PUMP STATION is no place for camera panorama! Main units are Fairbanks. Morse and Ingersoll-Rand centrifugals, jammed in to boost more than 6,000 gpm. from sump to portal 2 mi. away.

HEADING is crowded by fan line and 14-in. water line. Now another water line (12-in.) is in place. Wye in line is for hooking up Joy air motors and 6-in. Jaeger pumps when needed.

in to watch the work (as we did on June 22), it's all the same. You have nothing in your pockets, and probably no belt. You don't wear shoes, but you jam your feet into high rubber boots. You wear a battery belt and have a headlamp on your hard hat. (There's some gas in the tunnel, highly diluted by the volume of ventilating air. But to play it safe, there are no lights except at the pump station, and no smoking is permitted.)

During the 20-min. ride to the heading, you get thoroughly soaked. But you notice that the first 2 mi. of tunnel is well maintained. This section is all of 3 yr. old, but the steel is in good alignment, the lagging and blocking are tight. The new contractor rehabilitated the entire outlet leg as his first chore. New cribbing behind the ribs keeps loose material from sloughing on to the tracks. Everything is shipshape, and it has to be because your train is "sharing" the tunnel with a 14-in. fan line, a 14-in. and two 12-in. water lines, and two 6-in. compressed air lines. Three power cables—two 2,300-volt and one 440-volt—are also carried in this small bore. The tightest squeeze comes at passing tracks, where everything is carried overhead and the motorman yells for you to get your head down.

Pump station underground

So far, the tunnel remains unlined except for a concrete ring 245 ft. long placed in one of the wettest sections in October 1952. This ring is a little over 2 mi. in and its presence governed the location of the pump station. Carrying all the fancy plumbing through this 7-ft. circular bottleneck would have been difficult, so three of the biggest pumps and the fan line booster were installed just downstream. Here the tunnel was widened to 17 ft. for a length of a little over 60 ft. And an 8-ft. sump was dug into the tunnel invert to catch water pumped out of the heading

Crammed into the pump room are transformers and regulators for the 2,300-volt power, the 125-hp. Sutorbilt booster, and 5 electric motors and their pumps—two 8-in. Fairbanks Morse centrifugals (250 hp., 3,000 gpm. at 300-ft. head), two 6-in. Gardner-Denvers (50 hp., staged to pump 1,200 gpm. at 300-ft. head), and one 10-in. Ingersoll-Rand centrifugal (300 hp., 3,150 gpm.).

Ride in a bath tub!

Normally the pump station is a scheduled stop for all man trips in and out of the tunnel. And here is where you meet the truly unique feature of work on this unique job.

It all started one day this spring when Ray Blasongame, the superintendent, and a walker were riding in an empty muck car. The train happened to stop with Blasongame's car directly beneath a heavy outflow of fairly cool water. The shower felt pretty good, and an idea was born. Drain holes in several muck cars were plugged up and the cars filled with water. Ever since, these cars have been used to move personnel through the hottest part of the tunnel, between the pump room and the heading. During a regular driving shift, they are left at the heading—shunted by car passers as necessary during the mucking operation—to give the miners refuge from the heat when they need it. When you "take five" on this job, you climb into a bathtub!

Water for the purpose was originally gotten merely from one of the cooler water flows in the tunnel. But lately there have been refinements. Water is being brought in all the way from the outside. It's real cool!

Even when riding in a car full of water between the pump room and the heading, you wonder how this critical stretch of the tunnel was ever driven. Part of the answer is, of course, that conditions were a little better when driving was going on, since the fan line ended near the working face. Now, with the work having advanced, the fan line has been extended too, and the natural heat here is mighty impressive.

When you come to the face, it's a different story. You stand up in front of the fan line and you really appreciate the blower and booster setup. And when you run air tools without bringing in more moisture, you appreciate the big Joy Twins and their aftercoolers. The heavy pumping capacity for pulling water away from the heading has its effects too.

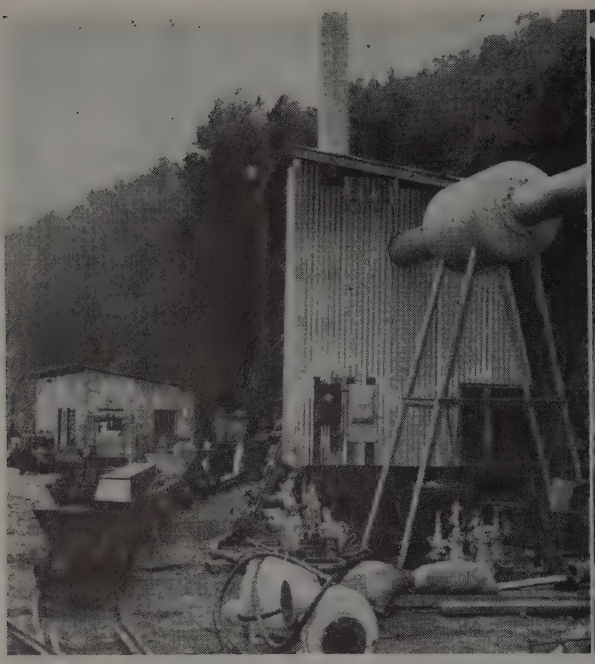
Here is a tabulation of average temperatures, taken from shift inspection reports for the week of May 17-22. At the pump station: wet bulb 93.7 deg., dry bulb 93.7, relative humidity 100%, water 106. At the end of the fan line: wet bulb 67.7, dry bulb 97.8, relative humidity 19%, water 112. At the heading: wet bulb 83.2, dry bulb 87.9, relative humidity 81%, water 114. All temperatures are Fahrenheit.

The fan line figures are the most startling, and show what Coker has been able to do. But the readings at the heading are the most significant for the men who work there. A wet bulb of 83.2 deg. isn't bad alongside 114-deg. water flows.

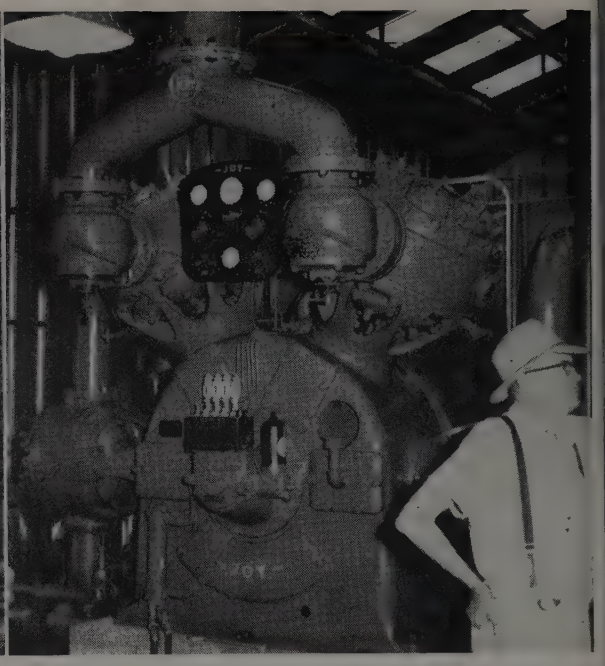
Fog is a problem too

But, without plenty of pumping, introduction of this dry air makes for another difficult condition—fog! If incoming water is not collected in a short space and pumped away from the heading, it flows about 1½ ft. deep in the tunnel invert and evaporates into the surrounding air to the point of saturation. When the dry blower air strikes this saturated air, the water condenses out like a king-size coffee pot. With your miner's headlamp, you can see only about 5 or 6 ft.

The particularly heavy flow causing this condition was brought in with a round shot by the contractor on May 27. The initial burst of water was too much for existing pumping capacity. Not only that, but in



AIR is vital, especially on this job, where 5,000-cfm. Sutorbilt blower figuratively (and in this picture) overshadows other machinery, including train of mucking equipment.



MORE AIR, this time for tools and air-motor driven pumps, comes from four of these Joy 2-stage compressors. Bob Long is the operator checking the board.

flowing along the tunnel it burned out several pumps and made matters worse. Since that day, the air motors have been brought in with four 6-in. pumps, and a new 12-in. discharge line has been installed in addition to an existing 14-in. line. The new installation was completed and put into operation on June 22 and within an hour had pulled all the water out of the invert and dissipated the fog.

Driving conditions

So much for working conditions. Tecolote Tunnel is far worse than anyone ever expected in this regard, but the problem shows signs of being licked. There's even a little excess pump and pipe capacity at this stage of the game, in case the water increases. Now, how about driving conditions?

To some extent, regardless of its heat and volume, the presence of water alone has affected driving conditions and procedures. In this troublesome outlet leg of the tunnel the ground consists of about four successive sedimentary formations—combinations of siltstone, shale, sandstone, and conglomerate. They have been severely folded and faulted and, whatever its source, the water is coming largely from fault-originated seams. The particular operation required by the presence of water, in order to hold down the flows of water and of gouge, has been grouting. This was done extensively by the original contractor at various points. So far, Coker and Kiewit have not grouted, but they have equipment and materials on hand and at the end of June were considering grouting in advance of further work.

For the 568 ft. driven by Coker in April and May of this year, standard procedure was to drill upwards of 25 holes for each round. An Ingersoll-Rand jumbo leads the work, fitted with three drifters. Drill steel with carbide insert bits is used and the holes drilled about 6 ft. deep. Atlas 40% gelatin is used, and delay electric blasting caps No. 1 to No. 8. Each round requires 40 to 50 lb. of gelatin. When shot it pulls about 5½ ft. Rock volumes run about 2 1/3 cu. yd. per lin. ft.

An Eimco 21 handles the mucking, into 1½-yd. Wood cars. A 6-ton Atlas locomotive pulls the train. Locomotives for the job were specially built. They are only 32 in. wide, operating on 24-in. gage track. Normally, bigger locomotives would be used in such a tunnel, but passing requirements and long hauls required the extra power in a small package.

Efficiency in the heading

Daily advance ran about 20 ft. per day when driving was continuous. This figure seems to provide a good index to work efficiency in Tecolote Tunnel. In a reasonably cool and dry tunnel, with similar rock and dimensions, the contractor would figure on an advance of about 40 ft. But, it must be noted that Coker is working 15 men per shift instead of the usual 9. So it turns out that they're not too far off when in conversation, they talk loosely of each shift amounting to only about 2 hr. effective work.

All the thought and hard work isn't underground in Tecolote Tunnel. Problems of heat and moisture control are brought to bear also on the outside crew and especially on Ole Kubsch, the chief electrician. His big problem is locomotive and pump motor controls. The pumps are likely to remain in one spot for a considerable length of time, working under fairly constant conditions. So keeping after them becomes fairly routine. But what a routine! All pump motor controls have to be rotated monthly for maintenance, except the oil-immersed equipment used in conjunction with the big pumps working out of the sump.

Locomotive maintenance

But locomotives are the real problem. There are five of these (four normally in use) and they must be expected to operate at times on this job in water as much as 2 ft. deep. Both open and closed (permissible) motors are on the job, but all had been altered so that they could be considered open by manufacturers' standards. Kubsch has gone to work for Coker to make these motors both waterproof and air-tight.

But it's an expensive proposition. (And it's reviewed in more detail in "Tricks of the Trade," page 123 of this issue). According to Kubsch, this job has to stock replacements for absolutely everything replaceable on a mine locomotive motor, and his inventory takes up about four times the space required on any "ordinary" tunnel job.

(Continued on page 128)

Atkinson Ostrander plant at The Dalles solves problems of stone-sand production

Pit run gravel at The Dalles is low on natural sand — Here is how the contractor designed and built the plant to manufacture 75% of the fine aggregate needed for 690,000 cu. yd. of concrete

OVER 690,000 CU. YD. of concrete is to be poured under two contracts that Guy F. Atkinson Company and Ostrander Construction Co. hold as joint venturers at The Dalles Dam on the Columbia River. Their aggregate plant is a fine example of the modern manufacture of sand to supplement small quantities of natural materials.

The gravel deposit at The Dalles is located 2½ mi. northwest of the damsite and consists of natural rounded basalt gravels and some quartz in the smaller sizes. The pit-run gradation of this gravel is such that it produces less than 25% of the total sand requirement of the batch plant. The gradation of the sand is similar to the condition found by Atkinson Ostrander at McNary Dam in that a gap grading exists on the #30 sieve.

An accompanying table shows the gradation of the fine aggregate at the pit, at two stages of the crushing operation, and at the batch plant. The job specification for the fine aggregate on the spillway portion of the two contracts is also given. This specification, coupled with the natural conditions summarized above, required close attention by the contractor to the design and operation of his aggregate plant.

A "pure" approach to the recurring problem of stone-sand production on heavy construction projects might conceivably result in one plant design considered to be best. But expression of such a design in terms of its machinery components would be misleading for at least two reasons. The obvious one is the wide range of natural conditions and aggregate requirements. Not so apparent is an economic reason—the desire of a contractor to utilize his equipment effectively from one job to another.

Paramount in consideration of this stone-sand plant of Atkinson Ostrander is the realization that plant machinery was available from previous work at McNary Dam. Design of The Dalles aggregate plant, carried out at Atkinson's South San Francisco headquarters, therefore represents a compromise between a pure solution and a haphazard one.

Solving the problem

Two articles in Western Construction last year reviewed the subject of stone-sand: "Production and use of stone-sand in the concrete for large dams (February 1953, p. 63), and "Planning the plant for production of stone-sand" (August 1953, p. 60).

Both articles emphasized the recurring nature of the stone-sand production problem: there is an increasing number of dam construction projects, involving large volumes of concrete, where adequate natural materials are in short supply. Aggregate availability is no longer a primary criterion of site selection. The result is that aggregate plant design has risen in economic importance to a contractor. It has become an engineering job.

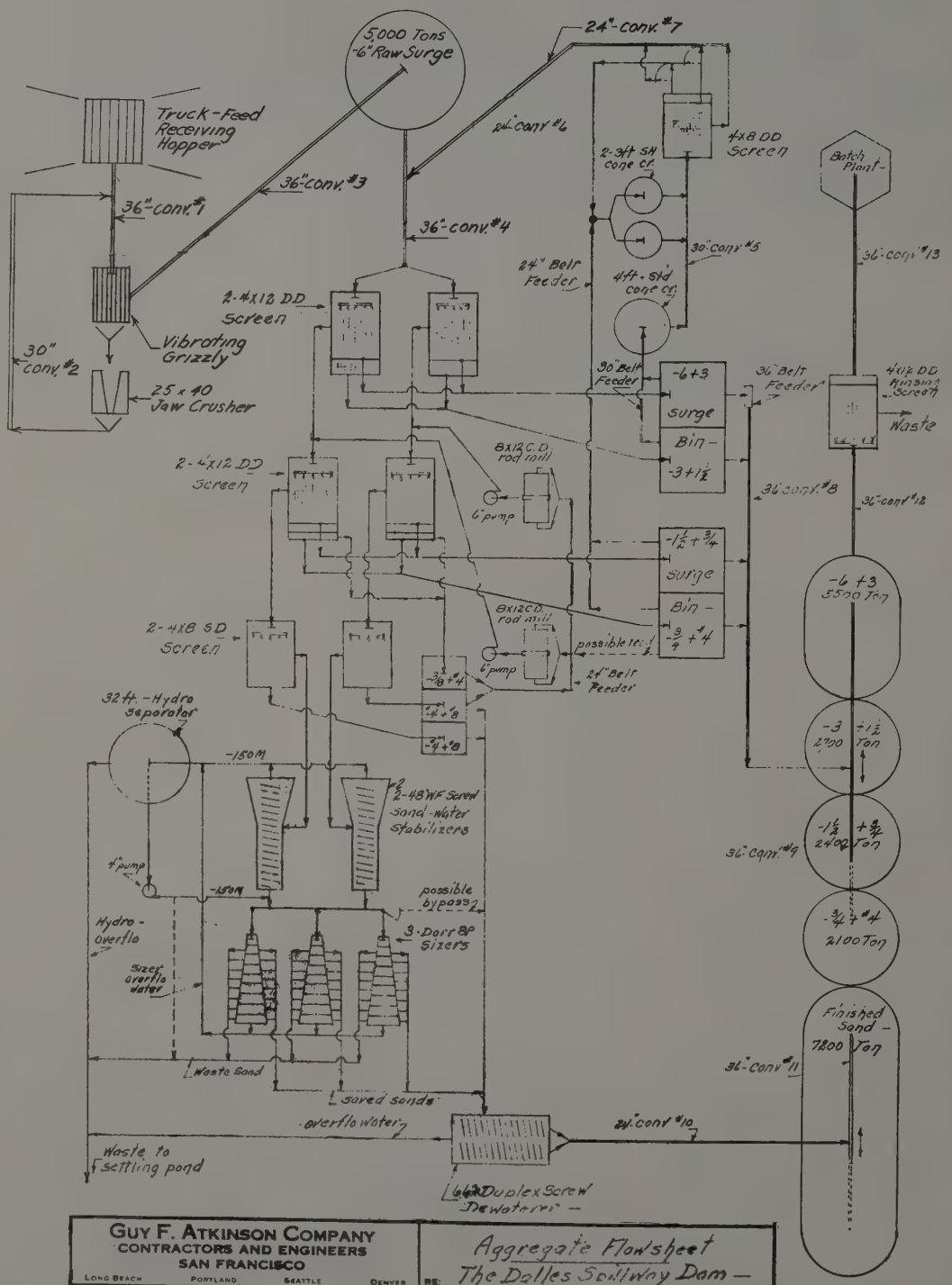
Illustrating such engineering, and rounding out Western Construction's presentation of material on this important subject, is the accompanying article. By actual field example on a major Western dam project of the Corps of Engineers, it reveiws a practical solution of the stone-sand production problem.—Editor.

Plant capacity

The aggregate plant as presently set up has a capacity of 400 tons per hour. The plant is currently operating at a rate to provide for the 6,000 to 8,000 cu. yd. of concrete being poured per week on the spillway contract. Plant operation requires 2,600 gpm. of water. Of this amount 1,000 gpm. is used in operation of three sand sizers, 500 gpm. is for the rod mills, 800 gpm. for washing sprays on the vibrating screens, and 300 gpm. for miscellaneous uses.

Digging the deposit is done with a 2½-cu. yd. shovel. Since the aggregate plant will handle only 18-in. diameter and smaller rock, the shovel must do a sorting job at the pit in setting aside rocks larger than 18 in. Gravel is loaded into 30-cu. yd. bottom dump truck trailers. Hauling is

Aggregate Flowsheet



GUY F. ATKINSON COMPANY
CONTRACTORS AND ENGINEERS
SAN FRANCISCO
LONG BEACH PORTLAND SEATTLE DENVER

RE: Aggregate Flowsheet The Dalles Spillway Dam —

Equipment List

1—4x7-ft. Telesmith plate feeder
1—25x40-in. Cedar Rapids jaw crusher
4—4x12-ft. 2-deck Symons screens
3—4x8-ft. 2-deck Symons screens
1—4x12-ft. 2 deck Cedar Rapids screen
2—48-in. Wemco screw sand-water stabilizers
1—66-in. Wemco screw duplex classifier
1—32-ft. diameter Wemco hydro separator
2—3-ft. Symons short head cone crushers
1—4-ft. Symons standard cone crusher
2—8x12-ft. Marcy rod mills
3—6 in. Wemco sand pumps
1—4-in. Wemco sand pump
1—3½x5-ft. Symons vibrating grizzly
3—8-pocket Dorrco sand sizers
2—Jeffrey Traylor vibrating feeders
Noble air rams and gates in recovery tunnel
404 ft. 24-in. conveyor belting
1,184 ft. 30-in. conveyor belting
4,810 ft. 36-in. conveyor belting
44 electric motors with total output of 1,853 hp.

over a job haul road to the aggregate plant located at the job site. These trucks dump into a 30-cu. yd. hopper through a stationary bar grizzly spaced at 18 in. Steel plates over the grizzly provide passageway for the truck wheels.

Flow chart analysis

The processing of aggregate from the time it passes the grizzly can best be understood by reference to the flow chart reproduced on these pages. A 4x7-ft. reciprocating feeder under this hopper feeds the raw material to a 36-in. conveyor #1, which discharges to a 3½x5-ft. vibrating grizzly, spaced at 6 in.

Rock that is +6 in. is chuted to a 25x40 jaw crusher set at 5 in., then discharges to a 30-in. conveyor #2, which in turn discharges back on to conveyor #1. Rock that is —6 in. or "throughs" from the vibrating grizzly chutes to a 36-in. conveyor #3 which discharges to the 5,000 live-ton surge pile. This pile is the raw feed for the aggregate plant, the analysis of which shows a deficiency in sand as a whole as well as deficiencies of intermediate sizes of sand. The —¾ +#4 aggregate is also deficient in intermediate sizes.

Feed for the plant is drawn from the pile by an adjustable speed 36-in. belt feeder to a 36-in. main conveyor #4. The feeder and end of the #4 conveyor are enclosed in an 8-ft. steel tunnel liner recovery tunnel under the pile with a small man-escape out the rear.

Conveyor #4 discharges the feed into a pants chute which splits the feed to two 4x12-ft. double deck vibrating screens with 3¼-in. and 1¾-in. cloth. The —6 +3-in. rock and the —3 +1½-in. rock are chuted respectively to 65-cu. yd. surge bins to be later either sent to storage or to secondary crushers. Two large nozzles spray water into the pants chute, mentioned above, to thoroughly soak the material before arriving on the screens. The screens also have spray pipes and nozzles arranged to thoroughly wash the rock on all sides.

The —1½-in. sizes through the lower decks are collected in launders and directed to two more 4x12-ft. double deck screens, fitted with ⅞-in. and ¼-in. cloth. The discharge end of the lower deck is fitted also with a 1-ft. length of ½-in. cloth to capture some of the —⅜ +#4 rock which is chuted to a 20-cu. yd. surge bin for mill feed. Rock, which is —1½ +⅜ and —¾ +#4, is chuted to two 65-cu. yd. surge bins to be used later as desired, as was the —6 +3-in. and —3 +1½-in. sizes previously. These two screens are also fitted with spray bars to give these smaller rock sizes additional washing. The —#4 sizes and all spray water is chuted to the sand plant.

Cone crushers

Near the base of the four 65-cu. yd. surge bins, containing the four rock sizes, are three cone crushers, one of which is a 4-ft. standard. The other two are 3-ft. shortheads. A 30-in. belt feeder draws either the —6 +3 in. or the —3 +1½ in. or some of each from the bins, for secondary crushing in the 4-ft. cone when an excess of these sizes occurs. Another 24-in. belt feeder can draw the —1½ +¾ in. or —¾ +#4 and feed the two 3-ft. shorthead crushers, either singly or both for fine crushing and production of mill feed.

A 30-in. conveyor #5 passes under these three crushers and discharges on a 4x8-ft. double deck screen fitted with 1½-in. and ½-in. cloth. With the splitter design receiving chutes, either the +1½ in. or the —1½+¼ in. can be directed to the main conveyor #4 by a 24-in conveyor #7 or directed back to the shorthead crushers by a 24-in. conveyor #6. Rock that is —½ in. throughs is collected in a launder discharging on conveyor #7, to conveyor #4, and to the main screens. Some of this —½ in. makes up the deficiency in the —¾ +#4 aggregate and the excess is drawn off through the 1-ft. length of ½-in. opening cloth and chuted to the mill feed surge bin. With this arrangement of secondary crushers, any deficiency in sizes smaller than 6 in. can be made as well as the necessary mill feed, maintaining a balance in the storage piles.

Wash water and —#4, mentioned earlier, is chuted to the sand plant, first passing over two 4x8-ft. single deck screens fitted with .120-in. square opening cloth. The plus sizes, or —#4 + #8, chute into two of three 20-cu. yd. surge bins below, to be used in making up the finished sand and the excess as additional mill feed. The —#8 and water, chute to two 48-in. screw classifiers with wide flare tanks. These machines are used to stabilize the water and sand ratio before entering the three 8-pocket sizers. The overflow water over the weirs contains —#150 solids and is directed to a 32-ft. hydro-separator for dewatering. It is then pumped back to the sizer feed. A provision is made to divert some of this —#150 to waste when an excess occurs.

Feed to the sizers from the 48-in. screw classifiers falls into a distributing box which divides the flow in three equal parts for the three sizers.

Sand gradation

These sizers are used for the sand classification in making up the finished sand grading. These machines consist of steel tanks, tapered in length, with height compartments, separated by adjustable weirs. The feed enters the narrow end of the sizer and as the flow moves along, the velocity decreases because of the increasing width, allowing more time for the smaller and lighter particles to settle. Each compartment or pocket is fitted with a controlled rising current of fresh water to provide a hindered settling of solids and maintain a teetering of particles in the pocket. This permits the small and lighter particles to rise and flow over into the next pocket. The heaviest particles settle in the first pockets and in the order of their weight settle in the remaining pockets. As the sized particles accumulate in the pockets and become dense to a selected density, the hydrostatic pres-

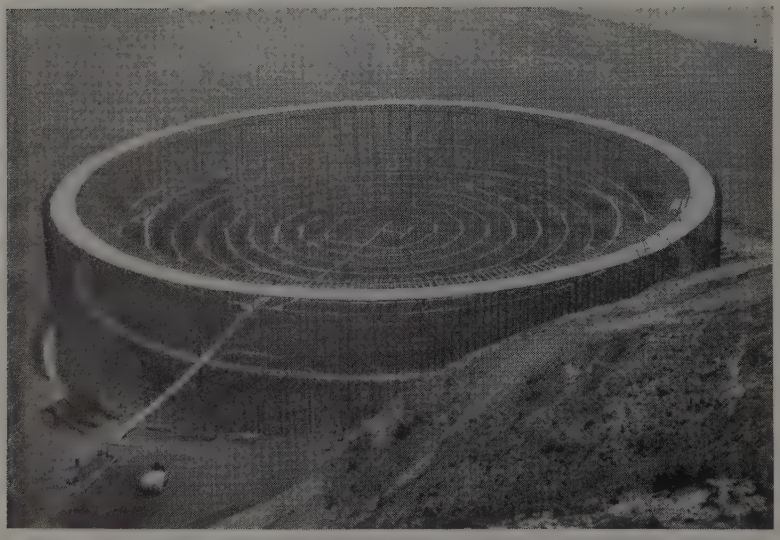
(Continued on page 86)

Fine Aggregate Grading at The Dalles Dam
(% retained on each sieve)

Sieve	Pit Run	Rod Mill	Cone Crusher	Batch Plant	Specifications
4	0	0	0	2.5	0-5
8	6	3	19	9.0	5-15
16	10	9	27	17.6	10-20
30	15	19	19	21.1	20-30
50	35	20	13	24.2	20-30
100	19	20	8	17.0	12-22
200	7	7	6	5.1	4-6
pan	8	22	8	3.5	2-4

World's largest tank reservoir

This project is unusual because of (a) the tank capacity of 12,000,000 gal., (b) the use of the Freyssinet system for prestressing the walls in two directions, and (c) the extensive use of steel scaffolding



OVER 5,000 FRAMES of Beatty steel scaffolding were erected for the dome and wall formwork at the rate of 250 to 300 per day. The frames are 4 ft. wide and 6 ft. 4 in. high.

THE largest, circular, domed, concrete reservoir in the world will soon be completed in the city of Richmond, Calif. This tank, which will hold 12,000,000 gal., will have its walls prestressed both vertically and horizontally by the Freyssinet system.

The reservoir was designed by the East Bay Municipal Utility District as part of its expanding system of water supply for a fast-growing area. The District has had 20 years of experience in the design of prestressed tanks, including the bar type and the wire wrapped units—over 30 in all. The Richmond Reservoir was designed as a wire wrapped unit.

When the bids were called for about a year ago, the firm of Erickson, Phillips & Weisberg submitted a bid of $345,424, or $16,000 below the nearest competitor. Their figure was based on the use of the Freyssinet system of prestressing under an alternate that would allow its use if it were equal to or better than the EBMUD system. Approval was given by the engineers for this new Freyssinet system.

The reservoir has a hillside location about 200 ft. above sea level. The tank is 200 ft. in diameter and 630 ft. in circumference. The walls are divided into eight segments about 80 ft. long and 43 ft. 8 in. high. They are 2 ft. thick at the base and step inward 2 in. every 4 ft. on the inside wall face until a 12-in. thickness is reached. This minimum wall thickness then carries upward until it increases again at the top for the dome ring. The wall foundation is a pad footing about 1½ ft. thick.

Using the Freyssinet system, pilasters were required to be added to the original design. These are located at 80-ft. intervals and project outward 8 in. from the outside face of the tank.

The foundation of the tank rests entirely on a cut into the hillside. The floor is similar to a pie tin in shape with the center area about 10 ft. below the rim. Except for the wall foundation, mentioned earlier, the tank floor is well designed to provide for drainage and imperviousness. Succeeding layers of material on top of the original excavation are a 2½-in. layer of ¾-in. drain rock, a 4-in. layer of blacktop, a 3/16-in. asphalt membrane, and then a 4-in. layer of concrete. A 6-in. vitrified clay pipe system will carry off any leakage or prevent uplift from the hillside water-table.

The arch dome of the tank is 4½ in. thick and rises 26 ft. 9 in. above the dome ring of the walls. It thickens to about 1½ ft. at the wall, but has the constant 4½-in. thickness at a distance of 12½ ft. out from the wall.

The principal items and quantities for the reservoir are: excavation—81,800 cu. yd.; concrete for walls—1,500 cu. yd.; dome—560 cu. yd.; footing—250 cu. yd.; floor—470 cu. yd.; reinforcing steel for the dome—53,000 lb.; footing—11,000 lb.; floor—32,000 lb.

Cable arrangement

The Freyssinet system of horizontal prestressing for this reservoir calls for 90 complete cable rings round the tank. Each ring is composed of four cables, each of these covering one-quarter of the circumference. The end of each cable passes through a pilaster for anchorage purposes. The cables are located in the center of the wall and spaced 3½ in. apart at the base of the wall; this distance increases to 24 in. just below the dome ring. There are 10 cables spaced at 4 in. in the dome ring for the high compression in the concrete required there. A total of 360 individual cables in all is required. The cables for vertical prestressing are spaced at 2-ft. centers along the circumference of the tank. These also are located in the middle of the wall. A total of 320 cables are required here.

Each cable is composed of 18 wires of .196-in. diameter. This is Super Tens-strain relieved wire of special composition high tensile strength, manufactured by U. S. Steel. These are encased in a 1½-in. flexible steel tubing on the horizontal runs, and in standard 1½-in. black pipe in the vertical runs. Notched metal templates are placed next to each vertical pipe; these provide for the spacing and anchorage of the horizontal cables.

The general considerations for the special arrangement of the horizontal and vertical cables are interesting. It was mentioned earlier that each horizontal cable ring is composed of four cables each covering 90 deg. of arc. Every other cable ring has its cables anchored to the same four pilasters. The other half of the cable rings are anchored to the remaining four pilasters. Each cable will pull together

two 80-ft. wall segments, but due to the friction developed between the wires and the tubing in passing around a curved surface, the tension in the wires will not be as great at its mid-point as it will be at each end where it is anchored.

But since this low tension point in any one cable is opposite a point where the highest tension exists in the cables immediately above and below it, the net result is to create a fairly uniform horizontal compression in the concrete at all points around the circumference of the tank.

The vertical cables are necessary to take care of the bending moment and tension in the concrete in the vertical plane of the wall. The weight of the wall and the dome ring creates a friction force at the base, opposing the movement of the wall inward during prestressing and outward during filling of the tank. The dome ring resists the thrust at the top of the wall. The distance to the maximum bending moment in the wall would be about 6 ft. above the base. However, by compressing the wall enough vertically, no tension in the concrete will result from this bending moment.

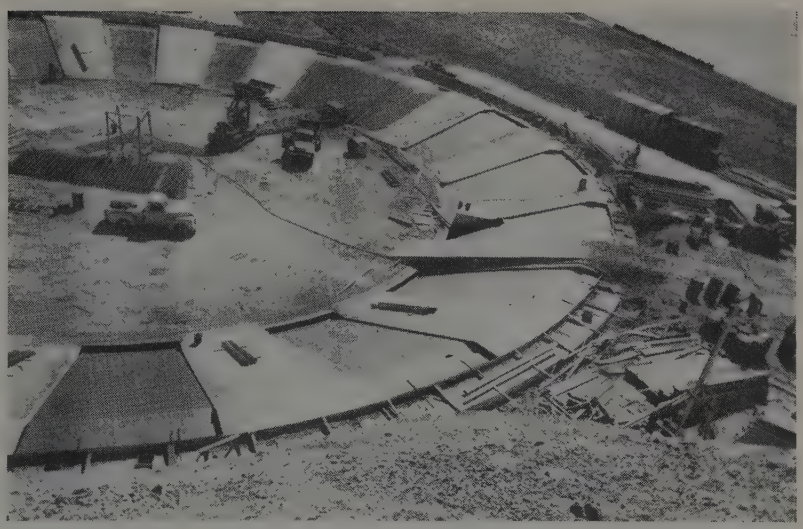
Prestressing

For prestressing horizontal cables, a hydraulic jack is mounted at each end of a cable. An initial stress of 193,000 psi. is desired in the cable at the jack; this will give only about 123,000 psi. at the midpoint because of friction losses. It is estimated that the ultimate average stress in the wire will be only 140,000 psi. because of losses in deformation of the anchorage, plastic flow in the concrete, creep in the steel, and other causes.

The vertical cables will only be stressed from the top of the wall. At the lower end of the cable the 18 wires have been splayed out to form a permanent anchorage similar to the hook used in ordinary reinforcing steel. An initial stress of 188,000 psi. will be put into these vertical cables and it is estimated that this will relax ultimately to 160,000 psi. from causes similar to those affecting the horizontal cables. Specially designed cones will permanently lock the wires of the cable when the jacking operation is over.

To measure the cable stress, two methods are employed. First, the cable elongation is measured based on the average stress desired. This should be 12⅝ in. in the case of the horizontal cables and 3⅜ in. in the case of the vertical cables. Second, the hydraulic jack gage pressure is noted and should be about 4,500 psi. for the normal jacks used in this operation.

The result of these operations is to place the wall concrete under a unit compression of 1,000 psi. when the tank is empty. This will be reduced to 50 psi. when the tank is full, but even this small amount is a sufficient safety factor to guarantee that no tension in the concrete will occur at any point. Since a compressive strength of 4,500 psi. was required for the concrete in the pilasters and the dome ring, all of the concrete in the walls is of this strength. Concrete for the foundation, floor, and the dome is designed for 3,000 psi. To minimize shrinkage of the concrete, a miximum 3-in. slump was specified.



SLOPING PORTION of the tank floor has foundation of drain gravel, 4 in. of blacktop, and 4 in. of concrete. Blacktop is being compacted by 10-ton roll pushed by a Cletrac.

WALLS have been poured with embedded horizontal and vertical cables but not yet stressed. Dome framing is placed at proper elevation by measuring down from pipe frame template.

Foundation

Excavation for this reservoir began in March 1953, with John H. McCosker the successful bidder at $36,871 for this portion of the work. The manner in which he handled the 81,000 cu. yd. of excavation is worth mentioning, especially the way in which he loosened up the sedimentary rock encountered here. He mounted a LeTourneau ripper attachment on the rear of a Cat D8 bulldozer. This not only broke up all rock, but allowed for close control of the limits of excavation in this confined area.

After the heavy work, McCosker served as a subcontractor to Erickson, Phillips & Weisberg for further foundation work required on the main contract for the reservoir. Here again he showed good planning and execution of the work. The floor of the tank slopes inward 25 ft. from the perimeter of the tank with a 10-ft. drop in this distance. The center area of the bottom is almost level. To fine grade the sloping portion with a grader, other contractors have utilized a cable arrangement to hold the grader from tipping over. McCosker's operator guessed that his Cat 12 grader would operate on this 40% slope unaided without tipping over, and he was right. The speed of work was greatly increased by this judgment.

The plans called for a 2½-in. layer of ¾-in. maximum size drain gravel spread uniformly on the floor area. This was handled on the sloping sec-

tion by operating from the center area. A Lorain crawler crane with a 50-ft. boom was used equipped with a ¾-yd. clamshell bucket. Trucks drove directly into the center area and were unloaded by this method. After rough spreading on the slopes by the crane, the gravel was hand raked to the proper thickness.

Compaction was obtained by use of the 2½-ton roller mounted on the end of a long pipe boom. The boom end was attached to a Cletrac that by forward and backward trips worked the roller up and down the slope.

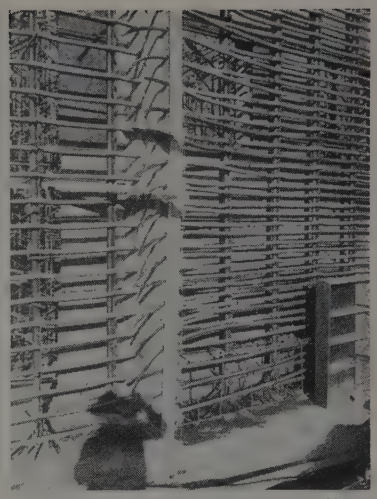
Over the gravel blanket is a 4-in. layer of blacktop laid down in two 2-in. layers. The procedure for spreading the asphalt mix was similar to that used for the gravel. This is — spread by crane, hand raked, and the initial compaction obtained with a 2½-ton roller. Final compaction with a 10½-ton roller after the mix had cooled a little gave the required results.

Over this foundation a 3/16-in. impervious asphalt membrane was sprayed on, then a 4-in. layer of concrete placed. Reinforcement in the slab was ⅜-in. bars at 12-in. centers both ways, but not passing through into the next concrete pour. An elastic joint sealer, Indaco, in 1-in. deep grooves will provide for additional water-tightness.

Steel scaffolding

With the foundation and floor completed, the next step was the erection of an impressive amount of steel scaffold in the center of the tank. No outside scaffolding was required. Over 5,000 rigid frames of Beatty scaffolding, each frame being 4 ft. wide by 6 ft. 4 in. tall, were erected and cross braced. That was done on a subcontract basis by Beatty Safway Scaffold, Inc. of San Francisco. These frames were placed at 4-ft. intervals toward the center of the tank and at 7-ft. intervals along circular lines. This allowed the contractor to use 4x6-in. stringers at 14 ft. long for the dome formwork framing. Screw jacks will allow accurate elevation adjustment of the upper dome framing. In addition, provision was made for two concrete buggy runways next to the wall at 20 ft. and 44 ft. above the foundation.

The walls were designed to be poured in eight sections with 2-ft. gaps left between sections. The 2-ft. gaps were to be poured after a two-week period when the wall concrete had taken its shrinkage. It was also intended that the contractor was to pour each of these eight wall sections the full height in one pour, with about 180 cu. yd. being required for each pour. The contractor pointed out the difficulty of pouring this amount in one day's operation. Permission was granted by the engineers to break this into a pour of 20-ft. height, and a second pour of 23 ft. 8 in., although this would make a horizontal construction joint. (It is understood that in Europe, for such tanks as this, the entire wall is poured in one long continuous operation).



HORIZONTAL CABLES are spaced at 3½ in. at bottom. Vertical cables are at 2-ft. intervals. Pilaster will be formed just to right of bulkhead in center of picture.

On this basis the contractor erected forms for one 80-ft. segment, and the first pour was made. The contractor continued on around the tank, pouring all the walls to a 20-ft. height. The 2-ft. gaps were closed and poured after a two weeks cure for the other wall sections.

It was noted in the meantime, however, that shrinkage cracks up to 3/64 in. wide had appeared in those sections located on the sunny side of the tank. There is no conventional reinforcing steel in the wall to prevent such a thing happening — only the cables that are to be stressed. It was then decided to prestress about one-third of the cables in this 20 ft. high wall in an effort to close up the cracks before pouring the upper concrete portion. By fully stressing 18 of the first 56 cables, this was accomplished.

The normal method of prestressing is to jack from both ends of the cable simultaneously for the full operation, but by chance, a better method was found on this preliminary work. Both jacks are used up to 12,000 lb. total pull (about 25,000 psi.). Then one jack alone exerts 75,000 lb. pull (about 150,000 psi.) and then the other. This has the effect of causing more movement of the wires within the cable and a more uniform tension results. Both jacks then operate together until the full 193,000 psi. is obtained at the jacks.

The second lift of wall was then poured in 40-ft. long sections to prevent a recurrence of the earlier mentioned shrinkage cracking. This also was successfully accomplished, followed with the additional 2-ft. gaps being poured two weeks after main curing of the 40-ft. long wall sections. The contractor used very successfully an A-frame mounted on rollers to move his forms. This frame was located at the top of the wall on the scaffolding. When a form had been picked up it was rolled over to its next position.

All concrete was batched and hoisted on the job by a Mixermobile. At each runway level, the concrete was wheeled by hand buggies to position and chuted into place through 4x4-ft. windows left in the formwork. In the lower portion of the wall, where the cables are spaced closely, care had to be taken to vibrate the 3-in. maximum slump concrete thoroughly. This was well done with the use of two Viber electric vibrators with 2¾-in. heads. Only two very small rock pockets were found in the entire wall pour and these promptly patched. This proves beyond doubt that it is possible, with sufficient care, to place low slump concrete and get excellent results.

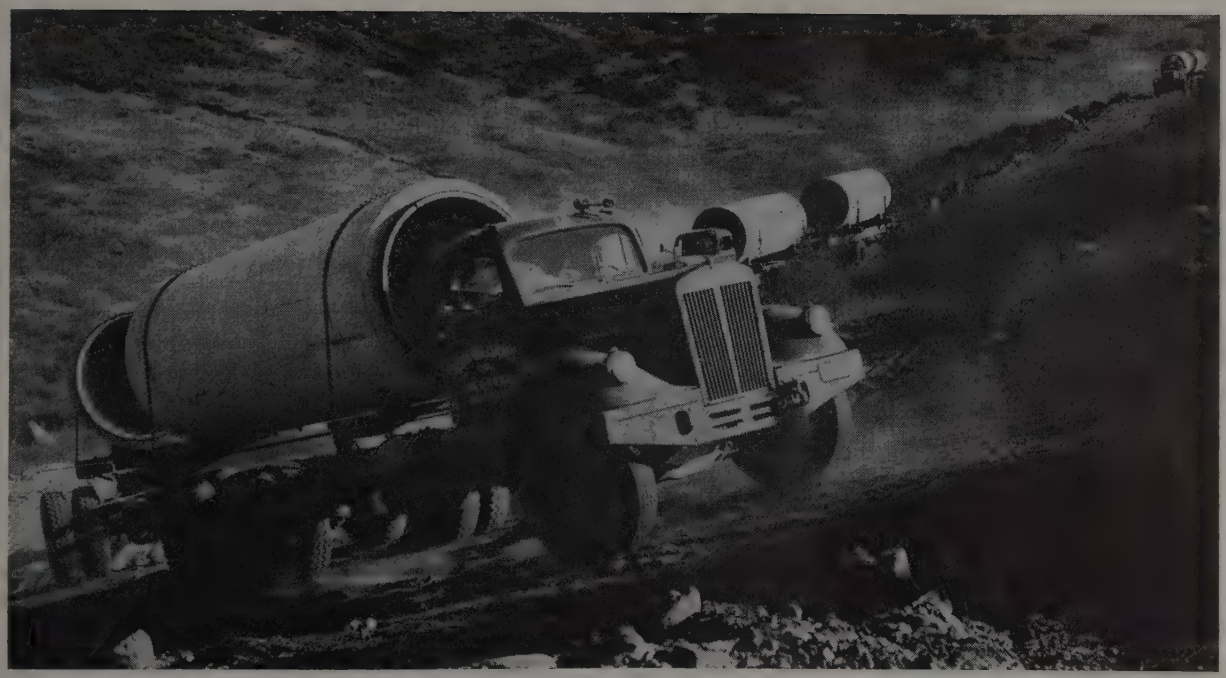
The dome formwork consists of 4x6-in. stringers at 4-ft. centers. On these are 2x4-in. joists at 16-in. centers. The sheathing is 1x6-in. lumber that is easily warped to the dome shape. Over 35,500 sq. ft. of lumber will be required for this purpose. The dome shape is gauged from a pipe frame template that spans the distance from the center of the tank to the walls. It can be moved around to any position to cover the entire area.

Water-tight seal

A water-tight seal is formed between the tank floor and the walls in a 3½-in. wide by 10-in. deep groove between the two. The lower 4 in. of this is filled with grout. On top of this is laid a 1½x3-in. half-round bar with ¾-in. Everdur studs projecting upward from it at 1-ft. intervals. A 2x3-in. rubber strip is then laid down over the studs and then another half-round bar. Sealing ring nuts are then tightened with a limited torque wrench to compress the rubber strip against the two concrete surfaces.

The entire schedule for prestressing the cables in this reservoir is as follows. Eighteen of the 90 horizontal cable rings have already been prestressed to close the shrinkage cracks. Next, two of the dome cable rings will be stressed to help take care of the initial thrust of the concrete pour of the dome. This will be followed by the tensioning of all vertical cables, this in turn to be followed by stressing the remainder of the horizontal cables as the last operation.

Key personnel closely associated with this project for the EBMUD organization are R. C. Kennedy, chief engineer; J. W. Trahern, supervising civil engineer; C. F. Yerby, in charge of design and assisted by L. H. Lee and V. M. Gallo. R. Tillotson is in charge of construction and W. E. Bradbury is resident engineer. Walt Phillips is superintendent for Erickson, Phillips & Weisberg. Pierre Courouce represented the Freyssinet Co., Inc., with Soule Steel Co. doing the steel cable erection.



PIPE TRANSPORT: An uphill job on the San Diego Aqueduct

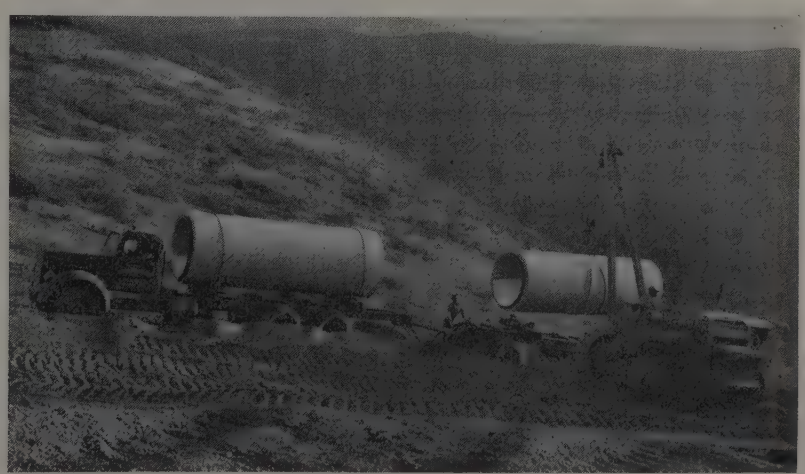
PIPE for the last 35 mi. of the San Diego Aqueduct was delivered along the ditch by a round-the-clock trucking operation involving round-trip hauls up to 175 mi. S. A. Healy Co. is the prime contractor, now winding up a $6,800,000 job. The hauling contractor is Keith Williams, equipped with a fleet of ten 184-hp. White trucks and 2-axle pull trailers.

Hauling began July 1953 and was scheduled to continue for 11 months, leaving a comfortable margin below the original estimate of 15 months. The pipe came in two sizes: 54-in. diameter by 16 ft., and 48-in. diameter by 20 ft. Source was the Basalt Rock Co. plant near Fontana. Destinations were strung out along rough haul roads between the San Luis Rey River and San Vicente, terminal points of the Healy contract.

Ted Roberts, superintendent of the Williams operation, reports that the work was set for 4,000 lin. ft. of pipe to be delivered each week. This meant six 12-hr. days. Each truck-trailer combination could haul two lengths of pipe. By making two round trips in a day, each rig laid 64 ft. of 54-in. pipe or 80 ft. of 48-in. pipe along the right-of-way. Leaving out downtime, this performance by 10 trucks comes to a maximum of 4,800 lin. ft. (all 48-in.) in one week. A tight schedule!

Service and maintenance were prime factors for this kind of hauling. So Williams had a full-time mechanic and lube man assigned to the Riverside yard. Trucks were serviced each night, as necessary.

Adding to the tough character of the haul was the state of things along the ditch. Access roads were dirt, built by bulldozer and given little maintenance other than the packing effect of traffic over them. Grades along the way ranged from 3% to 27%. With pipe sections weighing about 11 tons apiece, gross vehicle weights came to about 76,800 lb. for units of the trucking fleet. But the pipe was all put in place and the work carried out on schedule.



SIDE BOOM crawler takes delivery of pipe section on the job. Trucking schedule was arranged to hold re-handling to a minimum. This pipe is head straight for its final position in the trench.

Peaceful before reconstruction, then—

—Three cofferdam losses in one season at Savage Rapids

By J. L. HATCH
Resident Engineer
U.S. Bureau of Reclamation

YOUNG AND SMITH Construction Company of Salt Lake City, Utah, have found the Rogue River of southern Oregon a rogue indeed, creating many construction problems on their job of rehabilitating Savage Rapids Dam under contract with the Bureau of Reclamation. The Rogue River heads high in the Cascade Mountains near Crater Lake. From its head to the job site it falls rapidly, and when storms strike, it becomes a raging torrent overnight. Three times during the 1953 construction season it swept away cofferdams for the work.

The dam, originally constructed in 1921 by the Shattuck Construction Co., serves to divert water and provide pumping head for the canals of the Grants Pass Irrigation District. The dam is about 456 ft. long with a maximum height of 38 ft. It has an overflow crest 398 ft. in length consisting of 16 bays separated by piers at 25-ft. centers. As constructed, each bay was controlled by a radial gate 10 ft. 6 in. high which was raised during the irrigation season and lowered below the crest each winter to a rather poorly protected position on the downstream side of the dam.

On the north side of the river the dam has a cemented gravel foundation. Here there are seven multiple-arch bays and a spillway apron extending 50 ft. downstream from the dam axis. The remaining nine bays are gravity sections resting on solid rock.

Damage to structure

During the years since the dam was constructed there has been little damage to the concrete structure but recurrent floods rendered most of the radial gates inoperative and caused serious erosion at the downstream end of the spillway apron and under the tailrace wingwall. As the gates became inoperative, the District closed the openings between the piers with 12x12 timber stop logs 23 ft. long which they placed by hand at the beginning of each irrigation season and removed each fall. Placing the stoplogs in the spring was usually extremely hazardous. River flows in spring are normally higher than the capacity of the four sluice gates under the pumping plant. This meant placing the timber stoplogs with water flowing over the dam crest. In 1950 a boat containing three workmen was swept over the dam. One of the men drowned; another was injured.

Principal features of the rehabilitation plan are:

(1) Construction of two 16x7-ft. river outlets in bays 10 and 11 controlled by top-seal radial gates to unwater the dam crest at the beginning and end of the irrigation season to facilitate placing and removing stoplogs.

(2) Removal of alternate piers above the crest to be replaced by removal stoplog guides and modification of remaining piers to receive steel stoplogs.

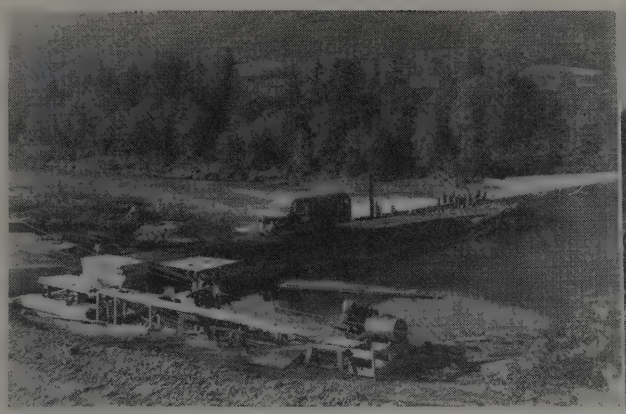
(3) Installation of a cableway and hoist to handle the new stoplogs.

(4) Placing of concrete fill for spillway apron and tailrace wing wall repairs.

(5) Reconstruction of the highway drain which extends for nearly 1,000 ft. along the floor of the reservoir using 15-in. diameter concrete pipe encased in concrete.

(6) Addition of a curved overflow section downstream from the dam crest covering the space formerly occupied by the original radial gates.

Little of this work could be undertaken during the irrigation season without extensive cofferdam construction. Some of it, such as the highway drain and repairs to the



MAY 12, 1953—First cofferdam has been completed on the upstream side of the south half of the dam. Ends of sheet piling can be seen projecting above the earth fill at right center.

MAY 27, 1953—View taken from the south bank the day after upstream cofferdam failure. River flow of 20,000 cfs. made a shambles of the sheet steel piling. Flow in picture is 12,800 cfs.

JUNE 30, 1953—Cofferdam No. 2 failed on June 24, washing out 125 ft. of the midstream section. It is being rebuilt here using old concrete piers, quarried granite, and an upstream clay blanket.

OCTOBER 15, 1953—Cofferdam No. 3 removal with completion of work on south half of dam. River flow is through sluiceways under pumphouse at right center. Note new river outlets under dam at left.

apron, would have to be done with the reservoir pool drained.

W. E. (Bill) Thatcher, general superintendent for the contractor, planned his work so that he could crowd the job into one year's time—provided he got the breaks in the weather and in the river flow. In general, his plan was to construct the cableway and river outlets structure together with pier and dam modifications south of the river outlets during the 1953 irrigation season. This called for a cofferdam extending from the south abutment to bay 8 (bay numbers decrease from south to north) with a full reservoir some 30 ft. deep against the upstream side. The remaining work, consisting of highway drain construction; spillway apron and tailrace wing wall repairs; pier and dam modification for bays 1 through 8, north of the river outlet; and gate installation, would be sandwiched into the brief period between the end of irrigation season on the first of October and the unpredictable first major fall storm, with completion during periods of low water during the winter.

The contractor started the job rolling March 19, 1953, with construction of an earth cofferdam along the upstream side of the dam from the south abutment. At the bank end of the cofferdam a timber culvert was built to carry water for the gravity canal and south bank fish ladder. Above bays 10 and 11 sheet piling was driven to permit removal of that part of the dam in preparation for constructing the new river outlets. This work was rushed so that the 48-ft. section of 42-in. diameter pipe through the dam could be replaced by a new steel pipe prior to the start of the 1953 irrigation season. This pipe extends completely through the dam delivering water from a pump in the north abutment pumphouse to the south high line canal. The new pipe was supported by hangers from a 24x9-in. I-beam trussed on the under side with two 1-in round steel rods. The pipe was sheathed with 2-in. planks for protection during further excavation operations.

During April, and until late May, the job was going well. On May 26, 1953, the river rose to an unprecedented late spring flood of approximately 20,000 cfs., washing out the cofferdam and the new section of 42-in. diameter pipe in the river outlets openings. A ¾-cu.yd. concrete bucket and 2,300-lb. demolition ball stored on the bank below the dam were carried away. Months later the concrete bucket was found 11 mi. downstream — battered beyond usability. The "headache" ball was never found. The sheet piling and 42-in. diameter pipe were in shambles on the bottom of the river. Irrigation water deliveries could no longer be made because of the breach in dam for the new river outlets.

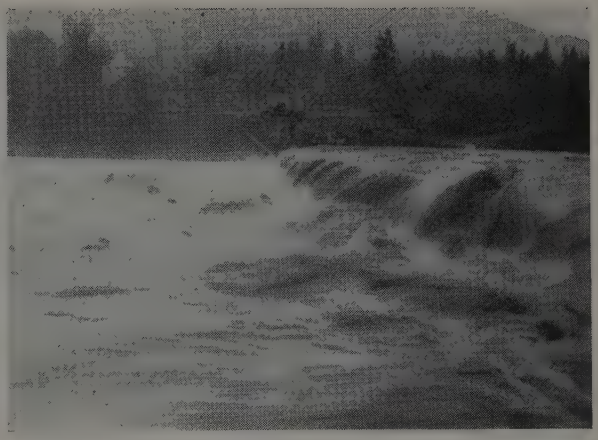
Cofferdam No. 1 rebuilt

The cofferdam which was originally built in slack water above the dam must now be rebuilt in fast water as most of the concrete had been removed from the dam in bays 10 and 11 preparing for river outlet construction, thus concentrating the flow and velocity.

Weather through the remainder of May and early June was rainy, keeping the river at a high level and making reconstruction of the cofferdam an extremely difficult job. The cool, rainy weather did reduce the early demand for restoring irrigation, but still, water users were worried as hot, dry weather was due and could be expected any day.

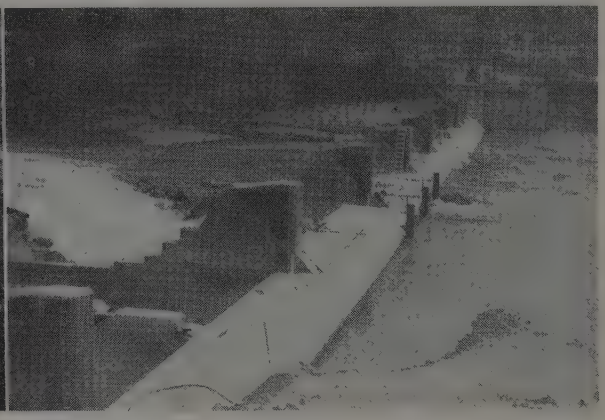
Initial attempts to rebuild the cofferdam using rock placer mine tail-

NOVEMBER 15, 1953—Downstream cofferdam for the north half of the dam has been completed to allow repair work on the badly eroded sluiceway and tailrace wing wall. Hole is 20 ft. deep.



NOVEMBER 23, 1953—About 300 cu. yd. of concrete had been placed in the spillway apron by November 22, when the river in 24 hr. time went from a flow of 3,000 cfs. to over 65,000 cfs.

NOVEMBER 30, 1953—This is all that remained of the downstream cofferdam after the November 23 flood. Little could be accomplished during the rest of the winter because of intermittent high water.



MARCH 18, 1954—View from south bank showing pier alterations. Clear opening between fixed stoplog guides is 47½ ft. for passage of drift logs in non-irrigation season.

ings and rock filled log cribs were unsuccessful. The mine tailings were too small to hold in the current and the log cribs washed away or collapsed before they could be filled with rock.

Taking a page from the Corps of Engineers' plan for diverting the Columbia River at McNary Dam with precast concrete tetrahedrons, the contractor located a source of concrete building piers at the abandoned part of the Camp White World War II army camp near Medford. The building piers were about 12 in. square with unformed footings and ranged from ¼ to ½ cu. yd. in volume. On June 11 work on the cofferdam was resumed using the building piers and placer mine tailings. Flow through the 49-ft. wide gap in the dam was then about 7,000 cfs. The building piers were end dumped and dozed ahead to form the foundation for the fill which was then built up with mine tailings which ranged in size from ½-in. to about 10-in. diameter with most of the rock in the smaller half of the size range. This combination of materials did the job. The rock and concrete block cofferdam was closed against bay 7 of the dam on June 17, forcing the river flow over the openings between the dam piers in bays 1 through 6. River flow was then slightly less than 6,000 cfs. Following closure of the cofferdam it was built up to above reservoir level with mine tailings and sealed by a clay blanket along the ustream side. Meanwhile the section of 42-in. diameter pipe was again placed spanning the river outlet excavation.

Cofferdam No. 2 lost

On June 24, as the dam was being readied for resumption of irrigation diversions, the river again came up, washing out a section of the cofferdam for some 125 ft. at the midstream end. Fortunately the 42-in. diameter pipe installed in the river outlet openings remained in place. Also most of the previously constructed cofferdam base of concrete building piers held fast. The cofferdam was rebuilt as before using concrete building piers supplemented this time with quarried granite rock, placer mine tailings, and sealed with a clay blanket on the upstream side. Full irrigation diversions were restored July 3.

The cofferdam proved surprisingly tight. Leakage, estimated at about 12 cfs., was collected by a secondary dike which raised it high enough for gravity diversion through the 16-in. diameter highway drain pipe opening through the dam in bay 12.

During the balance of the irrigation season, which ended October 2 when District crews opened the sluice gates under the pumping plant and drained the reservoir pool, the contractor completed concrete placement in the river outlets and carried forward other accessible work on the dam together with work on the cableway and stoplog storage facilities.

Following the end of irrigation it was necessary to remove the upstream cofferdam, thus diverting the river through the newly constructed river outlets before the spillway apron could be unwatered by a low downstream cofferdam. Removing and hauling the upstream cofferdam materials (made up of three successive constructions) proved a stubborn job. Haul roads were steep. Clay from the impervious blanket

had a soup-like consistency and slopped from the trucks, keeping the roads slick even when there was no rain. At the same time the contractor proceeded with construction of the overflow slabs in the multiple arch section of the dam.

When the upstream cofferdam was removed and the river diverted through the new river outlets, a downstream cofferdam was constructed and work was undertaken on the spillway apron repair where loose material was removed exposing a hole eroded under and downstream from the spillway apron, the sluiceway floor, and tailrace wing wall. This hole, which is 20 ft. deep below the apron at its deepest point, extends 9 ft. under the apron and more than 20 ft. under the tailrace wing wall. The concrete floor of the sluiceway was also found to be seriously eroded and it is planned to repair it under the present contract.

Heavy rains which began the afternoon of November 21 continued through Monday, November 23, swelling the river to flood stage. The river gage at the City of Grants Pass filtration plant read 1.7 ft. at 8:00 a.m. November 22, indicating a flow of approximately 3,000 cfs. Twenty-four hours later, when the flood crested on the morning of November 23, the gage reading was 21.2 ft. showing a discharge of 65,000+ cfs.

The river broke through the cofferdam and flooded out work on the spillway apron repairs Sunday, November 22. Up until then about 300 cu. yd. of concrete fill had been placed. This is approximately one-half of the concrete fill required for repairs to the spillway apron and tailrace wing wall. As the water was coming up, the contractor's superintendent, Bill Thatcher, put on his skin-diving outfit and salvaged pumps and equipment. Two small pumps and a coal tar enamel heating pot were lost.

During the winter little could be accomplished because of intermittent high water. The highway drain was extended and completed piecemeal. Cold weather in March held the river low permitting completion of the pier alterations, thus making it possible to use the new steel stoplogs for the 1954 irrigation season. At no time after their delivery early in February was it possible to install the radial gates in the new river outlets.

On April 16 the contractor dropped temporary stoplogs to close the river outlets for the 1954 irrigation season. These stoplogs were made of 10-in. diameter steel pipe filled with concrete for added weight and strength. They fitted between steel channel members set at each side of the outlet openings and were partially supported by a vertical steel I-beam in the center of each outlet opening. Attempts to seal off the stoplogged outlets sufficiently to install the radial gates have not been successful to date .The contractor plans to defer additional work until low water—probably August, when the reservoir pool will be lowered briefly while the gate openings are sealed. This plan will permit installation of the radial gates before the end of irrigation season.

When the end of the irrigation season comes about October 1, the downstream cofferdam will be restored and it will again be a race to get the spillway apron and tailrace wing wall repairs completed before the fall storms strike. It is hoped by then that it can be reported that the contractor, Young and Smith, can reflect on a job which has been delayed but not lost to the rascally Rogue.

The Savage Rapids Dam Rehabilitation is part of the Reclamation program administered under the supervision of Region 1, headquartered in Boise, Idaho, with H. T. Nelson as regional director. Designs and specifications were prepared under the supervision of the Bureau's assistant commissioner and chief engineer, L. N. McClellan, at Denver, Colorado. McClellan is responsible for contract administration. Field work is being supervised by J. W. Taylor, construction engineer, and the writer as resident engineer.

Highway fill to be "floated" over mud flats

AFTER TWO YEARS of close scrutiny by California Division of Highways engineers, the open-water unit of the Bayshore Freeway, which runs along the western shore of San Francisco Bay in San Francisco and San Mateo counties, will soon be under construction again.

This news was verified by the announcement that the Highway Commission had voted $1,500,000 for grading about a mile of the freeway between Sierra and Candlestick points. The job, which involves 1,500,000 cu. yd. of fill, can get under way soon after funds are allocated.

The scrutiny was required to establish the soundness of previous work, undertaken on a test basis to determine if it were possible to replace expensive pre-dredging of the unstable area by lateral displacement of Bay mud with fill construction **Western Construction**—August 1952, pp. 81-84.)

The Commission's action was taken on the basis of a letter received from George T. McCoy, state highway engineer, pertinent parts of which are quoted herewith.

"... this section of State highway is to be constructed across Candlestick Cove over soft mud varying in depth from 20 to 75 ft. An adequate design, based on exhaustinve tests of the underlying material, indicated that the fill should be constructed by pre-dredging to el. minus 20, backfilling the trench with 5 ft. of sand, building the remaining portion of the embankment to el. plus 8 with clean rocky material, and completing the fill to el. 17.5 with imported borrow. The estimated cost of constructing the fill in this manner in February 1951 was $7,706,000.

"This high cost, and the difficulties of financing such a project, led to further studies in an effort to determine if a less costly method might be found, even if it should invite greater risks.

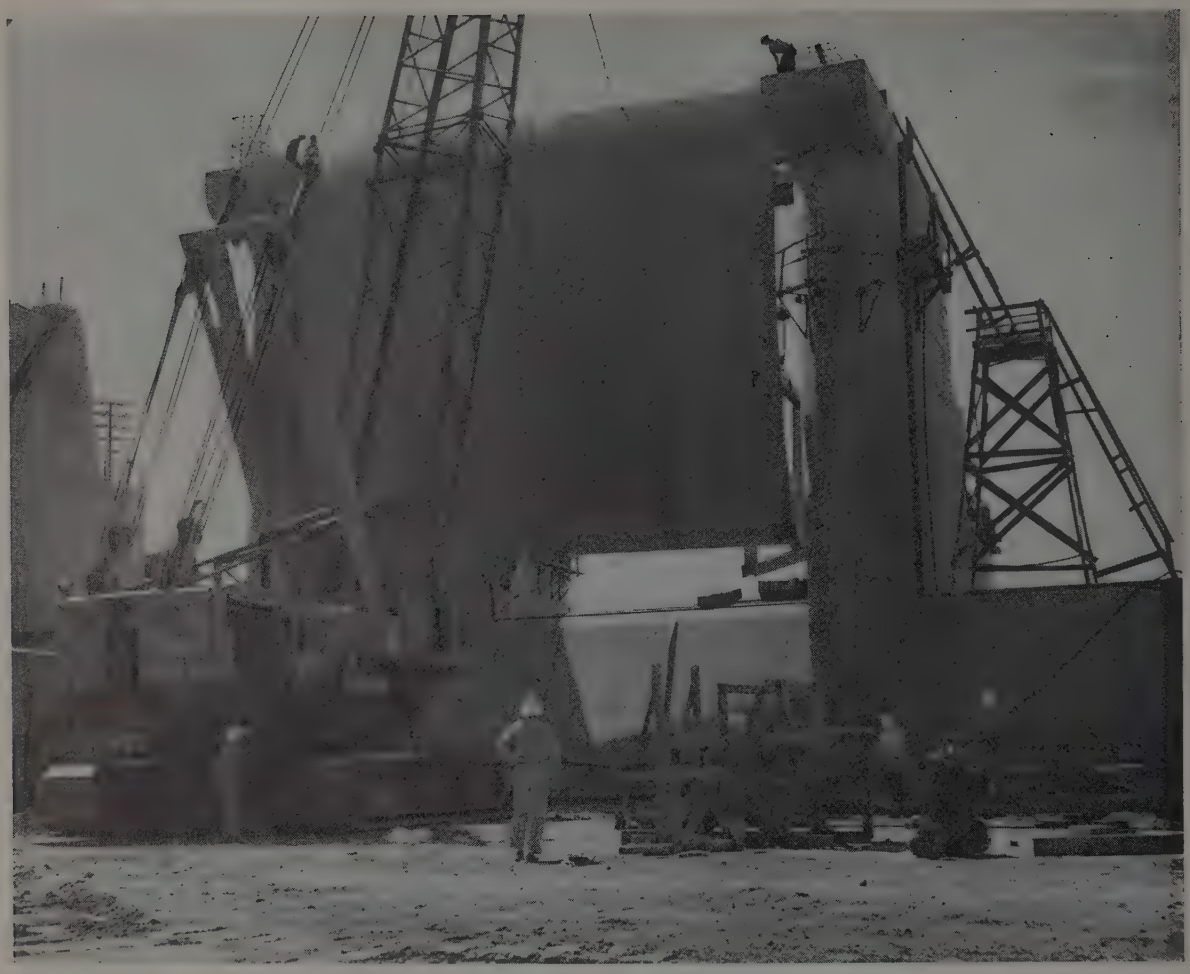
Experimental section

"Estimates dated February 23, 1951, indicated that, if a fill could be floated on the Bay mud, the work could be accomplished for $3,788,000. Although there was little engineering precedent to indicate such a method of construction would be successful, the possible savings, in my opinion, warranted the attempt. On February 28, 1951, I approved an experimental project to construct approximately 2,100 ft. of embankment southerly from Candlestick Point. It was believed possible to float a fill, 400 ft. wide at its base, at approximately el. minus 10.5 ft. below the top of the soft mud.

"While the flotation theory was not supported by construction, results of the first experiment were sufficiently promising to warrant further tests of the method on greater depths of mud, and in the spring of 1953, an additional section, approximately 1 mi. in length, extending over the deeper mud strata was placed under construction. The results of the two experiments demonstrate that a satisfactory fill can be constructed without pre-dredging. The embankment is stable with a base width of 200 ft. plus or minus and will carry eight lanes of traffic on a 132-ft. roadbed. It is now estimated that the total cost of the fill will be $5,200,000. While this is $1,412,000 more than the first estimate for the experimental fill, it is $2,506,000 less than the estimated cost of a pre-dredged fill.

"Based on tests to date, ultimate settlement on the fill is expected to be from 1½ to 5 ft., depending upon the depths of mud remaining beneath the constructed fill. Settlement is expected to continue over a long period."

The letter concludes with a table of costs for the total fill, which shows that of the overall total of $5,200.000, $1,060,000 has already been financed and plans have been prepared for another $1,500,000, leaving the sum of $2,640,000 yet to be provided.



Corps of Engineers photographs

Big lifts by a big crane

Prefabrication of tainter gates and precasting 60-ton concrete girders are possible when you have the equipment to handle the final product

AN EXCELLENT EXAMPLE of large-scale prefabrication, precasting, and erection was made recently at Dexter Dam. This dam, on the middle fork of the Willamette River in Oregon, will serve as a re-regulating reservoir for Lookout Point Dam, 3 mi. upstream. Contractors for construction of Dexter Dam under the Portland District Corps of Engineers administration are C. J. Montag & Sons and McNutt Bros.

The tainter gates were assembled and fabricated in what is believed to be a first for the method used. That is, construct the gates in a horizontal position in a cradle. According to Clyde Montag, the new method saves time, is more convenient, and is safer for workmen. The usual practice is to fabricate the gates partially elsewhere and assemble them at the dam, or to weld them together piece by piece in a vertical position where they are to remain.

The first gate was raised the latter part of May. The lift required only 45 min. from the time the cables were attached to the 44-ton gate until it was in place. The gate was then welded to the steel radial arms which will support it as it is raised and lowered to control the flow of the river. All seven gates are being fabricated at the project site and will be in place this month.

Similar in purpose was the precasting of the concrete bridge girders.

TAINTER GATE, all 44-tons of it, is shown being lifted shortly after taking it from the assembly cradle in the foreground.

MANITOWOC CRANE with 120-ft. boom has good control (above and below) in two steps of handling a 60-ton bridge girder.

These girders will form the roadway for the gantry cranes which ride the top of the dam and control the positions of the overflow gates. Normal construction practice would have been to construct the bridge in place between the piers. However, precasting the bridge on the ground increased the accessibility of supplies and materials and made it much easier for workers to do their job. It also substantially cut the total time and cost for that part of the work on the structure.

The bridge section shown in these pictures, which weighed 60 tons, was lifted into place by a Manitowoc crawler crane with a 120-ft. boom. This same crane was used to lift the tainter gates. There are two bridge sections between each set of piers. The downstream section weighs 60 tons and the upstream section weighs 75 tons. All sections of the bridge will eventually be lifted in the same manner.

Construction of Dexter Dam and powerhouse was started in April 1953. The plans provide for construction of an earth and gravel fill dam with a length of 2,250 ft., a maximum of 90 ft., and a gate-controlled concrete section 359 ft. long. The powerhouse will be located at the right end of the spillway section as part of the dam. To the right of this section will be constructed a concrete gravity non-overflow section. Re-regulation is scheduled at Dexter Dam in September 1954.

ROCK BOLTS

. . . theory and practice in tunnel construction and rock excavation

SECOND of two articles

By SETH D. WOODRUFF
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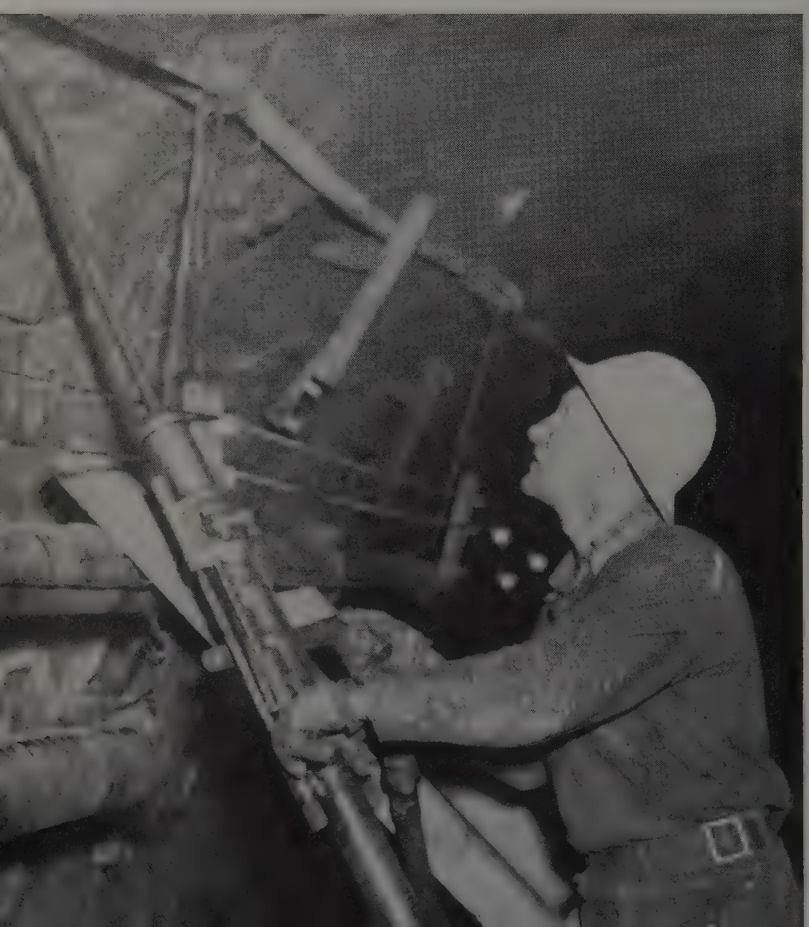
ROCK BOLTING is catching on in the West. Adoption of the technique has been slow only because of the widely varying rock conditions characteristic of rock tunnels and excavations in this region. By comparison to the fairly regular roof strata of eastern coal mines, for instance, Western metal mines and utility tunnel sites have required thorough geologic study and testing to determine safe standards of bolt installation.

An article in these pages last month might be said to summarize the findings of geologic study. Presently accepted theories, both as to the causes of structural failure of rocks and as to the remedial or preventive action of bolts, were reviewed. The article also described the common types of bolts, their anchorages and accessories.

This article treats of installation techniques and inspection, costs, and examples of bolt jobs. The examples —in excavations and in mine and utility tunnels—especially represent the program of testing that today has "proved" rock bolts in the West. Proof has meant acceptance, not only by engineers but also by contractors in the field. Here is the practical side of rock bolting.



DRIVING a bolt in Duchesne Tunnel, stoper steel fits into a "dolly" screwed on the bolt. Bureau of Mines tests show that bolt must go 1¼ in. over wedge to develop anchorage equal to bolt yield strength.

Bolt installation

Conditions are most satisfactory for bolting when the rock stands well enough that the face can be carried at least one or two rounds ahead of the bolts. In a few cases, however, bolts have been installed by working from the top of the muck pile before mucking out. Under these circumstances restricted headroom may require sectional rock bolts as well as special short-leg or offset stopers for drilling holes. Bolts may be installed to within a few inches of the face as they are not damaged by blasting.

Drilling

In tunnel work the holes may be drilled with either stopers or drifters. On large-diameter work drifters may be mounted on top of the jumbo so that bolt holes can be drilled and bolts installed in the roof at the same time that a round is being drilled in the face. In smaller tunnels where the roof can be reached from the floor, or by standing on a car, two men with a stoper can drill holes and install bolts in the roof, haunches, or walls, while a round is being drilled in the face.

For 1-in. bolts holes are usually drilled 1¼ in. in diameter. Anchor tests with a 50-ton jack have shown that the best shale anchorage is obtained with a 1¼-in. hole, best sandstone and limestone anchorage with a 1⅜-in. hole, and the best anchorage in granite and other hard rocks with a 1½-in. hole. For ¾-in. bolts with expansion shell anchors holes are usually drilled about 1⅜ in. diameter.

Bolt holes should be drilled with carbide-insert bits because they do not lose gage as rapidly as steel bits and the holes are of constant diameter, without taper, thus giving better anchorage.

Driving

One-inch bolts are anchored by starting a wedge in the slot, shoving the bolt up into hole, inserting the threaded bolt end into a "dolly" in the chuck of a stoper or drifter, and pounding the bolt for 20 sec. to 1 min. with drill throttle fully open. Various types of dollies are used to protect the threads while driving. One type screws on the threads, while another slips over the nut and bears against the chamfered end of the bolt.

Rock bolts should be tightened to the point where they exert enough pressure on the rock surface to prevent any movement. Pressure created should also be sufficient to close any seams and partings which have begun to open. The pressure required depends on the type and structural conditions of the rock and

the spacing of bolts, and may vary from a few hundred pounds to several thousand pounds per bolt.

In the stratified roof rock of coal mines bolts are commonly tensioned to about 10,000 lb. This force clamps the strata tightly together, as in a laminated beam, and supports wide roof spans.

If necessary, bolts could be loaded nearly to the elastic limit and a factor of safety would still exist before failure. With 1-in. mild steel bolts the average yield strength or elastic limit (pull at which bolt begins to stretch rapidly) is about 24,000 lb. and the breaking strength 35,000 lb. or more. The ¾-in. bolt has a yield strength of about 13,000 lb. and a breaking strength of about 20,000 lb. These breaking strengths are average figures and will vary with individual bolts and with the care used in threading and slotting.

Torque-load ratio

When installing rock bolts it is desirable to know what pull (in pounds) is being created in the bolt. If some torque-measuring device is used with the wrench as the nut is tightened, the pull can be calculated. The U. S. Bureau of Mines recently conducted experiments on 1-in. bolts to determine the ratio between torque applied to the nut and pull induced in the bolt. (U. S. Bureau of Mines Report of Investigations 4967, May 1953.) They found that the relation between torque and tension may be expressed: Torque (ft.-lb.) = 24 + 0.0235 x Tension. Conversely: Tension (lb.) = 42.5 x Torque — 1000. The tension will be within ± 2,700 ft.-lb. of that predicted by the above equation in 90% of the cases.

For quick approximation 1 ft.-lb. of torque produces about 40 lb. of load in the bolt. A torque of 260 ft.-lb. will produce an average load on a bolt of about 10,000 lb. The bolts tested by the Bureau of Mines were used as received, with no lubricants applied. Both rolled and cut threads were tested without significant differences. The tests were made with nuts bearing flat on plates and the threads in good condition. If the threads are damaged or a nut bears unevenly on its washer so that its corners dig in, then much of the torque will be used in overcoming this friction and less will go to stressing the bolt.

Wrenches

Torque wrenches may be ordinary long handled mechanic's wrenches equipped with a torque indicating scale or they may be pneumatic impact wrenches. The latter will quickly pay for themselves in increased speed of installation if many bolts are to be installed. Impact wrenches should be equipped with a torque indicating scale or provided with means for calibrating so that torque can be measured. A 600-ft.-lb. capacity pneumatic wrench will permit spot checking of installation by tightening an occasional bolt to the elastic limit. Electric torque wrenches available commercially are generally not of sufficient capacity for rock bolting use. Pneumatic wrenches suitable for rock bolting usually weigh 25 to 30 lb. and cost from $400 to $500.

ANCHOR BARS at Hoover Dam are king-size—2 in. in diameter and up to 30 ft. long. Driven on 7½-ft. centers and tensioned to 63,000 lb., they anchor a rock slab on the canyon wall above Nevada valve house. Slab is about 120 ft. high, 180 ft. long, and up to 19 ft. thick. After pinning, rock was pressure grouted as an added safety measure.

Bolting costs

The 1-in. bolts with slot-and-wedge anchorage sell for about $1.25 each in the 5-ft. lengths complete with wedge and nut. Bolts 3 ft. long sell for about $0.95 each complete, and 7-ft. bolts for about $1.60 each. The 5-ft. bolt assembly weighs about 14 lb. Plate washers 8x8 in. for bearing against the rock weigh about 7 lb. and cost about $0.50 each. Thus, one 5-ft. bolt complete with large plate header washer costs about $1.75 and weighs about 21 lb. If steel channels are used against the rock the large plate washers are not necessary.

A ¾-in. bolt 5 ft. long complete with expansion-shell anchor costs about $1.05 and weighs about 8 lb. A bolt together with an 8x8x⅜-in. bearing plate costs about $1.55 and the assembly weighs about 15 lb. All prices mentioned are f.o.b. factory and freight charges must be added for total cost.

Unit labor costs

In the coal mining industry where roofs are flat and easy to drill, and short bolts may be used, it is possible for two men to install more than 100 bolts per shift. In tunnel work, however, backs are ragged and irregular and the rock is usually hard and more time is required for spotting and drilling holes and for placing the bolts and headers. Under these conditions two men do not commonly install more than 30 bolts per shift. An average shift's work for two men is about 20 to 25 bolts and headers. This assumes that they are equipped with pneumatic torque wrenches for tightening bolts.

With wages at $15 per shift, miners working on a "contract" basis can install bolts for about $1.50 each. With miners' wages at $20 per shift the contract rate should be about $2 per bolt. When conditions are such that men cannot work continuously at installing bolts because of interfering operations and they must be installed on "company pay," then unit labor costs (with wages at $20) may run from $2.75 to $3.50 per bolt complete with headers.

The total labor costs for installing rock bolts and appurtenances are about the same as for installing the equivalent rib-and-lagging support. Thus, the economy of rock bolting is largely due to quantity reductions, that is, reductions in the amount of support materials, excavation and concrete.

Bid prices

On a tunnel job in 1953 the successful bidder's price for rock bolts and appurtenances was $0.25 per lb. complete, installed. At a price of $0.25 per lb., a 5-ft. rock bolt with 8x8x⅜-in. header plate would cost about $5.25 complete, installed. If, instead of header plates, light steel

channels are used to furnish continuous support between bolts, then a 4-in. channel weighing 5.4 lb. per ft., or a steel tunnel tie weighing 5 lb. per ft., will ordinarily be large enough. If bolts are spaced on 4-ft. centers then 4 ft. of channel will be 22 lb. + 14 lb. = 36 lb. At $0.25 per lb. the cost will be $9 a bolt, complete, installed with steel-channel header.

Bids are also taken on the basis of linear feet of rock bolt furnished and installed. In such cases low bids range from $1.00 to $1.50 per ft. Where large numbers of bolts are to be installed systematically and at relatively close spacing, the lower price would apply. The higher figure covers situations where bolts are to be infrequently used at widely scattered points.

COSTS COMPARED: Rock bolts vs. rib-and-lagging

EXAMPLE: 9-ft. nominal diameter (excavated section)

RIB-AND-LAGGING—Criteria: 4 in. 13-lb. H-section sets at 5-ft. centers

Materials	No.	Dimensions	Quantity		Unit Price	Cost
Steel set	1	4x4-in.	21 ft. at 13 lb.	273 lb.		
Splice & base plates	4	6x6x⅜-in.	at 4	16		
Tie rods & nuts	6	⅝-in. by 5.1-ft.	31 ft. at 1	31		
			Total steel	320 lb.	$0.25	$80.00
Lagging		2-in. by 5-ft.		60 fbm.		
Collar braces	6	3x4-in. by 5-ft.	30 ft. at 1 fbm.	30		
Blocking		Miscellaneous		10		
			Total timber	100 fbm.	0.35	35.00
			TOTAL COST			$115.00
			or $23 per lin. ft.			

ROCK BOLTS—Criteria: 5-ft. bolts at 3½-ft. centers along 5 longitudinal steel channels

Materials	No.	Dimensions	Quantity		Unit Price	Cost
Channels	5	4-in.	17½ ft. at 5.4 lb.	95 lb.		
Rock bolts	5	1-in. by 5-ft.	at 14	70		
Washers	5	3x3x⅜-in.	at 1	5		
			Total steel	170 lb.	$0.25	$42.50
			TOTAL COST			$42.50
			or $12.15 per lin. ft.			

EXAMPLE: 14-ft. nominal diameter (excavated section)

RIB-AND-LAGGING—Criteria: 6-in. 12.5-lb. I-section sets at 4-ft. centers

Materials	No.	Dimensions	Quantity		Unit Price	Cost
Steel set	1	6x3.3-in.	31 ft. at 12.5 lb.	387 lb.		
Splice & base plates	4	7x8x½-in.	at 8	32		
Tie rods & nuts	8	¾-in. by 4.1-ft.	33 ft. at 1.5	49		
			Total steel	468 lb.	$0.20	$93.60
Lagging		2-in. by 4-ft.		80 fbm.		
Collar braces	8	2x6-in. by 4-ft.	32 ft. at 1 fbm.	32		
Blocking		Miscellaneous		20		
			Total timber	132 fbm.	0.30	39.60
			TOTAL COST			$133.20
			or $33.30 per lin. ft.			

ROCK BOLTS—Criteria: 6½-ft. bolts at 3½-ft. centers along 7 longitudinal steel channels

Materials	No.	Dimensions	Quantity		Unit Price	Cost
Channels	7	4-in.	24½ ft. at 5.4 lb.	132 lb.		
Rock bolts	7	1-in. by 6½-ft.	at 18	126		
Washers	7	3-x3x⅜-in.	at 1	7		
			Total steel	265 lb.	$0.25	$66.25
			TOTAL COST			$66.25
			or $18.90 per lin. ft.			

Comparison to rib-and-lagging

Generally, other conditions being equal, the number of bolts required varies directly with the diameter of the tunnel. The following discussion assumes that structural steel channels (or steel ties) are installed approximately parallel to the length of the tunnel and that rock bolts are spaced at intervals along them.

In tunnels of 6- to 7-ft. nominal diameter, two or three channels across the roof, spaced at 1½ to 2½ ft. center to center, with rock bolts spaced at 3½- to 4-ft. intervals along the channels, should be sufficient to support the roof and/or haunches. In tunnels from 7- to 9-ft. diameter three or four channels may be required; tunnels 9- to 11-ft. diameter may require four to five channels; 11- to 13-ft. may take five to six channels; 13- to 15-ft. six or seven channels. These figures are only approximate and vary with rock conditions. They apply only to the roof and haunches.

It will frequently occur, when a tunnel parallels steeply dipping fault shearing, sedimentary bedding, or other planes of weakness, that the roof needs no support but slabs and blocks tend to peel from the sides. These can be prevented from peeling by bolting one or two steel channels or lagging horizontally along the tunnel sides with bolts on about 4-ft. centers. Often only one side of a tunnel needs any support.

Examples of costs

Comparison of tunnel support methods is most effectively done by example. A tabulation with this article reviews in detail the material requirements and bid costs for typical tunnel sections of 9-ft. and 14-ft. diameter.

The examples presented are cost comparisons for full support of roof and haunches. The cost will be more favorable to bolts where conditions are such that fewer channels or bolts are needed, as when only one wall or one haunch needs stabilizing. In such cases the cost of support by bolts may be only 20 to 30% of cost of rib-and-lagging support.

As mentioned above, the use of rock-bolt support allows a reduction in the amount of excavation and also in the amount of concrete required for lining. Tunnel designs ordinarily require that supported portions of tunnel be excavated to larger rock section than unsupported portions. When rock bolts are used the excavation dimensions remain the same, supported or unsupported. This means that the pay line is moved

in from 4 to 6 in. around the tunnel perimeter.

In large tunnels the saving in excavation and in concrete may amount to about ½ cu. yd. per lin. ft. of tunnel. With excavating and concreting each costing about $25 per cu. yd. the total saving will be about $25 per lin. ft. For small tunnels the smaller rock section will save about ¼ cu. yd. per lin. ft. With excavating and concreting each costing about $50 per cu. yd. the saving in cost per lin. ft. of tunnel will again be about $25.

Another important advantage is that bolts can often be installed at the same time that drilling proceeds at the face, thus reducing the time that other operations must be suspended while waiting for support to be installed. In the case of the East Delaware Tunnel, when rock bolting was substituted for conventional tunnel support it was found that 100% of the rock bolt support could be installed while the round was being drilled at the face. And bolting did not delay the other work. With conventional rib-type support only 25% could be installed during the time the round was being drilled. (U. S. Bureau of Mines Information Circular 7652 November 1952.)

Timber support

It will be noted that in the accompanying examples comparison was not made with cost of support by timber sets. In the past 20 yr. timber supports have been almost completely replaced by steel ribs in "utility" tunnel construction because less space is required for equivalent strength. The additional excavation required when timber is used together with added concrete required, generally makes the cost for using timber sets higher than that of steel —in addition to the objectionable feature that timber in the concrete may eventually decay and leave undesirable voids behind the tunnel lining.

Examples

The largest installation of rock bolts in utility tunnel work is in the above mentioned 25-mi. East Delaware Tunnel constructed for the New York City Board of Water Supply. Rock bolts 1 in. in diameter and 6 ft. long were installed with steel tunnel tie headers to support the roof. Up to May 1952 over 12 mi. of this 13-ft. diameter tunnel had been supported with bolts as compared with about 7 mi. supported with conventional steel ribs and 2 mi. unsupported. Steel tunnel ties were installed parallel to tunnel lengths, 5 or more across the width of the roof.

This tunnel was driven through thinly laminated flat lying shales and sandstones and sides stood well while slabs tended to peel from the roof. The shales tended to decompose when exposed to air and, after bolting, the rock surface was gunited with a ¾-in. layer of cement mortar to prevent the slaking. Steel used in this rock bolt installation averaged 50 lb. per ft., as compared with 350 lb. per ft. for conventional steel rib and lagging support. The contractor gained considerable time also, as he was able to install 100% of the rock bolts while the crew was drilling out the face. With steel rib support the contractor could install only 25% of the support while the crew drilled at the face. The remaining 75% had to be installed in competition with other operations.

Alcan project

Rock bolts were used in the Kemano Powerhouse in British Columbia. This cavern is 120 ft. high, 83 ft. wide and 700 ft. long. The rock is granodiorite and bolts up to 15 ft. long were used to pin slabs and otherwise stabilize the walls until the concrete could be poured for permanent support.

Western Construction in its September 1953 issue described an application of rock bolts at Folsom Dam where bolts 1½ in. diameter and 14 ft. long were used to pin a rock face 30 ft. high. Bolts were anchored with slot and wedge and were spaced on about 5-ft. centers in both directions. Bolts were installed as the rock excavation progressed downward.

Another instance of rock bolts applied to tunneling was described in **Western Construction** for August 1953. At Box Canyon Dam in Washington a diversion tunnel 38 ft. high, 38 ft. wide and 225 ft. long was driven through crystalline limestone. The rock at downstream portal was somewhat broken and blocky, so the contractor installed rock bolts 20 ft. long 8 ft. outside the tunnel perimeter and parallel with the tunnel center line. Other loose rock was secured with 6-in. structural steel channels pinned with 8-ft. rock bolts. The contractor began by driving a 5- x 7-ft. heading at the peak of the tunnel arch and bolting the back with 6- and 8-ft. bolts. He then enlarged the 5- x 7-ft. heading with one row of holes at a time and bolted each segment of back as exposed.

Reclamation tunnels

At Keyhole Dam in Wyoming, a Bureau of Reclamation project, bolts were used to support loose blocks of rock in the roof of the 650-ft. long outlet tunnel driven through sandstone. Except for 27 bolts at the outlet portal face of the tunnel all bolts were 1 in. in diameter and 6 ft. long. They were equipped with slot-and-wedge anchorage and with 8x8x⅜-in. plates for bearing against the rock. Angle washers were used when the rock surface was not normal to the axis of bolts. Bolts were installed in 1¼-in. holes drilled with a stoper. Each nut was tightened sufficiently to withstand a 275-ft.-lb. torque-wrench test or until the bearing plate began to distort. At the start of tunneling operations 4 bolts were installed for each 4-ft. length of tunnel. Experience, together with better rock conditions, indicated that fewer bolts could be used and finally 2 bolts for each 6 ft. of tunnel proved satisfactory. Additional bolts were installed where seams or joints angled across the tunnel.

At Duchesne Tunnel in Utah, another reclamation project, bolts were

PULL-OUT TEST in Duchesne Tunnel uses 50-ton jack. Pulls up to 10 tons were applied with no slippage. Bureau of Mines furnishes men and equipment for tests on request.

MODERATELY FRACTURED and blocky rock in Gateway Tunnel is bolted at irregular intervals over roof and haunches. These are 1-in. bolts with nuts set down on 3x3x⅜-in. header plates.

RAILROAD CUT in Montana uses bolts to stabilize massive, non-stratified rock which breaks into big, irregular slabs. Bolts stabilize toe, which in turn supports rest of cut bank.

used to control "popping" (minor rock bursts) and slabbing of the rock in a 238-ft. section of the tunnel driven through a thick bedded, hard quartzite. Bolts 1 in. in diameter were used in 5- and 6-ft. lengths and spaced at 4- to 5-ft. intervals. Holes were drilled and bolts driven with a stoper. Tests with a torque wrench on 10 bolts picked at random showed that the nuts had been tightened to from 300 to 640 ft.-lb. of torque.

Bolts in mines

Most Western metal mines have been experimenting with rock bolt applications for the past 4 yr. although Anaconda Copper Mining Co., at Butte, has been using rock bolts since 1939. In these mining operations tunneling (drifting or crosscutting) is a continuous process and there has been more opportunity to apply rock bolts than in the field of utility tunnel construction.

The pattern generally used in drifts and crosscuts in bad ground consists of a ring of 6 or 7 bolts installed radially around the perimeter of the tunnel with the lowest bolts at about hip height. Bolts are usually spaced about 2 to 2½ ft. apart around the ring and rings are spaced 3½ ft. to 5 ft. apart along the tunnel. Bolts are commonly used in 5- to 6-ft. lengths although occasionally 8-ft. bolts are used. The longer bolts may be used in the roof and shorter bolts in the sides, depending on the stress conditions. Where ground is firmer 3 bolts across the roof at 4- or 5-ft. intervals are usually sufficient.

Anaconda Copper Mining Co. in its Butte mines has recently been using more than 2,000 rock bolts a month in support of underground workings. The mine workings are in Butte granite which is, of course, a non-stratified rock. By replacing the conventional timber with rock bolts the company is able to reduce the size of openings by from 22 to 37%. Bolts have been completely successful in stabilizing rock. The surface of the granite tends to slake when exposed to warm, moist exhaust air from the mine and some openings have been gunited after bolting. The first crosscuts, which were driven and bolted in 1939, are still in perfect condition 15 yr. later.

Conclusions

The engineer who designs a concrete structure can obtain maximum reinforcement with least amount of steel by employing steel in tension for "prestressing" the structure. Similarly, the most effective rock support is obtained by employing steel in the form of rock bolts and tensioning them to "prestress" the rock.

The tendency is to adhere to the long-used methods of support because this support is entirely visible when installed and therefore "looks strong." Also the engineer can predict its behavior by mathematical means. Conventional support consists essentially of a framework of columns and beams erected under the rock to support it. Steel so employed cannot always utilize its strength to best advantage any more than would be the case if a concrete structure were supported with steel framework in lieu of using interior steel reinforcing. Conventional tunnel supports hold up the rock which has already loosened enough to drop down on the supports. Rock bolts reinforce the rock before it fails and enable it to support itself.

The writer is not advocating the indiscriminate use of rock bolts under all conditions. Obviously, rock composed of poorly consolidated sand, gravel, boulders, rounded or weathered fragments, fault clay or soft shale, and similar rocks cannot be held together by bolts. A rock bolting program should be planned by technical men familiar with geological conditions both visible and anticipated. The planners should also be familiar with the mineralogical composition, chemical and physical weaknesses, and structural characteristics of the rock being bolted, and should be familiar with tunneling practice. Generally, conditions will change from day to day. Therefore, if it is not possible to have close technical supervision on every shift to spot the locations for bolts, then a plan for regular installation should be blueprinted and rigidly adhered to by the miners. This pattern should allow ample factors of safety for all conditions and installations should be inspected periodically afterward for any signs of failure.

Checking installations

The most rapid and effective check is to spot check an occasional bolt with a torque wrench to see whether the load on the bolt has changed significantly since it was installed. Loadings which do not change indicate that the bolts have stabilized the rock. A decrease of the load on a bolt indicates either that adjacent bolts installed later have taken some of its load, that rock has "slaked" away under the header, or that the anchorage is slipping. Increase of load on a bolt may indicate that adjacent bolts have slipped, or that the rock was not pinned tightly enough and had loosened slightly with result that more rock above it has followed it down. This may be remedied by tightening bolts to greater loads at the time of installation or by spacing them closer together.

The author wishes to express his appreciation to Rush T. Sill, consulting engineer and geologist of Los Angeles, for his advice on the preparation of this article.

Seattle's Skagit Project has the world's first—

"Self winding traction slope hoist"

By C. W. CUTLER
Consulting Engineer
Seattle, Washington

Hoist unit has its own motor and traction drum, "crawls" up a dead cable —Ross Powerhouse personnel ride fast and safely in all weather—Low operation and maintenance costs are features

A "SELF WINDING traction slope hoist," the first of its kind anywhere, went into operation at Diablo Dam on the Skagit River in May 1954. The light, fast, economical installation was built to carry Ross Powerhouse operating personnel. Ross Powerhouse is at the upstream end of Diablo reservoir. Permanent camp for Seattle City Light personnel on the project is at the base of Diablo Dam.

Two problems

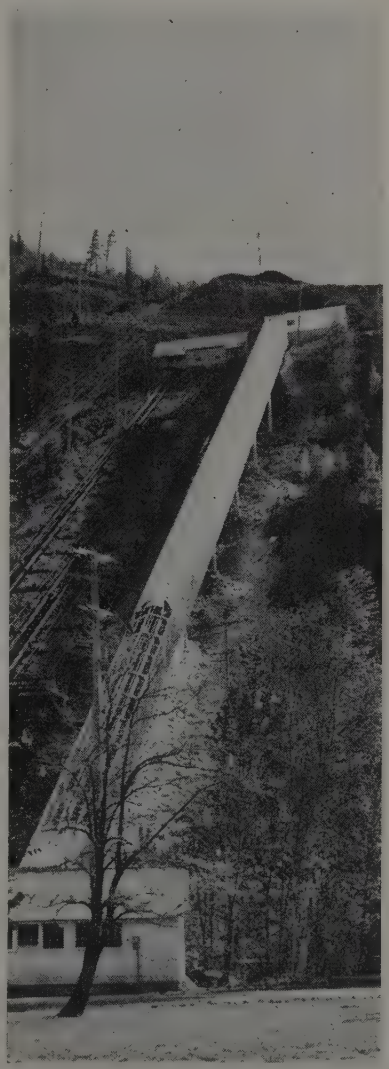
The hoist was designed to solve two problems. One was the expense of a 24-hr. hoist operating crew—necessary for the big drum hoist already in place, which had been built to move construction materials and supplies for Ross Dam construction. The other problem was the time element: the big hoist moves 600 ft. on a 42-deg. slope, and at a rate of only 100 ft. per min. The open platform of the drum hoist is an unpleasant ride when the weather is bad. Rain is a year-round proposition. And in December, January, and February; rain, sleet, slush, snow, and high wind frolic with each other almost continually. Temperatures vary from 45 deg. above zero to 10 deg. below.

Criteria for the new hoist were established—ten in all: (1) low cost, (2) fast travel, (3) dead cable construction with no idlers and resulting necessary maintenance, (4) no control cables, (5) fully automatic operation, (6) proper safety features in case of cable or power failure, (7) easy maintenance, (8) feasibility of manufacture with present factory methods, (9) simplicity of installation in the field, and (10) operation in any kind of weather.

Double cable layout

The resulting design is illustrated schematically on these pages. The figure also shows a layout of double cables. Only one would be necessary; the second is for safety on the Skagit installation. The cables are anchored at the top of the slope, pass around the traction drum combination, and at the bottom of the slope are held in heavy tension by a 6-ton counterweight.

A special feature of this unique design is the transition of the cable from the driving drum to the idler drum directly above. This combination makes multiple wraps possible and prevents rolling and slide slippage of the cable, as would be the case on a gipsy. By this arrangement the effective coefficient of friction is kept at a much higher value than were the cable crawling on the shell.



As built, the hoist has a cage with a usable floor space of 45 sq. ft. and a payload capacity of 1,750 lb. as a personnel carrier. Its speed of travel up the hill is 232 ft. per min., and down somewhat faster. Total weight of the cage, loaded, is 12,000 lb.

Full speed in 5 steps

The cage accelerates upward in five steps to full hoisting speed. It approaches the upper landing under control of track slowdown and stop limit switches. It accelerates in the downward direction, passing first through d-c dynamic braking into a-c regeneration. It approaches the lower landing in d-c dynamic braking position and stops, all under control of track limit switches. This gives a relatively low landing speed from which the car can be spotted by use of the service brake.

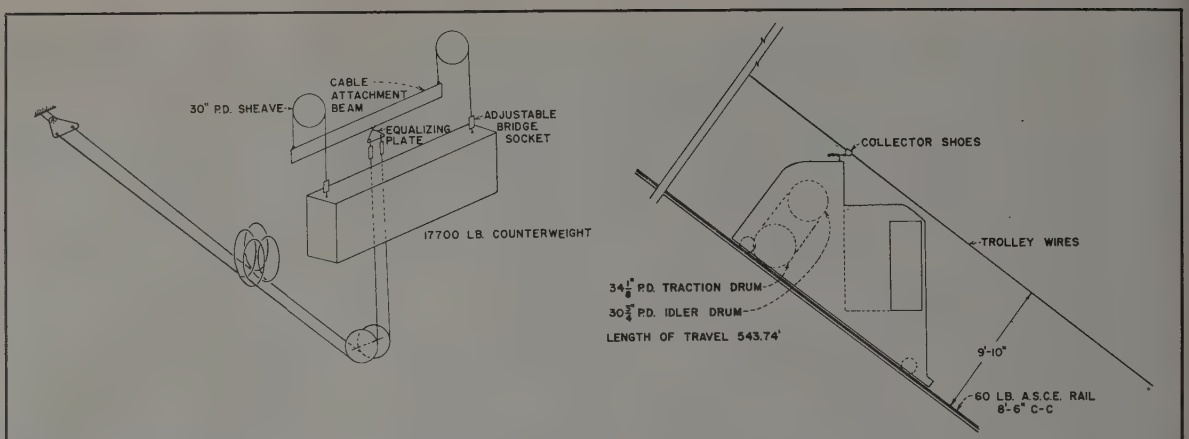
At the landing the controls are engaged with the platform doors through special bayonets so that the car cannot be started again until all doors have been closed and latched. There are no control trolleys up the slope, the only control outside the cage being at the platforms for calling the cage up or down.

Another feature is the track brake which grips the rails in case of emergency. This set of cast iron shoes snaps shut in 0.15 sec. or less upon failure of electric power, electrical equipment, gears, cable, or driving machinery. It also clamps the rails in case of cable slippage on the traction drive regardless of cause. This hoist, then, may be classed as having maximum safety. In fact, it exceeds most slope hoists in the United States in this respect.

Exploratory study first

An exploratory study preceded the hoist design. And all available types of conventional hoist were considered. Comparison was also made with monorail, overhead cable tram, and cog types. Due to the climate, all but drum and traction hoists were eliminated early in the analysis. (See box.)

Generally speaking, these remain-



SCHEMATIC SKETCHES show hoist operation essentials. Diablo Dam installation is powered by a 50-hp., planetary-type, General Electric gear motor (440-volt, 3-phase, 60-cycle, 68 rpm). Cables are 2⅞-in. plow steel wire rope—capacity 64,000 lb.

ing two types presented common problems. Most important, they involve live cables with many idlers per strand up the slope. For installation at Diablo Dam, a counterweighted drum hoist with machinery at the top would require two sets of tracks, one for the cage and one for the counterweight. It would require 630 ft. of cable for each hoist rope and 1,200 ft. for the counterweight—unless the counterweight cable were also wound on the main drum, in which case it would also be 630 ft. long. There would be required 30 idlers for the counterweight cable, and for each hoist rope.

Counterweighted hoist

A counterweighted traction hoist, again with machinery at the top of the incline, would have similar requirements. Each cable would be 1,200 ft. long, with a set of 30 idlers upgoing and 30 idlers downgoing.

The equipment offered by builders, adaptations of commercial elevator designs, was fairly costly. This was partly because of the size needed and partly because the safety features required were not available for slope hoists. Also, in adapting elevator equipment, the controls in the cab would have to communicate with the machinery at the top of the slope either by multiple conductor cable (as in vertical shaft elevators) or through multiple trolleys. In both cases the maintenance would be high. And weather conditions would make the use of low trolley voltages difficult. As a result, control wire interruptions would be frequent.

Many design problems

Design of a self winding traction hoist was found to pose many problems, not all of them operational as reviewed above. There was a need for light weight in order that the size of the drive be kept to a minimum. Only with great care in choice and use of materials is this type of hoist feasible. Since it is an unbalanced hoist, with no counterweight, the weight of the car and all its equipment bears directly on the power needed for operation. Bulky equipment means excessive cost.

Alternate bids on the mine hoist and conventional live rope friction drive were called for, leaving the design open to the supplier's wishes. It was found that the over-all costs were somewhat higher than for the self winding traction slope hoist. It was further found that manufacturers of both elevators and hoists were reluctant to invade this field of long slope hoist needs, either on a customer design or a design of their own. It is, therefore, considered that this manlift just now put into operation by the City of Seattle is a contribution to the art of long slope hoist design.

Longer run is better

One notable factor in this type of design is that the longer the run, the more favorable becomes the comparison with other types of lift. Adaptability to long runs in mountainous terrain may lead to many varied applications.

The motor was manufactured by the General Electric Co. and the automatic control by Rundel Electric Co. Manufacture of the cage and cage assembly was done by Pacific Coast Engineering Co., which showed fine co-operation and enthusiasm in detailing and execution of the construction. The runway and general installation was accomplished by Buchanan, Sather & De Rycht.

Cutler performed tests

The design was originated by C. W. Cutler of C. W. Cutler Co., Seattle, consultants. Direction of construction and tests were done by this company for the City of Seattle. Rundel and Pacific Coast Engineering furnished factory representatives as testing supervisors in the testing phases of the work. Much credit is due these companies for their fine work in producing this new type of hoist.

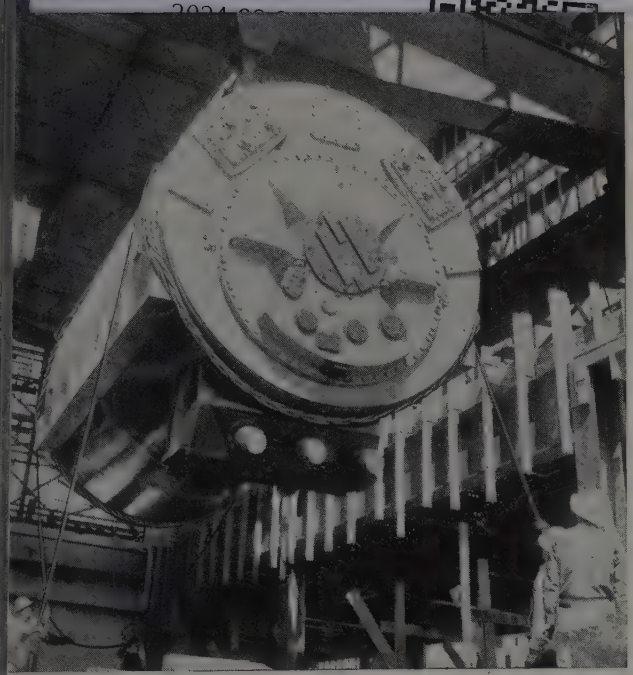
. . . only a few types

THE INCLINE is a familiar type of lift for material handling or for handling whole railroad cars in mountainous terrain. It generally takes one of two forms, both depending on moving cables.

The common arrangement is that the cable winds on a large drum in one layer. The drum is located at the top of the incline and is driven by an electric motor. Such a drum hoist is commonly known as the mine hoist or engine type.

A second type is the traction hoist. Its basic unit is a powered traction wheel, a single sheave lined with synthetic rubber for gripping power. At one end of the cable is a hoist platform and at the other is a counterweight. This method obviates the need for a large winding drum, reducing both size and cost. It is quite economical in a vertical shaft, but has its problems where both cage and weight must have inclined rails and idlers for the cables.

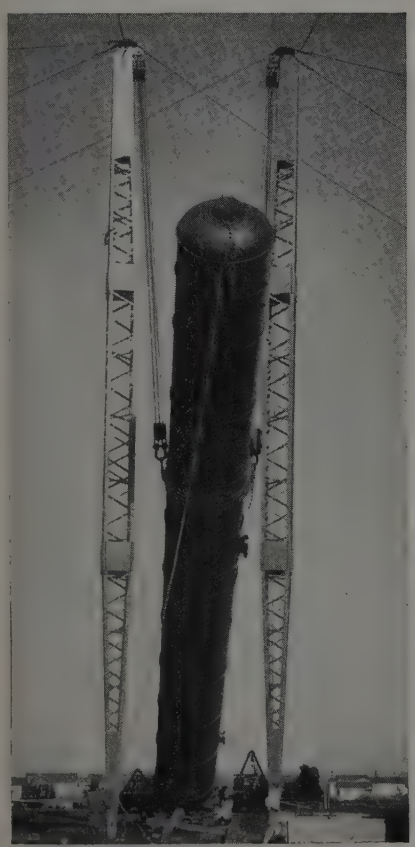
There is a light duty type known as a "spider," for short runs. It carries a reel in the cage and rolls the entire cable in as it ascends. It is not well suited for carrying personnel.



Multiple-part Red-Strand Slings are always trusted to handle heavy loads. They are easy to apply to both the load and the crane hook. User tests in Detroit proved Red-Strand slings withstood unusual abuse, yet maintained higher-than-rated strength.

A Gary plant uses Red-Strand single-part slings for many lifting jobs like this. These slings are available with various combinations of end fittings for attaching the sling to rings or lugs. Single-part slings frequently are the most economical to use.

How to Select the Correct Sling for Your Job



A heavy cylindrical load like this usually calls for the use of multiple-part Red-Strand Flat-Laced slings. They are strong, flexible and do not slip or abrade on smooth round surfaces.

Start your sling selection by analyzing five factors:

1. The load—its size, weight, shape, finish.
2. Working area, amount of head room.
3. Size and type of crane hook.
4. Angle of sling legs.
5. Location and type of lugs or rings, if any.

This is basic information. From it, your supplier can recommend the sling by type, size and length that is safest, longest lasting and most economical for your job.

Types of Slings

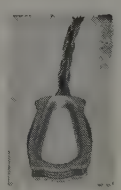
Multiple-part slings are always recommended for heavy duty service, because for equal strength they are far more flexible than single-part slings. They hug the shape of the load easily, present a greater bearing surface to the load, and reduce the possibility of marring finely finished surfaces.

Where these factors are not so important, either Red-Strand *single-part slings* or *grommet slings* may be used for economy. Single-part Red-Strand slings are often recommended for lifting lighter weight objects, or those that have fixed attaching rings or lugs. Grommet, or continuous strand Red-Strand slings are ideal for forming hitches of various types without fittings.

How to Gain Extra Savings

Two suggestions will help you save money on slings.

The first is to re-use Pin-Lock thimbles on multiple part slings. They increase sling life by protecting loops from abuse or damage. Besides, these exclusive Leschen Pin-Lock thimbles cut sling costs on an average of 21% because they may be used again and again. They lock into sling loops with pins instead of permanent clamps, permitting re-use, and eliminating constant expense of thimble replacements.



Re-useable Pin-Lock thimbles reduce sling costs by 21%

The second suggestion is to use Red-Strand slings—for a very simple but good reason: Red-Strand slings are made of *higher-than-rated* quality Leschen wire rope that delivers *longer-than-expected* service.

Get a copy of Leschen's *Sling Handbook* for complete information. Ask your Leschen man for one, or write.

LESCHEN WIRE ROPE DIVISION
The Watson-Stillman Company
(A SUBSIDIARY OF H. K. PORTER COMPANY, INC.)
St. Louis 12, Missouri

LESCHEN
HERCULES Red-Strand
WIRE ROPE

230 tons jacked 26 ft. in 9 days

UNLOADING two 230-ton main generator stators and moving them to position 650 ft. away horizontally and 26 ft. vertically was recently accomplished for the Etiwanda steam station of the Southern California Edison Co.

When the first stator arrived at the job site on a special railroad car, hydraulic jacks were placed under the hydrogen cooler frames at each end of the stator. Each end was raised sufficiently to allow insertion of two temporary 12-in. welded steel I-beams at right angles to the longitudinal axis of the stators. Under the two beams, four small steel sleds built of 4-in. I-beams were placed at each beam end to transfer the load from the large beams to 6-in. diameter hardwood rollers 4 ft. long. The entire stator was pulled ahead along 4-ft. high temporary cribbing topped with two 2x12 planks to form a base for the rollers. Using a single line from a winch truck, the stator was moved approximately 650 ft. in a horizontal direction along this type of temporary cribbing.

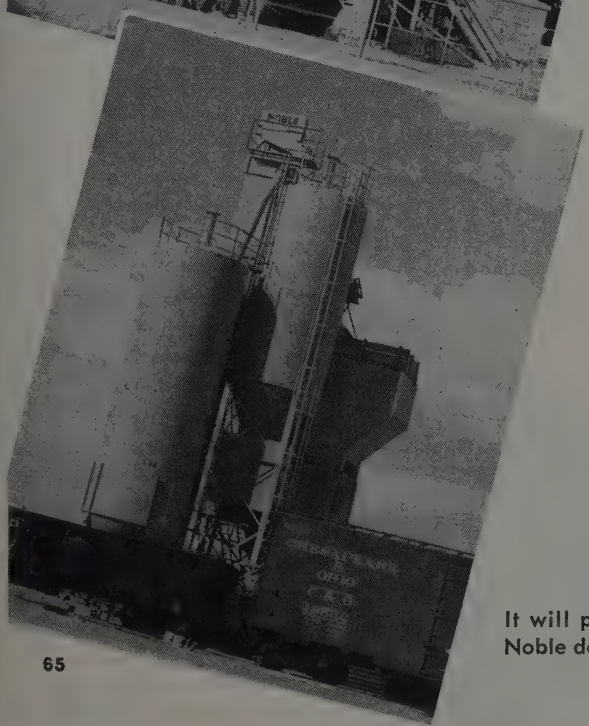
At a location where the stator was to be raised vertically 26 ft. by jacking, 12x12 timber beams were laid on the ground spaced closely together and with their longitudinal axis parallel with the axis of the stator. On top of the 12x12 timbers were placed 1½-in. thick steel plates to cover the area required for the main cribbing.

The cribbing consisted of 4,800 pieces of 6x8-in. by 4-ft. long Douglas fir. Ten sections or stacks of cribbing 4 ft. square were required—five stacks at each end of the stator. The sections of cribbing were also laced together with 2x12 planks running in alternate directions for each 4 ft. of vertical height.

Jacking to raise the stator vertically proceeded one end at a time in 6-in. lifts. Four 50-ton hydraulic jacks were set under the temporary steel beam under one end of the stator. As soon as a lift of slightly over 6 in. was made, temporary blocking was set around the jacks. Now the two sections of cribbing under the ends of the 12-in. steel beam were free and a full layer of permanent 6x8-in. cribbing was installed. The jacks then again raised the load, temporary blocks around the jacks were removed, and the load was set down on the permanent cribbing. A similar procedure on the opposite end of the stator then brought the load level and ready for another new lift.

When the stator had been raised to a position approximately 2 ft. above the top of the turbine foundation, the load was set down on rollers placed under the 12-in. I-beams at each end so the stator rolled sideways to the foundation.

MANUAL – SEMI-AUTOMATIC OR
FULL-AUTOMATIC WEIGH BATCHING



65

You can batch more accurately, faster, and at lower cost with a NOBLE BATCHING PLANT

THE ALBUQUERQUE GRAVEL PRODUCTS COMPANY own this attractive pre-mix concrete plant located at Albuquerque New Mexico. The plant is a standard Noble Plant with a 350 ton, 8 compartment aggregate bin; two 2000 cu. ft. bulk cement silos. A Noble designed and built belt conveyor loads the batch bins from a large capacity ground storage facilities.

ROBT. E. McKEE, General Contractor owns this attractive Noble Batching Plant set up at El Paso, Texas. The plant is a standard model with 150 ton, 4 compartment aggregate bin with a 2500 cu. ft. bulk cement batch silo and a 3250 cu. ft. additional bulk storage silo. This plant is one of many Noble Plants the Robt. E. McKee Company have at work throughout the Southwest.

It will pay you to check into the many advantages of Noble designed Batching and Material Handling Equipment.

Write us if you would like to have our Batching Plant and Conveyor Catalogs.

DESIGNERS AND BUILDERS

CEMENT AND AGGREGATE BATCHING PLANTS
BULK CEMENT PLANTS • AGGREGATE BINS
CEMENT SILOS • CONVEYORS AND ELEVATORS

NOBLE COMPANY

1860 SEVENTH STREET • OAKLAND 20, CALIFORNIA • TEMPLEBAR 2-5285

STONE-SAND PRODUCTION

. . . Continued from page 65

sure, through a tube and piping, actuates a pressure regulator. This excites a low voltage modutrol motor fitted with a cam and chain to raise and lower the discharging spigot valve. As the pocket discharges to a preselected level, the hydrostatic pressure lowers, and in turn causes the modutrol motor to reverse and close the spigot valve.

The spigot discharge under the sizer falls into collecting troughs. There are two of these troughs, one to collect the desired percentages of each spigot product to be saved, and the other to collect the excess of the spigot products. These excess amounts, if in the coarser sizes and very excessive, can be returned to the mill feed; otherwise they flow to waste. The trough collecting the saved sizes chutes them into a 66-in. dual screw dewatering unit as specification finished sand less the −#4 +#8 size. The latter, which has been screened into the 20-cu. yd. surge bin is withdrawn by a small variable control vibrating feeder in the amount required to complete the sand specification and is chuted into the dewatering unit. Here it is thoroughly mixed and blended with the other sands by the action of the screws.

The deficiency of sand is taken care of by manufacturing, using two 8x12-ft. end feed, center peripheral discharge rod mills. The feed consists of the −⅜ +#4 and the −#4 +#8 small aggregate sizes that are stored in three 20-cu. yd. surge bins. These bins fitted with controlled flow gates, feed a 24-in. belt feeder discharging into the mills with a controlled flow of feed water. The mill product is collected in a sump under each mill and pumped by two 6-in. sand pumps up to the second pair of 4x12-ft. double deck screens. It then follows the same route as the natural sands and is graded in the same manner. Being able to return the excess sand sizes back to the mill makes it a closed circuit.

The finished specification sand discharging from the final dewatering screws falls on a 24-in. conveyor #10 which takes it to the shuttle conveyor #11 over an elongated storage pile.

The four aggregate sizes are drawn from their surge bins through remote controlled gates, to a 36-in. conveyor #8 and discharged on shuttle conveyor #9. The latter deposits the aggregates in their respective piles, using rock ladders in the −6 +3-in. and −3 +1½-in. piles to lower the rock with a minimum of breakage. An 8-ft. diameter by 600-

ONE OF TWO 8 x 12-ft. Marcy rod mills aiding in the manufacture of stone-sand.

ft. long steel tunnel liner recovery tunnel is under the storage piles. It is equipped with remote air-controlled gates to draw the various sizes as required to a 36-in. reclaim conveyor #12, which in turn discharges to a 4x12-ft. double deck rinsing screen. The upper deck is fitted with 1¼-in. cloth and the lower deck with a .120-in. cloth mounted on ⅞-in. cloth for support. The dirty wash water passes through this to waste and the aggregates pass over the screen to a 36-in. conveyor #13 to the batch plant. When sand is drawn from the stock piles, a flop gate at the rinsing screen bypasses the sand around the screen directly to conveyor #13.

Operators control of plant

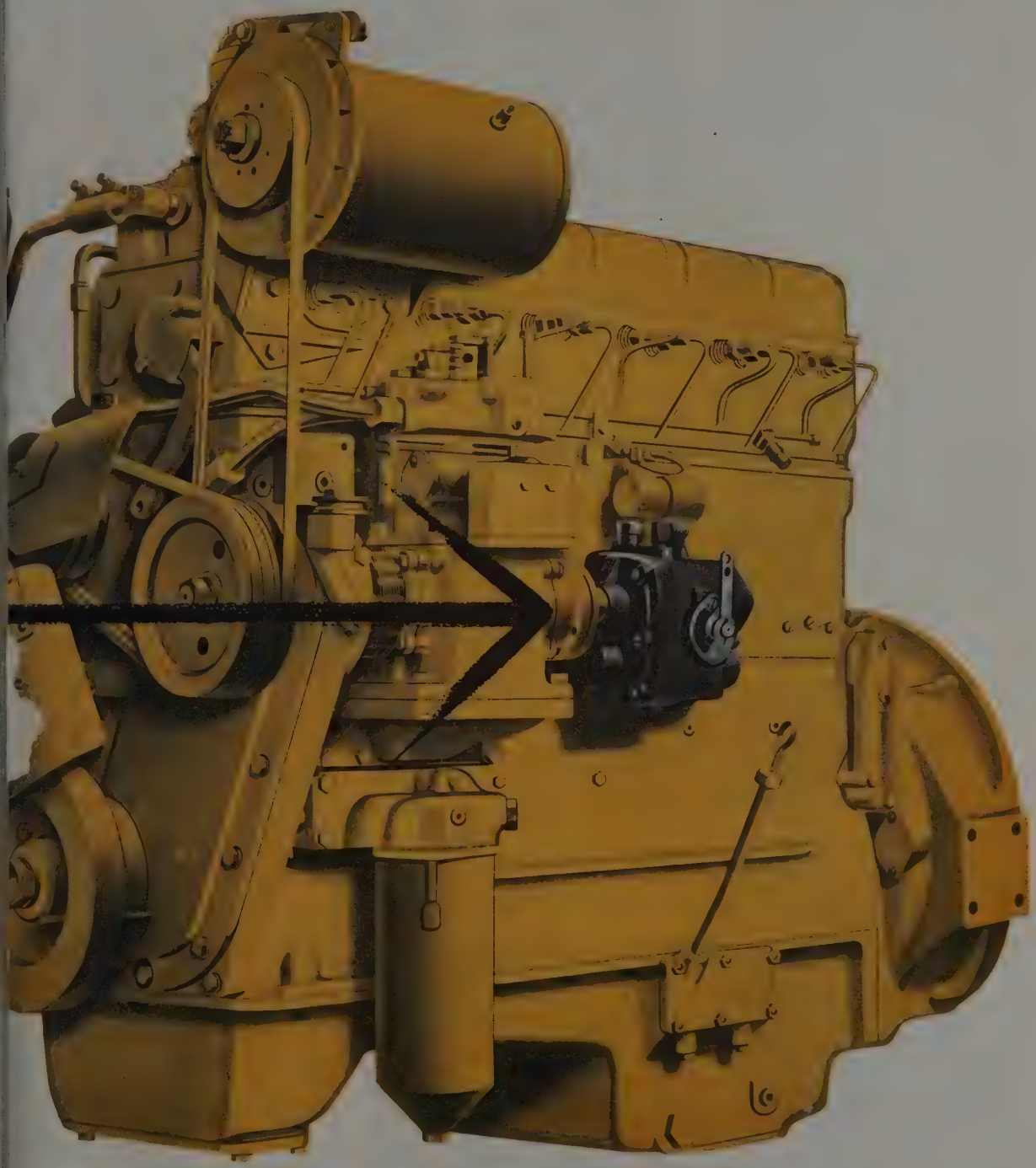
Control of the aggregate plant is under the thumb of one man in a control room at the top of the plant. He has an interlocking arrangement of certain groups of units to avoid any possible overloading or pile-ups such as a motor failure in the system. The sand circuit is under the watchful eye of an operator who controls all the mill and sandflow adjustments, as well as an hourly check of the finished sand grading.

Water used in washing and operation of the sizers and mill is pumped from the river and after going through the plant flows to a settling pond between the plant and the storage piles. Some of this water is recirculated back through the plant. This pond also collects seepage water from the jobsite area and it is necessary to keep it pumped down by pumping back to the river.

Heading the work for Atkinson Ostrander is J. J. Morton, project manager. Bill Rushing is plant superintendent and Andrew Duray is plant foreman. H. B. Elder is resident engineer for the Corps of Engineers.

Waterways experiment station notes 25th year

MODEL STUDIES, like this one of Folsom Dam on the American River in California, are a major service performed by the Corps of Engineers' Vicksburg (Miss.) experiment station, now observing its 25th anniversary. Duplication of the Folsom damsite (scale 1:80) helped evaluation of properly "balanced" design for the dam itself, where flood spill is a Corps responsibility and hydro output belongs to the Bureau of Reclamation. Photo of model shows supplemental spillway incorporated in concrete section above left bank of river. Flashy regimen of American River required this extra capacity; site conditions called for flip bucket design as being more economical than additional excavation and toe treatment. Continuing Folsom construction work was recently assured by Congressional appropriation of $14,500,000.



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PHOENIX: Cummins & Moran
Authorized Sales & Service: YUMA—Cooper Tractor Service; LAS VEGAS—Stirling Diesel Service.

DENVER: Cummins Diesel Sales of Colorado, Inc.
Branch: CASPER. *Authorized Sales & Service:* DURANGO — La Plata Repair Shop; CORTEZ—Cortez Diesel Sales; SCOTTSBLUFF—Western Motor Truck Company.

WESTERN CONSTRUCTION NEWS

ARIZONA

BLACK CANYON HIGHWAY—Tentative new fund allocations of $2,157,000 have been earmarked for work on the Black Canyon Highway in the 1954-55 highway department budget. Projects included are 30 mi. of paving, 8.5 mi. of grading and draining, construction of a cloverleaf traffic interchange, and construction of 8 mi. of new roadway.

CAPITOL BUILDING—Plans for additions to and remodeling of the state capitol building are being drawn up by H. H. Green, Edward Varney, and Lescher and Mahoney of Phoenix and Place and Place of Tucson. The sum of $4,500,000 has been appropriated by the legislature to pay for the building program.

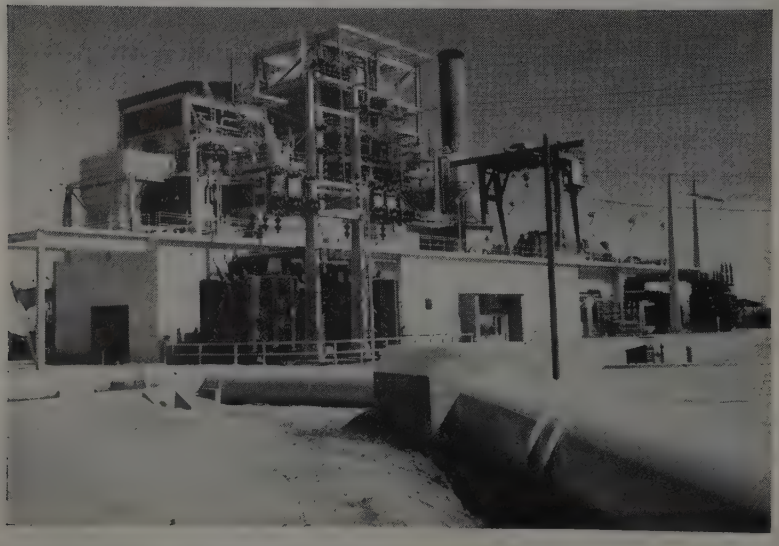
A TEMPORARY DAM was built above the Colorado Bridge near Yuma to help divert water into a 4,200-ft.-long by 300-ft.-wide channel which was intended to stop river bank erosion on the Arizona side. The dam was built by sinking 640 railroad rails 30 ft. long into the river on 5-ft. centers. Wire, strung along the rails, caught drifting brush and formed a barrier sufficient to force the water into its new channel.

AIRCRAFT TEST FACILITY—A joint venture of Kitchell-Phillips Contractors, Inc., and Utah Construction Co. is engaged in building a $4,500,000 aircraft accessory test facility at the Phoenix plant of Air-Research. Plans call for a 1-story, L-shaped structure and two test cell buildings on the 10-ac. site. Completion is expected in June 1955, according to E. R. Peterson, project superintendent. Most of the cost will come from special equipment needed for precise temperature, humidity, and air flow control. Compressed air heaters will toss out 7,980,000 BTU's per hr., refrigeration equipment will drop temperatures to 65 deg. below zero, and vacuum pumps will simulate high altitude conditions. Major buildings on the project have been designed for the use of precast concrete tilt-up panels in their construction. This method of construction was described in **Western Construction**—May, 1953, pp. 83-86. The C. D. Wailes Corp. of Los Angeles has the erection subcontract.

RECENT MAJOR CONTRACT AWARDS and low bids in Arizona include two low bids submitted by **W. J. Henson** of Prescott of $184,953 for 2.7 mi. grading and drainage near Ashfork Junction, and $264,585 for 3½ mi. of grading and drainage south of Globe. **Larsen Contracting Co.** of Phoenix submitted a low bid of $113,828 for 1 mi. of grading and drainage near Williams. **San Xavier Rock & Sand Co.** of Tucson submitted a low bid of $110,447 for construction of a 4-span steel girder underpass structure south of Tucson. **Tanner Brothers** of Phoenix submitted a low bid of $128,809 for 7¼ mi. of grading and paving in Apache County. **Wallace & Wallace** of Phoenix submitted a low bid of $667,786 for 2 mi. of grading north of Phoenix.

NEWEST POWER PLANT IN SALT RIVER VALLEY

Unit No. 2 of Salt River Power District's Kyrene steam plant south of Tempe, Ariz., has been completed at a cost of $8,400,000. Its capacity is 68,000 kw. Construction started in December 1952. (*Western Construction*—February 1954, p. 74.)



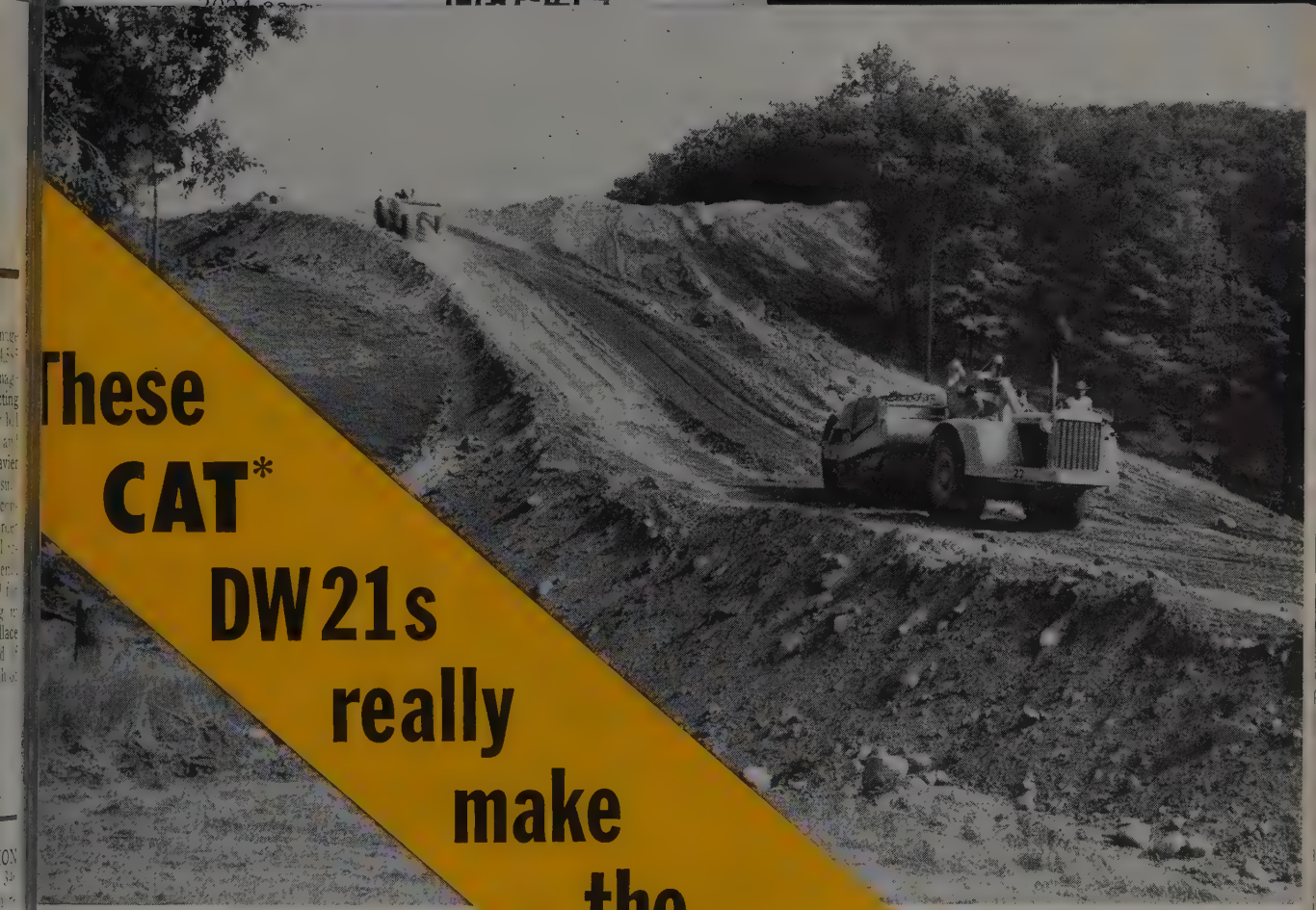
CALIFORNIA

HIGHWAY CONSTRUCTION RECORD—A new record of 346 contracts under way, totaling more than $170,000,000, has been set by the Division of Highways, according to Frank B. Durkee, director of Public Works. The previous high mark was chalked up on July 1, 1953, when 307 contracts, totaling almost $167,000,000, were being worked on. The present amount of highway construction is even greater than the comparative figures indicate, since costs have gone down 8% in the first quarter of 1954.

SANTA FELICIA DAM—Dr. Karl Terzaghi of Harvard University has been retained as a consultant on the Santa Felicia Dam on Piru Creek by the United Water Conservation District in a move to reassure those living downstream from the contemplated structure that it will be both safe and practical. Low bid on the project, submitted by a joint venture of Macco Corp., D & H Construction Co., and M. H. Hasler Construction Co., was $3,534,825 (**Western Construction**—May 1954, p. 80, February 1954, p. 67).

MODOC COUNTY'S Rt. 111 will be surfaced from Kandra to the Oregon border as a result of the State Highway Commission's nod of approval for spending $238,000 on the project.

NEW STEEL PLANT—Construction is expected to start this summer on a $4,000,000 structural steel fabricating plant on a 46-ac. tract in



These CAT* DW21s really make the grade

THAT'S a 28% grade these Caterpillar DW21 Tractors with No. 21 Scrapers are working.

They're starting an 85-foot cut through sandy clay and boulders. The DW21s load on the level, haul downhill, then scoot back up that slope for more.

"A steep grade like this is certainly a tough tryout for any rubber-tired machine," says Oscar Lindstrom, superintendent for Victor Nelson Construction Company, "but those DW21s take it in stride. They're about the best earthmovers you'll find on rubber."

Here, southwest of Slinger, Wisc., constructing a new grade and right-of-way for U.S.-Wisconsin No. 41, each of four Cat DW21 Tractors is moving 250 yards an hour—830,000 yards in all. "They handle a great deal of payload in a day," says Superintendent Lindstrom.

Other users say much the same. One reason: the DW21 is the only two-wheel earthmover designed and built by one company—every part *matched* to deliver peak performance on the job.

Another: its 225 HP is all there at the flywheel. As Mr. Lindstrom points out, here's one rig that won't smother on grades.

And a third reason: always handy with prompt, genuine parts service is your Caterpillar Dealer. He'll be glad to demonstrate this high-speed, high-capacity, big yellow machine any time you say.

Caterpillar Tractor Co., San Leandro, Calif.; Peoria, Ill., U.S.A.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks—®

NAME THE DATE... YOUR DEALER WILL DEMONSTRATE

SEAGOING TRACTOR

This International TD-14A tractor, owned by *William Magee*, pushes a load of gravel to form a dike around a new power plant at Carlsbad, Calif.

Torrance by Bethlehem Pacific Coast Steel Corp., according to H. H. Fuller, president. The new plant will have greater capacity and diversity of production than the present Los Angeles works, which it will replace.

NAPA COUNTY will have to spend $655,500 during the fiscal year which began July 1 if the county's roads are to be brought up to standard, according to R. P. O'Neill, county engineer.

FLOOD CONTROL in Orange County will ultimately require the expenditure of $266,000,000 for channels, retarding basins, and dams, according to K. J. Harrison and J. A. Woolley, consulting engineers retained by the Board of Supervisors. The engineers pointed out that $40,000,000 of this sum was needed immediately to take care of present drainage conditions.

SUBDIVIDERS in Sacramento County have asked the Board of Supervisors to meet a fair share of the cost of constructing thoroughfares adjacent to subdivisions. They complained that now they must pay the cost of extra wide streets which are used by the general public. Arthur L. Kiefer, county engineer, has been instructed to study the matter and report back to the Board.

TERMINAL ISLAND TUNNEL—A new plan to get around legal restrictions which has prevented construction of an under-water vehicular tunnel between San Pedro and Terminal Island was presented at a meeting of the Los Angeles Harbor Commission. It provides that the State Toll Bridge Authority will build the $15,000,000, 1,500-ft.-long tube if the Los Angeles Harbor Department will agree to lease, maintain, and pay interest on the bonds which will be issued to pay the construction costs. Legal restrictions prevent the Harbor Department from paying interest on the bonds directly, according to Edmund G. Brown, the State's attorney general.

LOS ANGELES BUILDING—A 12-story building to be erected in the Wilshire District of Los Angeles at a cost of $2,250,000 is being planned by the Texas Co. It would cover 150,000 sq. ft. and would include parking space in its first two stories. Welton Becket & Associates, architects and engineers, are drawing up the plans.

TWIN CATALYTIC REFORMING plants will be built by Bechtel Corp. for the Standard Oil Co. at Richmond and El Segundo as a start of a $30,000,000 refinery expansion program. Both are scheduled for completion in the spring of 1955.

FLOOD-RELIEF PROJECT—The first dragline bucketfull of earth which started a $2,000,000 flood-relief project in Los Angeles was loaded in view of a number of engineers, businessmen, and political officials interested in the job in a brief ceremony. The project, an underground storm drain, will run more than 3 mi. to an outfall at the Los Angeles River when it is completed.

LOS ANGELES HARBOR—The House Public Works Committee has approved two dredging projects at Los Angeles Harbor. One is an appropriation of $3,896,000 for navigational facilities at Marina del Rey Small Boat Basin and the other is an appropriation of $896,000 for dredging the harbor's East Basin.

GOLDEN GATE BRIDGE—Installation of bottom lateral bracing on the Golden Gate Bridge, damaged in 1951 by a storm, (**Western Construction**—March, 1953, p. 108, May, 1952, p. 77) is running about six months behind schedule, according to James E. Ricketts, general manager of the bridge. Judson Pacific-Murphy Corp., the contractor, may be required to pay a penalty of $500 for every day the work takes after May 30, 1954, he said.

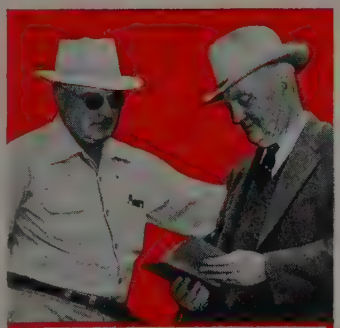
SAN DIEGO LIBRARY—City officials of San Diego gathered to dedicate the new 5-story, $2,000,000 library building. The structure had been planned since November 1949, when voters approved a bond issue for its construction.

MAJOR ROAD IMPROVEMENTS in San Diego have been recommended by the Southern California Highway Committee of the State Chamber of Commerce, which came up with the following 13-point program: (1) Complete U.S. 101 to freeway stardards from Leucadia to San Diego. (2) Build freeway from Grossmont Summit to U.S. 395. (3) Build grade separations along U.S. 80 through Mission Valley and Alvarado Canyon. (4) Revise traffic interchange where U.S. 80 connects with U.S. 395. (5) Widen U.S. 395 to four lanes from San Diego to Riverside. (6) Widen State 75 from Palm City to Coronado. (7) Extend U.S. 395 to Montgomery Freeway. (8) Relocate U.S. 80 from Pine Valley to Buckman Springs. (9) Reduce grade to 4% and eliminate curves on U.S. 80 from La Posta to Manzanita. (10) Rebuild highway from Julian to Descanso. (11) Improve Route 94 from Jamul to White Star. (12) Build bridge across San Luis Rey River west of Henshaw. (13) Improve State 78 between Vista and Escondido.

SACRAMENTO'S Municipal Utility District began buying power from the Central Valley Project of the federal government on July 1. The contract calls for furnishing up to 180,000 kw. during the first year

MORRISON-KNUDSEN REPORTS:

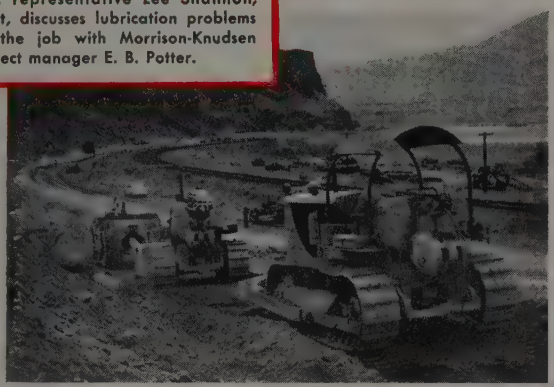
Longer Overhaul Periods with G.P. on the Job



G.P. representative Lee Shannon, right, discusses lubrication problems on the job with Morrison-Knudsen project manager E. B. Potter.

On the rugged U.S. Highway 30 relocation project, Morrison-Knudsen Co., Inc., at Pendleton, Ore., has found its equipment operates longer for less with General Petroleum products and lube engineering on the job.

Four miles of highway and railroad track at the mouth of the Deshutes River are being moved to clear the way for raised water level when The Dalles Dam is completed. The job calls for almost continual use of heavy-duty earth movers, scrapers, wagon drills and power shovels, thus placing a real premium on proper lubrication.



Heavy-duty equipment is put through its paces on rugged highway relocation job.

According to M-K project engineer E. B. Potter, "We've been able to chart an appreciable savings in reduced down-time and longer overhaul periods on this and other jobs since G.P. began working with us in the Pendleton district ten years ago."

Chances are your nearby G.P. representative can help you save real money in the operation of your expensive construction equipment, too. His proven line of Mobil products, coupled with a lube engineering program that's tailor-made to fit your individual operating conditions, is bound to result in longer life and smoother operation for *all* your equipment. Call him in today for the tops in products and service!

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of the agreement, with an eventual commitment of 290,000 kw. The project has a present output of 300,000 kw. from power plants at Shasta and Keswick dams. This will be increased to 400,000 kw. when plants at Folsom and Nimbus dams on the American River are added to the system next year. Present requirements of the District average about 145,000 kw.

ORANGE COUNTY'S Board of Supervisors has approved 14 recommendations by the Associated Chambers of Commerce for major highway improvements to be considered by the Division of Highways. Most of the projects included relocation, widening, and new construction on major highways in the county.

NEWPORT BEACH'S new $880,000 sewage treatment plant at the mouth of the Santa Ana River is now open for business. Construction of the plant, a 7,000-ft. marine outfall line, and various trunk lines were provided for in an $8,000,000 bond issue which was voted several years ago.

FOLSOM FUNDS—President Eisenhower has signed the $457,000,000 Army civil functions appropriation bill into law. This sum will be appropriated for the fiscal year which began July 1. The biggest chunk of that sum to be spent in California is a $14,500,000 appropriation for continuation of work on Folsom Dam on the American River (**Western Construction**—July 1954, p. 72; November 1953, p. 74; September 1953, p. 63; August 1953, p. 97).

KLAMATH RIVER SPAN—A new $354,000 bridge across the Klamath River on State 96 has been opened to traffic. It was built by the Bureau of Public Roads with cooperation of the Division of Highways and the U.S. Forest Service.

TUOLUMNE RIVER POWER PROJECT — Construction of a hydroelectric power project on the Tuolumne River above Early Lake was sought in a bill offered in Congress by Rep. Engle. It would authorize Tuolumne County Water District No. 2 to use government lands for diverting and using, but not storing, water just below Hetch Hetchy Reservoir, provided such waters are returned to the Tuolumne's bed.

SUPERIOR CALIFORNIA has been allocated $1,576,000 by the Highway Commission for construction on 12 projects in Humboldt, Del Norte, Shasta, Placer, Tehama, Solano, Trinity, Nevada, Yolo, and Amador counties.

WATER RESOURCES in Big Valley are being studied by the newly appointed Lassen County Water Resources Committee in order to prepare a plan for a comprehensive irrigation system which will provide scientific development and control of the Pit River and its tributaries.

TOP PRIORITIES on developing freeways on U.S. 50 and 99 in San Joaquin County have been recommended by a State Chamber of Commerce Committee. The proposed program will cost $36,700,000, according to John Meyers, district highway engineer.

RECENT MAJOR CONTRACT AWARDS and low bids in California include an award of $2,330,346 to **ABC Construction Co., Inc.**, of Norwalk for construction of 4 mi. of water pipeline near Corona. **American Pipe & Construction Co.** of Los Angeles received a $2,057,956 award for construction of 4½ mi. of water feeder pipeline near Corona. **James I. Barnes** of Redwood City received a 1,203,700 award for construction of a 4-story Mercy hospital addition at Bakersfield, and submitted a low bid of $1,318,000 for construction of a high school at Richmond. **Basich Brothers Construction Co.** of San Gabriel submitted a low bid of $280,675 for 12.9 mi. of grading and surfacing of shoulders in Imperial County. **Bayshore Construction Co.** of Berkeley submitted a low bid of $1,864,699 for construction of a maintenance hangar at Mather AFB.

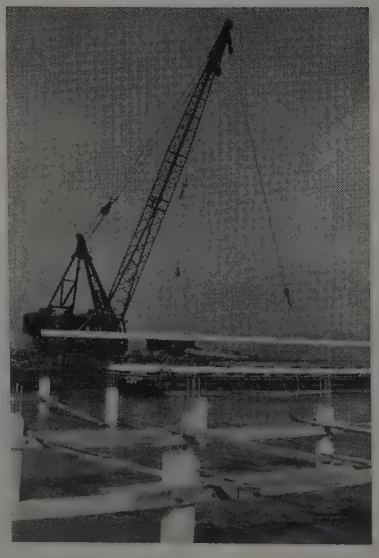
Brown-Ely Co. and **W. H. Darrough & Sons** of Yuba City submitted a low bid of $524,306 for 5.3 mi. of grading and surfacing US 40 in Sutter County. **Brighton Sand & Gravel Co.** and **R. M. Skamnes** of Sacramento submitted a low bid of $289,166 for construction of a concrete and steel bridge across the American River at Fair Oaks. **Campbell Construction Co.** and **Erickson Construction Co.** of Sacramento submitted a low bid of $585,096 for clearing and grading for expansion of McClellan AFB near Sacramento. **Continental Drilling Co., Inc.,** of Los Angeles submitted a low bid of $229,520 for foundation drilling and grouting at Folsom Dam. **D & J Concrete Construction Co.** of Los Angeles submitted a low bid of $238,163 for repaving Hill Street in Los Angeles. **Dimmitt & Taylor** of Monrovia submitted a low bid of $571,735 for construction on the Bull Creek flood channel in San Fernando.

Fredrickson & Watson Construction Co. of Oakland received a $686,677 award for 3.7 mi. of grading and paving in Shasta County. **George A. Fuller Co.** of Los Angeles received a $2,830,000 award for construction of an 8-story central office building in Sacramento, and submitted a low bid of $6,576,000 for construction of a 1,000-bed, 9-story naval hospital at Balboa Park in San Diego. **Griffith Company** of Los Angeles submitted a low bid of $404,641 for 5.6 mi. of grading and surfacing in Kern County. **R. R. Hensler** of Sun Valley submitted a low bid of $479,650 for 8.5 mi. of grading and surfacing in Imperial County. **Kenworthy & Patterson** of Stockton submitted a low bid of $442,867 for 2.8 mi. of grading and surfacing in Tuolumne County.

Peter Kiewit Sons' Co. of Arcadia received a $906,235 award for grading, paving, and three bridges in Los Angeles County. **Macco Corp., D & H Construction Co.** and **M. H. Hasler Construction Co.** of Paramount received a $3,534,826 award for construction of Santa Felicia Dam in Ventura County. **Madonna Construction Co.** of San Luis Obispo submitted a low bid of $287,070 for 3.3 mi. of grading and surfacing in Santa Barbara County. **McCammon-Wunderlich Co.** of Palo Alto submitted a low bid of $2,210,215 for 2.8 mi. of grading and surfacing near Punta Gorda. **M. S. Mecham & Son** of South Gate submitted a low bid of $846,264 for 4.7 mi. of grading and surfacing in Los Angeles. **E. C. Nesser** of Los Angeles received a $1,854,500 award for construction of a junior high school in Los Angeles. **Oberg Brothers Construction Co.** of Inglewood received a $1,403,264 award for construction of the Rio Hondo channel in Los Angeles County.

H. Earl Parker of Marysville submitted two low bids of $655,138 and $382,072 for bank protection work on the Sacramento River in Yolo, Sutter, and Colusa counties. **Slough Construction Co.** of Whittier submitted a low bid of $368,792 for levee embankment work in San Joaquin

LONGEST CONCRETE PILES
Concrete piles 106 ft. long, 18 in. sq. and weighing 16 tons are being used for a Union Oil Co. dock at Oleum, Calif. Among the longest of their type, they were made by Ben C. Gerwick, Inc., at Petaluma.



County. **B. J. Ukropina, T. P. Polich, Steve Kral & John R. Ukropina** of San Gabriel submitted a low bid of $953,329 for construction of four steel girder bridges and ramp connections in Los Angeles County, and another low bid of $2,447,821 for 1 mi. of grading and paving on a freeway in Los Angeles. **Vinnell Company, Inc.,** of Alhambra submitted a low bid of $3,077,970 for 2.8 mi. of construction on the Harbor Freeway in Los Angeles. **Walsh Construction Co.** of San Francisco received a $1,533,720 award for construction of 1¼ mi. of water supply in tunnel in Orange County.

COLORADO

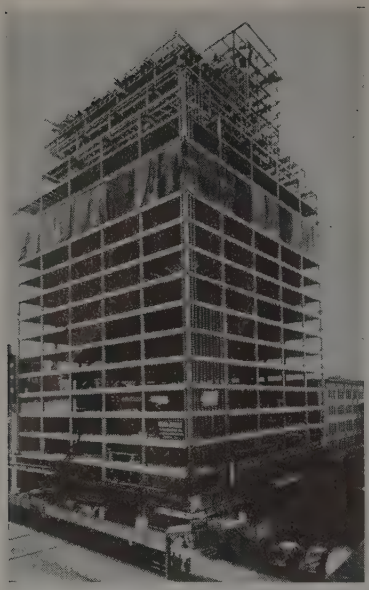
CITY BUILDER—Del E. Webb, Arizona contractor, has announced plans for construction of a complete city of 20,000 people on the northern outskirts of Denver, to be undertaken in association with the Aldon Construction Co. at a cost of $100,000,000. The community, to be built on a 2,000-ac. site, will include homes, schools, parks, playgrounds, theaters, shopping centers, and a business district.

AIR FORCE ACADEMY—A 15,000-ac. site 10 mi. northwest of Colorado Springs has been selected for the much-discussed new U.S. Air Force Academy by Air Force Secretary Talbott after months of debate over where it was going to be placed. President Eisenhower had already signed a bill setting aside $126,000,000 for acquisition of land and design and construction of the institution. Construction is expected to be completed by July 1, 1957. A 4-lane highway between Denver and Colorado Springs will be ready by the time the Academy opens, according to Mark U. Watrous, state highway engineer.

HIGHWAY CONSTRUCTION STATUS in Colorado is shown in a map-type bulletin, issued to highway travelers each month during the summer. This enables them to plan their trips so they can avoid or allow for delays due to major construction projects.

BIG BUILDING PROGRAM—A $3,000,000 building and improvement program covering seven state institutions is almost finished, according to Luke Smith, state institutions board chairman.

PUBLIC RELATIONS GETS THE AIR in Colorado every week, when a public relations program is broadcast by commercial radio stations in 14 cities. These programs describe various interesting phases of the Department of Highways' work, pay tribute to outstanding



FIREPROOF SKYSCRAPER

The 23-story Denver Club, now under construction in Denver, is being fireproofed with 8,500 bags of Zonolite vermiculite plaster. Mead & Mount of Denver have the general contract and M. A. McKay is plastering boss.

public servants, and give safety hints.

WORLD'S LARGEST trout hatchery, now under construction in Rifle Creek Canyon, is expected to be completed by December 1. Units being built include a diversion dam, a hatchery building, offices, raceways, residences, and a shop utility building.

BIDS for grading, stabilization, structures, and asphaltic concrete surfacing on 2 mi. of U.S. 85 through Brighton have been requested. The engineers' estimate is about $250,000 for the 4-laning job, which will take about 6 months to finish.

COLLEGE DEDICATION—A new $1,000,000 petroleum engineering building which has an experimental oil well in its basement was dedicated at the Golden campus of the Colorado School of Mines. It was named Alderson Hall, in honor of Victor C. Alderson, president of the college in 1903-1913 and 1917-1925, who died in 1946.

RECENT MAJOR CONTRACT AWARDS and low bids in Colorado include a low bid of $1,596,890 by **Brown-Schrepferman & Co.** of Denver for construction of a junior high school in Denver. **Colorado Constructors, Inc.**, of Denver received a $254,604 award for 6.6 mi. of grading and surfacing SR 8 in Lincoln County, and a $773,861 award for construction of a reservoir for Boulder. **Lippert Brothers** of Oklahoma City received a $386,643 award for construction of an off-street parking structure in Denver. **N. G. Petry Construction Co.** of Denver submitted a low bid of $1,405,000 for construction of a 7-story public library for Denver. **Siegrist Construction Co.** of Denver received a $105,402 award for 5.3 mi. of grading and paving in Kit Carson County. **Western Paving Construction Co.** of Denver received two awards of $181,360 and $118,375 for street paving work in Denver.

IDAHO

WASHO TEST ROAD—After 18 months of testing (**Western Construction**—May 1954, p. 84; June 1953, p. 68; January 1953, pp. 79-82), traffic on the WASHO Test Road in southeastern Idaho has been stopped and the post-test condition of the pavement components is in the process of being examined by Highway Research Board engineers. During the tests, 238,000 heavy axle loads were applied to each of the test pavements by eight trucks which traveled 630,000 mi. during the tests. Total cost of the experiment came to $890,000, contributed by the 11 Western States, Alaska, Bureau of Public Roads, truck and trailer manufacturers, and the petroleum industry. A final report containing test results and analysis of all data taken will be published by the Highway Research Board, probably in the spring of 1955.

SODA SPRINGS' City Council says the city needs more power, since the demand has more than quadrupled since 1945. So the group has authorized construction of a new power plant on Soda Creek. It will cost $125,000.

WAR WHOOPS sounded in Lewiston when Joseph Blackeagle, a Nez Perce Indian leader, expressed the opposition of his people to the construction of dams at Bruces Eddy and Penny Cliffs on the Clearwater River. He charged that each time a dam is built, migratory salmon are prevented from traveling upstream and valuable fishing rights, given the Indians in 1855 by treaties with the government, are damaged. See **Western Construction**—June 1953, p. 108 and March 1954, p. 76 for more information on these projects.

HOME CONSTRUCTION at Mountain Home Air Force Base is expected to start soon, according to Verne Jensen, director of the Boise office of the Federal Housing Administration. Low bid on the 500-unit, $4,000,000 project was submitted by Mountain Village, Inc., of Dallas, Tex., a subsidiary of Centex Construction Co. and Murchison Bros. The whole job is expected to take 23 months.

TRANSMISSION LINE — Construction of a $250,000, 28-mi., 69,000-volt transmission line between Cascade and McCall and a $150,000 substation at McCall is well under way, according to R. S. Overstreet, Boise Division manager for the Idaho Power Co.

EXPERIMENTAL truck passing bays, each 1,000 ft. long, which will allow slow moving trucks to pull out and let other vehicles pass are being built under the supervision of John Phelps, Lewiston district highway engineer.

RECENT MAJOR CONTRACT AWARDS and low bids in Idaho include a $146,458 award to **L. T. Johnson Construction Co.** for 8.1 mi. of roadway reconstruction in Fremont County. **Mountain Home Development Corp.** submitted a low bid of $4,982,183 for construction of a 500-unit rental housing project for the Mountain AFB. **H. G. Palmberg** of Astoria received a $664,255 award for 1.1 mi. grading and paving at Sandpoint.

MONTANA

YELLOWSTONE PIPE LINE—Oil was scheduled to start moving through the 530-mi. Yellowstone pipe line by August 1, according to Joseph L. Seger, president of Carter Oil Co. This will enable oil to be transported from Billings to Spokane, Wash., for about half the present cost at the rate of 2.5 mi. per hr., he said.

MORE POWER for Butte was made possible by looping a 100,000-volt transmission line on the Milwaukee Railroad through the Montana St. substation of Montana Power Co.

CONTRACTOR REASSIGNS CONTRACT—The Madsen Construction Co. of Minneapolis, which submitted a low bid of $906,100 for construction of an 8-story bank and office building at Billings (**Western Construction**—May 1954, p. 86), has reassigned the job to Hitz Construction Co. of Billings, second low bidder at $938,000. Completion of the structure is scheduled for May 1955. Subcontracts, awarded separately by bank officials, bring the total cost of construction up to $2,000,000.

RECENT MAJOR CONTRACT AWARDS and low bids in Montana include a $627,800 award to **Haggerty-Messmer** of Bozeman for construction of a dormitory at Montana State College at Bozeman. **Madsen Construction Co.** of Minneapolis

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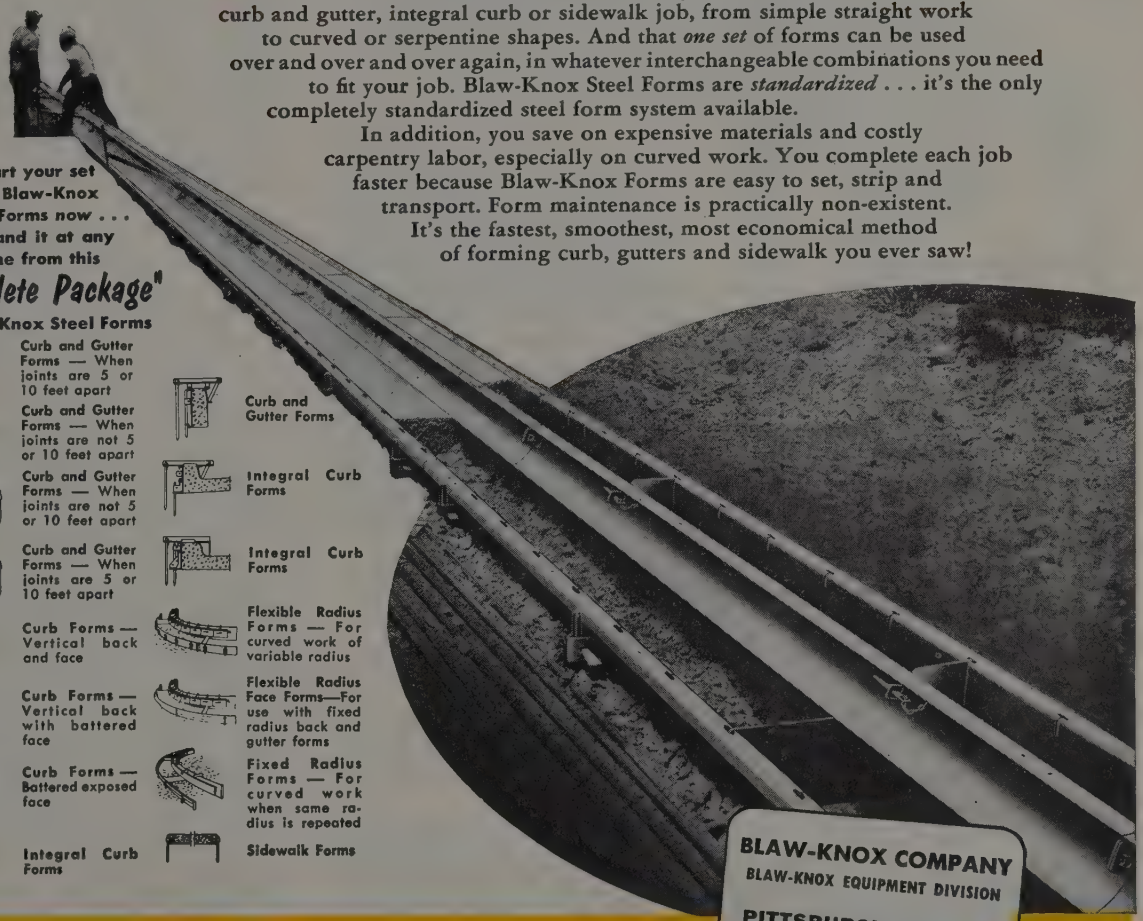

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LIVELY EQUIPMENT CO. .....2601 No. Fourth Street, Albuquerque, New Mexico
P. O. Box 1436 1423 E. Missouri Street, El Paso, Texas
INDUSTRIAL EQUIPMENT CO.....415 N. 27th Street, Billings, Montana
NORMONT EQUIPMENT CO. .....420 Third Ave., So., Great Falls, Montana
STAR MACHINERY CO., 241 Lander St., Seattle, Wash.; E. 415 Sprague Ave., Spokane, Wash.
SHAW SALES AND SERVICE COMPANY.....5100 Telegraph Road, Los Angeles 22, Calif.;
Branch: .....2175 Newton St., San Diego, Calif.

submitted a low bid of $906,100 for construction of an 8-story bank building at Billings. **McLaughlin, Inc.**, of Great Falls received a $164,741 award for construction of one taxiway and the rehabilitation of two others at Gore Field.

NEVADA

NAVY STEAMS AHEAD — Approval of a $4,582,000 enlargement program at the Fallon Naval Auxiliary Air Station has been expressed by the House Committee on Appropriations. This was an important hurdle in the path of the work. If the Senate Appropriations Committee also gives its approval, work can start immediately, since Congress had already appropriated the money but had specified approval of both committees before it could be spent. Planned construction includes hangars, an aircraft control tower, parking aprons, and living quarters.

VIRGINIAN IN RENO — An 8-story luxury hotel, to be called the Virginian, is planned for downtown Reno. Estimated to cost $2,000,000, the structure will be built by Boudwin Construction Co. Completion is expected by April 1955.

BID MARGIN — $15 — Silver State Construction Co. of Fallon was awarded a contract to widen and straighten 28 mi. of U.S. 50 by virtue of its low bid of $416,388.65 for the job — $15.50 lower than the second low bidder, Isbell Construction Co. of Reno, which asked $416,304.15 to do the job.

ADDED HOSPITAL FACILITIES at Washoe Medical Center in Reno will be sought by asking Washoe County voters to approve a $600,000 bond issue to pay for them, if the county commissioners agree to put the proposition on the ballot.

LAS VEGAS STEAM PLANT — Construction of a 44,000-kw. steam plant near Las Vegas will start November 1, according to Reid Gardner, president of the Southern Nevada Power Co. Stearns-Roger Co. of Denver will build the whole system, including main plant, substations, and outside equipment. The bill will come to about $6,000,000.

RECENT MAJOR CONTRACT AWARDS and low bids in Nevada include an award of $1,313,182 to **Isbell Construction Co.** of Reno for construction of runways, aprons, and taxiways at Hubbard Field at Reno and also a low bid of $113,766 for grading and paving streets in Reno. **G. E. Miller** of Reno submitted a low bid of $139,991 for construction of storm drains in Reno.

NEW MEXICO

PRINCESS JEANNE PARK is the name of a new $15,000,000 subdivision now under construction on the east side of Albuquerque by Dale Bellamah Estates, Inc. When finished, the area will contain 1,600 homes, 4 shopping centers, a recreation area, and an 18-ac. school site.

FOREST HIGHWAY HURRYUP —One of the major aims of the federal road act now being considered in Congress is the speeding up of blacktopping some 485 mi. of forest highway in the state. In this connection, the Bureau of Public Roads is considering state requests for furnishing $1,500,000 for resurfacing and building structures on 36 mi. of U.S. 666 and $1,225,000 for grading, surfacing, and building structures on 15 mi. of U.S. 260 in the Gila National Forest.

FLOOD CONTROL for New Mexico is being considered in an omnibus bill in Congress which includes, among other things, a $10,000,000 project for the Sandia Conservancy District at Albuquerque and the $4,800,000 Rio Hondo Basin Project near Roswell.

CONCHAS DAM ROAD — Work has started on preparing a subgrade for future paving of State 104 from Tucumcari to Conchas Dam under the supervision of Bert Riddling and Clayborne Davidson, Tucumcari city engineers.

ARTESIA may lose federal-aid funds for the James Canyon Project on State 83 unless "they get together on the right-of-way," W. J. Keller, district engineer for the Bureau of Public Roads, has warned. The job was scheduled to be bid on during July. If right-of-way isn't obtained in time, the money will be used on some other job, he said.

RECENT MAJOR CONTRACT AWARDS and low bids in New Mexico include a low bid of $1,982,609 by the **Austin Contracting Co.** and **Worth Construction Co.** for construction of aprons, runways, and taxiways at Clovis AFB. **Robert E. McKee, General Contractor, Inc.** of Albuquerque submitted a low bid of $1,955,000 for group housing at Los Alamos, and received a $3,369,000 award for construction of a new state penitentiary at Santa Fe. **George A. Rutherford, Jr.**, of Albuquerque received a $569,084 award for construction of four 2-story masonry barracks at Kirtland AFB.

POWER OUTPUT NEARS AT LOOKOUT POINT DAM

Downstream view of Lookout Point Dam on the Middle Fork of the Willamette River in Oregon shows skip-load of workmen hanging from hi-line cableway as they work on dam face. Contractors McNutt Brothers and C. J. Montag & Sons are diverting flow to form power reservoir pool. First power is expected by first of year.

OREGON

BIDS were scheduled to be called for the fifth major construction phase of The Dalles Dam, including navigation locks, north overflow dam, and north fish ladder, by the Corps of Engineers. To be opened August 31, they are expected to total about $20,000,000. Completion of the work has been set for October 1956.

INCREASED OIL storage and tanker unloading facilities are scheduled to be built soon at the Linton plant of Tide Water Associated Oil Co. Specific projects to be constructed include a 17,000-bbl. oil storage tank and four new 10- and

12-in. pipe lines. P. S. Lord of Portland has the general contract.

POSTMAN RINGS LATE—Although Cisco Construction Co. of Portland submitted a low bid of $274,950 for construction of a reactor test facility building at the National Reactor Testing Station, Idaho Falls, Ida., it was not received until after the 2 p.m. bid opening time. Investigation revealed, however, that it had been mailed in time to reach the bidder's office at the designated hour, so H. K. Ferguson Co. of San Francisco, originally low at $286,560, slipped back to second place and Cisco got the job.

MOST MONEY EVER—Clackamas County will have more money than ever before to spend on road and bridges during a 12-month period. This was indicated when the County Budget Committee set aside $1,500,000 for the fiscal year which began July 1.

ESTIMATOR'S NIGHTMARE—The type of thing that makes an estimator wake up screaming and tearing his hair out in big chunks occurred recently when Stoen, Stoen & Frazier of Seattle submitted a low bid of $112,000 for repairing the south jetty at the entrance of the Coquille River near Bandon. The firm asked to be excused on the grounds that it had figured the job in error, so the Portland district, Corps of Engineers, awarded the job to Somers & Stacy of Klamath Falls, second low bidder, for $198,000. Completion is scheduled for November 30, 1954.

WATER STORAGE CAPACITY behind Bull Run Dam in Lake Ben S. Morrow will be increased by construction of three 8-ft.-high by 40-ft.-long steel lift gates, each weighing 20 tons, above the dam's lip.

HIGHWAY LINK—Construction of a 26-mi. highway link between Pine Valley and Imnaha River is planned for the spring of 1955 by the Bureau of Public Roads.

PRINEVILLE HOTEL—A tract of land in Prineville has been purchased as the site of a $1,000,000, 2-story concrete hotel.

MULTNOMAH COUNTY has set up a 5-yr. program of road improvements totaling $3,500,000 for six major projects in Portland, according to George W. Buck, roadmaster.

NORTHEAST PORTLAND will be the site of a $7,500,000, 450-home residential area to be built on a 121-ac. tract by Clifford Orth Construction Co.

RECENT MAJOR CONTRACT AWARDS and low bids in Oregon include an award of $1,000,000 to An-

derson-Westfall Co. of Portland for construction of a shopping center in Portland. **Donald M. Drake Co.** of Portland submitted a low bid of $1,273,736 for construction of the University of Oregon dental school in Portland. **Gibbons & Reed Co.** of Salt Lake City submitted a low bid of $501,492 for relocation of 5 mi. of Union Pacific RR and 3.6 mi. of highway near The Dalles Dam. **Lee Hoffman** of Beaverton submitted a low bid of $519,191 for construction of a steel and concrete railroad bridge across the Deschutes River east of The Dalles. **Ross B. Hammond Co.** of Portland received a $1,075,488 award for construction of an Oregon State Hospital building at Salem.

Larson Construction of Astoria submitted a low bid of $678,150 for restoration work on the south half of the spillway baffle deck at Bonneville Dam. **Montgomery-Macri** and **Western Line Construction Co.** of Portland submitted a low bid of $1,788,727 for construction of 66 mi. of the Chief Joseph-Snohomish 345-kv. transmission line. **Morrison-Knudsen Co., Inc.**, of Seattle received a $1,446,736 award for construction of the Timothy Meadows earth-fill dam in Clackamas County. **Schrader Construction Co.** of Portland received a $229,850 award for construction of fish ponds, residences, and utilities at Bonneville hatchery. **Ward & Greene Contractors** and **Thompson & Georgeson** of Portland submitted a low bid of $505,584 for construction of a launcher site on Mt. Hebo.

UTAH

WEBER BASIN FUNDS — Congress is now considering the Bureau of the Budget's request for $7,900,000 for construction on the Weber Basin Project during the fiscal year which started July 1. The entire project, estimated to cost $70,000,000 is intended to supply more municipal, irrigation, and industrial water for residents on the eastern shore of Great Salt Lake between Salt Lake City and Ogden.

SCHOOL CONSTRUCTION by the Salt Lake City Board of Education is continuing under a 4-yr. plan which will affect 34 schools at a cost of $10,000,000.

STEEL FOUNDATION BEAMS— for the new 12-story, First Security Bank Building in Salt Lake City have been erected by American Bridge Division of U.S. Steel Corp., which subcontracted the job from Utah Construction Co., general contractor on the $2,700,000 project.

RECENT MAJOR CONTRACT AWARDS and low bids in Utah include a low bid of $499,130 submitted by **Ragner Benson, Inc.**, for a concrete and steel bridge in Grand County, **W. W. Clyde & Co.** of Springville submitted a low bid of $683,743 for grading and surfacing in Summit County. The following contractors submitted low bids for construction of trunk and collection sewer lines in Salt Lake City: **Hilton & Carr** — $281,859; **Kloepfer Construction Co.** — $524,276; **Schmidt Construction Co.**—$1,623,-883; **Statewide Plumbing & Heating** — $1,093,259. **United Concrete Pipe Corp.** of Baldwin Park submitted a low bid of $3,896,146 for 17.8 mi. of concrete pipe on the Weber Basin water development project. **Utah Construction Co.** of Salt Lake City submitted a low bid of $2,423,046 for construction of Wanship Dam as the third phase of the Weber Basin development.

PROPOSED SEMI-FLOATING BASCULE BRIDGE

This cut-away perspective drawing shows a proposed bascule bridge over the Duwamish Waterway at First Ave. South in Seattle, Wash., to be built by the city. Soil sample borings disclosed a deep-seated clay stratum underlying sand formation requiring an unusual semi-floating bascule pier design. The piers are of cellular construction and will be connected under the channel bottom by two reinforced cellular struts. The design of the piers is predicated on the factor of about 85% buoyancy. This balance is maintained throughout the tidal range by allowing flow in and out of an impounding chamber.

WASHINGTON

CHIWAWA-WENATCHEE POWER DAMS — Chelan County's Public Utility District No. 1 has received a 36-month preliminary permit for three dams and reservoirs and two power plants in Chelan County. Stone & Webster Engineering Corp. of Boston has been retained to carry on preliminary studies, including core drilling, foundations, waterflow calculations, project design, and fish protection facilities, according to Ed Metcalf, chief engineer of the utility. The project would include a 250-ft.-high, rock-fill dam on the Chiwawa River with a 350,000 acre-foot reservoir and a 10,000-kw. power plant, a regulating dam at the outlet of Lake Wenatchee capable of containing 24,800 acre-feet, and a 75-ft.-high dam on the Wenatchee River with a 6-mi.-long tunnel and penstock to a 135,000-kw. power plant near Leavenworth.

HOW TO MAKE a mistake in bidding so that the tenth-low basic bidder receives the award was demonstrated recently when an elementary school building job was put out to bid by the Othello School District in Adams County. It came about when Cherf Bros. Construction Co. and Sandkay Constructors of Ephrata subtracted from instead of added to the basic bid for two alternates for additional work. E. F. Shuck Construction Co. of Seattle was low basic bidder at $260,613, plus $14,000 for jalousies and $300 for a flagpole, making a total of $274,913. The Cherf-Sandkay basic bid was $284,000, minus $15,000 for the jalousies and minus $260 more for the flagpole, making a total bid of $268,740.

POST OFFICE PROPOSAL— Seattle's proposed $15,000,000 post office building will be built by The Terminal Development Corp. of Seattle under a 20-yr. lease contract. Facilities will include parking space and a helicopter landing area. Completion is expected by late 1955.

A $3,000,000 PROGRAM for facilities at the Port of Seattle has been

approved by the port commissioners. To be financed by a bond issue, the work will include expansion of elevator facilities, construction of bulk oil tanks, net sheds, and buildings, and extension of the jet runway at Seattle-Tacoma Airport.

SEATTLE'S Department of Lighting has completed writing specifications for Gorge High Dam and bids were expected to be advertised for its construction before August 1. Other Department activity includes diamond drilling continuing at the site of Copper Creek Dam.

SPOKANE STORE-GARAGE—Construction of a 6-story, 500-car garage and store building in Spokane was expected to get under way soon, with completion scheduled for early 1955. A tower on the southwest corner will rise 11 stories in the air.

CENTRAL VALLEY'S school district will start construction on its new $1,000,000 high school "as soon as possible next spring," according to Gilbert C. Mills, superintendent. Completion date is scheduled for September 1956.

BOEING BUILDING—Boeing Airplane Co. is planning to start construction of a new material handling building at a cost of more than $2,000,000. The structure, to cover 285,000 sq. ft. in a 1-story, 480 x 600-ft. unit, is scheduled for completion in 1955.

FEDERAL AID FUNDS totaling $28,000,000 will be received by Washington during the next two years for its highway construction program, according to W. A Bugge, state director of highways. The $14,000,000 to be received each year will be divided up into $5,207,000 for primary highways, $3,479,000 for secondary highways, $2,604,000 for urban areas, and $2,737,00 for work on U. S. 10 and 99.

SPOKANE'S plan to spend $1,900,000 on a new sewage disposal project was pronounced "highly acceptable" by the State Pollution Control Commission, according to B. J. Garnett, city engineer, who presented the plan.

RECENT MAJOR CONTRACT AWARDS and low bids in Washington include an $862,978 award to **Asphalt Paving & Engineering Co.** of Tacoma for 12.7 mi. of grading and surfacing on SR 1 near Tumwater. **Associated Sand & Gravel Co.** of Everett received a $410,186 award for 5.4 mi. of grading and surfacing on SR 1 in Snohomish County, and a $604,814 award for 2.9 mi. of grading, and paving near Mt. Vernon. **Cherf Brothers, Inc. & Sandkay Contractors, Inc.,** of Ephrata submitted a low bid of $1,676,547 for earthwork, pipe lines, and structures on the Columbia Basin Project. **D-H**

Paving Company of Vancouver received a $389,048 award for 10.3 mi. of grading and surfacing in Pacific County.

Engineers Ltd. Pipeline Co. of Seattle received a $2,000,000 award for 31 mi. of steel pipeline from Sumas to Ferndale. **Fiorito Brothers** of Seattle received a $392,991 award for 3.6 mi. of grading and paving on SR 2 in King County. **Paul Jarvis, Inc.,** of Seattle submitted a low bid of $450,424 for construction of a bridge on SR 2 over the Wenatchee River. **Peter Kiewit Sons' Co.** of Longview received a $1,065,681 award for 6.8 mi. of paving on SR 1 in Lewis County. **Natt McDougall Co.** of Portland received a $329,383 award for construction of 0.4 mi. of the Vancouver Freeway at Burnt Bridge Creek. **Newport News Shipbuilding & Drydock Co.** of Newport News received a $1,146,845 award to furnish a hydraulic turbine for Ross Powerhouse.

Sellen Construction Co. of Seattle submitted a low bid of $1,581,168 for construction of a fuel tank farm at Boeing Field. **Sound Construction & Engineering Co.** of Seattle submitted a low bid of $973,191 for construction of launcher sites at Camp Hanford. **Strong MacDonald, Inc.,** of Tacoma received a $349,640 award for 11.2 mi. of grading and surfacing in Lewis County. **J. P. Surace Construction Co.** of Seattle received a $433,209 award for 4.6 mi. of grading and surfacing SR 9 in Clallam County. **Thorburn & Logozo** of Seattle submitted a low bid of $288,341 for construction of 21 mi. of unlined laterals for the Columbia River Basin project.

WYOMING

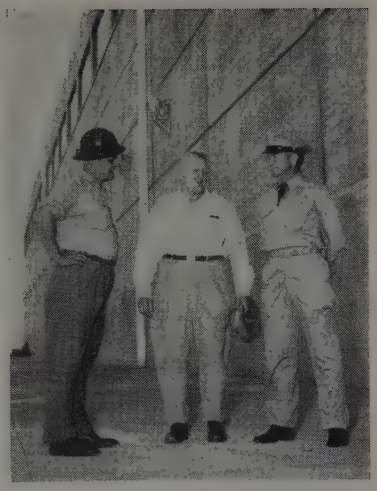
CONSTRUCTION TOTALING almost $1,000,000 is under way at three state institutions: the state hospital at Evanston, the state training school at Lander, and the Wyoming Home for the Aged at Thermopolis.

A $23,000,000 PIPE LINE will be built from Rock Springs to Denver by Colorado Interstate Gas Co.

HIGHWAY STRIPING for 1954 is well under way, according to Robert O'Connell, State Highway Department traffic engineer. The Department has recently acquired a faster striping machine.

RUNWAY SURFACING with soil cement preparatory to paving about 1,300 ft. of runway at the Lusk Municipal Airport is in progress.

RECENT MAJOR CONTRACT AWARDS and low bids in Wyoming include a low bid of $174,262 submitted by **McWaters & Bartlett** of Boise for earthwork and structures on the Eden Project. **Gilpatrick Construction Co.** of Riverton submitted a low bid of $138,000 for grading and surfacing on the Togwotee Pass Highway.



TURNING OVER GARRISON DAM INTAKE

Talking over construction problems on the intake structure of Garrison Dam, recently turned over to the Corps of Engineers by the Peter Kiewet Sons'-Morrison-Knudsen, joint builders, are (from left) *Harlan C. Hutchins*, chief of Construction Division, C. of E.; *Ben Williams*, contractors' project manager; and *Col. Henry L. Hille*, district engineer, C. of E. The intake cost $21,000,000.

ALASKA

CATERING ON THE TUNDRA—One of the big problems on construction of the 621-mi. pipeline from Haines to Fairbanks is keeping construction workers and supervisory personnel well fed and housed. The job has been turned over to Canus Services, Inc., by the contractor and so far this aspect of the project has gone very well. Canus feeds and houses the workers at 11 mobile and permanent camps spotted along the right-of-way. Canus is feeding about 70 men at Tok and 80 at Haines. The average cost of feeding one man per day is $5.75.

RECENT MAJOR CONTRACT AWARDS and low bids in Alaska include a low bid of $2,839,489 submitted by **Morrison-Knudsen Co., Inc.,** of Seattle for construction of an AC&W military installation on Middleton Island in the Gulf of Alaska. **L. E. Baldwin Inc.** of Seattle received a $2,403,338 award for construction of two 200x800-ft. warehouses at Elmendorf AFB. **Lease & Leigland** and **M-B Contracting Co., Inc.,** of Seattle submitted a low bid of $1,250,135 for construction of hardstands and parking aprons for family housing at Fort Richardson. **Mannix International Corp.** of Winnipeg submitted a low bid of $1,731,414 for rehabilitation work on 59 mi. of the Alaska RR from Seward to Portage. **Patti-MacDonald Construction Co.** of Kansas City received a $3,788,714 award for construction of docking facilities at the Port of Whittier.

Here and There

ENGINEER SHORTAGE—Maj. Gen. Samuel D. Sturgis, Jr., Chief of Army Engineers, blamed America's shortage of engineers on an educational system that has thrown overboard the mental discipline of the three R's in favor of "happy, well adjusted children." This statement was made in the May issue of **American Engineer,** published by the National Society of Professional Engineers.

General Sturgis predicted that the "drift in the public schools away from mathematics and science toward the so-called social studies would result in an insidious influence on both the quality and quantity of engineers."

He warned that "while our fine engineering educational system is being starved to death through lack of adequate material, the Russian engineering schools are getting plenty of students who are fully prepared for advanced work."

General Sturgis closed by expressing concern over the number of regular and reserve engineering officers in the top grades who leave the service and the number of junior officers with no previous engineering experience. He called upon the engineering profession to cooperate with the Corps of Engineers in an effort to maintain "the high position the Corps deserves within the Army in this day of reliance on technology for national survival."

GAS FOR THE NORTHWEST!—Pacific Northwest Pipeline Corp. of Houston, Tex., has been authorized to build a $160,000,000 pipe line system to transport natural gas from the San Juan Basin in New Mexico and Colorado to market areas in Colorado, Utah, Wyoming, Idaho, Oregon, and Washington after much debate before the Federal Power Commission. Construction during the first year will include 1,466 mi. of main line, 106 mi. of supply laterals, 327 mi. of sales laterals, and 14 compressor stations. Construction is scheduled to begin before October 1. An additional $47,600,000 will be spent for well drilling and other plant additions during the first three years of the line's existence, press reports said. Competing applications, which would import gas from Canada, were denied.

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Now...a motor oil so superior it can save up to ¾ gallon of gas in every 5 ...a heavy-duty motor oil so far ahead that just one grade serves all cars and light trucks, all year 'round, in all climates. Proved in the toughest stop-and-go driving, easier-starting "RPM" 10-30 Special saves you money, saves engine wear, boosts performance. Start saving today with RPM 10-30 Special Motor Oil.

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DESIGNED FOR OLDER CARS AS WELL AS NEW—covers all car manufacturers' motor oil recommendations.

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THE TWINING LABORATORIES

By Fred W Twining

STANDARD OIL COMPANY OF CALIFORNIA

ALASKA Newsletter

By CLIFFORD S. CERNICK, Anchorage

BIG JOB AT BIG DELTA — One of the biggest construction projects currently under way in Alaska is the Big Delta training and indoctrination center job. Right now, about 400 men are at work on the project, which is being performed by Peter Kiewit, Early, Boen Koon, and Egge-Cummins construction companies. More than $12,000,000 will be spent in the Big Delta construction program, 320 mi. north of Anchorage. The project is to provide complete facilities including housing, testing, and recreational facilities for troops and technical personnel working at the center.

RUNNING BATTLE—A verbal battle between Anchorage union officials and the Air Force concerning construction work at the Bristol Bay air base of Naknek could well have profound implications for the entire construction industry. Anchorage union leaders say the Air Force is doing too much construction with troop labor at Naknek, and these leaders contend that this work rightfully belongs to civilian forces. The latest volley in the battle was fired by the labor faction which declared that the Air Force contemplated spending "several millions of dollars" in work on which all labor will be performed by troops.

QUICK REBUTTAL—The Air Force was quick to deny the charges. They announced that the project complained of consisted merely of "repairing runways." The same press release stated that the Alaskan Command had no intention of depriving any civilian of work. "Rather," said the statement, "it is the policy to assist the community in any way it can. This has been the goal in the past and shall continue to be so in the future." The Alaskan Federation of Labor, building trades department, came back by naming two major projects at Naknek on which construction was to be done by troop labor.

APPEAL SENT TO IKE — R. E. McFarland, executive secretary of the building trades department, has appealed to President Eisenhower for an investigation of the charges. McFarland advised Ike by wire that Alaska has developed "a permanent population of skilled craftsmen during recent years and hundreds are now idle while troops presently perform and contemplate additional major construction projects at Naknek." McFarland added that such projects properly belong in the "new construction" category for competitive bidding by private industry using civilian labor. He said the Air Force action "threatens to deplete permanent working forces in Alaska if permitted to continue."

SIGNIFICANCE EXPLORED — What does the protest against use of troop labor mean to the average contractor doing business in Alaska and to the average construction worker? After sifting the charges and counter-charges in an attempt at objectivity, it does appear that some work now going on at Naknek could be performed by civilian contractors more expeditiously and at perhaps less cost. Assuming that such is the case, and that an investigation will bring out some such conclusion, it seems clear that decisions made in this case could mean more work for civilian construction men and for civilian contractors. Naknek is only one of a number of Alaskan bases where a great deal of work is performed by troops. The big problem seems to be where to draw the line between work that logically and feasibly can be done by servicemen and work that ought to be done by civilian agencies. The opinion of military commanders in the field can't be overlooked; right now, it is their contention that much of this work should be done by troops to give them training in construction methods which could well come in handy in an emergency. The military also finds itself at some bases with a large supply of manpower on its hands and naturally wants to keep these troops busy during their duty hours. All indications here are that some compromise will be worked out, whether as a result of a military directive or as the consequence of a special investigation of the matter. It's clear now that the balance is not likely to swing toward more construction work for troops. The other alternative is more likely, and thus will be of benefit, in some degree at least, to the construction industry in Alaska.

BEST BY TEST — The ability of construction firms to adapt their resources and planning to the harsh conditions existing in remote areas will be tested again. In the past, stateside construction firms have been able to push through Alaskan projects on schedule despite significant obstacles raised by weather, remoteness, and lack of supplies. One such project — a desolate island off the Alaskan coast — has just been awarded to Morrison-Knudsen Company, Inc. M-K was awarded a $2,839,489 contract for construction of troop housing, utilities, technical facilities, roads, and extension of an airport at Middleton Island. Completion of the project must be effected by December of 1955. At the present time there is virtually nothing on the island, and M-K must start "from scratch" in carrying out this project under rugged Alaskan conditions.

ON THE LABOR SCENE—With construction activity in Alaska now nearing its peak, a labor force of between 20,000 and 30,000 persons is now at work on projects in Western and Central Alaska alone. On the whole, there has been remarkably little labor turmoil during the 1954 construction season. An example of this is the willingness of the carpenters to continue work pending settlement of a wage dispute. Last year, they refused. Carpenters can consider themselves rewarded for their cooperation by the whopping big settlement bestowed on them recently by the Associated General Contractors. Western Alaska carpenters have been given a 12½-cent wage boost, bringing their total hourly pay to $3.69. Southeastern Alaska carpenters were given 15-cents an hour more, bringing their wages to $3.37½ an hour. The best part of the new wage rate, from the carpenters' standpoint, is that it is retroactive to February 12.

SHOT IN THE ARM FOR VILLAGE — One of the little-known effects of heavy construction in remote Alaskan localities is the stimulating boost such construction gives general business conditions in near-by villages. The village of Big Delta has shown few signs of any activity for some years. Now that large-scale construction work is beginning at the near-by base, Big Delta is experiencing a pint-sized "boom." An Anchorage man has just completed construction of a $100,000 luxury hotel in the village and many other businesses are being installed. Trade at the stores, which once catered largely to sourdoughs and trappers, now is brisk. The same effect was noticed at the village of Haines on the seacoast when it became a center for operations on the Haines-Fairbanks pipeline.

JUNE CONSTRUCTION—Defense contracts totaling close to $7,000,000 were awarded during the last week in June by the Alaska District Corps of Engineers, bringing the total for the month of June alone to nearly $14,000,000. The contracts were for construction in all parts of the territory. They ranged from a few thousand dollars to those running into millions. The Engineer office says that July will also be a bumper month for contract awards, with calls for bids already issued on 11 different projects.

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gives up to *twice* the engine life between overhauls

ENGINEERS on the move

Colonel Andrew J. Goodpaster, Jr., now with Supreme Headquarters Allied Powers Europe (SHAPE) in Paris, has been assigned as district engineer for the San Francisco District, Corps of Engineers. Colonel Goodpaster replaces **Colonel H. Walker,** who is taking over another assignment. Colonel Goodpaster has been with the Corps of Engineers since his graduation from West Point in 1939. Named as special assistant to the San Francisco district engineer is **Lt. Colonel William A. Allison,** of McMinnville, Ore.

* * *

The Colorado Department of Highways reports the following changes and appointments among its engineers. **A. V. Williamson** has become assistant to the Department's administrative engineer. He was recently retired from the Bureau of Public Roads, with title of district engineer. **Paul S. Bailey,** formerly bridge engineer, has retired after 32 years of service with the Department and is replaced by **A. D. Newbold,** who had been assistant bridge engineer. That position is now occupied by **E. F. Schoenbeck. J. A. Solmonson** was recently named district engineer for District No. 2 at Pueblo, where he had been construction engineer. **J. E. Casey** was appointed to a -corresponding position with District No. 5 with headquarters at Durango. He had been construction engineer there.

E. G. Swanson succeeded to the position of staff materials engineer following the death of **A. H. Bunte. L. T. Waymire** was named superintendent of maintenance equipment, a position vacated by the death of **Fred E. Cummings.**

* * *

R. W. LaRue has been appointed acting right-of-way engineer in the New Mexico State Highway Department, replacing **Don Roser** who recently returned to his duties as administrative assistant.

* * *

A. A. Wagner, materials engineer, Bureau of Reclamation, Denver, was among the authors of outstanding technical papers published by the American Society for Testing Materials who received awards at the ASTM 57th annual meeting. Wagner received first award for his paper "Lateral Load Tests on Piles for Design Information."

* * *

Verne Gongwer, who recently retired from Federal service where he had been employed in the civil, hydraulic and structural engineering field, has been engaged as consultant to Tacoma City Light on a dam project being contemplated on the South Fork of the Skokomish River. Now engaged in private practice in California, Gongwer had been a long-time employee of Tacoma City Light. Among the many projects designed and directed by him for City Light was the second Nisqually Project in 1940-1946.

* * *

LeRoy Crandall, Frederick Barnes, and **Leopold Hirschfeldt** have formed the firm of LeRoy Crandall & Associates for the practice of consulting foundation engineering. The office of the firm is located at 1614 Beverly Blvd., Los Angeles 26, Calif.

* * *

A. P. Beiser, field engineer for Rothschild, Raffin & Weirick, is engaged on the construction of a high school project in San Mateo, Calif., costing more than $3,500,000.

Richard C. Thompson and **Frank E. Cornwall,** president and executive vice president of Macco Panpacific Co., internanational engineers and contractors, have acquired all the assets and current construction contracts of that company and in future will operate under the name of Thompson-Cornwall, Inc. Principal offices of the company will continue in New York, with a branch at Los Angeles, as well as in the Latin American countries. Vice president Cornwall is widely known in the West, having been general manager of the Macco Corporation of Los Angeles before joining the Macco Panpacific Co.

L. P. Staman has been named public works director of the city of Tacoma, Wash. He was formerly civilian engineer with the Corps of Engineers at Fort Lewis.

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Harvey F. McPhail, an assistant commissioner of the Bureau of Reclamation, was recently retired from Government service. He plans to engage in consulting engineering practice.

* * *

Lyman D. Wilbur and **Murray E. Burns,** engineers, as well as vice presidents of Morrison-Knudsen Co., Inc., have returned from Panama, where they were engaged by the Corps of Engineers in surveying the problem of a sliding mountain which is threatening the Panama Canal.

* * *

Oliver A. Lewis, chief, investigation and survey reports section of the Engineering Division, Walla Walla District (Wash.) Corps of Engineers, has been named chief of the District Construction Division, fill-

GATHERED to watch the bid opening for Idaho Highway Department's 6,000-ft. concrete bridge over the Pend Oreille River at Sandpoint (Western Construction—June 1954, pp. 65-67) are (from left) *F. E. McLeane,* Peter Kiewit Sons' Co.; *R. W. Austin,* Cascade-Austin Co.; *J. C. Dougherty,* LeBoeuf-Dougherty Contracting Co.; *E. V. Miller,* Idaho state highway engineer; *H. C. Washburn,* Peter Kiewit Sons' Co.; *R. M. Parsons,* district highway engineer; and *John S. Ward,* Cascade-Austin Co. The joint venture of Kiewit and LeBoeuf-Dougherty submitted low bid at $1,135,332. Cascade-Austin was second low at $1,185,336.

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With the new Model "520" Case industrial diesel the emphasis is on power . . . utility . . . and economy. Its big 65 h.p. engine steps right out with heavy loaders, dozers, rollers, plows and scrapers. It starts and runs on low-cost diesel fuel . . . has Case-designed "Powrcel" combustion to squeeze more work out of every fuel charge . . . 6-point protection to eliminate dirt in fuel, and a crankshaft with seven main bearings for smooth operation.

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Reynolds Equipment Co.	Fresno, Calif.
Liberty Truck & Parts Co.	Denver, Colorado
Contractors Machinery Co.	San Francisco, Calif.
Jenkins & Albright	Reno, Nevada
Fowler Equipment Co.	Salt Lake City, Utah
Montana Powder & Equipment Co.	Helena & Billings, Montana
Columbia Equipment Co.	Portland, Oregon
Star Machinery Co.	Seattle & Spokane, Washington
Wortham Machinery Co.	Cheyenne, Casper, Rock Springs, Sheridan, Wyo.

ing the position made vacant by **Sam G. Neff** who was recently promoted to the Portland Division Office.

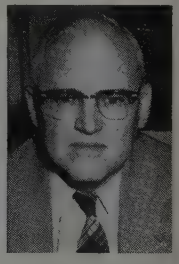
* * *

The following personnel changes in the Wyoming Highway Department, 5th District, headed by **Glen T. Shrum,** district engineer, have taken place. **K. A. Peck,** project engineer at Thermopolis, has been moved to the Cheyenne drafting offices. **Darrell Robertson,** assistant project engineer at Lovell will take his place at Thermopolis. **W. D. Whitlock,** project engineer at Basin, hereafter covers Lovell area from Basin.

* * *

Colonel James U. Moorhead, executive officer of the North Pacific Division, Corps of Engineers, has been appointed Portland district engineer, effective August 2. **Colonel Thomas H. Lipscomb,** who for the past three years has been district engineer at Portland and prior to that executive officer of the North Pacific Division, has been reassigned to the Office of the Chief of Engineers, Washington, D. C.

Moorhead



Field

Robert Hayes, chief of the engineering division of the Corps of Engineers at Garrison Dam, Riverdale, No. Dak., since 1946, has been appointed to head a staff of about eight engineering specialists who will work on the joint Canada-U. S. hydroelectric power project to be built on the International Rapids Section of the St. Lawrence River. Leaving Riverdale to join Hayes in New York are **Harold K. Pratt** and **John T. Nikko,** two important engineers who worked on Garrison Dam under Hayes. **Richard D. Field,** who has been chief of the design branch, Engineering Division, since his appointment to the Garrison District in 1946, succeeds to Hayes' former post.

* * *

A. F. Ghiglione, Commissioner of Roads for Alaska, reports the following news among the engineers: **Frank Morris,** resident engineer, Alaska C-1 project, promoted to assistant district engineer, Valdez district. **Robert Smith,** resident engineer, Fairbanks district, reassigned to resident engineer, Copper River Highway, Section C project. **Alan Goldberg,** acting resident engineer, Valdez district, promoted to resident engineer, approaches, Chena River and Noyes slough bridges. **Richard**

Stack, assigned as resident engineer to Richardson Highway, section C-1 project. **Andrew Divine,** resident engineer, Glenn Highway, Section C, continues as resident engineer, Glenn Highway, Section C-1, D-1.

Norman Smith, resident engineer, Anchorage district, to resident engineer, Alaska Highway, Section C-1 and C-2 projects, completion of paving of the Alaska Highway within Alaska. **Lawrence E. Hough,** assigned as construction engineer for the Cantwell area, Anchorage district. **Bruce Campbell,** assistant resident engineer, Anchorage district, to resident engineer, Cantwell area bridges project. **Wilfield Tilton,** construction inspector, Fairbanks district, to resident engineer, Knik River bridge project.

* * *

W. D. Nesbitt, as president, heads the activities of the Associated Engineers of Spokane, Wash. He has the assistance of vice presidents **R. E. Blasen, K. P. Norrie, H. A. Halstead, Sr., F. A. Long, Lee Patchen** and **Byron Barber,** and of **W. L. King,** secretary-treasurer of the association. Active in mining engineering circles, Nesbitt is manager of the Spokane office of Allis-Chalmers Co.

Nesbitt

Starr

Eugene C. Starr, professor of electrical engineering at Oregon State College, Corvallis, has been appointed to the post of chief engineer, Bonneville Power Administration, replacing **Sol E. Schultz** who resigned in June. Starr has taught at Oregon State College since 1927 and since 1939 has served as a consulting engineer for BPA.

* * *

Charles Faris recently returned from Punjab, India, where he was assistant supervisor of plant design, Bhakfa Dam, to become office engineer for Morrison-Knudsen Co., Inc., on construction of Box Canyon Dam, Ione, Wash.

* * *

Sol E. Schultz, since 1940 chief engineer of the Bonneville Power Administration and a pioneer in the development of high-voltage transmission facilities, recently announced his resignation from this federal agency.

* * *

Clinton W. Cote has been appointed city manager of Walla Walla, Wash. This position was vacated by the resignation of **G. C.**

Cookerly, who had held the position for 24 years.

* * *

Dr. Paul J. Raver, superintendent of Seattle City Light, was elected permanent chairman of the recently organized Puget Sound Utilities Council. **Jack Stevens,** consulting engineer, was elected secretary.

* * *

P. C. Leonard, resident engineer, District 1, Seattle, of the Washington Department of highways, recently assigned the following men as resident engineers on three grading, drainage and paving jobs in the district; **H. F. Wallace,** at Rockport, west; **G. A. Patterson,** Tolt to Duvall, and **Ed. A. Wilkerson,** Mukeltio to Pidgeon Creek Fill.

* * *

Frank J. Bennett has accepted a position with the Navy Public Works Office of the 13th Naval Dis-

trict, Seattle, as construction inspector at the Navy Fueling Branch, Manchester, Wash. Bennett was for 18 years in the employ of the Bureau of Reclamation, as a surveyor, inspector, and construction engineer, on Grand Coulee, Shasta and Kortes dams, and most recently at Hungry Horse Dam in Montana.

DEATHS

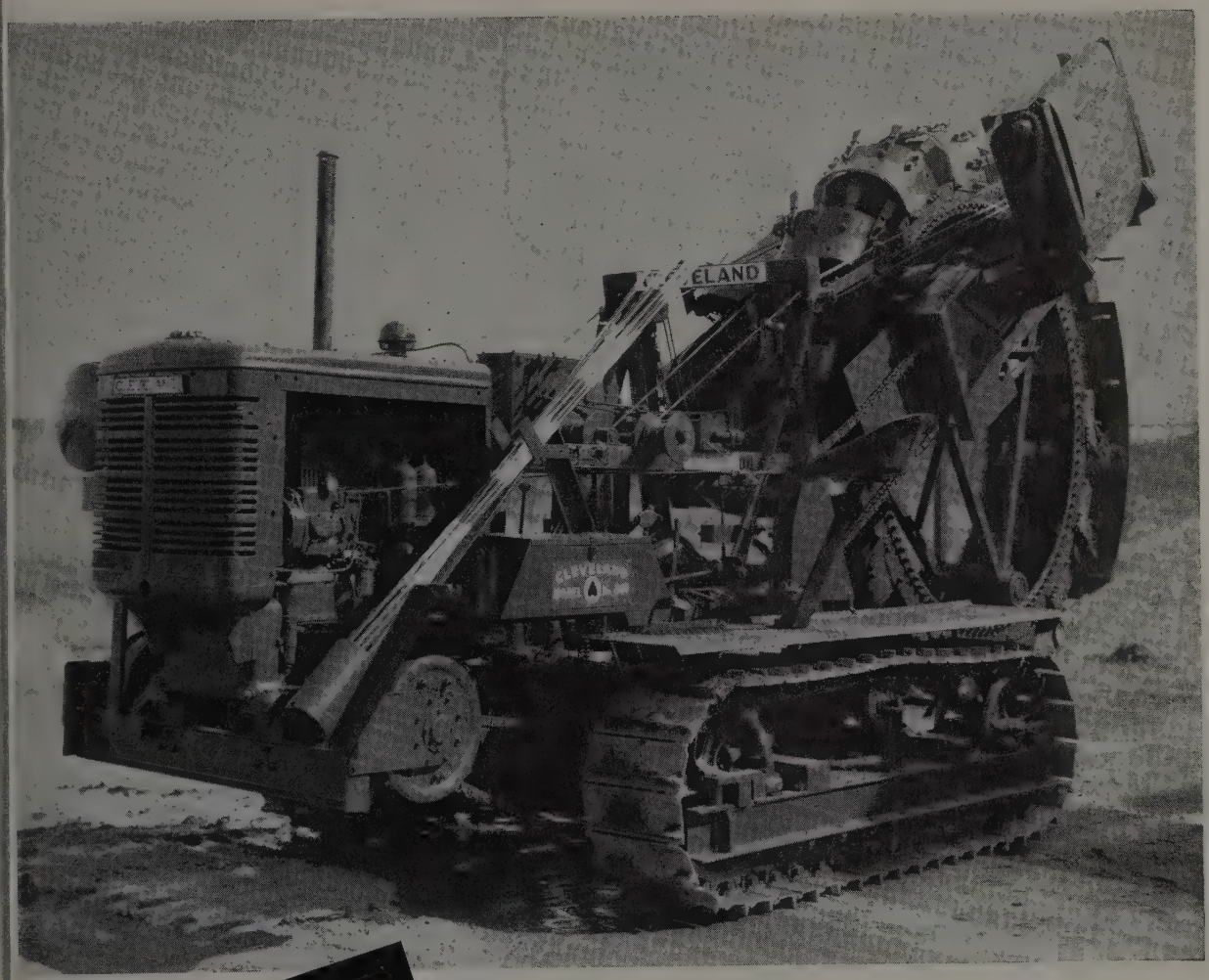
R. C. Perkins, 69, state highway engineer of Arizona, died July 4. For over 28 years he had served the highway department and under his direction many notable engineering projects were built. Although in ill health for over a year, he had continued in his duties with his customary enthusiasm.

* * *

A. H. Bunte, 53, staff materials engineer for the Colorado Department of Highways, died of a heart attack in Denver, June 3. He had been an employee of the Department since 1937.

* * *

Fred E. Cummings, 69, superintendent of maintenance equipment, and an employee of the Colorado Department of Highways since 1930, died recently at Denver.



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SUPERVISING the jobs

George W. Harris, superintendent, and **William Comer,** office manager, are key men for F. W. Case Co., contractor on the $484,160 job of repairing the San Mateo-Hayward Bridge, Bents 603 to 823, located on south San Francisco Bay.

* * *

George Wiggers, under the general superintendence of J. E. Haddock, is supervising construction of 1.4 mi. of Harbor Freeway between 42nd and 23rd Sts., in Los Angeles. Other key men on the job are **Jess Black,** general foreman; **Dick Mueller,** job engineer, and **Bren. Madden,** job office manager. This is a $3,135,-122 contract awarded J. E. Haddock, Ltd. The work is in the heart of a heavily built-up section of Metropolitan Los Angeles and involves 10 bridges, 3 pedestrian crossings, 11 concrete retaining walls, a pumping plant, plus grading and paving of freeway and service roads and ramps.

* * *

R. Hoffman is general superintendent working under **J. H. Tacke,** resident manager for Kaiser Engineers-Walsh-Perini-Raymond, joint venture contractors on the $56,000,-000 construction of the 14-mi. tunnel, diversion dam, and concrete arch dam, known as the Snowy Mountain Project, in New South Wales, Australia. **J. E. Lents** is administrative manager; **K. A. Nielson,** purchasing agent; **O. M. Mikkelson,** master mechanic. **J. D. Jacobs** is the project engineer. **V. A. Palmer** is another key man among the 35 Americans employed on the job. The rest of a 2,000-man labor force on the 7-year construction will be Australians.

* * *

Bob Osborn, project manager; **Jim Stinson,** superintendent; **Bob Pote,** master mechanic; **Bill Parrott,** mechanic, and **Dan Borradorri,** superintendent of equipment, comprise the supervisory force of Madonna Construction Co. working on 3.3 mi. of grading and plant-mixed surfacing and reinforced concrete bridge construction between Buellton and Route 80 in Santa Barbara County, Calif. This is a $287,070 contract.

* * *

Here is a run-down of the Bechtel Corporation's top personnel at the General Petroleum refinery under construction by Bechtel near Ferndale, Wash. Heading construction operations are **John Shea,** project superintendent, and **W. B. Hanna,** general superintendent. Superintendents are **N. L. Barron, H. M. Koons** and **F. E. Yost.** Assistant superintendents are **C. M. Able, L. B. Christman, W. J. Gould, B. M. Ince, O. L. Sweet, E. Wilson, H. O. Youngblood** and **J. Zeuen. G. D. Hammond** heads labor relations and **Al Thro** is materials coordinator.

In the engineering department, **C. E. Frishholz** is chief field engi-

Shea

Hanna

Barron

Yost

neer. Acting as area engineers are **C. T. Anneberg, H. W. Bishop, K. I. Clarke, D. W. Dunn, V. R. Hyatt, L. K. Levorsen** and **J. D. McNeeley.** Senior field engineer is **F. E. Driscoll,** and field engineers are **P. V. Boose, E. P. Davenport, W. M. Miller, H. S. Stillings** and **R. L. Stuhr. H. T. Losch** is cost engineer.

Supervising the various crafts are the following men. Area foremen: **W. P. Abendroth, W. M. Barnett, G. Easterbrook, A. Fuller, H. Graham, C. C. Graham, E. Hall, E. Ireland, W. F. Kirk, R. McCracken, J. Stuart** and **L. H. Seiber.** General foremen: **C. J. Aregger, C. Bach, A. Berg, T. Brown, Andy Carr, V. M. Clark, A. Carrol, E. Daugherty, C. W. James, C. Larson, R. C. Laughren, C. H. Martin, D. Pair, S. S. England** and **T. M. Harris.** Foremen: **D. Cook, K. Priest, P. D. LaGrone, Harold Cooper, Cal Kitchener, A. O. Exelby, Wray Symons, R. O. Reynolds, A. C. Yost, J. W. Estep, "Chuck" Watters, Charles E. Nelson, Jack Edwards, William Irving, S. E. Whittenburg, R. C. Willis, E. R. Bray,** and **L. J. Wells.**

Handling the administrative end of the job are the following men: **W. H. Carlin,** office manager; **J. W. Beasley,** chief accountant; **C. H. Eliason,** paymaster; **W. G. Lyle,** accounts payable; **W. J. Mathew,** chief timekeeper; **P. J. McGonigal,** field buyer; **F. M. Schumacher,** superintendent of materials, and **N. Siemens,** first aid attendant.

* * *

General foreman **Clyde H. Gile** and his assistant **Grover Tachell** are directing the work of Chicago Bridge & Iron Co. which has the subcontract for tank erection at the General Petroleum installation going on at Ferndale, Wash. Office manager for CB&I is **James Bagby.**

* * *

Charles H. Calkins, project manager; **Fred Muth,** general superintendent; **Floyd E. Muth,** grade superintendent; **Mike Berosik,** equipment foreman, and **Homer Currier,** master mechanic, are top men working for Herman Kathman, contractor who recently was awarded a $166,753 contract for 2.3 mi. of grading on state route 13-A, Pacific County, Wash.

* * *

Talbot D. Bailey, manager, with the assistance of **Robert Kurtz,** superintendent, and **Fred Robie,** office manager, is executing a $686,677 contract for Fredrickson & Watson Construction Co. Work involves 3.7 mi. of highway between Project City and Mountain Gate, Shasta County, Calif.

* * *

Arthur W. Rogers is superintendent for Tanner Bros. Construction Co. on a $129,000 highway contract for 7½ mi. of grading, drainage, and widening, with aggregate base and bituminous surfacing treatment, in Apache County, Ariz.

* * *

J. C. Henson is general superintendent and **C. L. Cleveland** is job superintendent on a $184,953 contract held by W. J. Henson for 2.7 mi. of grading and drainage, on U.S. 66-89, Arizona. Other assistants on the work are **George Willett,** grade foreman and **Richard O'Donnal,** concrete foreman. **W. J. Dubbell** is office manager. Job is now drawing to a close.

* * *

Jim Holland, superintendent, is working on Peter Kiewit Sons' Co.'s paving job consisting of 6.8 mi. on P.S.H. 1, in Lewis County, Wash., a $1,065,681 contract. **Ed Coniff** is job office manager.

* * *

Harry G. Thompson, project manager; **William Carroll,** project engi-

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REPAIRS..ONE FUEL PUMP!

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neer, and **Bruce Baker,** superintendent, comprise the top personnel handing a military project on Mt. Hebo, Tillamook, Ore., for Ward & Greene Contractors and Thompson & Georgeson, who won the award on a bid of $405,548.

* * *

C. T. Glenn, superintendent, assisted by **R. F. Carseallen,** is supervising two contracts at Long Beach, Calif., recently awarded Guy F. Atkinson Co. One, a $924,299 job, is for construction of a wharf at Pier B, Berths 17, 18 and 19; and the other a $608,480 contract for a wharf at Pier B, Berths 20, 21 and 22. Assisting these superintendents are **Joe Mabery,** foreman; **Domonick Billi,** master mechanic; **Leonard C. Marsh,** project engineer, and **Bert L. Bewley,** assistant project engineer. **Robert H. Hessler** is in the office.

* * *

Ken Baird, superintendent, and **Evan Street,** foreman, are top men working for Woodward Construction Co. on this contractor's $367,977 job consisting of 11.7 mi. of grading, drainage, base course surfacing, sand-gravel seal coat and miscellaneous work on the Pinedale-Rock Springs road from Rock Springs north, Sweetwater County, Wyo.

* * *

Lloyd W. Keith is in the superintendent spot and **Harold W. Cole** is engineer for Price-McNemar Construction Co. on a $271,428 contract for construction of a tactical facility (Special AAA) at Los Angeles, Calif. Job is expected to be completed by the end of 1954.

* * *

Howard J. Repp, superintendent, and **B. J. Wood,** general foreman, are top men working for E. F. Grandy who recently secured a contract for construction of a tactical facility (Special AAA) at a cost of $236,440. Installation is in Orange County, Calif.

* * *

J. R. Pilcher, superintendent, with the assistance of **Paul Patchin,** carpenter foreman, is supervising the construction of a 215 x 200-ft. concrete steel grandstand at Puyallup, Wash., for R. T. Early Co. which is doing the job at a cost of $500,000.

* * *

Don Turner, superintendent, assisted by **George Kochis,** grade foreman, is heading a $254,384 job recently awarded Duffy Construction Co. for 8.4 mi. of roadway and bituminous surface treatment on S.H. 25 in Jerome County, Idaho.

* * *

B. W. Bacon is engineer in charge of the erection of a men's dormitory at Fort Collins, Colo., by Mead & Mount Construction Co., a $1,017,400 project on which **John Hogan** is superintendent.

SUPERVISING CONSTRUCTION on the 12,000,000-gal. East Bay Municipal Utility District reservoir at Richmond, Calif., is *Walt Phillips,* shown (above) on the job. For the complete story of job progress, please turn to page 66 of this issue.

R. M. Skamnes is superintending the construction of a reinforced concrete and steel bridge across the American River in Sacramento County, Calif. He has the assistance of **Floyd Kidwell,** carpenter superintendent, and **Bill Rickman,** concrete superintendent. Skamnes was for 15 years with Ukropina, Polich & Kral, and recently went into business for himself. On a joint venture with Brighton Sand & Gravel Co., the combination firm won this contract on a bid of $289,166.

* * *

Eddie Surufka, superintendent, and **Reuben Sell,** foreman, are two top men working for Charles MacClosky Co. on a contract awarded to MacClosky for construction of the Ramona Freeway-Santa Ana Freeway interchange in Los Angeles County, Calif. MacClosky's bid was $465,443.

* * *

Walter Reed is general superintendent working under C. E. Wooster, president and general manager of the construction firm of George E. France, on a road job in Inyo County, Calif. On the grading end, **Gustav Rauser,** vice president of the company, is in charge as foreman. This is a $143,917 job consisting of grading and surfacing 7.9 mi. of Sign Route 190 between Junction Route 23 and 8 mi. east, 5 mi. northwest of Keeler. Job is just about finished.

Edward M. Pozzo is project manager on a 2-story and basement reinforced concrete structure being erected as an annex to the Examiner building in Los Angeles. Work is being carried out by Pozzo Construction Co., with **George Smith** in the superintendent spot, and **Glen Roberts** doing the purchasing.

* * *

Jerry Malchus is general superintendent for D. W. Nicholson, contractor who won the award for additions and modernization of the Kraft Tile Co. plant at Niles, Calif., on a bid of $500,000.

* * *

J. C. Henson, general superintendent; **Charlie Joy,** superintendent, and **W. J. Dubbell,** office manager, are key men who have been carrying out the grading and drainage work on 4.5 mi. of roadway in Graham County, Ariz., for W. J. Henson who is just finishing up this $178,707 job. The same men are supervising another job for Henson in Arizona, a $267,781 contract on U.S. 70.

* * *

John J. Doane, general manager; **A. H. Rodes,** general superintendent, and **Steve Macri,** superintendent, comprise the top personnel carrying out a $719,242 contract for S. Macri & Sons. This is a sewer job located at the Elmendorf AFB, Alaska.

* * *

C. R. Jurgensen is superintendent for a O. D. Cowart contract just finishing in New Mexico. This $191,167 job consists of 12 mi. of grading and surfacing on U.S. 85 in Bernalillo County. **F. W. Roeder** is handling the office work.

* * *

Clyde Hawken, superintendent, is supervising a $1,279,096 contract for Lytle & Green and S. Birch & Sons for paving a 63-mi. section of Glenn highway between Big Timber and Porcupine, Alaska, a $1,279,096 award. Two other key men are **E. W. Casper,** field engineer, and **Paul Kendall,** job office manager.

* * *

Reid W. Erickson, superintendent, and **R. K. Erickson,** mechanic, are heading a job in Oregon for Erickson Paving Co. consisting of 4.2 mi. of grading on a section of the Woodburn - Estacada highway in Clackamas County. The Erickson company is doing the work at a cost of $166,724.

* * *

Phil S. Johnston, superintendent for Skousen-Hise Contracting Co., is directing a 14.5-mi. grading and surfacing job on U.S. 85 in Mora County, New Mex., which recently

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Albuquerque, New Mexico

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went to the company on a bid of $454,287. Other key men on the job are foremen **Perry D. McElroy** (structures), **W. A. Christy** (grade), **E. L. Glass** (carpenter), and **Carl Austin** (crusher). **Ernest Kirchmeier** is timekeeper.

* * *

James W. Cox, superintendent, assisted by **Willis H. Slaughter**, foreman, is supervising a $266,614 contract recently awarded to Ralph B. Slaughter for 2.1 mi. of grading and surfacing with PMS on CTB, and widening a reinforced concrete bridge near Indio, Calif.

* * *

Norman Skousen is in the superintendent spot on a $386,495 job consisting of 9.6 mi. of grading and surfacing on State Route 17 in New Mexico. **Lars Johnson** is grade foreman and **F. E. Cassidy** is in charge of the office. Skousen Construction Co. which is doing the work expects the job to be completed the end of September.

* * *

J. A. Brunzell, project manager, and **Jay Grendahl**, superintendent, are top men for Hallett Construction Co. and Continental Co., joint venture firm doing the work of constructing a 30-mi. section of the Detroit-Albany 230-kv. transmission line in Oregon. Cost of the job is $248,229.

* * *

Floyd O. Helm, superintendent, with the assistance of **Art Stuart**, **Sam Martinelli** and **Jim Olsen**, foremen, is in charge of a $737,303 contract being executed by McCammon-Wunderlich Co. Work consists of 6.7 mi. of grading and structures in Del Norte County, Calif. **Carol Ward** is office manager.

* * *

O'Neil Jones is project manager, and **Carl Lowry** is superintendent for Albert Lalonde Co. which recently received a $135,027 contract for 6.8 mi. of grading, road-mix surfacing, and drainage structures on a highway in Valley County, Mont.

* * *

R. S. (Spaatz) Bowsfield is project superintendent under the direction of **H. F. Hudson**, president, and **Harold A. (Pat) Murphy**, vice president and project manager of the Transocean Engineering Corp. which recently was awarded a contract for 1.4 mi. of grading and appurtenant work on a highway north of the Napa-Lake county line, Calif.

* * *

William E. Djernas is general superintendent and **John LaGiusa** is job superintendent on an $858,353 contract for construction of Los Altos High School, Los Altos, Calif. W. R. Kalsched & Co. is the contractor.

* * *

DeWitt Hawkins, general superintendent, and **Glenn Neufer**, superintendent, with the help of **Walter Van Dyke** and **M. Beehler**, carpenter foremen, are directing the construction of an addition to the Beaverton High School at Portland, Ore., for Sterner Construction Co. which is doing the work at a cost of $676,738.

* * *

Addison C. Smith, general manager, and **Clyde Gerfers**, general superintendent, are two top men for Lewis Construction Co. on a $1,974,900 contract for construction of a 3-story, reinforced concrete, 100-bed hospital at Fairchild AFB, in Washington. **Adam Pierson** is general foreman. **James Fretwell** is labor foreman.

* * *

Walter Christiansen, project manager; **Wally Christiansen**, superintendent, and **Simon Christiansen**, construction engineer, are heading the contract awarded Christiansen Bros. for a classroom building at Provo, Utah, an $812,000 job.

* * *

J. H. Marshall, superintendent, and his assistant **Walter Ewers**, are heading up a job for G. I. Martin, contractor, covering 13.5 mi. of grading and surfacing in Roosevelt County, New Mex., a $170,198 award.

* * *

A. L. (Pete) Pace, superintendent, **Joe Mancebo**, master mechanic, and **Floyd Hicks**, timekeeper, are top personnel working for Fredrickson & Watson Construction Co. which is doing 12.2 mi. of grading and surfacing in Tehama County, Calif., a $587,778 undertaking.

* * *

W. N. Dahlstrom, superintendent, under the general direction of **George R. Stacey** and **F. L. Somers**, of the joint firm of F. L. Somers and George R. Stacey Co., is directing the work of 11.4 mi. of grading on a section of Pacific Highway in Oregon, contract for which was recently awarded to this contracting combination on a bid of $709,346.

* * *

O'Neil Jones, project manager, and **Elmer Wuertz**, superintendent, are the top men supervising Albert Lalonde Co.'s $113,001 grading and road-mix surfacing job in Roosevelt County, Mont. Located on Poplar north highway, work will be finished in mid-September.

* * *

William P. Lang, a senior highway foreman with the California Division of Highways, recently retired from the department. His immediate plans are to do a bit of traveling.

* * *

Mike Hamsler is superintendent of construction of the new Washington state office building being erected in Olympia. Prime contractor is Macdonald - Woodworth-Wright. **D. R. Nelson** is superin-

Turtle Club

D. A. Barton, an employee of Kaiser Engineers, qualified for membership on May 24, 1954. While working at the Hanford Works, Richland, Wash., he was struck by a wrench which was accidentally dropped. The force of the blow staggered him, but he was saved from injury.

Kenneth Whisman, a worker in the Calaveras Cement Co. quarry at San Andreas, Calif., recently escaped serious injury

Whisman *Metzger*

when he was hit on the side of the head by a tool with which he was trying to loosen a quarry drill, but most of the shock was absorbed by his safety hat. Presentation of the award was made by **Grant Metzger**, company plant manager.

Frank Vande qualified for membership on May 10, 1954. While at work at the Hanford Works, Richland, Wash., he was hit on the head by a spud wrench, which glanced down and inflicted a severe contusion on his left shoulder.

•

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SAFETY

Job accidents take their toll

THESE were the accidents that resulted in death or serious injury on the West's construction jobs during the last reported month.

Arthur Pittman, 44, carpenter, was buried under a cubic yard of concrete while working on a 23-story building in Denver, Colo. He was busy at the basement level when a bucket of cement cascaded upon him. Fellow workers dug him out and it was found he was not fatally injured.

John Roach, 62, and **Ambrose J. Trudell,** 35, two workmen in the employ of the Southern Pacific R. R., were killed at Elko, Nev., in mid-June. The men were engaged in removing rock to be used for a roadbed when a rock slide occurred as a result of an earlier dynamite blast.

Robert Lloyd, 38, truck driver, while working at Redding, Calif., caught his hand in a gravel conveyor belt. He was alone at the time and amputated his own forearm with a pen knife.

Lawrence A. Waldemer, 42, Lewiston, Idaho, was drowned five minutes after starting to work on a highway job for Baulne Construction Co. He was driving a dirt moving machine when it went off the highway and landed in the Salmon River.

William Mitchell, 32, was killed June 25 at Moses Lake, Wash. when his truck jack-knifed on a turn and the cab crushed him against the road. He was working for Curtis Construction Co. on a paving job when the accident occurred.

Louis Clifton, 41, bridge construction worker, was killed on the Golden Gate Bridge at San Francisco recently. A pick-up truck swerved past a warning signal and into a Judson Pacific-Murphy Corp. bridge crew busy moving its shanty office. **William Choate,** 34, job superintendent, was injured in the same accident, as was the driver of the truck.

Robert G. Cantonwine, 45, foreman for Francis McGee Construction Co., was electrocuted June 18 at Pendleton, Ore. He was driving a truck on which a derrick had been rigged when it contacted a power line.

Virgil O. Mueller, 25, died at Laramie, Wyo, as a result of having accidentally touched a wire on which he was working.

William Lynch, 30, Aberdeen, Wash., a Grays Harbor Public Utility District lineman, was electrocuted June 14 when he touched a 7,200-volt line.

---

tending for the J and B Manufacturing Co., subcontractor under Macdonald Buliding Co.

Soren N. Jacobsen, project manager, and **Severn D. Loder,** general superintendent, head the construction crew working on the $4,000,000 Mormon Temple building going up in Los Angeles. Other key men for the contractor, Jacobsen Construction Co., are **V. M. Butler,** project engineer; **O. Drysdale,** general concrete foreman, and **William Wright,** general carpenter foreman. Subcontractor superintendents are, **Stanley Child,** masonry; **E. M. Evans,** plumbing; **Harry Moorehead,** electrical, and **Joseph Young,** plastering.

Jim Jones is general superintendent for Henry George & Sons, holder of a $1,750,000 contract for the erec-

Continued on page 127

TRICKS of the TRADES

Waterproofing battery locomotives for Tecolote Tunnel

WATERPROOFING EVERYTHING electrical in Tecolote Tunnel is the big job of Ole Kubsch, chief electrician for Coker and Kiewit. The broad range of his tricks is mentioned in the lead article this month. But his work on the contractor's electric locomotives is worth special mention.

To start with, marine fittings are used for battery connections to the motors. These and all other joints and bolts are treated with various seals. About five compounds have been tried. One is a special seal put out by the Safety Seal Co. of Burbank, Calif. Another is General Electric Glyptal enamel. Scotchkote, by Minnesota Mining & Manufacturing Co., is a non-setting sealing compound that is just now being tried. In use for a longer time is Permatex No. 2—satisfactory but not a cure-all.

The most radical treatment so far undertaken is the use of a hard-setting compound, Epoxylite resin, a product of American Chemical Co. This seal is resistant to water, chemicals, and acid. The only trouble with it is that you can't apply it yourself. One locomotive motor from Tecolote Tunnel was in a Los Angeles shop almost the entire month of June to be processed by the franchised Epoxylite representative there. Epoxylite is a hard material in the first place, and has to be heated up for use. Then it must be individually applied to every element of the motor, wire by wire and part by part. Coker and Kiewit have high hopes for this product. If it doesn't do the trick—Goodbye, motor!

Pumping air to motor

It's one thing to waterproof the motor elements. But it's even better if you can keep the water out entirely. This is also attempted and is made more nearly possible by the fact that the motor cases are so carefully sealed as described above. The big item now is the use of a compressor on each locomotive for pumping air into the motor casing. For this purpose a 40-psi. Quincy compressor (ordinarily used for a paint sprayer) is bracketed on the motor frame, with a ¼-hp. d-c motor for power.

These compressors are doing a good job. Although they are pumping moist air any time the locomotive is in the tunnel, the air is warm and it becomes warmer inside the motor casing, so there is no worry about condensation unless the compressor is stopped. And this possibility introduces two more refinements rigged up by Kubsch.

Compressor always runs

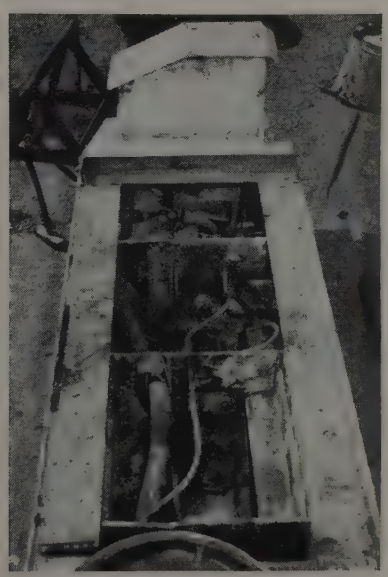
First, to be sure the compressor isn't stopped, a marine-type starting switch is provided, in conjunction with an indicator light. Thus, the motorman always knows when and if the compressor is going. And he is instructed never to turn it off in the tunnel, regardless of whether there is any water in the invert and regardless of how much noise the compressor makes while he is eating his lunch underground! The problem, of course, is the possibility that moisture would condense in the bottom of the sealed motor deep enough to do damage.

Also, if the locomotive were standing in water, the motor still has one vulnerable spot—where the shaft passes from motor to gear box. Ordinarily this shaft is equipped with one seal in a flanged fitting. But this acts only to stop flow in one direction. On this job, the problem is twofold: air flowing one direction, water flowing the other.

So Kubsch has had special deep flanges machined to take two seals. Clearance between the motor and the gear box isn't enough for this flange, so it has been necessary also

RAINSTORM 2 mi. underground shows why it takes a lot of work to keep locomotives going. (Making Rusty Rowe and George Benson look happier is one job the electricians can't do! That's a chore for the photographer.)

COMPRESSOR mounted in box on end of locomotive pumps 40-psi. air through rubber lines into motor casing; keeps moisture out even when the motor is in 2 ft. of water.



to machine a hollow in one side of the shaft pinion.

Controller shafts were another source of trouble. Conventional insulation for these square shafts is made up of two L-sectioned pieces, which are seemingly waterproof. Kubsch solved this one by having all controller shafts machined down to ⅝-in. section and fitting them with hollow square Bakelite conduit.

Sodden rubbish—mica insulation, burned-out brushes—tells the story of the challenge Tecolote Tunnel has tossed at the electrical force. It's been an uphill fight, with parts life measured in shifts instead of in weeks or months. (Storage battery life is about half what you'd expect.) But Kubsch—and the other trades—are beating the problems, one by one. They haven't yet gotten to the bottom of their bag of tricks.

Geiger counters and water

A RADIO-TELEMETERING snow gage which used the principle of absorption by water (liquid or solid phase) of the gamma emissions from an artificial radio-active isotope has been developed as a Civil Works investigation project in cooperation with the U. S. Weather Bureau. The radioactive, radio-telemetering snow gage has been used successfully to measure up to 55 water-equivalent inches of snow by counting the pulses from a suitably located Geiger-Muller tube. These pulses are transmitted and relayed by radio.

Testing of the initial installation at the Central Sierra Snow Laboratory was essentially completed in 1952 and the equipment has been installed by the Sacramento District in the Kings River Basin above Pine Flat Dam. Two reporting stations, State Lakes and Woodchuck Meadows, have been established at locations inaccessible during the winter and early spring. Three other stations are planned for installation in the Kern River Basin above Isabella Dam. Additional installations in the mountain snow areas of the bella Dam.

CALENDAR

Sept. 16-18—Western Association of State Highways Officials, 33rd annual conference, at Challenger Inn, Sun Valley, Idaho.

Oct. 14-16—Structural Engineers Association of California, annual convention at Hotel Del Coronado, San Diego.

Oct. 25-28—American Institute of Steel Construction, 32nd annual convention, at the Greenbrier, White Sulphur Springs, W. Va.

Oct. 28-29—American Concrete Institute, regional meeting at Statler Hotel, Los Angeles.

TOOLS of the TRADES

Use the coupon on page 133 for free information on any of these items

1

PORTABLE HACK SAW—The A&G Electro-Lift Oscillo-saw, designed to provide a portable electric hack saw for construction and other trades, has been announced by **Frank Anacabe.** Weight of the saw is about 17 lb. including accessories. The saw is about 8 in. high and has a no-load speed of 320 strokes per min. A regular 12-in. flexible hack saw blade can be used, although a longer blade may be used with an interchangeable frame. Tests with an 18-teeth-per-in. steel hack saw blade showed that it cuts ⅛-in. steel plate at the rate of about 10 in. per min. and cuts a 1 x 6 board in less than 15 sec.

2

OIL CONDITIONERS—Winslow Engineering Co. has published a 138-page general catalog on oil conditioners for fuel and lubricating oil. Each type of conditioner is described, pictured in photograph and drawing, and each has a complete specification table. The use for which each series was designed is indicated clearly. A cross-indexed reference table lists the filters of other manufacturers and the comparable Winslow elements. Another section lists tractors and power units produced by various manufacturers, their original filter equipment, including element, make, or number, and the comparable Winslow replacement element.

3

MALLEABLE IRON FITTINGS — Stanley G. Flagg & Co., Inc., has published a 20-page booklet on malleable iron solder-joint fittings. It contains photographs and specification tables on each type of fitting described as well as helpful hints on how to make a soft solder joint with malleable iron solder joint fittings and steel tubing. Another table gives melting data on tin-lead alloys.

4

SEMI-AUTOMATIC NAILERS—Fox Nailer Corp. has announced two new models of its semi-automatic nailers which attach to any pneumatic hammer with a No. 2 Morse Taper. The nailers, which are 6 in. long and weigh less than a pound, have two moving parts and require no lubrication. Model 20-P was designed to drive 16- to 20-penny nails. Model 6-P was designed for finishing nails and box nails from 3- to 6-penny. These nailers are used for production nailing, building projects, and are especially good for overhead nailing, where they reduce operator fatigue 90%, the manufacturer says.

5

NEW WATER LEVEL—Leveleasy, a hand-size water level which combines a fluid reservoir, tube reel, and 50-ft. clear plastic tube in a 6⅝ by 3¼-in. aluminum container has been announced by **Hydrolevel.** This hydrostatic level was designed for setting batters, grade stakes, masonry work, form erection, setting screeds, and general landscape work. The level can be filled and ready for operation in about 3 min. Cost $7.95. For more information, ask for your free copy of Bulletin 103-B.

6

MIDGET ROLLING SCAFFOLD—Superior Scaffold Co. has announced a new Midget Rolling Scaffold especially designed for workers engaged in the light building trades. It is 4 ft. long, 4 ft. high, and 23½ in. wide. The rungs are spaced 6 in. apart. Its four basic features are that it can get into almost any area the worker himself can reach, it moves on rubber casters, it is equipped with four-wheel brakes, and its rungs are permanently fixed to put the worker at any height off the ground from 6 in. to 4 ft. without mechanical adjustments.

7

PERMANENT SURVEY MARKERS—Copperweld Steel Co. has announced two types of non-rusting, copper-covered steel survey markers which will give property owners the protection of permanently-marked boundary lines. Each marker has a steel core with a thick copper covering molten-welded over it. One type has high visibility from its 1½-in. long, brightly-tinned end. It comes in ½- or ⅝-in. dia. and is recommended for use in uneven or heavy-foliaged ground. The other type has a compression-fit, 1½-in. dia. bronze head which provides ample space for center-punching the precise point of reference. The bronze-head marker, which comes in ⅝-in. dia., can be driven flush with pavements, roadbeds, bridge buttresses, and other surfaces. Standard lengths are 3 ft. In case these markers are buried a few inches under the surface, they can be located easily by using a dip needle.

8

CAT PARTS and how they are designed to give extra-long service is the subject of an 8-page, 2-color booklet, "A Good Reconditioning Job," published by **Caterpillar Tractor Co.** The booklet, Form D419, describes and pictures pistons, rings, cylinder liners, bearings, and valves, tells how they are made, and lists their advantages.

9

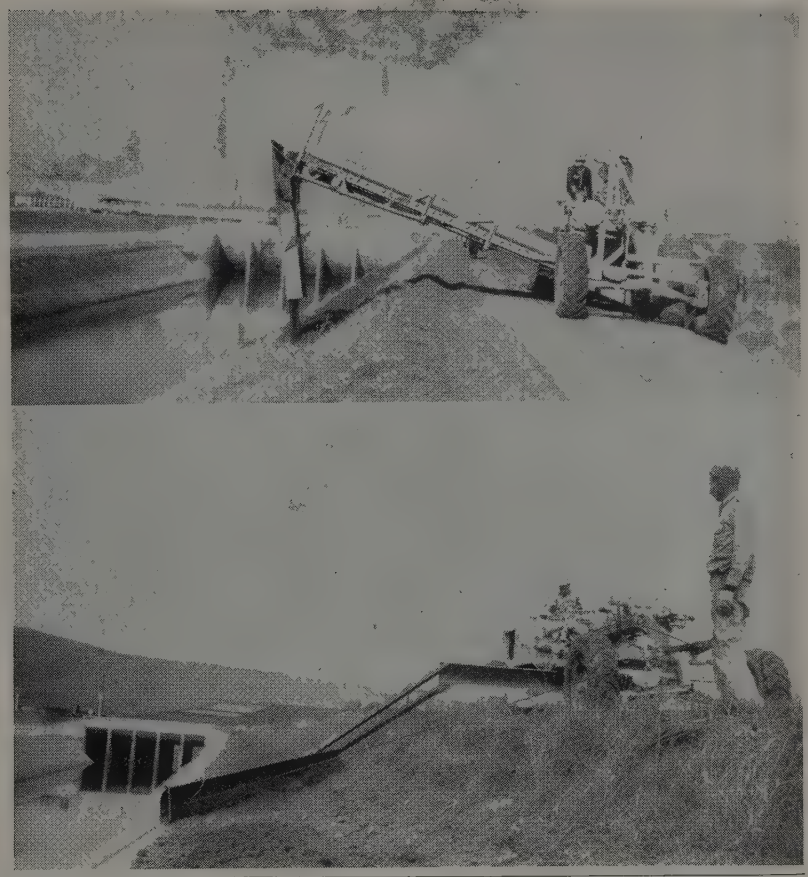
"SAFETY" is the title of a 32-page booklet, especially designed for welding and cutting operators handling oxy-acetelyne and arc welding equipment, published by **Air Reduction Pacific Co.** The booklet outlines safety precautions and rules for personal safety, handling and maintenance of cylinders, torches, regulators, and hoses. It discusses safe practices in setting up, adjusting, using, and shutting down welding equipment. Drawings show what to do and what not to do in various situations.

How to fill and grade a difficult strip

A LITTLE INGENUITY often makes the difficult job run better and at a substantial profit. It paid off recently when special equipment was used on the Friant-Kern irrigation canal near Visalia, Calif. This canal received 70 mi. of fill to provide a sloping bank just above the concrete wall of the canal.

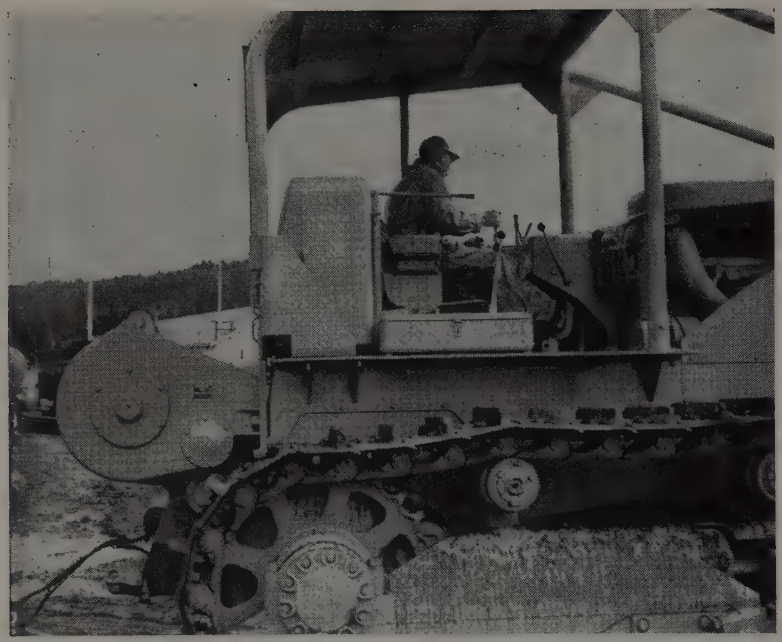
The 38,500 cu. yd. of earth needed to complete the fill was sidecase and finish graded at the rate of 220 cu. yd. per hour by a Caterpillar No. 12 Motor Grader with a Domor Elevating Grader and two special attachments.

As the elevating grader cut the fill material from the far edge of a road paralleling the canal and lifted it over the road, a special discharge chute placed the fill material accurately onto the upper channel wall. The Cat No. 12 Motor Grader was then equipped with a special "sloping" attachment and made short work of finish grading the project.



TOP—First pass of a Caterpillar motor grader with side delivery elevator places required amount of fill at top of canal bank.

BOTTOM—Another Caterpillar motor grader follows and, with its special attachment, smooths out the fill to the required slope.



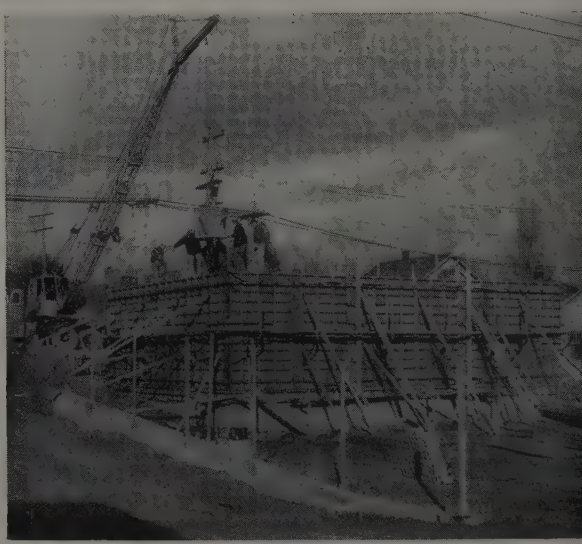
POWERFUL WINCH IN TESTING STAGE

What is said to be the largest and most powerful winch of its kind is currently undergoing exhaustive field testing by Hyster Company engineers. This powerful towing winch has been designed especially for use with the much-publicized, but not yet released for production, Caterpillar D9 tractor, the world's largest. Actual proving ground and field testing of the winch has been going on for the last 15 months. Its line pull is greater than that of any similar model and is of "matched design" to obtain peak performance from the tremendous power which the Cat D9 is reported to have.

THE 1954 EDITION of American Road Builders' Association's convenient, pocket-sized directory of "Highway Officials and Engineers" is now available for distribution.

This new edition of ARBA's directory contains the names of the administrative personnel of the 48 state highway departments, the District of Columbia, and the Bureau of Public Roads, as well as a listing of the personnel of toll road authorities. The officers and directors of the Association, its seven divisions and its Washington headquarters staff are also listed. In addition, it contains a tabulation by states showing highway funds expended during 1953 and an estimate for 1954, besides a tabulation of states having legislative authority to construct toll roads.

Directory sells for $1.00 per copy and can be obtained from the American Road Builders' Association, World Center Building, Washington 6, D. C.



First of four rectifier buildings for City Light, Seattle
C & R Builders, Seattle and Alaska, Gen. Con.

Symons Prefab Forms Re-Used on Building Jobs

Symons prefab plywood panels being used on the first of four rectifier buildings for City Light, Seattle.

Use Symons Perfab Forms on your next job. Send in your plans and get complete layout and cost sheet—No obligation. Our catalog F-9 will also be sent upon request. Symons Clamp & Mfg. Co., 4293 Diversey Avenue, Dept. H-4, Chicago 39, Illinois.

State of Washington—Homer Allen, Bellevue, Washington. Phone Gibson 1220.

State of Oregon—Concrete Forms, 5475 N. Lagoon, Portland 18 Oregon. Phone: TW 8831.

SUPERVISING the jobs . . . CONTINUED

. . . Continued from page 120

tion of a municipal coliseum in Spokane, Wash. **Don Huey** is project engineer. Other key men in supervisory positions are **Troy Pence, Roger McDonnell, Burley Bohannon** and **Ted Engstrom,** carpenter foremen, **Ken Webster,** steel superintendent; **Mark Bennett,** cement-finisher foreman; and **John Rubertt,** concrete foreman. Another foreman is **Clyde Hensley. L. H. Licht** is general foreman and **C. E. Rorberg,** job engineer for Power City Electric Co., subcontractor. **Walt Pockert** is superintending for Senna Service Inc., heating contractor.

* * *

W. C. Onan, superintendent, and his assistant **Joe Strand** are heading a $936,270 contract being executed by Purvis Construction Co. on erection of a 5-story addition to the Deaconess Hospital in Spokane, Wash. Concrete foreman is **"Andy" Anderson.**

* * *

L. E. (Lee) Cox, general superintendent, with the assistance of **Robert M. (Bob) McKee** is directing the job of Guy F. Atkinson Co. for construction of the Skagit River bridge at Mount Vernon, Wash., a $1,033,000 contract. Other personnel working in key positions at the site are **Harold Percival,** carpenter superintendent and **Charley Saar,** carpenter foreman; **Gordon Hamm,** general labor foreman; **Bud Kemp,** master mechanic; **Whitey Berg** and **Harvey Swanson,** piledriver foremen. Office manager is **Eldon Gaucher.** Job engineer is **Dick Seeley.**

* * *

Chief personnel working on the Box Canyon Dam and Powerhouse being constructed by Morrison-Knudsen Co., Inc., at Ione, Wash., for Public Utility District No. 1 of Pend Oreille County include the following men under **Simon S. Piedmont,** project manager; **Fred A. Reif,** project engineer. Superintendents—**H. P. O'Hagan,** carpentry and embedded parts; **C. C. Browner,** excavation; **Edgar C. Bryan,** resteel; **William A. Denton,** graveyard; **Odus J. Hankins,** rigger; **C. L. Harmon,** plant and equipment; **Harry E. Smith,** electrical; **Denver C. Thomas,** swing shift. Foremen—**William E. Hardin,** job foreman; **Roy Gochnour,** pipe; **L. G. Jones** and **John D. Bryson,** general carpenter; **Don Lantz,** electrical line; **Edd Hardin,** shop; **E. J. Rupe,** drill; **Glenn Hersey,** sand blast; **Marvin Harris,** concrete; **C. B. Brewer,** clean-up; **Gilbert F. Brown,** resteel; **John W. Ramey, William F. Brooker, Jess Ward** and **Archie Jefferies,** carpenter; **Gus Maguire,** labor; **William L. Gibson,** truck; **Rolland Weekes, P. G. McNeese** and **Frank Wilson,** rigger. **Don F. Simm** is equipment engineer. **E. R. Rice** is safety engineer. **Dennis D. Lucy** is business manager, and **W. R. Green** is in charge of purchasing.

H. W. Laurance is superintending for Morgan Company-Wismer & Becker handling the hydroelectric turbine subcontract. He is assisted by **Ross Calhoun,** mechanic superintendent. On the electrical installation subcontracted to the Morgan Company, **John Sander** is superintendent.

W. G. Nickol, superintendent, assisted by **T. J. Serna,** foreman, is heading a 6.1-mi. grading and surfacing job on S.R. 65 near Las Vegas, New Mexico, a $119,974 contract being carried out by Haake Construction Co.

* * *

G. C. Weeshoff is project manager, and **M. E. Noble** is superintendent for W. A. Irish who has a contract for $591,799 to construct a reservoir storm drain in Southern California at Pomona and Claremont. **Roy Thomas** is master mechanic, **A. Tosti** is tunnel foreman.

Aggregate test results published for roadbuilders

"RESULTS OF PHYSICAL TESTS of road-building aggregates" makes available to highway engineers and builders results of recent experiments on the qualities of various road-building aggregates. Tests were conducted on samples of ledge rock, crushed stone, gravel, blast-furnace or smelter slag, and natural or manufactured fine aggregates. The book gives physical qualities of both coarse and fine aggregates as well as detailed descriptions of the methods used for determining values in the test. It contains tables showing test results on both coarse and fine aggregates ranged alphabetically by states. The tables also define the aggregates in terms of hardness, size, kind of material, abrasive loss, toughness, soundness, specific gravity, absorption, crushing strength, and compacted weight. The manuals, published in 1953, may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. for $1 each.

Safety confab recommends construction practices

SAFETY CONFERENCE RECOMMENDATIONS — The 1954 California Industrial Safety Conference held in San Francisco included a recommendation that use of reinforcing steel for pick-up points in handling precast concrete slabs and beams in tilt-up construction be prohibited. The recommendation pointed out that use of reinforcing steel for such purposes is not safe, inasmuch as it does not have the same uniform molecular structure as cold rolled steel due to its manufacturing process.

SAFETY PAYS OFF AT GARRISON DAM

A plaque honoring Garrison Spillway Contractors for chalking up the best safety record in heavy construction during 1953 was presented in a recent ceremony at Garrison Dam in North Dakota. *John B. Jardine,* president of the North Dakota Chapter, Associated General Contractors (left), gave the plaque to *Joe Kellogg,* project manager for the contractor. *Brig. Gen. W. E. Potter,* Missouri River division engineer (right) looks on. The award was given because the contractors had only three minor injuries reported in more than 500,000 man hours worked during 1953.

Fighting 6,800-gpm. hot water flow in Tecolote Tunnel

The story . . . . . and the top men for Coker and Kiewit

. . . Continued from page 62

All in all, Tecolote Tunnel is a landmark job—not just for the West but for the world. It's the hottest, the wettest, the toughest, and certainly one of the most expensive. Decision to subcontraction completion of the work is no reflection on the prime contractor, Halvorson Constructors. In fact, they did drive 6 mi. of tunnel over a 3½-yr. period and placed concrete lining in half of that (the upstream leg). But 3½ yr. is a long time to fight a job like this one. In addition to administrative difficulties that are bound to come with changed conditions on tunnel work, it may be said that the spiritual challenge and incentive had begun to fade.

Bureau of Reclamation

By the same token, completion of the job will be a high point of achievement now, both for the Bureau of Reclamation and for the present contractor. Tecolote Tunnel is an element of the Cachuma Project and has been under the direction of E. R. Crocker, project manager, since the beginning. Richard E. Burnett is chief of construction division. Max T. Hedges is field engineer. W. F. McDonald is chief inspector. Inspectors on the tunnel work include, Ed Joswick, F. H. Youdell, A. O. Hadley, and B. A. Fowler. Bob Trefzger is geologist.

L. N. McClellan, assistant commissioner and chief engineer of the Bureau of Reclamation, is the contracting officer.

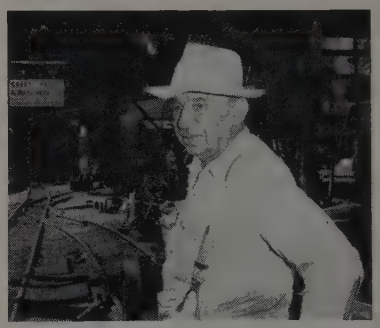
Contractor

Completely responsible for the work, although technically a subcontractor, is a joint venture of Coker Construction Co. and Peter Kiewit Sons' Co. A. M. Coker is manager of the joint venture, directing the work personally. Ray Blasongame is general superintendent. Both he and the project engineer, Don R. McGregor, came to this job with Coker from the Eklutna Tunnel in Alaska (**Western Construction**—October 1953, p. 83).

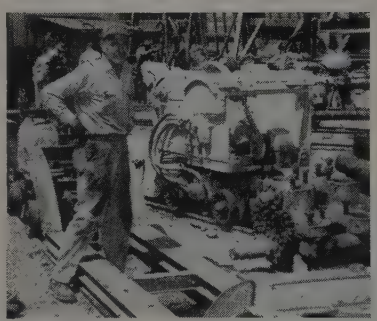
Charles Conrad is assistant superintendent and Henry Franey is safety engineer. Frank Weibel is master mechanic and Ole Kubsch is chief electrician.

Shift walkers include Bill Roberts and Cecil Passmore from the Eklutna job; also Johnny Coyle and Howard Beasley. J. P. Omann is office manager. J. S. McMullan is administrative assistant, and S. S. Johnston is timekeeper.

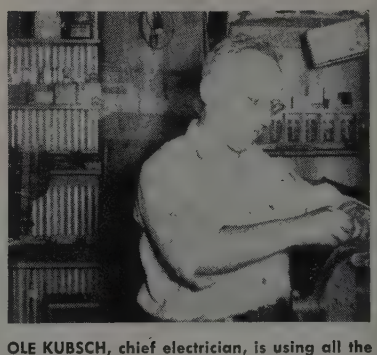
RAY BLASONGAME, general superintendent, works out a point with his engineer, Don McGregor. These men are part of the Eklutna Tunnel team formed in Alaska 2½ yr. ago. An inside-outside man, Ray dresses a little heavier than the others . . . black long-johns to avoid outside chills!



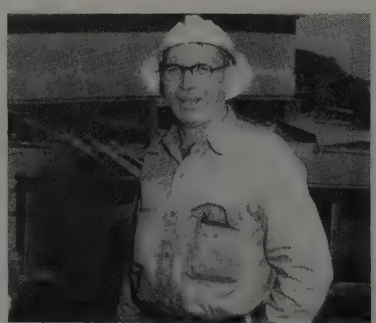
CHARLIE CONRAD, outside superintendent at Tecolote, is an old hand in soft-ground tunnels especially. When he outfits a train for mucking or for grouting, for drilling or for pump repairs, you know that everything is there, in the right amount and in the right place to be handy underground.



FRANK WEIBEL, master mechanic, knows everything when it comes to a spread of equipment put together over a 4½-year period. Here, surrounded by mucker and grout pump, he straddles "the handiest thing on the job," a low-boy mine car he built to haul 5-ton pumps underground.



OLE KUBSCH, chief electrician, is using all the tricks in his book—and they're outlined in "Tricks of the Trades," page 123 of this issue. Ole came down from Frenchman Hills Tunnel, which he says was "just an average job" in the matter of electrical problems that were tossed his way.



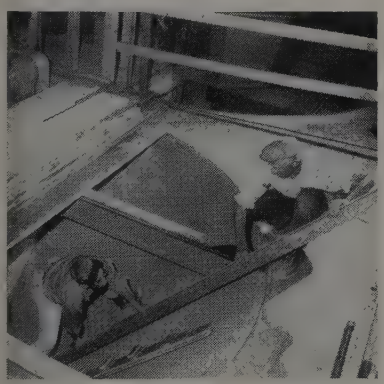
JIM FRANEY, safety engineer, plays a big part on this job. Daily temperature reports, gas checks, and records of water volume are the bases for his recommendations on safe practices. His work pays off: only one heat casualty so far for Coker and Kiewit, and that a minor one.

BILL ROBERTS, day walker and another of the Eklutna gang, shows how easy it is to pour water from a boot! Like the others, he hopes it won't be necessary to do much more grouting. It takes time, and "it seems like you're just pushing the water ahead of you instead of getting rid of it."

Difficult concrete pouring problem solved on job

A CONTRACTOR'S fortunate combination of field experience and imagination has solved the tricky problem of pouring a series of 8-ft. deep half-cone concrete pits at the El Segundo Division of Douglas Aircraft Co. MacIsaac & Menke Co., general contractor of Los Angeles, was the firm involved.

A unique method of pouring the half-cones was developed while the firm was constructing foundations for eight new high cycle radial arm routers for the Douglas plant. The half-cones will be used as chip removal pits for the routers.



Walls of the half-cones angle upward at from 45 to 60 deg. and form an opening at the top of the pit nearly 15 ft. across. In an effort to avoid the high cost of erecting cone-shaped forms, attempts had been made by others on previous jobs in the plant to form the sides of the half-cones by pressure shooting the concrete. This had proved unsuccessful because of the difficulties of properly screeding the material.

MacIsaac and Menke reasoned that the mix had to be applied by some method that would allow for constant control of the moisture content as the walls of the cones rose higher. Slump tests were carried out by MacMen in the field to determine the exact water contact desirable at the various levels. As a result of these tests, the lower one-third portion of the cone walls were poured with a 2½-in. slump, the second one-third with a 3½-in. slump, and the top third with a 4½-in. slump.

Screeding the steeply sloping mix was accomplished by pivoting a 2x4 screed on a pin placed at the bottom of the cone. A 2x2 shaped into a half-circle provided the guide angle for the upper end. Hand-trowelling was next and the job was finished with important savings in time and money.

Both the routers and their foundations were designed by Douglas El Segundo engineers.

NEW LITERATURE

Free copies of any of the items in this section may be obtained by using coupon on page 133.

10

Fiberglas expansion joints

A 4-page, 2-color brochure describing physical makeup and application of Fiberglas Expansion Joint has been published by **Owens-Corning Fiberglas Corp.** It contains information concerning expansion joint application on highways, streets, sidewalks, parking areas, driveways, airports, bridges, and general construction. Weight, width, and thickness tables are also included.

11

Shoveloader catalog

Baker-Lull Corp. has published a 4-page, condensed picture catalog describing the Model 20 Shoveloader, which has a standard bucket capacity of 12 cu. ft. Also contains a diagram of the unit in action, specification tables, operating instructions, and photographs. Available accessories are described and pictured.

12

Tensioning prestressed concrete

A 16-page, illustrated catalog entitled "Tensioning Materials for Prestressed Concrete" has been published by **John A. Roebling's Sons Corp.** It gives detailed information and charts on characteristic properties of wire and strand, including descriptions and photographs of various construction jobs on which use of prestressing has been made. The booklet is broken down into sections on strand, fittings, post-tensioned design, tensioning procedures, applications, and wire. Of special note is a description and photograph of how four of the largest prestressed concrete girders ever fabricated were applied in construction of a San Francisco garage.

13

Sierra Loader pamphlet

A 4-page, 2-color booklet describing the new Models C-27 and C-30 Sierra Loaders has been published by **C & D Manufacturing Co.** Salient features of the units are pictured and described in a numbered photographic sequence. Also contains specification table and photographs of the unit in action.

14

Link-Belt "Inside Story"

A 12-page booklet entitled "The Inside Story of Today's Most Advance Shovel-Crane Control System" has been published by **Link-Belt Speeder Corp.** It contains big type, pictures, and drawings which describe the power hydraulic control system found on the company's shovels, cranes, and draglines. It explains how the controls work and why.

15

Parts for dragline buckets

Replacement parts for any make or model of dragline bucket are described in a 28-page catalog published by **Electric Steel Foundry Co.** Easy-to-read drawings and photographs illustrate the various parts of the buckets, chain links, rigging, shackles, rope sockets, drag hitch assemblies, grouser tips, caps, and pedestals. Each item is accompanied by a complete specification table allowing the reader to select the correct size and weight for a desired replacement part.

16

Gas-diesel engine bulletin

Bulletin J-73, providing specifications and descriptions on the line of 13-in. bore and 16-in. stroke diesel and gas engines built by **The Cooper-Bessemer Corp.**, has been published. It pictures the various types of engines, contains specifications, and has detailed drawings and cross sections of Type JS engines. Also contains photographs of typical installations and a rating curve showing the break-horsepower rating of each engine in relation to its rpm. rating.

17

Asbestos cement pipe

Keasbey & Mattison has published a 4-page, color booklet on its Century asbestos-cement pipe. It contains a specification table listing standard sizes and classes, historical information on the derivation of material used, and lists of the advantages offered by using this pipe.

18

Selecting a motor pump

How to select the proper motor pump for any specific job is the subject of a 16-page booklet published by **Ingersoll-Rand.** This booklet, which is actually a slide film presentation in printed form, gives a brief description of what a centrifugal pump is and how it works. It points out the various factors, such as quantity, pressure, friction losses, and head that must be considered in selecting a pump to meet a specific installation. Then it takes up the presentation of a typical problem and its solution, by means of material shown on previous pages, such as charts and curves of various forms. Last it gives the material recommended for various pumping installations, including pictures showing the pumps being installed.

19

Power steering brochure

Garrison Manufacturing Co. has published a 4-page brochure on the hydraulic booster units which make up the company's power steering units. Contains drawings, photographs, and descriptions of the steering operation.

20

38 custom jobs

"Profitable Custom Work with Caterpillar-Built Equipment" is the name of a 12-page booklet published by **Caterpillar Tractor Co.** It describes, in picture and story, 38 different custom jobs for the user of heavy equipment. Ask for Form D408.

21

Metal Retaining walls

"Lock Up Unruly Slopes Behind These Metal Walls" is the title of a 4-page, illustrated folder published by **Armco Drainage & Metal Products, Inc.** It tells how metal bin-type retaining walls confine earth and

stabilize embankments along highways, railroads, streets, and streams. Photographs show the various types of installation.

22

Pressure pipe coupling

Johns-Manville has published a 6-page, illustrated folder describing Ring-Tite, a new coupling for transite pressure pipe. The folder describes how the coupling goes together, points out installation time saving practices, explains economies and service, and cites difficult uses. Also included are data on sizes and weights and basic information on transite asbestos cement pipe.

23

Hensley catalog

Hensley Equipment Co. has published a 12-page catalog and price list containing specifications, pictures, and descriptions of various tractor and grader attachments and replacement parts made by the company.

24

Concrete form booklet

Masonite Corp. has published an 8-page, 2-color illustrated booklet about its concrete form Presdwood. It describes the material, gives suggestions on where and why to use it, and lists specifications for various types of usage. A deflection and span chart enables the user to read off the deflection between supporting boards in inches. A number of photographs and drawings illustrate varying uses.

25

Reinforcing steel service

Joseph T. Ryerson & Son, Inc., has published an 8-page bulletin entitled "Ryerson Specialized Reinforcing Service for Contractors," which describes the various services performed for contractors ordering their reinforcing steel from this company. Also contains specification tables and lists various types of accessories.

26

Pioneer jaw crushers

A 48-page, 2-color booklet describing new developments and improved features of design in the interest of increased efficiency and reduced operating costs, has been published by **Pioneer Engineering Works, Inc.** It lists the advantages of overhead eccentric jaw crushers, and describes their principle and design, construction facilities and parts, operation, and application. Also contains sug-

gestions on how to select and order the proper size crusher. Many product illustrations, cutaways, and job photographs, as well as dimension and footing drawings, describe the line of jaw crushers. Also contains tables on capacity, toggle, and jaw plate selection, and specifications.

27

Belting catalog

Boston Woven Hose & Rubber Co. has published a 28-page catalog describing the company's line of rotocured transmission, conveyor, and elevator belting. Each product is pictured in color and tabulated as to its specifications, type of construction, and recommended use. A section contains formulae and rules for estimating horsepower requirements.

28

Complete Gardner-Denver catalog

A catalog covering its complete line of pumps, compressors, rock drills, and pneumatic equipment has been published by **Gardner-Denver Co.** to show all products made by the firm. The basic information and specification for each product, or group of related products, has been condensed into a single-sheet, 2-page bulletin. These single-sheet bulletins are fastened with a plastic binding which allows the book to open flat at any page. Indexed dividers split the book into 11 product sections. Ask for bulletin GP-100. Additional bulletins containing more information on most products are also available. Reference No. 840.

29

Truck crane booklet

Harnischfeger Corp. has published a 28-page, 2-color bulletin describing P&H truck crane Models 255-A, 355-A, and 555-A. It contains specifications and descriptions on such features as carriers, power plants, torsion bar front axles, and convertibility. Also illustrated are the live roller circle and machinery decks of each model. Sequence photographs show how the truck crane boom is taken down and made ready for road travel. Ask for Bulletin TX-143. Reference No. 847.

30

Briscoe slopers, ditchers

E. V. Briscoe & Son has published two catalogs describing the slopers and ditchers made by the company. One, entitled "Modern

Methods and Equipment Economically Solve Age-Old Problems of Ditchers for Irrigation and Drainage," is a compilation of magazine reprints, catalogs, and instruction manuals which combine to make a thorough explanation of the various types of ditches and how they are used. Contains specification tables, drawings, and photographs explaining how to operate and maintain the units. The other booklet, a 15-page description of the company's sloper, also contains specifications, descriptions of the various models, and action photographs.

31

Schramm air compressors

Bulletin 125, a 4-page folder describing 3 types of air compressors, has been published by **Schramm, Inc.** It contains specification tables, color pictures of the various units, and drawings of various types of equipment which may be used with one of the units.

32

Power equipment bulletin

"Power Equipment for your Profit Zone" is the title of a 16-page, color catalog, published by the Tractor and Implement Division, **Ford Motor Co.** It illustrates many jobs which can be handled by the Ford tractor and lists the Dearborn accessories including loaders, angle dozers, blades, cranes, snow plows, discs, mowers, and moldboard plows. Many photographs and drawings illustrate suggested uses.

33

Powder-tool selector

A pocket-size selector which gives at-a-glance guidance in the proper selection of fasteners, discs, and charges to be used with powder-actuated tools, has been made available by Ramset Fasteners Division, **Olin Industries, Inc.** The selector is made of laminated cardboard. A cross-line reading can be obtained by matching a sliding scale indicator with hardness and thickness data for each use in steel or concrete. Reference tables indicate the proper charge. Handy for use wherever powder-actuated tools are required.

34

Land clearing bulletin

R. G. LeTourneau, Inc., has published Bulletin No. 21, a 2-color folder describing the company's line of heavy-duty, land-clearing equipment. This equipment, which is electrically controlled and operated, includes a Tree Saw, LC tractor, and Disc Harrow. One page in the bulletin is a cost analysis sheet on which can be figured ownership and operating costs of a Tree Saw.

Literature briefs . . .

35

MOTOR UNITS for valves, floorstands, and sluice gates are described in Catalog 51, published by **The Chapman Valve Manufacturing Co.**

36

ZIPPER BELT CONVEYORS move carbon black without dust or degradation, according to Bulletin 349, published by **Stephens-Adamson Manufacturing Co.**

37

THE DIFFERENCE between wrought iron and steel is described graphically in "The ABC's of Wrought Iron," published by **A. M. Byers Co.**

38

HOW TO PREVENT glare on air-entrained concrete roads is discussed in "Highway Safety with AE Dispersed Black," a booklet published by **A. C. Horn Company, Inc.**

39

DESIGNED FOR CONTRACTORS is the claim made for this pump. Send for Contractors' Pump Bulletin No. 4-CP-11, published by **The Gorman-Rupp Co.**

40

HIGH-STRENGTH, lightweight piling is described in Bulletin W7, published by **L. B. Foster Co.**

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NEW EQUIPMENT

More information on any of the items in this section may be obtained by using coupon on page 133.

41

Improved windrow-stockpile loader designed to meet job requirements

Athey Products Corp. has announced Model 7-11 Force-Feed Loader, designed to supersede the company's Model 3. The new model can be fitted with two types of

moldboard-feeder arrangements. One arrangement includes augers working with a bulldozer type moldboard that can load from either stockpile or windrow with a 90-in. width of gather. The other arrangement includes two tapered, grader-type moldboards angling out from the front to provide an 84-in. width of gather for heavy-duty windrow work where oversize material is encountered.

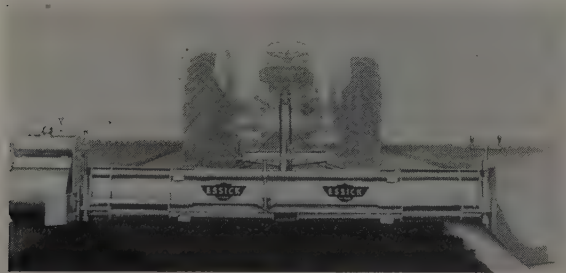
Field tests reveal that ¾- to 2-in. crushed limestone mixed with bank-run gravel for use as sub-base for an air field, was loaded out at the rate of 1,800 tons of material in an 8-hr. shift. Conversion from the auger feeder to the tapered moldboard feeder can be accomplished in about an hour by one man.

Specifications include a 101-hp., 6-cylinder Ford engine, loading speed range of 0.26 to 1.74 mph., and travel speeds up to 20 mph. Simple hydraulic controls are featured. Many attachments to meet varied working conditions are available.

42

Paving material spreader speeds up job

A paving material spreader designed to reduce costs and time necessary to finish a paving job has been announced by **Essick Mfg. Co.** Operating features of the unit, known as Model 710, include a 16-in. wide, 16-in. dia. roll to guide spreader on level of finish, a large fluid tank, adjustable telescoping extension blade sections



3 ft. long, a center blade section 6 ft. long, a leveling skid 8 ft. long, and twin-handled screw shafts for adjusting height of either roll or skids.

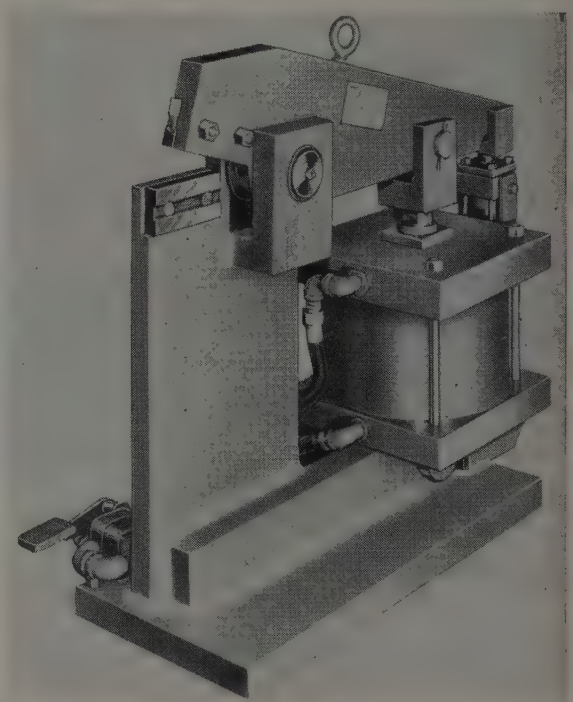
Specifications include a maximum overall operating width of 13 ft. 9 in. (spreader with one roll and one skid), a maximum adjustment of 6 in. on spreader blade clearance, and a shipping weight (spreader with one roll and two skids) of 929 lb.

This unit comes equipped with one roll and two skids. The two skids can be attached to each end of the adjustable spreader blade and serve as a guide for leveling high and low spots of the base grade.

43

Air-operated shear cuts reinforcing bars, cables to size

A new air-operated shear for cutting reinforcing bars and cables to size either on the construction job or in prefabrication operations has been developed by **Curry Air Shear Corp.** It operates from any standard compressor at



pressures from 60 to 125 psi. It has no motors or gears to maintain and practically no wearing parts.

This shear, recommended by the manufacturer for cutting bar or flat stock in general production work and shearing sections, operates only while cutting. Model A has 6-in. knives with four cutting edges, which can be adjusted by set-screws after grinding. The shear, operating by a foot treadle, remains closed when not cutting. Overloading does not harm the equipment, since the limiting factor is the pressure in the air cylinder. There is only one grease fitting in the entire unit so little lubrication is required.

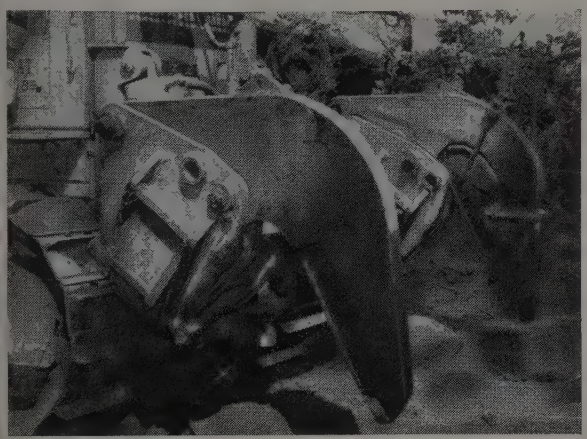
The shear will cut 1-in. diameter, cold mild steel at 80-psi. air pressure. Normal speed is 2 sec. per cycle. The

unit which is 3 ft. 2 in. high, 15 in. wide, and 36 in. deep, may be mounted on casters for more convenient handling. The jaws open 2¾ in. They are located 30 in. above the floor. Ask for Bulletin 50-Y-2 for more information.

44

New root cutter speeds up land clearing operations

A new root-cutting blade which can penetrate 30 in. below the ground surface and cut roots up to 12 in. in diameter has been developed by **American Tractor Equipment Corp.** for use with the Ateco rock ripper for Caterpillar D8 tractors. The new root knife replaces usual ripper standards on the rock ripper, making a compact, tractor-mounted, root-cutting tool which will work anywhere a tractor can.



The operator lowers the hydraulically-controlled root knife close to the tree and makes a few deep passes to cut the supporting roots. Any push high up on the trunk with a special "stinger" mounted above the bulldozer brings the tree down where it can be dozed into a burning pile. The 860-lb. blade is made of 3-in.-thick heat-treated alloy steel and is 18 in. wide at the bend and tapers to a 10½-in. width at the point.

The complete rock ripper with blade weighs about 8,000 lb. Pull is taken on the drawbar with no strain on the tractor case. As a rock ripper, the unit will penetrate and shatter rock, concrete paving, cemented gravel, and other hard materials to speed loading operations and reduce scraper damage.

45

Fluid drive saves fuel on Galion tandem rollers

The Galion Iron Works & Mfg. Co. has announced the availability of Roll-O-Matic drive, a combination of fluid drive and torque converter, on four models of variable weight tandem rollers. The engine driving force is transmitted by means of oil in motion instead of by transmission gears.

Use of this drive eliminates the master clutch and gear shift mechanisms. Desired speed of the roller is selected and set by the operator by means of a control lever at the side of the seat. The engine adjusts itself to the driving power required, with uniform roller speed being maintained automatically regardless of the grade or resistance encountered. Rolling speeds from .8 up to 5.5 mph. are possible. Tests show a saving in fuel up to 25%.

It is reported that at least 10% more surface can be rolled per day under any conditions because of the wide range of working speeds, faster and smoother roller reversing at the end of each pass, and because correct and uniform speeds are maintained automatically. Engine

Turn NOW to pages 151 & 152

braking power is available on downhill grades. This drive is reported to eliminate most stalling or harmful

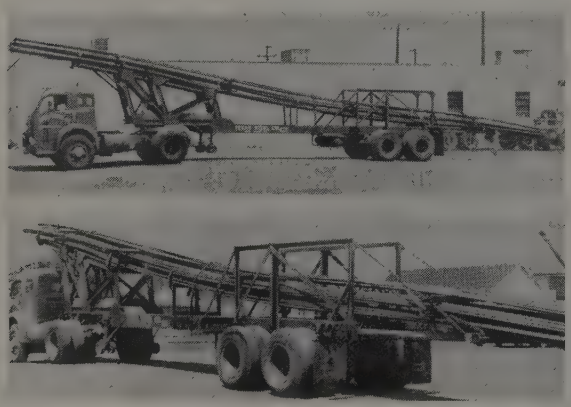
engine lugging.

It is claimed that all shock loads are absorbed by the fluid in the drive, thus increasing the life of the engine up to 35%. This drive is available on 5-8, 8-10½, 8-12, and 10-14-ton tandem rollers.

46

New trailer hauls extra-long reinforcing rods

A specially-designed trailer which can haul reinforcing rods up to 60 ft. long or travel empty with an overall tractor-trailer length of 45 ft. has been announced by **Hobbs Mfg. Co.**



Two unusual features of the rig are a structural frame over the fifth wheel mounting which slants up over the tractor cab and helps to support payloads of up to 36,000 lb. The other is a telescoping 12-ft. rear extension which pulls out to support the rods during a haul, then shoves back into the trailer platform above the tandem assembly when the rig makes a return trip. A transverse upright structure is situated midway on the trailer's 36-in.-wide steel deck to distribute the weight of the steel. Both this structure and the one over the cab were built to cradle bundles of reinforcing rods, thus facilitating both loading and carrying.

47

Form-strapping tool designed for handling ease, rough treatment

A. J. Gerrard & Co. has announced the availability of the Formbinder, which was designed to be light in weight, easy to operate, and yet sturdy enough to meet rough handling on the job. It makes strapping concrete

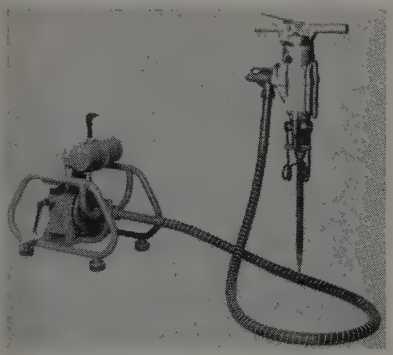
forms easy from any position for tying floor, wall, or bridge forms. One tool handles all gauges of strapping.

Besides form work, the tool is used by manufacturers of prefabricated homes to draw up the X bracing of strapping put in these houses. The tool sells for $13.25. Literature is available on request.

48

Portable rock drilling hammer

Pinazza rock drills and concrete-breaking hammers have been announced for the American market by **Pitnam Industrial Products Co.** Fea-



tures of these hammers include light weight, easy portability, operating efficiency at high altitudes, interchangeable rods, bits, and special tools with standard American types, and a steady air stream through the hollow rod and bit which automatically clears the drill hole. Model P60 weighs 35 lb. and is driven by a 3.5-hp. gasoline engine or electric motor. Model P70 weighs 49 lb. and is powered by a 5.5-hp. unit. The concrete breaking hammer weighs 53 lb. and is driven by a 2.2-hp. gasoline engine or 2½-hp. electric motor.

49

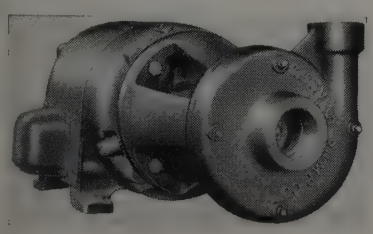
Servo hoist clutch

The Easytouch disc-type, Servo Hoist-Clutch has been announced by **Osgood-General.** It actuates the hoist clutch through a brake friction plate, turning with the driver, which contacts the hoist drum. This allows the hoist clutch to be engaged smoothly and provides control of the hoist drums. A combination of this clutch and a torque converter on the engine makes it possible to hold a load in mid-air safely or inch it up or down. This mechanism is standard equipment on Model 322, 25-ton truck crane. It is optional on Models 325, 320, and 327. The torque converter and foot throttle are optional on all models.

50

New Carver Electropump

Model BB centrifugal pump, a close-coupled combination of motor and pump designed for use where



space is at a premium, has been announced as the newest addition to the line of electropumps offered by **Carver Pump Co.** These new models have 1½-in. discharge outlets and come in 2-, 3-, and 5-hp. sizes. They have capacities up to 150 gpm. and heads up to 140 ft.

51

Self-propelled, twin-drill rig

A new self-contained, self-propelled, twin-drill rig designed to cut cost and speed up operations on

heavy-duty wagon drill type jobs has been announced by **Ingersoll-Rand.** It includes two hydraulic booms, two 10-ft. wagon drill towers, two heavy-duty, X-71-WD rock drills, a crawler assembly, and a 600-ft. rotary compressor. The unit weighs 28,500 lb., uses two drills with an 8-ft. steel change, drills holes up to 18 ft. 6 in. between centers, has a moving speed of 2 mph. on the level, and will negotiate a 15% grade. Requiring two operators, it is suitable for drilling on highway work, railroad rights of way, airports, power developments, canals, and general construction. Descriptive literature is available upon request.

52

Heavy-duty bucket loader

N. P. Nelson Iron Works, Inc., has announced two models of its new heavy-duty bucket loader with hydraulically operated swivel discharge conveyor. Model P-11B weighs 17,500 lb. and has forward speeds of 166 and 432 ft. per min. and reverse speeds of 27 and 67 ft. per min. Model Q-11B weighs 18,700 lb., has forward speeds of 114 and 290 ft. per minute and reverse speeds of 18 and 46 ft. per min.

Model P-11B is mounted on rubber tires and Model Q-11B is mounted on crawlers. Both models have loading capacities of up to 4 cu. yd. per min., turn a full 180 deg., discharge at heights of over 14 ft., and have reaches of more than 11 ft. The boom tilts down for easy highway transport. Ask for Bulletin 541 for more information.

53

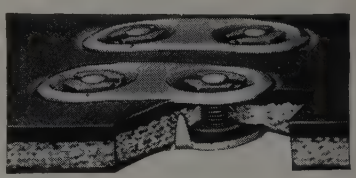
Lightweight troweling machine

Model M, a new lightweight, small-size concrete finishing machine, has been announced by **Whiteman Manufacturing Co.** It weighs 91 lb., has a 29⅞-in. trowel diameter, and is powered by a 1½-hp. Continental AU 7 engine. It uses 6x13-in. single trowels for both floating and finishing, eliminating the need for changing trowels. A rigid trowel arm prevents misalignment resulting from wear of the arm in the base. Its light weight permits it to be placed on the slab much earlier, expediting completion of the slab.

54

New belt fastener

Flexible Steel Lacing Co. has developed a new Flexco belt fastener for joining conveyor belts wherever



scrapers and plows are used on belts conveying sand, clay, gumbo, tacky materials, and wet fines. These scraper plates are beveled at both ends so that scrapers will ride readily over them. Protrusion above the belt is held to a minimum. They are made in one size for joining 5/16- to ½-in.-thick belts with not more than 500-ft. centers. Available in steel, monel, and everdur. Bulletin F-108 available on request.

55

New Hough tractor-shovel

The Frank G. Hough Co. has announced Model HRC, a 4-wheel-drive unit with bucket capacity of 1-cu. yd. struck-load and 1⅓-cu. yd. payload (heaped), to its line of torque-converter-driven tractor-shovels. Available with either gas or diesel engine and equipped with power steering and the torque-converter drive, its full-reversing transmission provides four speed ranges in either direction. This torque-converter drive makes possible considerable reduction in the amount of clutching and gear-shifting, acts as a cushion for the entire power train, minimizes maintenance, and prolongs machine life. Its "quick tip-back" action automatically posi-

tions the hydraulically-controlled bucket for digging.

56

Bituminous concrete-aggregate spreader

Highway Equipment Co., Inc., announces a new bituminous concrete and aggregate spreader for drive-

ways, parking lots, tennis courts, alleys, highways, streets, and other hot and cold mix applications. It features a staggered wheel arrangement of 10 pneumatic tired wheels which keep the unit level at all times and maintain a level finish course. An adjustable screen permits spreading depths from ½ to 8 in. It handles rocks up to 4 in. in size for base course. Four sizes are available in 8-, 9-, 10-, and 12-ft. spreading widths. Motor-driven auger-type agitators are available in the 10- and 12-ft. width. Descriptive literature is available on request.

57

Short haul belt conveyor

Barber-Greene Co. has announced transfer conveyors, a new, standardized belt conveyor for short haul requirements. This is a system of standardized components for the short conveyor range which may be assembled to form conveyors ranging from 8 to 44 ft. in length in increments of 1 ft. Mounted on a 5-in. channel frame, this conveyor is available in 18-, 24-, and 30-in. belt widths. Units up to 20 ft. long are shipped, completely factory assembled, except for carriers and belt. This conveyor can be used in underground installations or elsewhere where head room is limited. Capacities range from 50 to 480 tons per hr. depending upon belt width and weight of material handled.

58

New Dozer-Rooter blade

Electric Steel Foundry Co. announces a new model of the ESCO Dozer-Rooter which enables operators to convert tractors in the smaller horsepower range to rooters. The new unit is designed for the 40- to 70-hp. range with blade heights of 26 to 37 in. Specifically, it is intended for tractors of the D-4 to D-6, HD-5, and TD-9 classification. The new units are called Models 26 and 32, weigh 495 lb. Each unit is a heavy-duty ripping device consisting of a tooth

shank housing which mounts on the moldboard of a bulldozer by means of a special clamp. Ask for folder 194-A for more information.

59

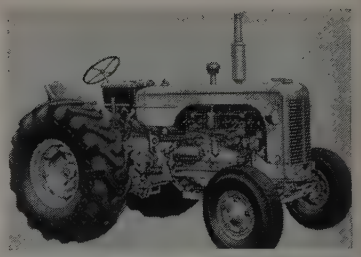
Kohler air-cooled engine

Kohler Co. has announced its K90T, 3.6-hp. air-cooled engine with retractable starter which provides easy, quick starting. It weighs 40 lb., has a fly-ball type governor, oil bath air cleaner, silencer-type muffler, and 1-gal. fuel tank. List price is $73.80.

60

Case 6-cylinder diesel tractor

J. I. Case Co. has announced its 6-cylinder, all-diesel tractor with 7-bearing crankshaft and Powrcel controlled combustion which eliminates

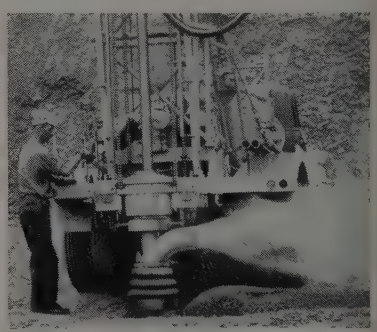


peak pressures and distributes downward thrust on the pistons more uniformly throughout the power stroke. A cold-weather starting aid is provided in addition to the normal 12-volt electric starting system. Cylinder bore is 4 in.. and the stroke is 5 in., giving a displacement of 377 cu. in. Normal full-load speed is 1,350 rpm. It has a wheel base of 87½ in., overall length of 136 in., turning radius of 16 ft. 1 in., and height to top of hood of 67⅝ in.

61

Heavy-duty rotary air drill

Model M-8A, a new rotary air drill for heavy-duty service, has been announced by **Davey Compressor Co.** It is recommended for core drilling,



well drilling, structure testing, and drilling of shot and blast holes. Rated capacity is 5⅝ in. holes to a depth of 150 ft. with air and 6¼-in. holes to a depth of 1,000 ft. with mud. Suitable for mounting on any make of truck, it may be driven by a power take-off from the truck engine or by a separate gasoline or diesel engine. Its 8-in. rotary table has a capacity sufficient to support and rotate 100,000-lb. loads. Draw works are of the 2-drum type, with line capacity of 470 ft. of ½-in. line per drum. The complete unit, including a recommended truck, weighs about 20,000 lb.

62

Hydraulic hoist lifts 1,500 lb. 25 ft. in air

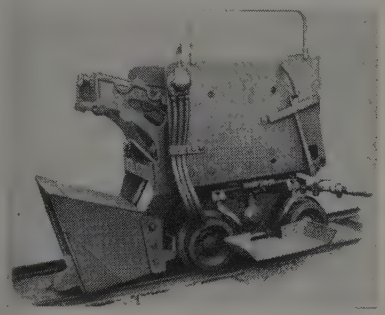
Utili-A-Lift, a hydraulic hoist mounted on a tractor, can lift a load of 1,500 lb. up to 25 ft. off the ground. It has a turning radius of 17 ft. Specifications include a Minneapolis-Moline 50-hp. gasoline engine, overall width of 54 in., weight of 9,835 lb., and continuous operating hydraulic pump with a 1 ft. per sec. lift-

ing speed. Recommended maximum capacity of the unit is 5,000 lb. Manufactured by **American Road Equipment Co.**

63

Faster underground loader

Gardner-Denver Co. has announced its Model GD 10 underground loader which has been designed to speed up loading of mine cars and increase safety for the operator. It is equip-



ped with a 4¾-cu. ft. dipper which is reported to load cars in mines or tunnels at the rate of about 1½ tons per min. Safety features include low center of gravity, high-flange, wide-tread wheels to prevent rail jumping, and controls placed for convenience and ease of operation. Power is supplied by two Gardner-Denver, high-torque, 5-cylinder, radial air motors. Reference No. 841.

64

Finer reduction with new Gyradisc

Gyradisc, built to provide finer reduction than obtainable in conventional crushing machines, has been announced by **Nordberg Manufacturing Co.** This new method of communition uses the Grunder method of reduction. It is a process of alternately impacting and releasing a thick mass of material, resulting in the production of large tonnages of fine particles. The Gyradisc is built in 54-in. size. Ideal feed is the open circuit product of a Symons Cone crusher or equivalent product containing material minus 1, ½, or ⅜ in., with or without fines.

65

Seismic refraction system

Southwestern Industrial Electronics Co. has announced its new SIE refraction seismograph system which can be used for determination of depth-to-bedrock, analysis of fill material, location of water-bearing strata, and other subsurface determinations. This method has proven more accurate than core-drilling even though equipment investment is lower and operating costs in time needed to complete a survey are much less. Information is presented in continuous horizontal and vertical profile, giving a complete subsurface picture from relatively few determi-

nations. Has been used on dam site investigations, tunnel projects, water strata locations, bedrock determinations for building foundations, and highway and airport runway construction. Two men can carry the complete system. An illustrated booklet, "Bedrock Determination by the Seismic Method," will be sent on request.

66

Improved Vibrating screed

An improved design of vibrating screed is now offered by **Stow Manufacturing Co.**, Binghamton, N. Y. Long screed beams (over 25 ft.) are

now built with a tapered stiffener, which better distributes vibrator engine weight and prevents downward deflection of the screed. The new units have been used successfully on spans up to 30 ft.

67

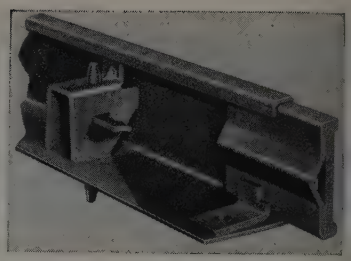
Loader has 1-cu. yd. bucket

Tractomotive Corp. has announced Model TL-12 Tracto-Loader, a new 4-wheel drive, rubber-tired loader with a 1-cu. yd. bucket. The unit weighs about 12,000 lb. and is equipped with rear wheel power steering, a clutch type transmission with four speeds in each direction, and a torque converter drive. It has a ground clearance of 15 in., a 62½-in. tread on both front and rear wheels, and overall width of 86 in. Clearance under the bucket cutting edge when dumped in maximum raise is 8 ft. Reach from the bucket cutting edge to the forward-most point of the machine at the 8-ft. dumping clearance is 2 ft. 4 in.; it is 3 ft. 3½ in. at a 7-ft. dumping clearance.

68

Heavy-duty road form

Superform, a heavy-duty road form built of ¼-in. steel, features a rigid box-type joint lock and box-type stake pockets welded to the base, face, and flange. Made by **Superform Co.** Its locking plate, reinforced with a longitudinal rib and vertical end bars, telescopes with the form sections to produce a rigid joint and give support to the outside edge of the top flange. It is said to eliminate 95% of form breakage. The V rib and end bars also offer a large hammering area extending 3 in. from the face of the form and reinforced to take rough pounding. Rigidity of the form is also increased by welding the stake pockets to the base, face, and flange so as to give 2-way bracing.



69

New 172-cu. in. industrial engine

Ford Motor Co. has announced its new 172-cu. in., 4-cylinder industrial engine which develops 61-brake hp at 2,800 rpm. The 3.90-in. bore is combined with a 3.60-in. stroke to cut piston travel, friction, and fuel costs. A deep-skirt crankcase provides rigidity. The shaft has mirror polished bearing surfaces to reduce friction to a minimum. Free-turn intake and exhaust valves permit even wear, help maintain high compression for longer periods, and reduce the possibility of sticky valves.

70

Loader for John Deere crawler tractor

Shepherd Tractor and Equipment Co. has developed Model L40H Hydraulic Loader for the John Deere Model 40, 5-roller crawler tractor. The loader, which has a standard

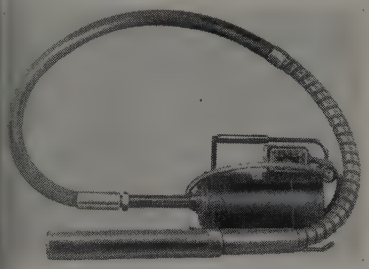
bucket capacity of 11 cu. ft., consists of two frame members which mount directly on the tractor cross members. On these main frame members is mounted the complete loader assembly. The hydraulic system in

cludes a 16-gpm. Vickers pump. Lift rams are 2½ in. in diameter with 1⅜ in. rods. The bucket rams are 3 in. in diameter, 10 in. long with 1⅜-in. rods. The bottom of the bucket has a ground clearance of 9 ft. 4 in. in top loaded position. In top dumping position the bucket cutting edge has a clearance of 7 ft. 9 in. Bucket tilt in the dumping position is a maximum of 45 deg. List price of the loader is $1,390 f.o.b. Los Angeles.

71

Concrete vibrator uses electric power

Roeth Vibrator, Inc., announces a new concrete vibrator for use with electric power. The motor weighs 32



lb., develops 2 hp. under full load, and produces a maximum of 8,000 vibrations per min. A complete unit consists of a vibrator head, a 10-ft. flexible shaft, and a Universal type motor. Descriptive literature is available.

72

Portable washing-screening plant

Pioneer Engineering Works, Inc., announces the 412-VW portable sand washing and screening plant designed for production from sand bars or gravel pits and washing and separating pre-crushed aggregate. Total capacity of the plant, which can produce both sand and coarse aggregate, is 100 to 150 tons per hr. Power needs are 60 hp. continuous. Water required will run to a maximum of 700 gpm. at 50 psi. Dimensions are, wheelbase 24 ft. 3 in., traveling width 8 ft., and traveling height 13 ft. Total weight (with power) is about 48,000 lb., with about 30,000 lb. on the rear equalizer and about 18,000 lb. on the front axle.

73

Portable pressure pump

A choice of two motors is now available to buyers of Porto Pump, the portable pressure pump with rubber gear construction. A Kohler K160 engine can now be specified in place of the Wisconsin AKN engine. Total weight of the pump with the Kohler engine is 89½ lb. The pump is mounted directly to the engine and the power is transmitted through a self-aligning flexible coupling which absorbs shock. The rubber gear construction permits use of most water sources. Manufactured by **Porto Pump, Inc.**

UNIT PRICES

Selected abstracts for Western projects

HIGHWAY—Grading, base placement, prime coat, and seal coat in California

California—Mendocino County—State. Huntington Brothers of Napa submitted a low bid of $233,814 for 6.1 mi. of grading, placing imported base and subbase material, prime coating, and seal coating, County Highway 980 near Ukiah. Unit Prices were as follows:

(1)	Huntington Brothers	$233,814
(2)	McCammon-Wunderlich Co.	264,542
	Humboldt Constructors, Inc.	267,744
	M. Malfitano & Son, Inc.	277,908
	McGuire & Hester	287,243
	Arthur B. Siri, Inc.	293,394
	C. V. Kenworthy	298,171
	Morison Construction Co. and Ted Swartz	298,683
	J. Henry Harris	302,437
	W. H. O'Hair Co.	303,130
	John G. Mehren and Floyd O. Bailey	329,555

		(1)	(2)
26 ac.	Clearing and grubbing	$ 400.00	$ 325.25
118,100 cu. yd.	Roadway excavation	.45	.40
1,400 cu. yd.	Structure excavaton	2.00	3.00
650 cu. yd.	Ditch & channel excavation	2.00	2.00
8,000 sq. yd.	Compacting original ground	.08	.05
1,509,000 sta. yd.	Overhaul	.005	.005
7,000 cu. yd.	Imported borrow	1.00	1.00
31,750 ton	Imported subbase material	1.10	1.30
37,250 ton	Imported base material	1.60	1.80
102 sta. yd.	Prepar. exist. subgrade for surfacing	9.60	20.00
	Dev. wat. sup. & furn. wat. equipment	3,500.00	5,500.00
5,500,000 gal.	Applying water	1.50	4.00
320 sta. yd.	Finishing roadway	7.50	15.00
120 ton	Liquid asphalt SC-2 (pr. ct.)	31.50	30.00
135 ton	Asph. emuls. (Cl. "C-double" sl. ct.)	35.00	40.00
1,780 ton	Screenings (cl. "C-Double" sl. ct.)	4.95	6.50
90 cu. yd.	Class "A" P.C.C. (structures)	75.00	80.00
80 ea.	Culvert markers	6.50	6.50
15 lin. ft.	30-inch R.C.P. (std. str.)	15.00	14.00
82 lin. ft.	12-inch C.M.P. (16 ga.)	3.00	3.25
1,942 lin. ft.	18-inch C.M.P. (16 ga.)	4.00	4.50
96 lin. ft.	24-inch C.M.P. (14 ga.)	5.00	5.50
150 lin. ft.	30-inch C.M.P. (14 ga.)	7.00	7.00
154 lin. ft.	36-inch C.M.P. (12 ga.)	10.00	10.00
60 lin. ft.	54-inch C.M.P. (12 ga.)	25.00	18.00
84 lin. ft.	25"x16" C.M.P. Arch (14 ga.)	5.00	7.00
550 lin. ft.	8" P.M.P. underdrains (16 ga.)	2.00	2.25
100 cu. yd.	Filter material	6.00	4.00
200 linl ft.	8" C.M.P. down drains (16 ga.)	2.00	2.25
13 ea.	Spillway assemblies	35.00	31.00
6,400 lb.	Bar reinforcing steel	.15	.15

MISCELLANEOUS—Drilling pilot hole and experimental wells on Middle Rio Grande Project in New Mexico

New Mexico—Middle Rio Grande Project—Bureau of Reclamation. Harold P. Doty of Albuquerque submitted a low bid of $68,473 for drilling a pilot hole and five experimental wells on the Middle Rio Grande Project in New Mexico. Unit prices were as follows:

(1)	Harold P. Doty	$68,473
(2)	Miller and Smith, Contractors	69,379
	Layne Texas Co.	69,486

		(1)	(2)
Lump Sum	Moving in, setting up, dismantling, and removing equipment	$6,000.00	$9,342.00
100 lin. ft.	Drilling and coring 6-inch diam. pilot hole	12.00	12.25
500 lin. ft.	Drilling 30-inch diameter holes for experimental wells	20.00	15.75
300 lin. ft.	Furnishing and installing 16-inch diameter well screen	11.72	9.98
205 lin. ft.	Furnishing and installing 16-inch diameter well casing	6.42	6.64
55 cu. yd.	Furnishing and placing gravel packing	20.00	26.45
15 cu. yd.	Backfilling	15.00	11.50
Lump Sum	Developing and testing 5 wells	5,000.00	6.235.00
15 cu. yd.	Concrete	100.00	100.00
5 ea.	Furnishing and installing natural-gas engine driven pumping units	3,990.00	4,000.00
5 ea.	Furnishing & installing 14-inch line meters	800.00	1,000.00
12,130 lb.	Furnishing & installing pump discharge lines	.20	.31
170 sq. yd.	Furnishing & placing riprap & gravel blanket	20.00	10.00
5,200 lin. ft.	Furnishing & installing 2-inch steel pipe gas line	1.70	1.30

BRIDGE—A railroad bridge at Fulton Canyon near The Dalles Dam in Oregon

Oregon—The Dalles Dam—C. of E. Louis Elterich Co. of Port Angeles, Wash., submitted a low bid of $77,120 for construction of concrete piers and abutments and the fabrication and erection of deck girder spans and appurtenances for a railroad bridge at Fulton Canyon, about 17 mi. east of The Dalles. Unit prices were as follows:

(1)	Louis Elterich Co.	$ 77,120
(2)	Young and Smith Construction Co.	81,820
	Lee Hoffman	85,880
	Clifton and Applegate	89,915
	H. A. Starr Concrete, Inc.	94,950
	Pettijohn Engineering Co.	96,430
	Valley Construction Co.	98,180
	John E. Alexander	99,240
	Lewis Hopkins Co.	99,397
	George Chicha Co.	101,079

		(1)	(2)
1,500 cu. yd.	Excavation, unclassified	$ 3.00	$ 4.00
940 cu. yd.	Concrete, in place	31.00	33.00
1,400 bbl.	Cement	5.20	6.00
60,000 lb.	Steel reinforcement	.12	.11
1 job	Fabrication & erect. of deck gircer spans & appurtenances	25,000.00	25,000.00
1 job	Lumber, in place	4,000.00	4,500.00

HIGHWAY — Clearing, rolling and surfacing various highways in Washington

Washington—Lewis County—State. Peter Kiewit Sons' Co. of Longview was awarded a contract for clearing, rolling, and surfacing various portions of state highway in Lewis County on a low bid of $1,212,782. Unit prices were as follows:

1)	Peter Kiewit Sons' Co.	$1,212,782
2)	Fiorito Brothers	1,240,718
	Goetz and Brennan	1,315,909
	N. Fiorito Co.	1,352,047
	Northwest Construction Co.	1,357,716
	Erickson Paving Co.	1,372,995

			(1)	(2)
6.20	ac.	Clearing	$ .10	$ .01
6.20	ac.	Grubbing	.10	.01
1,930	cu. yd.	Common excavation incl. haul	1.15	.50
40	cu. yd.	Common trench excav. Incl. haul	3.00	4.00
20,000	cu. yd.	Strip'g borrow & surf. pit incl. haul.	.001	.001
855	cu. yd.	Structure excavation	3.00	3.00
375	da.	Smooth-wheeled power roller	61.00	45.00
376	da.	Pneumatic-tired roller	52.00	45.00
22	da.	Mechanical tamper	55.00	50.00
623.4	sta.(100')	Finishing roadway	11.00	8.00
7,950	M gal.	Water	2.25	2.00
5	cu. yd.	Gravel backfill for foundations	3.00	5.00
440	cu. yd.	Gravel backfill for drains	5.00	5.00
17,190	ton	Selected sand borrow	1.45	1.50
234,330	ton	Selected roadway borrow	1.00	1.55
48,360	ton	Cr. stone surf-top crae. in place from stockpile	.55	.48
38,020	ton	Cr. stone surf.-base crae. in place from stockpile	.60	.48
		LIGHT BITUMINOUS SURFACE TREATMENT—METHOD A		
1.0	mi.	Preparation, construction, finishing	500.00	350.00
33	ton	Asphalt cement MC-3	42.00	50.00
290	cu. yd.	Pl. cr. cover stone from stockpile	2.50	1.50
		TYPE I-1 ASPHALTIC CONCRETE PAVEMENT		
50	ton	Asphalt cement MC-3 prime coat	42.00	50.00
510	cu. yd.	New fine mineral aggregates	2.50	1.50
2,690	ton	Class "C" wearing course	5.60	6.25
5,350	ton	Class "L" leveling course	5.60	6.25
		ONE COURSE PORTLAND CEMENT CONCRETE PAVEMENT		
223,738	sq. yd.	Cem. conc. pav't std. 14 da. s. mix 9" sec.	3.08	2.68
39,600	lb.	Pav't reinforcement type No. 2	.10	.11
1,008	only	Dow elbars without caps	.40	.50
10	only	Temp. brd's across pav't, take-d type	100.00	100.00
288	lin. ft.	Pavement headers	1.50	1.00
330	sq. yd.	Concrete placed as extra thickness	3.60	3.00
1,850	bbl.	Portland cement	4.50	4.75
		OTHER ITEMS		
7,810	lin. ft.	Asphaltic concrete gutter	.50	.70
100	only	Precast traffic buttons	3.00	3.00
240	lin. ft.	Asphaltic concrete traffic bars	1.00	2.00
8	cu. yd.	Concrete class "A"	150.00	80.00
1,830	lb	Steel reinforcing bars	.10	.14

1,440	lin. ft.	Concrete or V.C. sewer pipe 4" diam.	.60	.90
350	lin. ft.	Concrete or V.C. drain pipe 8" diam.	.85	1.10
350	lin. ft.	Concrete or V.C. drain pipe 10" diam.	1.10	1.30
401	lin. ft.	Std. reinf. conc. culv. pipe 12" diam.	2.65	3.00
1,120	lin. ft.	Bit. coat. corr. met. pipe No. 16 ga. 8" diam. type No. 2	2.05	3.00
6	only	Catch basins	110.00	110.00
24	only	Concrete inlets	110.00	90.00
Lump Sum		Illum. sys. boone road intersection	1,800.00	1,700.00
Lump Sum		Illum. sys. Avery road intersection	3.350.00	3,200.00
Lump Sum		Illum. sys. Koontz road intersection	1,800.00	1,700.00
Lump Sum		Illum. sys. Forest-Napavine rd. inter	1,850.00	1 700.00
909	lin. ft.	Standard beam guard rail	3.50	2.70
168	only	Type A metal guide posts	5.00	5.20
19	only	Type B metal guide posts	6.00	7.50
13	cu. yd.	Hand placed riprap	30.00	25.00
1,850	sq. yd.	Removing asphaltic conc. pav't	.40	.50
Lump Sum		Removing portions of conc. box culv.	800.00	450.00
148.9	sta.(100')	Finishing roadway	7.50	10.00
3.120	ton	Cr. stone surf.-top crse, in place from stockpile	1.65	2.00
		TYPE I-1 ASPHALTIC CONCRETE PAVEMENT		
1,900	ton	Class "C" wearing course	8.00	8.25
2,850	ton	Class "L" leveling course	8.00	8.25

BRIDGE—Concrete and steel bridge and approaches across the Colorado River in Utah

Utah—Grand County—State. Ragnar Benson, Inc., submitted a low bid of $499,130 for construction of a 1,000-ft. concrete and steel bridge and approaches across the Colorado River on U.S. 160. Unit prices were as follows:

(1) Ragnar Benson, Inc.	$499,130
(2) Gardner Construction Co. & Schmidt Construction Co.	477,576
W. W. Clyde and Co.	684,454
Young and Smith Construction Co.	701,275

			(1)	(2)
4,000	gal.	Bituminous material, type SC-3	$ .10	$ .25
0.19	mi.	Scarifying & mixing 24' wide	1,500.00	1,500.00
700	cu. yd.	Gravel surf. from state stockpile	.75	1.00
19,000	cu. yd.	Unclassified roadway excavation	2.05	1.50
150	cu. yd.	Imported borrow	.40	1.00
30,000	sta. yd.	Class "A" overhaul	.02	.02
5.000	yd. mi.	Class "B" overhaul	.25	.20
500	1,000 gal.	Watering	2.00	1.50
300	hr.	Rolling, pneu. tire or power roller	8.00	8.00
56	lin. ft.	18" corrugated metal pipe	4.50	4.00
850	lin. ft.	Right of way fence, type "B"	.40	.35
Lump Sum		Furnishing water equipment	500.00	500.00
Lump Sum		Furnishing construction signs (1) Concrete & steel bridge 1006.5]	500.00	500.00
1,650	cu. yd.	Excav. for structures, unclassified	6.00	30.00
Lump Sum		Cofferdams	50,000.00	5,000.00
2,560	cu. yd.	Concrete, class "A"	53.00	55.00
241,000	lb.	Reinforcing steel	.11	.13
1,120,000	lb.	Structural steel	.14	.165
Lump Sum		Painting	12,000.00	5,600.00
2,074	lin. ft.	Steel handrail	7.00	10.00
3.020	lin. ft.	Piles (other than timber)	13.00	30.00
Lump Sum		Furnishing pile driving equipment	3,000.00	7,500.00
800	cu. yd.	Loose riprap	5.00	6.00

HIGHWAY—Plant-mix surfacing and asphalt subsealing on 18.8 mi. in California

California—Contra Costa, Alameda, and Santa Clara Counties—State. Lee J. Immel of San Pablo submitted a low bid of $184,917 for 18.8 mi. of play-mix surfacing and asphalt subsealing sn portions of various state highways. Unit Prices were as follows:

(1) Lee J. Immel	$184,917
(2) Clements Construction Co.	189,010
J. Henry Harris	190,337
L. C. Smith Company, Inc.	192,440
E. A. Forde Co.	197,730

			(1)	(2)
24,000	ton	Mineral aggregate (P.M.S.)	$ 6.55	$ 6.65
1,200	ton	Paving asphalt (P.M.S)	6.55	6.65
225	ton	Asphaltic emulsion (pnt. bndr.)	35.00	40.00
2,200	ea.	Drilling holes (subsealing)	.35	.40
225	ton	Furnishing air-refined asphalt (subseal.)	44.50	46.00
24	ea.	Adjusting manholes to grade	50.00	50.00

BRIDGE—A concrete and steel bridge across the Ogden River in Utah

Utah—Weber County—State. Gibbons and Reed Co. of Salt Lake City submitted a low bid of $97,108 for construction of a 140-ft. concrete and steel bridge across the Ogden River at Wall Ave. in Ogden on State 204. Unit prices were as follows:

(1) Gibbons and Reed Co.	$ 97,108
(2) Whitney Brothers	100,123
Young and Smith Construction Co.	104,041
Wheelwright Construction Co.	104,794
F. R. Knowlton and Son	104,801
Ragnar Benson, Inc.	114,155
Hilton and Carr Construction Co.	114,897
Waterfall Construction Co.	118,740

			(1)	(2)
1,430	cu. yd.	Excavation for structures, unclassified.	$ 3.00	$ 5.00
702	cu. yd.	Concrete, class "A"	48.00	50.00
113,450	lb.	Reinforcing steel	.10	.11
269,600	lb.	Structural steel	.145	.14
315	lin. ft.	Steel handrail	9.00	10.00
Lump Sum		Removal of existing structure	4,650.00	4,000.00
Lump Sum		Furnishing construction signs	1,200.00	500.00

News of DISTRIBUTORS

Triangle Steel appointed wire rope distributor

Improved service to Southern California's wire rope and allied products users is assured with the appointment by Bethlehem Pacific Coast Steel Corp. of Triangle Steel, Los Angeles, as distributor of Bethlehem wire rope. Jim McLaughlin, sales manager for Triangle Steel, says they have more than 30,000 items stocked for immediate delivery, including a wide range of other Bethlehem Pacific steel products.

Worthington equipment handled by Calif. concern

West Coast Engine & Equipment Co., Berkeley, Calif., has received the distributorship for the Worthington Corporation line of portable mixers, plaster and mortar mixers, pneumatic concrete placers, portable self-priming pumps, portable compressors and air tools in the central section of California. Rhea Tractor & Engine Co., Sacramento, is a sub-dealer.

Industrial Tool named Carboloy distributor

Industrial Tool & Supply Co., San Jose, Calif., has been named an authorized distributor for the Carboloy Department of General Electric Co., Detroit. The organization will carry the Department's entire line of standard cemented carbide tools and blanks, carbide-tipped masonry drills and diamond wheel dressers.

Dart Truck Co. signs new dealers

Dart Truck Co., specializing in the construction of heavy-duty, off-highway trucks, recently named several new dealers in the West: Balzer Machinery Co., Portland, Ore.; C. H. Grant Co., Oakland, Calif.; Smith-Booth Usher Co., Los Angeles, and Bowlake Equipment Co., Seattle, Wash.

New location and lines for WEMCO

Western Machinery Co.'s new building at Phoenix, Ariz., is now nearing completion and the company expects to move in prior to September 1. The new quarters afford twice the undercover area of the old location and ten times the property area. WEMCO has recently taken on several additional lines: Littleford Bros., Inc.; Clark Equipment Co., and The Salem Tool Co.

Fornaciari handles Brushmaster

Fornaciari Company, Los Angeles construction and industrial distributor, announces distribution of the Brushmaster saw for the Southern California area. Fornaciari maintains a complete stock and service facilities for this new tool, a gasoline engine driven rotary saw specifically designed for clearing and maintenance work and developed by Harrington & Richardson Arms Co.

Byers appoints new Northwest engineer

A. M. Byers has appointed William E. Weber as field service engineer in the Seattle, Wash., area. He will work out of the company's San Francisco division, with an office in Seattle. The firm produces wrought iron products used in industrial, building, railroad and marine installations.

News from C. H. Grant Co.

Glen Ludy, for many years with the service department of Marion Power Shovel Co., is now spearheading Marion shovel sales for C. H. Grant Co. The Oakland company also announces it is offering the Browning Rock Buster for pulverizing windrows of subgrade material as they lay on the subgrade and without picking them up.

Coast Equipment Co. sells used machinery

Consolidated Builders, Inc., Salem, Ore., announces the appointment of Coast Equipment Co. of San Francisco as a sales agent for the disposal of contractor's machinery and equipment used in the construction of the Detroit Dam Project. This large inventory of heavy construction equipment is being liquidated at attractive prices in line with today's market.

J. I. Case appoints

Paul L. Eades has been appointed assistant branch manager on credits and collections at the Oakland branch of J. I. Case Co., succeeding Leslie C. Acheson who has been transferred from California to Charlotte, N. C.

New Hensley dealers

Hensley Equipment Co., manufacturer of dozer and scraper rippers, brush rakes, track rollers, and allied parts, recently appointed the following exclusive distributors: Hudson Equipment Co., San Diego, Calif.; Bay Cities Equipment Co., for three Northern California counties; Pioneer Equipment Co., Reno, Nev., and Herb Sharpe Equipment Co., Trinidad, Colo., for the southeastern part of Colorado.

Superior Equipment Co. moves

Superior Equipment Co. is moving into its new quarters the first of August. Located at 2402 South Nineteenth Ave., Phoenix, Ariz., the new headquarters consists of showroom,

offices and parts section, covering an area of 90 x 120 ft. Mardian Construction Co. was the contractor.

New quarters for CF&I

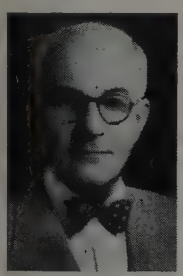
Colorado Fuel & Iron Corp. has moved its Los Angeles operations to new quarters at 2444 South Saybrook Ave. The new building has a floor area of 50,000 sq. ft., a spur track and represents an expenditure of more than $250,000. H. B. Hansen is general manager of the Los Angeles area.

Mack Motor Truck news

Mack Motor Truck Corp. recently announced the retirement of W. R. Stoner after 37 years, during which period Stoner occupied many responsible positions in the Los Angeles branch and in the Western division office. Mack, during recent months, moved into new factory branch headquarters both at Seattle, Wash., and at Salt Lake City, Utah.

Leslie H. Garlinghouse dies

Leslie H. Garlinghouse, 66, cofounder and partner of Gar-Bro Manufacturing Co., Los Angeles, died June 26 in Pasadena, Calif., after a long illness. From 1923 (founding) till 1951, he had been associated with his brother, Albert F. Garlinghouse, in the firms of Garlinghouse Brothers, and Gar-Bro Manufacturing Co., distributor and manufacturer of construction equipment. Through the years, he handled engineering development and design, and was chief engineer and general manager of Gar-Bro Manufacturing Co. and Gar-Bro Wheel Co. Before coming to California, he was a designing engineer for Blaw-Knox Co. and American Bridge Co., Pittsburgh, Pa.



Leslie H. Garlinghouse

Broderick-Bascom appoints new branch mgr.

John E. Carmichael recently succeeded W. C. Hamilton as factory branch manager of Broderick-Bascom Rope Co. at San Francisco.

Jack Hatten forms own company

Jack T. Hatten, well known Western construction equipment man, has announced the formation of his own company. Under the firm name of

Hatten Machinery Co., headquarters are at 3433 Fourth Ave. S. in Seattle, and include a 20,000-sq. ft. structure with offices, storage, and display space, and a large yard area designed to provide complete customer service facilities. Hatten recently resigned as secretary and equipment division manager of Star Machinery Co. to establish the new company. Prominent in local and national activities of Associated Equipment Distributors, Hatten has held numerous offices in the Seattle AED and was president in 1952, as well as program chairman of the AED convention in Seattle in 1953. In the national organization he has served as chairman on several important committees.

Appointments at Kaiser Steel

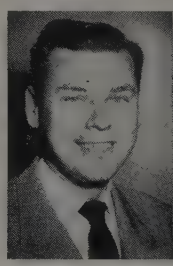
R. R. Hogan was recently named manager of Kaiser Steel Corp's district sales office in the Southwest, with headquarters in Los Angeles. C. L. Griffith was named assistant manager. Hogan joined the steel company in 1944, and Griffith has been associated with the Kaiser organization since 1942, joining the steel company in 1944.

Chuck Hart named Smith-Blair rep in So. Calif.

Charles (Chuck) G. Hart of Portland, Ore., recently joined the Smith-Blair Co. as a sales engineer. He was formerly associated with H. D. Fowler Co. of Seattle, Wash. Hart will work out of the branch office at South Gate, Calif.

Joe Preston joins Calavar sales staff

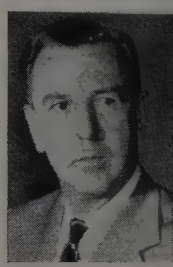
Calavar Corporation, Los Angeles, has appointed Joe Preston to its sales staff, where he will specialize in the sale of crushing and material handling equipment. Preston was formerly with Universal Engineering Co. at Cedar Rapids, Iowa. Calavar was recently appointed distributor for the Osgood-General Co. to cover the territory of southern Nevada and the southern section of California.



Joe Preston

William McMahan is Western rep for Carver Pump

William A. McMahan was recently made Western district sales manager for the Carver Pump Co., Muscatine, Iowa, manufacturer of pumps for construction, irrigation, and industry. His territory takes in all of the Western states with the exception of Colorado and New Mexico. He is making his headquarters at Rolling Hills, Calif.



William A. McMahan

Change of address

The Los Angeles offices of the S. K. Wellman Co., recently moved to a new address: 240 West 21st St., Los Angeles 7, Calif.

Gar Wood appoints district mgr.

The appointment of R. L. Schurhammer as a district manager was recently announced by Gar Wood Industries, Inc. Since January, 1949, he has been a tractor equipment service representative. In his new position, Schurhammer will work with the following Gar Wood Allis-

Chalmers dealers: Mountain Tractor Co., Missoula, Mont.; Richland Machinery Co., Sidney, Mont.; Seitz Machinery Co., Inc., Billings and Great Falls, Mont., and Studer Tractor & Equipment Co., Casper, Wyo.

New Granco Steel distributors

Granco Steel Products Co. recently announced the names of two new representatives to handle its "Cofar" products in the West: Soule Steel Co., San Francisco, and Norris Steel in Gardena, Calif.

Black & Decker expands

Black & Decker Mfg. Co. has opened a new sub-branch at Spokane, Wash., according to recent announcement by P. W. Lund, manager of the Seattle branch. The new branch is located at North 2706 Hemlock St. Gus Nelson is sales representative and James E. Gramache is service supervisor.

Jack Sahlberg occupies new home

Jack Sahlberg Equipment Co. is now occupying its new facilities at 5950 Fourth Ave. S., Seattle, Wash. Sahlberg distributes such well known lines as Iowa Manufacturing Co., Seaman Motors, Inc., Eagle Iron Works; Barco Mfg. Co., Marlow Pumps, etc.

MANUFACTURERS

Preload to appoint U. S. licensees

The Preload Company, Inc. announces from its headquarters in New York City a program of granting exclusive territorial licenses in the United States covering its methods of construction in all fields of prestressed concrete, including tanks, pressure pipe, precast structural members, cast-in-place and continuous structures, and pavements. The company believes that operations under this licensing program will be beneficial to the licensee, its clients, and to itself as well.

New prexy at Air Reduction Sales Co.

H. R. Salisbury, president of Air Reduction Sales Co., retired as of June 1 and was succeeded by J. H. Humberstone, vice president. Salisbury joined Airco in 1926 and held various managerial positions with the company. He will continue as a director. Humberstone joined Air Reduction in 1948 after several years association with General Electric.

G. V. Leece elected president

Gifford V. Leece was recently elected president of Gardner-Denver Co., and Benjamin C. Essig was chosen executive vice president. Leece has been vice president and sales manager since 1947. He served in various capacities and at one time was branch manager of Southern California activities, and also served as Pacific Coast manager. Essig joined the company in 1923. At one time, in 1938, he was vice president in charge of the Denver plant, and has for some time served on the executive committee of the company.

H. K. Porter Co. takes over Pioneer Rubber

H. K. Porter Co., Inc., recently announced the acquisition of Pioneer Rubber Mills, Inc., Pacific Coast manufacturer of industrial rubber products. The Pioneer company, with headquarters in San Francisco, and factory in Pittsburg, Calif., becomes part of Quaker Rubber Corp., one of Porter's nine divisions. Pioneer Rubber Mills will retain its identity. Sumner M. Suhr, sales manager, who has been with the company since 1917, has been appointed manager of the new division under George A. Dauphinais, vice president and general manager of Quaker Rubber Corp.

West Coast consolidation

Announcement of the consolidation of Wilgus Mfg. Co., pioneer Los

Angeles manufacturer of gas and oil regulators, into an operating manufacturing division and wholly-owned subsidiary of Natural Gas Equipment, Inc., was recently made by J. V. Thomas, NGE president. According to R. L. Grutzmacher, executive vice president, approximately 60,000 sq. ft. of floor space in the new and larger quarters in Pasadena, Calif., are now occupied by NGE in order to accommodate Wilgus machinery and the increased activities of the company.

Bay City elects president

Donald E. Hawkins was recently elected to the presidency of Bay City Shovels, Inc., succeeding Morgan Ramsay who retired because of ill health. The new president joined the company in 1928 and was named a director in 1943. He was made secretary and treasurer in 1947. This new appointment covers the dual post of president and treasurer.

LOOKING OVER plans for the new fabricating works of Bethlehem Pacific Coast Steel Corp., to be built on a 46-ac. site in Los Angeles, Calif., are the following Bethlehem officials: (from left) *W. W. Hofmann*, chief engineer of construction; *E. F. Gohl*, vice president, fabricated steel construction; *F. C. Todd, Jr.*, Los Angeles Fabricating Works manager; and *H. H. Fuller*, president. The building will cost about $4,000,000.

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BACKFILL, uncompacted

Even half an article on rock bolts pays off

Our two-part article on rock bolts winds up this month. And the cost discussion in this issue figures to be what most of you will like best. But the critical review last month—all about how bolts work to prevent different kinds of rock failure—has already paid its way.

We're thinking of what we heard from an engineer for one of the Western utility companies. He read the article carefully, and on that basis he has decided to make sure his company's specifications permit the use of rock bolts for future tunnel work. Up to now they've always used timber or steel ribs.

This represents a good point in progress. And we're inclined to take a little bow for it. The owner will save some money—on rock, on steel, on concrete, and on time all around. The contractor will also benefit from that time saving. And besides, he will save a little equipment life that can be put to work earning profits on another job.

These dams made history for the West

We bragged a bit on the editorial page last month, talking up the subject of dam building in the Western states. Among other things we remarked that the West has established most of the height records—19 out of 33 dams (over 100 ft.) that have exceeded previous highs for their types. Now, someone is sure to want the names of those Western dams; so here they are, by type, with heights and completion dates noted:

Gravity: Cheeseman (Colo.) 236 ft. in 1904; Roosevelt (Ariz.), 280 ft. in 1911; Arrowrock (Ida.), 348 ft. in 1915; Hoover (Ariz.-Nev.), 726 ft. in 1935. Grand Dixence Dam in Switzerland will be completed in 1955, standing at 912 ft.

Arch: Shoshone (Wyo.), 328 ft. in 1910; Pacoima (Calif.), 380 ft. in 1929; Diablo (Wash.), 389 ft. in 1930; Ross (Wash.), 540 ft. in 1949. Mauvoisin Dam in Switzerland will set a new record of 745 ft. upon completion in 1955.

Rockfill: Bowman Lake (Calif.), 107 ft. in 1875, dismantled in 1927; Relief (Calif.), 140 ft. in 1909; Strawberry (Calif.), 160 ft. in 1917; Salt Springs (Calif.), 328 ft. in 1931; San Gabriel No. 1 (Calif.), 375 ft. in 1938.

Earthfill: Terrace (Colo.), 180 ft. in 1909; Tieton (Wash.), 223 ft. in 1924; Ft. Peck (Mont.), 270 ft. in 1940; Green Mountain (Colo.), 267 ft. in 1943; Mud Mountain (Wash.), 425 ft. in 1948; Anderson Ranch (Ida.), 456 ft. in 1948. The inconsistency involving Green Mountain Dam is hard to explain. Drawings published in this magazine show it to be about 260 ft. high; but it has been described as a 309-ft. dam. It's the old story of how do you measure height!

Twenty-five Years Ago in *Western Construction*

"Steel erection has been started on the $5,800,000 interstate highway toll bridge between Longview, Wash., and Ranier, Ore. . . . It is estimated that the bridge will be completed November 15, 1929."

* * *

"Stevens & Koon, consulting engineers of Portland, have been commissioned to make a survey of the water system for Baker, Ore. It is proposed to increase the city water supply to an extent which will warrant the erection of a municipal hydroelectric plant."

* * *

"The **T. L. Smith Co.** of Milwaukee has developed a new mixer attachment called the Smith Weigh-Mix, which will enable contractors and owners of commercial concrete plants to meet the most stringent specifications imposed by engineers. The new equipment is designed to accurately proportion all materials by weight and then to thoroughly mix them."

* * *

"It needs but a brief glance at the bids—total as well as unit—on all types of construction throughout the country to convince anyone that the problem of 'too-low bids' is still with us."

* * *

"F. M. Stearman, of Phoenix, Ariz., will complete his contract during February 1930 for constructing a bridge over the Agua Fria River near Coldwater on the Phoenix-Yuma highway. One of the six concrete piers has been finished and 64 concrete piles, each 40 ft. long, are cast for the approach span bents. The contractor is using steel sheet piling in the 40-ft. excavation for piers. Two 10-in. electrically driven 3-stage pumps are being used for unwatering, and one crawler tread dragline with ¾-yd. clamshell is being used for excavation."

This contractor doesn't stand in the shadow

The vitality and positive approach of heavy construction contracting came before the Hells Canyon dam hearing last month. That's when C. B. "Woody" Williams, vice president of Morrison-Knudsen, testified.

Williams was examined on M-K's proposal to build three low dams in the Hells Canyon vicinity for Idaho Power Co. The price tag under discussion made it interesting—$133,000,000 for all three dams, as against estimates of over $350,000,000 for the federal high dam.

Reported by a wire service as the "brusque and broad - shouldered Westerner, . . . sun-bronzed from supervising dam construction around the world," Williams avoided quibbles and qualifications. He answered questions directly. He volunteered pertinent information where it would save time. He took it upon himself to check with the hearing reporter, to satisfy himself as to what he had said.

It would seem that he brought the contracting game through the hearings with flying colors. Fast, too. Thinking of his latest tough assignment, a tricky diversion proposition at Box Canyon Dam, we would guess he was pretty anxious to get back out in that bronzing sun again!

Growth is the mark of the construction West

Which came first, the chicken or the egg? So far as construction in the West is concerned, we figure it this way: Population comes first, requiring housing and municipal services. At some later date, the cumulative effects back up—from driveways to freeways, from sewer laterals to outfalls, from switchyards to steam and hydro plants, from water meters at the house to conservation works at the headwaters. Then, the population "egg" hatches again.

On this basis, California is heading for more of the growing pains it has enjoyed these past several years. Recent word from the Department of Public Works is that the last year saw over $215,585,000 spent on public school construction. This was spread over 1,000 projects.

For the previous year there were 800-odd projects totaling about $173,870,000.

. . . The Editors