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FEATURED THIS ISSUE

Five hours to erect a
prestressed concrete bridge

The Columbia River Basin —
An authoritative appraisal

19 miles of rock are rough
for Arizona pipeliners

Steel forms on gantry for
highway tunnel concreting

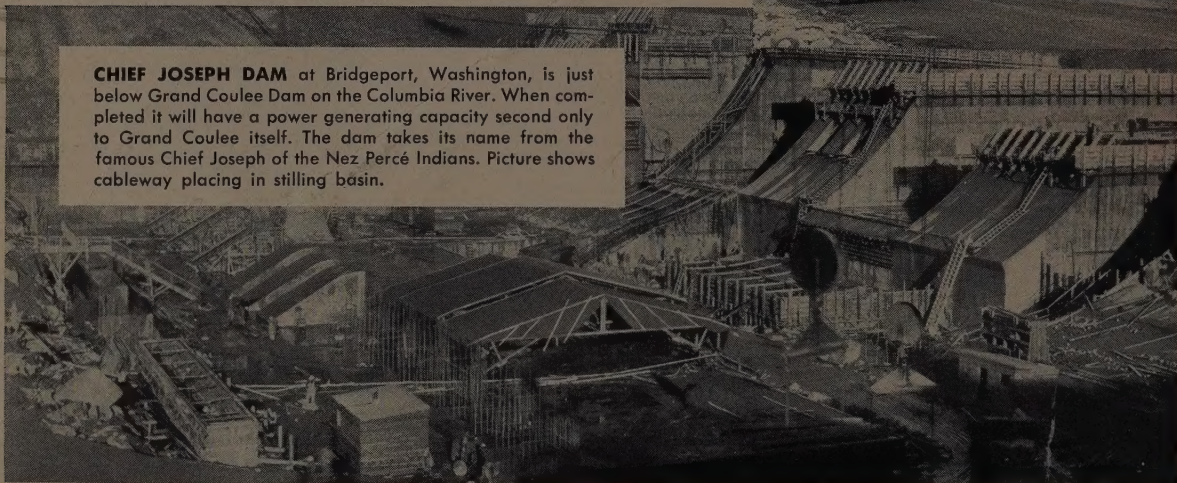
MAY 1953

HOW CONTRACTORS* SPEED WORK ON CHIEF JOSEPH DAM

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WESTERN

CONSTRUCTION

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Number 5

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FRONT COVER

W. D. "WHIT" WHITLEY worked hard one day last March. A half-day anyhow, because that's all the time he needed to direct a pair of truck cranes that erected 10 prestressed concrete beams forming the essential structure of the Weber Ave. overcrossing in Fresno, Calif. The full field story of stressing and erection by Thomas Construction Co. appears on pages 63-66.

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The two-way street

Engineering and construction were once two distinct fields of endeavor. Commonly they were considered as the science of design and the business of contracting. For many purposes the distinction still exists. But over the years there has evolved the exacting field of engineering construction, the highest form of the contracting business. Its practice calls for a technical knowledge of civil engineering and a fund of practical job experience.

Most often the talents of the engineering construction man are applied during and subsequent to the building of a project. He works for the contractor, and he thereby becomes established on that side of the traditional line between engineering and contracting. What he knows and what he comes to know are added to the reservoir of experience of the contracting game alone.

At the outset, in an individual case, this is perfectly proper. But over the years, the value of this experience ceases to bear directly on job or company loyalties, and there no longer is reason for reserving to field personnel what might also benefit the designing engineer.

Even as the contractor's engineer has benefited from his own technical background, so does the design engineer benefit from a knowledge of construction. Engineering construction should be a two-way street. The American Society of Civil Engineers, in fact, has its largest following within its own Construction Division, one of thirteen technical divisions of the society. This division exists for the purpose of advancing the practical knowledge of all its members in what otherwise could be a sterile, academic professional pursuit.

Yet, many of the men who could contribute the most to this division—contractor's engineers—do not appear in the society's ranks. This is unfortunate since, after all, construction specifications written in the office are part and parcel of the daily working orders followed in the field. It would therefore seem that a selfish interest alone would cause more field men to contribute their peculiar knowledge to the deliberations of the Construction Division.

The knowledge of these qualified field engineers, properly channeled through the medium of the professional society, would make the field of engineering construction truly a two-way street. Overall civil engineering practice would be enhanced, and a mutual understanding would be brought about, expressed in improved project specifications.

WASHO has a responsibility

The West has a vital interest in the present Congressional resolutions aimed at developing a long-range plan to meet the nation's highway needs and their financing. Combining both engineering and economic studies, such a fundamental review has long been advocated by the American Road Builders Association. Specifications for this type of comprehensive study must be based on overall national needs. But if these specifications do not provide sufficient flexibility for recognizing the peculiar characteristics of this region, the West may find resulting recommendations in the report that could upset and impede our future highway development.

For example, an ultimate highway system set up in such a plan for the population distribution of Connecticut would be completely unsuited to Wyoming. Again, in the matter of existing transportation facilities, an 800-mi. single track railroad line connects Los Angeles and Salt Lake City, with no alternate route within a reasonable distance. In the East, any such an area would have available a whole network of rail transportation. This indicates the dependence of the West on highways for commerce and industry. Other factors such as the rate of Western population increase, the high ratio of cars per capita, the mileage of mountain grades with special problems of passing lanes and sight distance are too well understood to require more than mention.

WASHO is the logical agency to assume responsibility to watch the initiating of these proposed studies and protect against any inflexible thinking that might have an adverse effect on the future development of the highway system of the West.

Tilt-up construction for schools

Tilt-up type precast concrete construction has been adapted to meet the strict requirements for school buildings in California. Considering the legal provisions for design to take care of lateral forces, and the successful record achieved in their enforcement, this latest development is a further endorsement of this modern method of building. It is fitting that this latest advance for tilt-up should take place in Southern California where the basic idea was developed and has received its greatest impetus. An article in this issue describes the features of design and presents significant cost data. The introduction of a prestressed beam for a roof supporting member only adds the final touch of modern design.

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MAY 1953

With 19 straight miles of trench to shoot —

Arizona pipeline is rough

*Malapai rock kept 10 drill set-ups going —
Looping the natural gas line to California
meant 30-degree bends in a single pipe
length—But work finished 2 weeks ahead*

WEST OF KINGMAN, Arizona, among jutting outcrops of malapai rock, El Paso Natural Gas Co. has under construction a 50-mi. section of its 30-in.-diameter gas loop between Farmington, New Mexico, and the California state line. This section between Kingman and Topock represents the last link in the 800-mi. loop built by company construction forces, and because of difficult excavation in malapai rock, it ranks as the toughest.

Right-of-way clearing

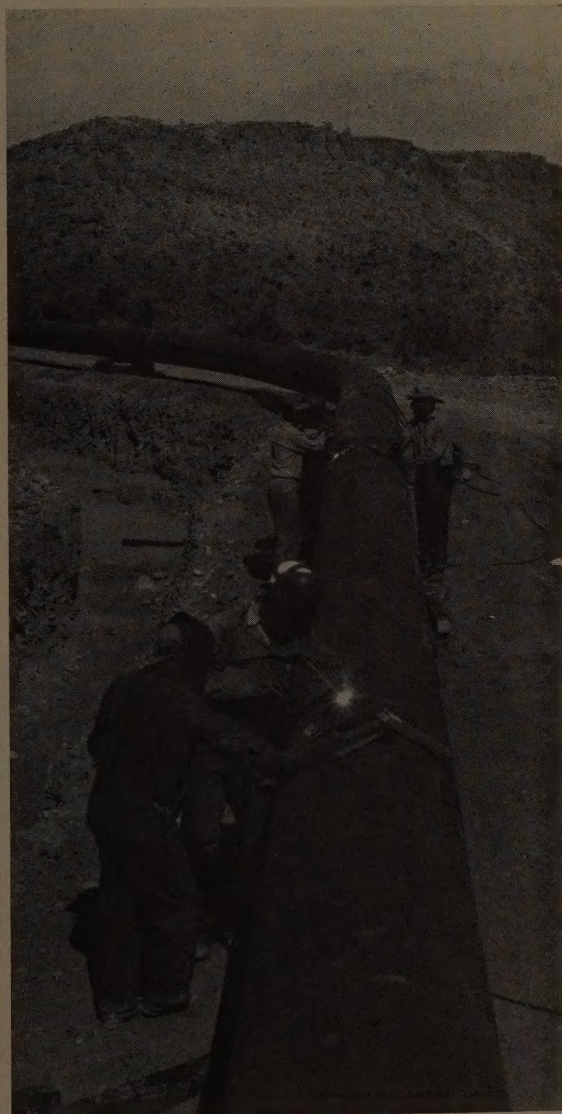
The pipeline right-of-way was generally covered with typical Arizona desert growth: yucca, cactus, and brush. Clearing consists of scraping this off with an International TD-24 tractor and a matched Bucyrus-Erie dozer blade. Brush piles are burned behind the dozer as it moves along. At the same time, this machine pioneered an access road up and down the hilly terrain so pipe stringing crews could get in with their delivery trucks. The access road, after being roughed in by the TD-24, was bladed smooth by a Model 610 Adams motor grader.

Since the loop line is situated 20 ft. from the main line, clearing work on this section will leave the right-of-way in excellent condition for years to come. Desert growth will come back slowly, but the lack of dependable rainfall will leave the pipeline location clean for a long time.

The 30-in. steel pipe was rolled in 30-ft. sections. Pipe walls vary in thickness from .324 to .335 in. The 30-ft. sections were shipped by railroad to sidings in Kingman, Topock, and Yucca, the latter a town about midway in the job. Dunn Bros., Inc., of Dallas, Texas, has a contract for stringing the pipe beyond the railroad unloading points.

Although many of the pipeliners have laid pipe in rough terrain before, the ditch excavation for the Kingman-Topock link gets universal credit for being the worst they have ever seen. Biggest problem was a 19-mi. section just west of Kingman where malapai rock, a dull, reddish rock full of bubble holes which give it a porous appearance, had flowed close to the surface. It is so hard that ordinary rock bits burn up on contact, and even the finest tungsten carbide-tipped bits, which cost \$28 apiece and usually drill 800 to 1,000 ft., dulled after 15 to 75 ft. of drilling.

In spite of this, J. A. Smith, pipeline superintendent, had his rock crew equipped and organized to make as





THIS DIGGING looks easy, but sandstone wore out bucket teeth in one shift. About two-thirds of the job was like this, and ditching progressed at better than 1 mi. per day.

much speed as possible. Two International TD-18 tractors were fitted with welded braces and standards to carry a set of twin Gardner-Denver wagon drills apiece. Eight halftracks were brought in and each unit was equipped with a 210-cfm. air compressor and Gardner-Denver or Ingersoll-Rand wagon drills. These being highly mobile, a minimum of time was devoted to rig moves.

In solid rock, a double row of holes 40 in. center to center was staggered on the edge of ditch line. Holes were sunk 18 in. below grade to get good breakage. In easier formations which were somewhat open or fractured in their natural state, a single row of holes 24 in. on center was drilled down the center line. Caprock formations

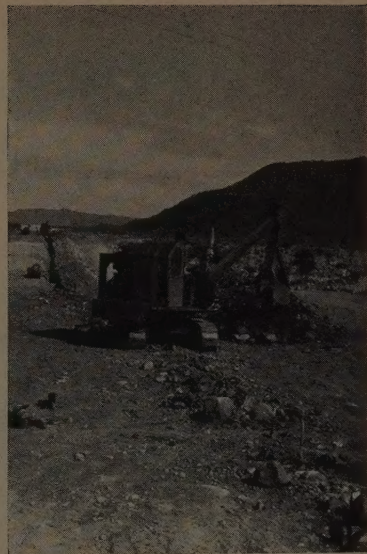
were sometimes found, and these were drilled only to their lower edge.

Slow burning 40% Apache bag powder worked better than high-velocity gelatine. The bag powder was simply poured in to within about 24 in. of the ground surface, and was stemmed with tamped dirt. Seven-ft. fuses were cut from a reel mounted on a specially rigged truck, and shots were set off by lighting about 50 fuses progressively. In sections where softer caliche had to be shot, the single row of holes was hooked for perhaps half a mile to Primacord detonating fuse, and set off by one fuse and a cap at the end. No electric blasting caps were used because every foreman on the job had a 2-way radio transmitter in his car, and these transmitters sometimes fire electric caps accidentally.

Excavation

Broken material was excavated by a fleet of five backhoes. The excavated material was dumped in a spoil bank alongside the ditch, and was used later on for backfill. Through the rocky sections, however, jagged and high bottomed places sometimes protruded above grade line in spite of all the drillers could do. A small compressor and a jackhammer, along with plaster shots, blew these places to bits. A 3-in. leveling pad of select sand and dirt was then trucked in to form the foundation for the pipe.

An interesting sidelight on the ditching operation was a crossing of U. S. Highway 66 about halfway between Kingman and Topock. A 34-in. sleeve 400 ft. long was laid at this point to carry the pipeline through the present highway embankment and through the location of a future embankment to be built when the road goes to 4-lane divided standards. The 34-in. sleeve had to fit tight, so the installation would not disturb the embankment. A Crose auger machine



BROKEN MATERIAL came out by backhoe. Five of these rigs opened up a lot of trench so that the bending gang also could stay well ahead of other work.

bored the hole and installed the steel casing.

About 31 mi. of ditch was excavated by a Buckeye 48 ditching machine, but the job was far from easy. Some of the formations assigned to this machine included soft sandstone, and bucket line teeth often were replaced once a shift as they wore down. When this machine was new it weighed about 25 tons, but by the time the assignment was finished, enough steel plate and other bracing had been welded on to boost its weight to 35 tons. The machine moved along at a steady rate, however, making from 4,000 to 6,800 ft. per 10-hr. day.

All ditching was designed to produce a 5-ft. trench with a 44-in. bottom and just enough side slope to prevent the material from raveling. In a few cases the ditching machine went slightly deeper to reduce the work of the pipe bending crew, but the typical size of the trench governed both the ditching machine and the powder and drilling gang's operations.

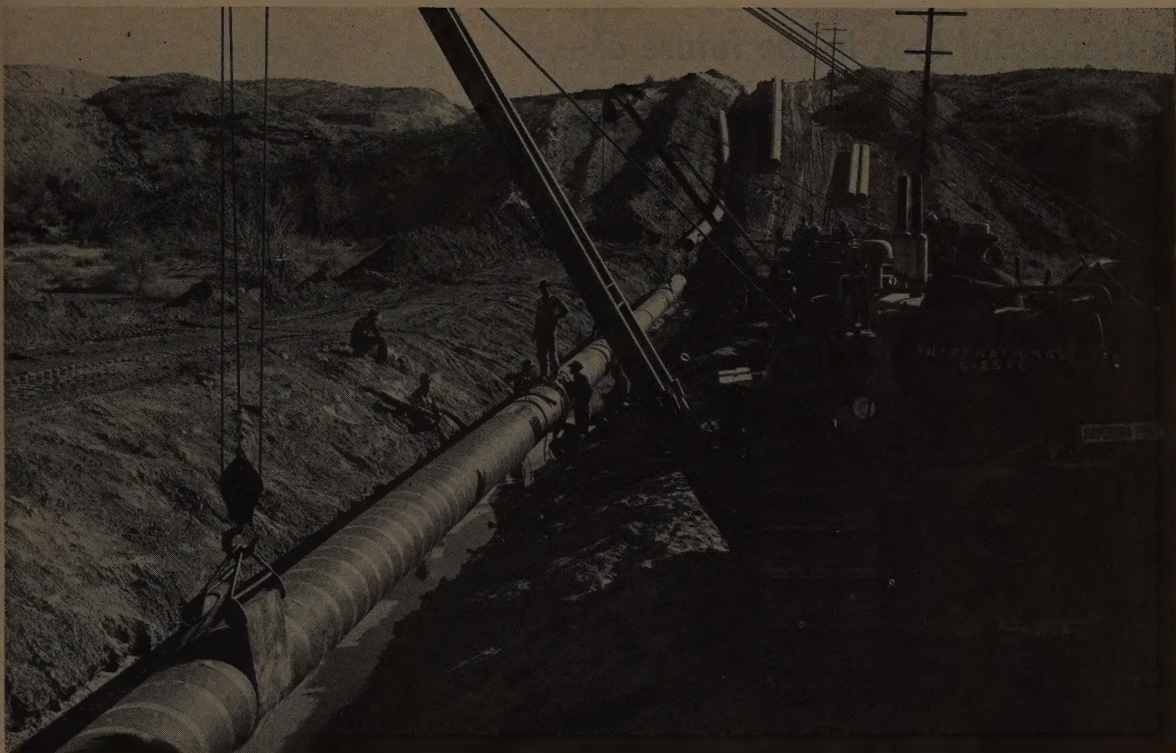
Extreme bends

The mountainous terrain made necessary considerable pipe bending to curve the line up, down and side-wise. One 60-ft. section passing over a crooked hump took four bends, none in the same direction, with deflections up to 27 degrees. It was not unusual to weld two 30-ft. sections together and give the piece as much as 30 degrees of bend. With the entire pipeline crew following close behind, pipe bending was one of the most important construction subdivisions on the project.

The CRC smooth bender assigned to the job turned out to be unusually

HERE'S THE THING for this country: A drill set-up on a half-track. Eight of these drilled the pipe alignment preparatory to blasting a 5-ft. trench.





FOUR SIDEBOOMS teamed up to lower the coated pipeline. Select material had to be trucked in to bed the pipe and to backfill close around it.

dependable, however. To make sure of this phase, Superintendent Smith kept the bending crew working far ahead . . . usually close to the excavation gang. A survey party measured the bends ahead, set stakes, indicated the degrees of bend, and was generally helpful to the bending crew.

The 60-ft. doubled sections usually fed to the bender were handled by an International TD-18 tractor, equipped with a Superior side boom. When the bends were completed, this tractor moved over to the ditch and placed the pipe in position for the lineup crew, following close behind.

Welded joints

Pipe lineup work was done by a small crew working with two side-boom-equipped crawler tractors. Each machine alternated, bringing the 30-ft. joints together near the edge of the ditch. As the ends were lined up, a 5/32 Fleetweld stringer bead was run to join the beveled edges together, and a hot pass with similar rod built up the joint to resist further handling. Four Lincoln 300-amp. welding machines were used for stringer and hot pass welds. The two filler beads and a cap bead were put on by Lincoln 200-amp. welding machines and 3/16 Shieldarc 85 rod. Welding units were mounted in pairs on small rubber-wheeled carriages, and the carriers were towed quickly to wherever they were needed by crawler or rubber-tire tractors.

When the last weld had been made on a day's run of pipe, the cleaning

gang was ready to go to work. Three International TD-18 tractors assigned to this crew handled the pipe with their side booms while cleaning machines took over. A Model "C" CRC cleaning and priming machine used revolving knives and brushes to clean the metal thoroughly, even if it was rusty. This machine was also equipped to spray on a coat of Koppers bitumastic enamel and dope, followed by a wrapping of glass paper. This coating was planned to protect the line from corrosion, rust, or electrolysis.

Cleaning and coating was usually done on alternate days to give the dope gang a full day's work.

Early in the morning on the day following the dope gang's work, four tractors moved in to lower the pipe to its place in the ditch. Equipped with side booms and counterweights, they were able to handle 200 ft. each.

When the pipe was down, a pair of crawlers with dozer blades shoved in the excavated material to complete the backfill. In the rocky areas, select sand was shoveled in to cover the pipe to 12-in. depth, and blasted rock was then used as a cover. Track rolling on a leveled ditch was done to develop some compaction.

The motor grader dressed the backfill as a final step, and everything was done at this time to leave the access road in good shape for any ranchers living nearby to use. In a few cases

ranch roads were bladed lightly, and a few stock ponds were made to leave ranchmen with a good opinion of El Paso Natural Gas Co.

Started in December 1952, the 50-mi. section was slated for April 1 completion. By mid-February the crews were ahead of schedule by two weeks, and all hands expected to participate in a job-ending celebration about March 15.

Completion of the tough-to-build link will make gas deliveries to California much more dependable, because the long loop line will contain much valuable storage space which can be used in peak demand periods. If a 3-week winter cold snap should come suddenly to San Francisco, the vital loop space will contain a tidal wave of heat and energy for the Bay Area.

Personnel

Heading all field construction operations is J. F. Eichelmann of the El Paso headquarters staff, with R. W. Harris as pipeline construction superintendent. The Kingman project was under the supervision of pipeline superintendent J. A. Smith.

Key field assistants included Smith's assistant, William Page; drilling foreman Leo Stanley; welding foreman Hardy Jones; bending foreman Albert Rising; lineup foreman Lewis W. Orr; dope foreman Irving McLaughlin; lowering foreman Al Cody; cleanup foreman Grady Wright; and office manager W. W. Harris.

A thoughtful look to the future of—

THE COLUMBIA RIVER BASIN

Its power potential makes this river system the perpetual basic resource of the Northwest — Without resorting to the usual array of tables and charts, this analysis presents a summary and expression of opinion covering the utilization of the river and the proper balance of its resources in the future

WHAT ELSE can be the future of this Northwest with potentialities of 30,000,000 kw. of electric power, but that it is destined to become the greatest industrial center in the world?

But let's keep our feet firmly on the ground and not anticipate a too sudden transformation. A good start has already been made toward realization of that goal but unless we can cease this name calling and jealous bickering between public and private power interests that goal will not be reached.

*O! he who draws a circle premature,
Heedless of far gain,
Greedy for quick returns of profit
Sure has made a bad bargain.*

—Robert Browning

Power development

The first reported hydroelectric development in the Northwest was made by the Willamette Falls Electric Co. when, in 1888, a 450-light Edison direct current dynamo was installed on the east bank of Willamette River for lighting residences and stores at Oregon City. On June 3, 1889 direct current was transmitted from Oregon City to Portland. The first alternating current was generated and transmitted from Oregon City to Portland some time in 1890. On April 30 of that year Westinghouse Electric & Mfg. Co. shipped the first 80-kw., 125-cycle alternator to Oregon City. Five other units followed, the last one being shipped Oct. 10, 1891. The exact date of the first transmission of alternating current is obscure but it doubtless followed shortly the installation of the first 80-kw. unit, probably by September 1890.

Markets unforeseen

The first federal power development was the Bonneville Plant authorized in 1933 as a "made work" project. Our vision was somewhat obscured by the then current prophecy that the market for that amount of power would never materialize. The first two units were rated at 43,200 kw., but the remaining eight are rated at 54,000 kw. Today Bonneville with its 10 units is considered as materially

By
**J. C.
STEVENS**
Stevens &
Thompson
Engineers
Portland,
Oregon



under-developed. Its prime is 479,000 and total capacity 518,400 kw. McNary has 620,000 kw. prime in a total of 980,000 kw. The Dalles will have 14 units of 78,000-kw. size totaling 1,092,000 kw., of which 690,000 is considered prime, and there is space provided for 8 more units. Grand Coulee

REPORTS on the development of the Columbia River Basin since the first Federal power project at Bonneville would form a reasonable dam in themselves, both as to sheer volume and their tendency toward aridity. They are loaded with statistics, are slanted in different directions depending on the sponsoring agency, and up with many contradictions and in general remain unread. The average engineer cannot find time to digest any one thoroughly, much less keep up with all of them.

Yet every engineer in the West wants to feel acquainted with the present and future of the development of this mighty Western asset, and its multiple and overlapping uses.

To meet this desire we have secured this down-to-earth, shorn-of-detail and realistic summary from an authority on the subject. It condenses in a short space the future of this hard-working resource.—Editor.

has 1,575,000 prime out of a total of 1,944,000 kw.

A substantial excess capacity in Columbia River plants is abundantly justified, based on the secondary power available for 3 to 4 months of each year during the spring snow melt period. The great advantage of this secondary power is to maintain the connected load of the reservoir power plants during this period while their reservoirs are being replenished from the spring flood waters. In brief, this certain-every-year secondary power will firm up the production from the reservoir plants far beyond what their prime could otherwise be.

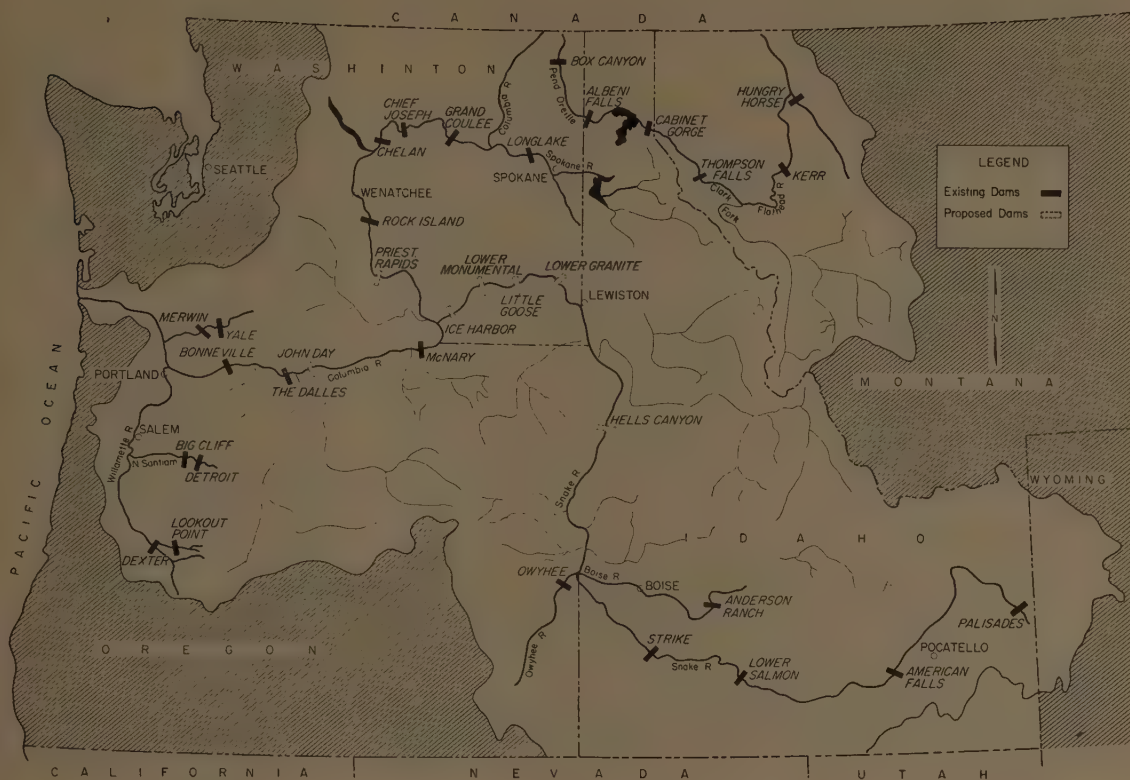
An accompanying table shows the present status of hydroelectric developments in the Columbia River Basin, with which is included the Puget Sound area. Developments in Canada are not included. A second table lists the existing thermo-electric generating stations in the same areas.

Present power status

The tables show that there are existing and under construction plants totaling 9,310,000 kw., at name-plate capacity. Federal projects authorized and recommended would raise this total to 14,231,000 kw., of these 13,775,000 kw. are hydroelectric. Thus the goal of 30,000,000 kw. of hydroelectric generating capacity is approaching the halfway mark. Of the plants in existence and under construction with a capacity of 9,310,000 kw., 20.5% are private utilities, 11.7% are credited to municipalities and public utility districts, and 67.8% are federally owned.

It has been proposed that the federal government build large steam plants to firm up its hydroelectric capabilities. Wouldn't it be far more profitable if the government would make it safe and worthwhile for such plants to be built by private enterprise?

Another proposal has been a transmission inter-tie between the Columbia Basin and the private utility systems in California. While interconnection generally results in extensive benefits to both parties this particular proposal should be carefully scruti-



FACTS ABOUT THE COLUMBIA RIVER

WITH A TOTAL watershed area of 259,000 sq. mi. (85% in the United States) the Columbia River is fourth in size on the North American Continent measured in volume of flow, but first in hydroelectric power potential. The United States portion of its drainage comprises most of the area known as the Pacific Northwest and represents 7% of the total area of the country. In length, the river extends 1,210 mi., including the Canadian section, and its principal tributary, the Snake River, is about 1,000 mi. long.

Backing up to the Continental Divide in Montana and Idaho, the Columbia River secures its chief source of supply from the western slope of the Rockies. Flowing west the Columbia and the Snake traverse the plateau area where both streams have cut spectacular canyons. Through the Cascade Range the Columbia flows through its well known gorge, and gathers in three tributaries (Willamette, Lewis and Cowlitz Rivers) before reaching the Coast Range.

Precipitation over the watershed comes from prevailing westerly winds bearing moisture from the Pacific and depositing it in substantial amounts on the western slope of the Cascades, and further east on the series of north-south ranges up to the Continental Divide. With the exception of these high mountain areas the rainfall is scant and almost completely lacking during summer months. Considering its latitude the temperatures in the Columbia Basin are mild.

General characteristics in the Columbia River area include:

Land. Of the 135,000,000 ac. in the basin, about 45% is classed as forest, although much of this is non-commercial. Land used solely for grazing represents another 35% of the total. Prior to the delivery of water to lands from the Grand Coulee project, the cropped land was only

about 12%. Agricultural production would probably be confined to a total area of about 9,000,000 ac.

Power. Power potential and the Columbia River are synonymous. On the United States section of the river, and not including other rivers of the region, the estimate of the U. S. G. S. is 10,200,000 kw., which is 35% of the available water power of the entire U. S. By comparison, a similar estimate for the Colorado River is 4,500,000 kw. This estimate is for practically firm power and does not include important blocks of secondary power. Further, it is based on 35,000,000 ac. ft. of storage and the reservoir potential is much higher.

Of the existing storage, much of it was developed for, and is used on irrigated lands, which depletes stream flow for power.

Water. Accurate knowledge of the amount and seasonal characteristics of this natural resource is the key to the development of the Pacific Northwest. Available streamflow records are short and incomplete, compared to the extent of hydrological data that is necessary to provide the complete picture. (About five years ago the total number of gauging stations on the Columbia River was 517.)

Because it represents a most important measurement of the water resource and at the same time represents the potential of danger and damage, the highest flood flow of record is an important figure in the evaluation of any river. On the Columbia this was in 1894, with an official estimate of a peak of 1,240,000 cfs. at The Dalles. This same station had a record minimum flow of 35,000 cfs. in 1937 due to up-stream ice gorging.

* * * * *

The foregoing factual summary contains information taken from a Governmental report on the Columbia River.

nized. California has no surplus hydroelectric power. The state would not be willing to exchange steam-generated 2½ cent energy (kwh.) for Columbia's 2½ mill product. Instead of buying California steam power it would be best to construct our own steam plants and save transmission losses. There are abundant fuel resources in this Northwest to justify such developments.

Northwest power pool

This agency is composed of representatives of the federal government, public utilities, municipalities and public power districts. It is administered by a joint committee in the capacity of a power dispatcher to obtain and distribute the maximum quantity of energy from the water and fuel resources of the Northwest. If the same degree of cooperation existed in the construction of power plants as in their present operation there would be no need for power shortages such as we have been cursed with in the past.

Irrigation

There are about 6,000,000 ac. of land under irrigation in the Columbia River Basin. Much of this area lies in the Snake River Valley. The Bureau of Reclamation has plans for the ultimate irrigation of 3,800,000 more acres of new land and the provision of supplemental water for 1,500,000 ac. now inadequately irrigated. Among these is the Mountain Home project in Idaho of 380,000 ac. A realistic cost of this project will reach some \$1,200 per ac.

The Columbia Basin Project contemplates the irrigation of about 1,000,000 ac. watered by pumping from Grand Coulee dam and power plant. Grand Coulee equalizing reservoir, into which the pumps discharge,

has been completed. The canal and distribution system for the first major unit are nearing completion. Ultimate reclamation cost will reach about \$800 per ac., of which the water user is expected to pay only \$85 and the balance is paid off by power revenues—an involuntary subsidy to the irrigators by the power consumers of the Northwest.

There should be a critical look-see before any more such expensive irrigation projects as the Grand Coulee are developed. That same amount of money now being spent on an irrigated acre would reclaim and make productive 5 to 10 ac. of lands elsewhere in this country by drainage of swamp areas, removal of stumps and brush, or by proper drains, crop rotation and fertilization of other unused areas. When the pressure of population on our food resources becomes critical, several generations hence, it is then time enough to seriously consider such exorbitant irrigation subsidies.

Spring floods on the Columbia that last well into the irrigation season will furnish abundant water not only for irrigation of the Columbia Basin Project lands but also for the power with which to pump this water without interfering materially with commercial power production, since most of this pumping can be done with secondary power.

Tributary development

In the Snake River basin above Hells Canyon, storage reservoirs built and building will provide 8,500,000 ac. ft. Ultimately some 11,000,000 ac. ft. of storage will be provided. This combined storage will be used primarily for irrigation combined with power production wherever practicable. They will also provide some storage available for flood control.

Along the lower tributaries—Yakima, Deschutes, Hood River, Cowlitz, Willamette—and in the Puget Sound area extensive irrigation is practiced. In the arid portions, such as in the Yakima Valley, irrigation is effected for the most part by gravity systems with water supplies enhanced by storage reservoirs. In the more humid portions (Willamette and Puget Sound) irrigation by pumped water through sprinkling systems is in vogue. Some 20,000 ac. in the Willamette Valley alone is irrigated in this manner.

Flood control

The plan adopted by the Corps of Engineers to provide against flood damage is: (1) to construct sufficient reservoir capacity to reduce the maximum known flood flow in the lower reaches of the river (1,250,000 cfs. in 1894) to 800,000 cfs.; (2) prevent overflow of lowlands by strengthening existing dikes and by constructing new ones; (3) by channel clearing and rectification principally on tributaries, to facilitate earlier run-off and to prevent local flood damages.

This plan will require about 22,000,000 ac. ft. of storage capacity. No such single reservoir is available, hence recourse will be had to vest the manipulation of all important reservoirs, both public and private, in the Engineer Corps during critical flood periods. Regimen of Columbia River and of the principal tributaries above the gorge through Cascade Mountains lends itself admirably to the triple use for power, irrigation and flood control. Floods occur only during the spring snow melt period and overlap the irrigation season. The magnitude of the spring floods can be foretold approximately from forecasts made from snow surveys and weather records, now carried on systematically by federal agencies.

Reservoir operation

Reservoirs at power plants are normally drawn down for power production during the winter months and may be emptied to dead storage levels if spring flood forecasts indicate such necessity. In normal years, therefore, manipulation of storage reservoirs primarily for power purposes will automatically provide the required storage for flood control. Only in abnormal years, with an exceptional flood in prospect, will it be necessary to operate reservoir gates for flood control. Columbia River has had only 10 floods in 75 years of record during which the discharge in the lower reaches of the river exceeded 800,000 cfs.

Among the flood control benefits that are usually ignored are those that result from extensive irrigation developments. In the Snake River basin, for example, the river has been subject to periodic floods during the spring snow melting periods from time immemorial. As irrigation has

Hydroelectric plants in the Columbia River Basin and Puget Sound area

FEDERAL PLANTS*	Oregon	Washington	Idaho	Montana	Total
Existing	518,000	1,944,000	50,000	—	2,512,000
Building	2,320,000	1,152,000	43,000	285,000	3,800,000
Subtotal	2,838,000	3,096,000	93,000	285,000	6,312,000
Authorized	1,246,000	1,956,000	144,000	618,000	3,964,000
Recommended	—	—	957,000	—	957,000
TOTAL	4,084,000	5,052,000	1,194,000	903,000	11,233,000
PRIVATE UTILITIES					
Existing	119,000	576,000	488,000	155,000	1,338,000
Building	14,000	—	100,000	—	114,000
TOTAL PRIVATE	133,000	576,000	588,000	155,000	1,452,000
PUBLIC AGENCIES					
Existing	26,000	747,000	2,000	—	775,000
Building	—	315,000	—	—	315,000
TOTAL PUBLIC	26,000	1,062,000	2,000	—	1,090,000
GRAND TOTAL ..	4,243,000	6,690,000	1,784,000	1,058,000	13,775,000

* Where plants are on state boundaries the state in which the powerhouse is located is credited with the plant's capacity. Capacities are based on name-plate rating.

developed floods have been abated by the amount of water diverted onto the land even though a goodly portion thereof may later find its way into the stream as return waters. It is estimated that with full development of irrigation in that basin, including storage reservoirs, flood damages will be a thing of the past.

Navigation

When the power dams on the main stem of the Columbia and the lower Snake are completed slack water navigation between Bonneville and Lewiston, Idaho, will be a fact and not a theory. Bonneville is completed, McNary is nearing completion. The Dalles is under way, John Day and the four dams on lower Snake River are authorized.

Below Bonneville a channel 27 ft. deep, 300 ft. wide, to Portland-Vancouver has been authorized. A 35-ft. channel, 500 ft. wide, is maintained throughout the 100-mi. stretch thence to the mouth, and a 40-ft. channel between jetties to the sea.

The old bar at Columbia's mouth no longer exists. Jetties on both sides have eliminated it and the entrance to the river is being continually deepened by extension and maintenance of these jetties. Deep sea navigation exists on Willamette River as far as the Portland harbor and barge navigation is used extensively as far south as Albany. The design by the U. S. Engineers is complete for replacing the old locks at Oregon City. Storage reservoirs built and planned in the Willamette River basin will materially increase navigable depths at low water.

What of the future?

The greatest single incentive to increased power production will be a treaty with Canada through which both countries will greatly and justifiably benefit by the development of the great potentialities for storage on the Canadian reaches of Columbia River. One reservoir site alone—Mica Creek—can be developed to provide 14,000,000 ac. ft. of storage. It and other sites for power production will bring the total power capabilities of the entire Columbia River Basin in Canada and the United States, exclusive of the Puget Sound area, to well over the 30,000,000-kw. goal set forth at the beginning of this paper. The Canadian portion now has developed capabilities of 750,000 kw. Industry is following these developments in Canada the same as in the United States.

Industry thrives enormously on low cost power and will blossom wherever such power is available. Low cost power, however, must not be promoted at the expense of the general taxpayer. Power developments should stand on their own foundation as is generally the case now with developments by private industry. The moot question of taxation subsidies now

Thermo-electric generating plants in Columbia River Basin and Puget Sound area

	Steam-electric	Internal combustion	Total
Washington	222,540	—	222,540
Oregon	215,710	4,540	220,250
Idaho	9,750	2,860	12,610
TOTAL	448,000	7,400	455,400

Plants of more than 1,000 kw. included in table, at name-plate rating.

granted federal and municipal projects is a worthy subject for critical scrutiny. It is claimed they are fully justified by the general benefits flowing therefrom. If so, does not that argument apply with equal force to corporate utilities? Yet who would think of depriving the private utilities of the privilege of paying their many taxes?

Non-reimbursable costs

Another subsidy to federal power developments lies in the present practice of deducting large sums from the cost of power facilities for flood control, navigation, recreation, fish and wild life. For example on the Hells Canyon project it is proposed to deduct \$43,500,000 for such items from the cost of the dam, powerhouse generating equipment, and other strictly power facilities. Yet on the project itself not a thin dime is to be expended for either flood control or navigation. Moreover this deduction does not represent the cost of flood control and navigation per se elsewhere but rather the "value" of the "benefits" arising from expenditures elsewhere, and these "benefits" happen to be about double their cost.

The effect of this practice of course is to load the general taxpayer with the value of these benefits and thereby reduce the cost of federal power, enabling it more effectively to compete with private enterprise.

These large multiple-use developments can only be constructed by the federal government, not on account of the capital required since private capital could abundantly meet that hurdle, but because of the human problems that only can be resolved by the federal government.

In the Columbia River Basin one such problem is that of fish. The clamor that would arise if a private corporation should attempt to dam the Columbia would be heard over the entire nation and it would not subside until the company gave up in despair.

Another human problem arose in connection with the construction of The Dalles project. Early treaties with Northwest Indian tribes gave them liberal fishing concessions at Celilo Falls. Those falls will be submerged under 80 ft. of water. No private agency could have coped with that problem but the Army Engineers

are coping to the extent of about \$40,000,000 in its solution.

The cost of these large multiple-purpose projects is a great drain on the federal treasury. The proposal has been made that they be built from the sale of revenue bonds thus giving private capital opportunities for safe investments. That plan is worthy of earnest consideration and an early trial. It would insure a more rigorous review of the plans for proposed projects and would guarantee against the authorization and construction of projects of questionable feasibility. It would moreover be a great boon to the now harassed taxpayer.

Finally, if the advocates of private and public power should get together across the conference table, resolve their differences, and try a new era of wholesome cooperation instead of the name calling, face-making and political chicaneries, now in varying degrees characteristic of both, the entire country would benefit immeasurably. 'Tis a consummation devoutly to be wished."

At Priest Rapids, problems are resolved

TWO LOW-LEVEL dams, at Priest Rapids and Beverly on the Columbia River in Washington, have been proposed by Grant County Utility District No. 1 in place of the originally planned high-level dam at Priest Rapids.

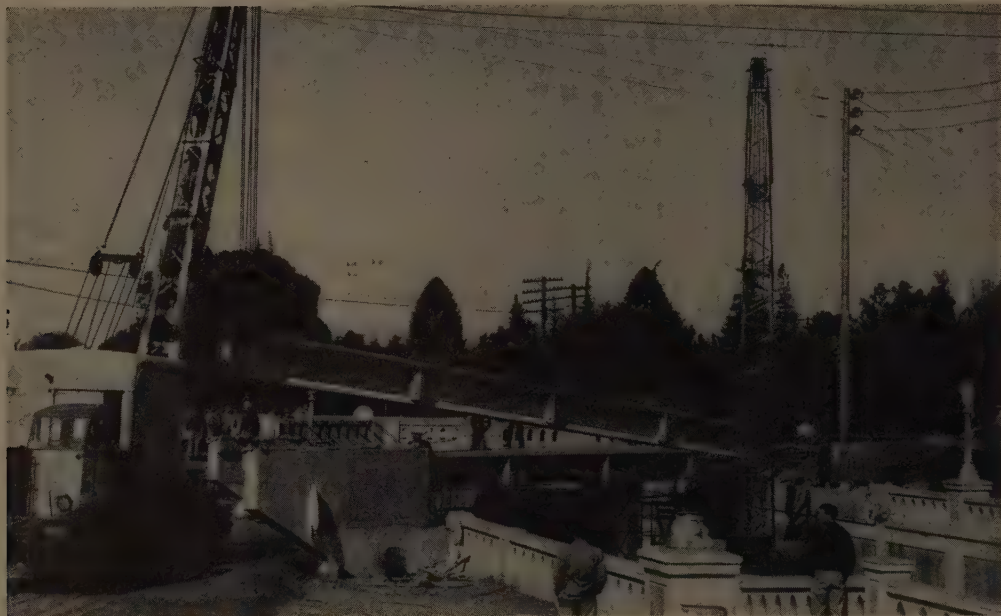
Advantages of the new scheme would be lower cost and quicker completion, according to Glenn Smothers, manager of the district, although the two-dam proposal would eliminate flood-control features.

In addition, Smothers said, the two-dam project would overcome the objections of the Atomic Energy Commission, which claimed that the proposed single high dam would flood AEC installations at nearby Hanford if the dam were bombed in wartime.

Cost of an 80-ft. dam at Priest Rapids and a 70-ft. dam at Beverly would total \$365,000,000, as compared with an estimated \$412,000,000 cost for a single 150-ft. dam at Priest Rapids. The lower dams could be completed by 1956, with peak power production by 1958, as compared to a 1961 finishing date for the high dam.

Two truck cranes and 5½ hours resulted in a —

Prestressed highway overcrossing



It happened fast at Fresno, when the first prestressed structure for automobile use took shape on the California highway system — Prestressing and erection operations handled with surprising precision — Here is the field story

IN A 5½-hr. period on the morning of March 17, two truck cranes and the crews of Thomas Construction Co. swung 10 prestressed concrete beams into place to form the essential structure of the Weber Avenue overcrossing in Fresno, California. Later in the day, as grout was being dry-packed between the beam flanges and diaphragms to prepare for transverse prestressing of the entire 31-ft. width, Thomas J. Bezouska, assistant bridge engineer for the State Division of Highways and designer of the structure, stood back for a long look. "Well," he said, "I guess it's going to stay up!"

Bezouska's remark is not an uncommon one around prestress jobs, for these structures do have unusual proportions by comparison with conventional reinforced concrete. But the words also expressed in a left-handed way Bezouska's pride of engineering a "first." For this bridge is the first to bring prestress out of the experimental category on California state highway work. Its only predecessor is the pedestrian overcrossing con-

structed in Southern California two years ago (*Western Construction*—December 1950, p. 67; April 1951, p. 76).

Scope of work

The Fresno job was undertaken to increase the usefulness of an underpass that carries U. S. Highway 99 beneath the double-track Southern Pacific main line at the north end of town. Weber Avenue, parallel to the tracks, is being connected across the underpass by means of the new structure, composed of 10 beams, each 3 ft. in maximum width (top flange) and 66 ft., 9½ in. between bearings.

Unit bid prices received from six bidders on the job were published in *Western Construction* for January 1953, p. 140. Low bid total was \$91,363.

High points of the job have been prestressing, carried out during the four days preceding erection, and the erection itself. Both "main events" attracted crowds. In fact, the prestressing was purposely spread out over four days so that various engineering groups might visit the work. Erection

was attended by a less distinguished group of sidewalk superintendents, few of whom understood the significance of the occasion!

The erection problem was a nice one. The 18-ton beams had been cast in a lot only about 150 ft. from their final position, and they were grouped very much the way they would sit after erection—parallel to the bridge axis and alongside each other in order of handling. The problem was how to maneuver the two truck cranes that were rented to get the beams from "here" to "there." Street traffic around the job and the need for high crane-boom angles made it impossible for both cranes to work at grade elevation, that is, to roll along the ground surface at each side of the underpass with the beams held between them.

So one crane was moved into the underpass. Reaching up over the retaining wall, it was able to hook on one end of a beam, while its team mate operated at grade on the other end. For the topside crane, this meant backing up to bring one beam end over the "near" abutment. For the crane in the hole, it meant backing downhill and across the street to a similar position over the "far" abutment—all the time hoisting away to keep the beam fairly level.

After the first beam had been placed, this shuttle system was well under control. Cycle time dropped



SQUARED AWAY (left) with an 18-ton beam after picking it up from casting area behind crane at right, the two cranes move out together under directions from boss rigger.

CRANE IN THE HOLE (right) nears right abutment, is temporarily a bit behind in "holding up its own end." Crane operator had "boardwalk" placed under wheels to be sure rig stayed as level as possible. Outriggers were added precaution despite high boom angle.

guide for all later ones. The idea was to leave a uniform 1-in. gap between adjacent top flanges. This practice worked out well, despite the fact that the beams did have slight dimensional errors. The last beam was placed at the proper spacing and proved to be well centered on its bearing plates—no error had accumulated.

Forming for a skew

The principal forming "error" to be noticed was an almost unavoidable one in the diaphragms cast at the quarter points and at midspan. These diaphragms parallel the roadway axis through the underpass. Therefore, they are not normal to the bridge axis, but at a 49-degree angle. Forming to this accuracy proved difficult: the diaphragms present a slight zig-zag pattern when viewed from below the erected structure. The re-use of



from 1 hr., needed on the first run, to a minimum of 18 min., needed for the sixth member.

Bearing assemblies for the beams consisted of male and female castings set in the abutments and in the beams, respectively. Bolts set in the abutments carried the male member on leveling nuts. Actually, the bolts were welded into cylinders 12 in. long, and these were embedded in the abutment. This gave the bolts a little play, even with the bearing plate on them, to ease the job of making up to the beam.

The female member, cast into each beam soffit, was a recessed casting. Meeting surfaces of the two bearing elements were convex, giving point contact.

Bearing plate flexibility

At the north end of the span, the bearing plate bolts were grouted in after the plates were assembled. The bearing was therefore rigid, and the beams were landed at this end first. At the south end, the beams were lowered on the bearing plates in final position, but they were shimmed up with timber wedges so that the bearing plates didn't take all the weight at first. This way, the bearing plates could be beaten to exact center of their recesses before grouting. The beams themselves would not move during this process. The reason for all this flexibility was the realization that casting 10 perfect beams, particularly with a 41-degree skew, was not possible—a little form deflection, otherwise of no importance, would have made erection difficult.

Basic guides for erection, of course, were the bearing plates, which had been precisely located at proper spacing, although actual installation left them the leeway described above. The first beam placed became the practical

one set of side forms meant that the same error repeats from beam to beam. Except for a little extra friction encountered during transverse prestressing, the effect of this mis-alignment was negligible.

Preliminary designs for this overpass were made in all three major mediums—structural steel, reinforced concrete, and prestressed concrete.

After the work, a look at costs

THIS ARTICLE is light on design. It is a story of field methods in prestressed concrete construction. It is another instance of pioneering in the new construction medium, because it represents the "first time around" on a prestress job for the contractor, Thomas Construction Co.

The job is the Weber Avenue overcrossing in Fresno, California, and it is the first non-experimental prestressed construction undertaken by the California Division of Highways. Even so, California highways engineers, and a lot of other engineers, have tinkered with prestressing theory. But not many contractors have had a chance to work with it.

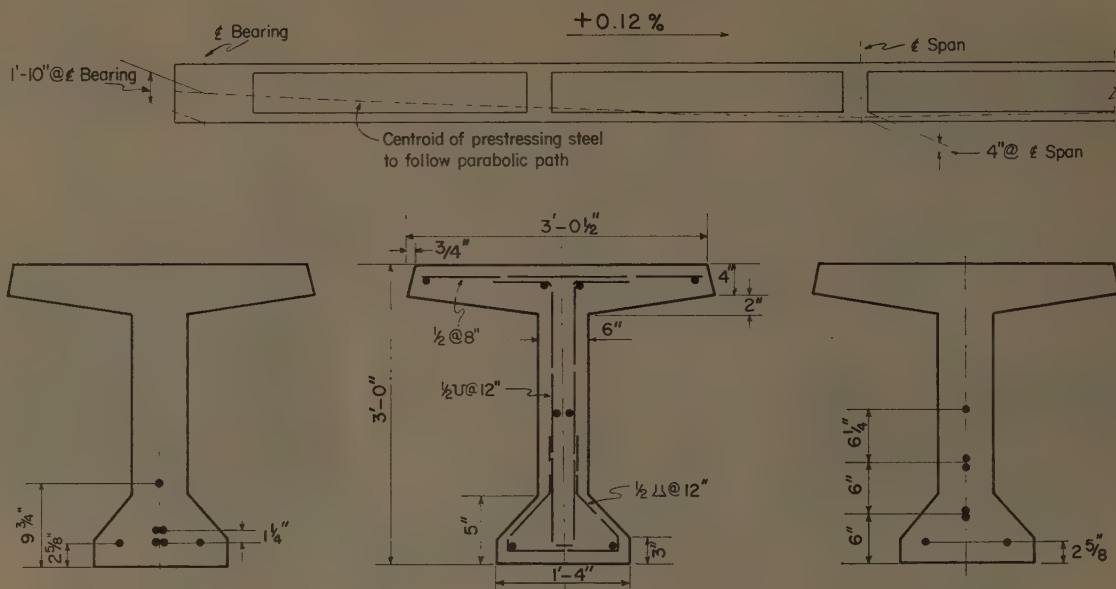
Prestressing is coming along in the West, and we feel it our best duty that *Western Construction* articles on the subject should be for contractors of the West. So we paid our closest attention to prestressing and erection operations for presentation in this article. And we asked Thomas Construction Co. for comments on the work.

Generally, they said, they were pleased with how things had gone. Here is some specific comment:

"There was, frankly, an error in computing the cost of formwork needed for the prestressed beams. It amounted to about \$24 per cu. yd. above our bid price of \$68. With 90 yd. of concrete involved, this figured to set us back about \$2,200, plus overhead, and we were pretty disappointed when we found it out later.

"But the prestressing operation and the erection went off like clockwork. To our surprise, this turned out to be the item where we made up part of the \$2,200. The labor cost in prestressing wasn't nearly what we had estimated.

"This was our first prestress job, and the formwork error only served to dramatize the fact that prestressing can be done without a lot of sweat. With the experience we have now, we're looking for more work of this kind, and we're sure we can handle it at an economical unit cost to the owner."



ESSENTIAL DETAILS of the beams include profile showing state's method for establishing general prestress requirements. A further note presented calculated deflections at midspan: 0.06 ft. upward under initial prestress and girder weight; 0.04 ft. upward under

full dead load. Cross sections of beam show reinforcing steel specified by the state (center) and positions taken by prestressing cables at midspan (left) and quarterspan (right) according to Freyssinet Co. design.

The prestress design was actually the cheapest, without giving it an edge for intangibles such as experience to be gained. The first alternative to be eliminated was cast-in-place concrete: Highway 99 could not be blocked for the necessary time.

Steel would have been more expensive than prestress. In addition, at the time the overcrossing was designed, steel was hard to get.

BEARING PLATES (below) show skewed alignment of beams. Someone always asks why extra nuts go on top of plate, when an 18-ton beam should hold it down!



Precast reinforced concrete members were the nearest competitor, but not too close. They would have weighed nearly twice as much—35 tons—and would have required a more extensive job of beefing up the underpass retaining walls that serve as abutments. In addition, they would have been 4 1/2 ft. deep, as opposed to 3 ft., and this would have meant (for the same traffic clearance below) the addition of 1 1/2 ft. to the abutment height and to the prism of both approach fills.

Prestress specifications

A practical problem in setting up specifications for a prestress job is how to let everybody in, without seeming to favor one of the several proprietary prestressing systems. For the Weber Avenue job, the Division of Highways called for the center of gravity of the prestressing steel to lie in a particular position. Beyond that, they stated that prestressing could be done by any one of several systems, "such as . . ."—and they listed the major ones in use today. The prestress experts then furnished their services to the bidders directly.

The Freyssinet Co. representative in Los Angeles, James R. Libby, worked with Thomas Construction Co. Libby did the detail design for prestressing in the beams, subject to approval by the state. Also, the prestressing accessories—cones and jacks—were furnished through him. He consulted with the contractor as necessary. But the Freyssinet Co. was

not a subcontractor: it performed none of the contract items.

The job began early in December. The first operation was to excavate down behind both underpass retaining walls. They had to be thickened by 2 ft., with extended spread footings at the bottom. Clearing of the casting area and construction of beam forms was begun at the same time.

There are a number of points worth mentioning in connection with the contractor's work in forming and pouring the beams. The forms were built with no bolts through them at all. Instead, 2 x 6-in. wood collars were framed clear around the forms at 3-ft. intervals and wedged up to final dimension. The idea here was to simplify stripping and avoid the need for patching the concrete afterward.

Construction of each beam included a minimum of conventional reinforcing steel. Prior to stressing, this steel was not enough for the beam to support its own weight. The pattern included 1/2-in. stirrups and 1/2-in. longitudinal bars as shown in the detail.

In addition, 7 prestressing cables were placed, each "cable" actually being an unstranded bunch of 12 high tensile wires 0.196 in. in diameter threaded through a 1 1/2-in. flexible metal sheath. They were positioned on the proper curvature by wiring to the stirrups. Actually, with the prestressing wires in them, the sheaths became quite rigid enough to resist displacement during concrete pouring. Diaphragms and end blocks were fitted with transverse segments of 1 1/2-in.



ALL SMILES over the morning's work (10 beams in place), D. B. Winniford, superintendent, listens to a pronouncement from the prestressing man, Jim Libby of Freyssinet Co.



ANSWERING QUESTIONS, Tom Bezouska (left) and Walter Joens of the Division of Highways perch on one end of the bridge and face the "gallery." Joens is resident engineer on the job; Bezouska is assistant resident and designer.

pipe—one each near top and bottom of the section. These were oiled before installation; and they were pulled before the concrete had taken its final set, leaving channels for the transverse prestressing. Near the ends of each beam loops of re-steel protruded for hooking on the cranes at erection time.

Concrete for the beams—a total of 90 cu. yd.—was specified by the state to be Class E: a 7-sack mix reaching 4,500 psi. compressive strength at 28 days. In the field this was achieved with a mix that used $\frac{3}{4}$ -in. maximum aggregate and had a 2-in. slump. Performance was for the most part better than specification, many samples going over 5,000 psi. And, in every case, stressing was okayed after only 17 days because the beams had attained 4,500 psi. by that time.

Actually, stressing wasn't completed until March 16, which meant

FOUR TO GO finds scaffolds and workmen already under the first six beams and grouting between diaphragms. Wide slot at right shows that near end of beam hasn't been landed yet.



that the oldest beam was then 39 days old, and the youngest 17 days. The use of only one set of side forms caused the slow succession of pouring operations. But there wasn't any rush, since progress on abutment preparation was the controlling factor.

When the beams were poured, vibration promised to be a problem. After all, there were stirrups and bars in the forms, and the added complexity of the prestressing cables, all within a 6-in. web section. Lacking an external vibrator, the contractor jammed an internal vibrator between a waler and a wood wedge, held in position with his foot, to get satisfactory vibration of the form.

Prestressing operation

The beams are identical in general section and overall dimension. Prestressing is the same in all 10. Only differences occur in the two outside beams of the bridge, and in the one next to outside on the east. These three have dowel steel for anchoring later deck work—a curb and handrail on each side, and a sidewalk on the east. Also, the two outer beams have slightly different treatment of the diaphragms, recesses being provided for grouting over the transverse prestress anchor cones.

Longitudinal stressing was done, for the most part, from one end only. General practice under the Freyssinet system calls for stressing from both ends only when the member is designed for continuity, where wires and their sheaths are carried up over intervening supports and down again to successive midspan low points. The Fresno job featured simple beams. Here's how the jacking procedure goes:

The jack is fitted on the cable at one end of the beam and pulled to a

gauge-measured hydraulic force of 5,000 lb. This is assumed to get all the slack and "kinks" out of the wires. Elongation at this point is considered zero, and this is the starting point. Thereafter, jacking is continued and the accumulated stress is measured by the elongation of the wires.

Guaranteed ultimate strength for the wires was 240,000 psi. Tests averaged 266,000 psi, with a minimum of 246,000 psi. Stressing was performed to give an initial stress of 60% of the ultimate; this would be at least 144,000 psi. "Initial stress" is what is desired to remain in the beam. "Jacking stress" is somewhat more. It involves additional stress to overcome friction and cone deformation.

The friction force varies from job to job and is determined in the following manner. After the jack on the first beam has been brought up to the

Concluded on page 139

GROUTING between flanges is done from top, with wet burlap marking finished work. This view shows how the new overcrossing connects to Weber Avenue, in the background north of the structure.



Site conditions increase costs and problems of—

Canal lining maintenance in Utah



Unlike specially picked test sites, this rocky side hill canal alignment is an operating project — Lining costs reflect difficult access and laborious preparation of canal section

AN INCREASING battle against seepage has been the feature of maintenance operations on the Yellowstone feeder canal in northeastern Utah. The canal is located along high foothills between East Fork of Lake Fork and the Uintah River. Material along the course of the canal is highly variable, ranging from fine-textured bentonitic material to coarse gravel containing boulders. In some sections, less than 25% passes a 1½-in. screen. A section of the canal just north of Altonah, Utah, located in the coarser material, has given the most trouble.

When water was first turned into the canal, seepage accounted for the full stream and the water had to be removed so that the canal could be repaired as a safeguard against damaging breaks. As an emergency measure, fine-textured bentonitic material in the vicinity was used to line extensive portions of this section while similar repairs were made to other sections of the canal.

This type of lining was installed piecemeal over a period of about 12 yr., until it became almost continuous over a length of about 2 mi. in the canal section north of Altonah. But, although the work has served to keep the canal in operation, it has not provided protection against recurring breaks, even in those sections carefully treated.

In the fall of 1951, it was decided to make this section the site of a seepage and lining test. Some bulkhead footings were constructed, removable bulkheads installed, and ponding

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tests made on three sections. Two of the sections were about 800 ft. long, and one, 500 ft. The footings were installed late in the season. Frost prevented backfilling with compacted moist material, but dry bentonitic material could be used and was carefully compacted around the footings.

Seepage vs. piping

Seepage measurements were obtained in two sections. Provided the lining remains intact, losses in earth-lined portions of the canal are small, except in the vicinity of the water surface when the water depth is near or above the operation level.

In this connection, it is interesting to note that without exception, a large hole developed in the undisturbed portion of every section as a result of piping before a measurement could be completed. The frequency of these breaks was greater than the normal expectancy, judging from the

number of breaks of record during normal operation. It is possible that removing the water from the canal and allowing it to dry and freeze was a contributing factor, shrinkage and frost cracks forming the focal points for piping.

Provision was made for the installation of three types of lining following the original seepage measurements: a section of buried asphaltic membrane (sprayed); a section of buried asphaltic membrane (prefabricated); and a section of gravel-covered earth lining. Later, a section of concrete was added for comparison.

The buried asphaltic membranes were installed in June 1952, and the concrete lining during the first two weeks of July. The earth lining has yet to be installed. The section for the buried asphaltic membrane linings was excavated with contracted equipment, and the finish grading accomplished with hand labor. Because of the coarse texture of the subgrade, the specified application rate for the sprayed membrane was 2 gal. per sq. yd. Actually, the rate was about 2.7 gal. per sq. yd. The prefabricated asphalt membrane was the asbestos-

Cost of linings installed in Yellowstone Feeder Canal

	Per sq. yd.	Per lin. ft.
Buried asphalt membrane (sprayed).....	\$4.82	\$13.63
Buried asphalt membrane (prefabricated).....	4.14	11.70
Concrete	5.05	9.07

coated type and was supplied gratis by Johns-Manville, Inc.

The linings were installed on a close schedule and work was hampered by unfavorable weather. As a result, specifications for preparation of the subgrade and the placing of cover on the asphalt membrane linings were not followed, in part. Specifically, the subgrade for the sprayed membrane was not rolled and much of the cover for the membrane was bulldozed into place from a high bank instead of cast in place from the bottom to the top.

Prefabricated membrane

The subgrade for the prefabricated membrane, though not as smooth as desired, was firm when the membrane was laid. It was covered first by a thin cushion course of fine-textured material followed by coarse material, some of which was bulldozed into place from the bank. The prefabricated membrane appears to have provided an effective barrier against seepage except in one location, where it was known to have been damaged during covering. Here, a break developed necessitating removal of about 100 lin. ft. of lining. The section from which the membrane lining was removed was replaced with earth several feet in thickness, installed following a procedure similar to that for the earth lining of earlier years. The break apparently began with a small leak that enlarged rapidly, removing the fine-textured material from under the membrane lining and allowing the subgrade to settle, leaving the membrane unsupported.

This job emphasizes that buried asphaltic membrane lining installations should be carefully scheduled and established procedures followed if a satisfactory job is to be obtained. Subgrades should be firm and smooth and cover material placed in such a manner as not to damage the membrane. Since the asphalt, once it arrives on the job, must be applied with a minimum delay, it should not be delivered until all subgrade preparation is complete. Although it has been stressed that a minimum of subgrade preparation is necessary when buried asphaltic membrane linings are used, it does not follow that a satisfactory job can be obtained with haphazard methods. It is unfortunate that a standard installation of the membrane linings was not obtained so that a comparison of the various types of lining could be made. The tests, however, have provided some significant information on cost and subgrade.

First, imperfections in the membrane lining where the subgrade is coarse textured likely will result in failures through piping and eventual rupture of the unsupported membrane. This was true of the membrane linings installed, whether of the sprayed or prefabricated type, although it is believed that occurrence of imperfections is less likely with the



PIPING through earth lining resulted from drying shrinkage and frost cracks after canal had been emptied for construction work.

prefabricated type than with the sprayed type. No information is available on the point, however, and likewise, nothing is known of the quantity of seepage contributing to the breaks. But, if any number of imperfections are present, breaks will eventually occur. This observation is supported by our experience at the River Laboratory where an application of 2 gal. per sq. yd. was found to be insufficient to provide a watertight membrane when applied on a subgrade of pea gravel.

Conclusions

Under the conditions of this installation, the cost of the buried asphalt membrane lining was greater than that of concrete lining, per linear foot of canal lined, as shown in the table. The smaller unit cost of lining with

concrete results from the smaller lined perimeter required with concrete lining: 16.25 ft. as compared to 29.50 ft.

In evaluating the results of this job, it must be remembered that the job was isolated, subgrade material was extremely coarse textured, and material cost above average. Concrete aggregate cost \$6.50 per cu. yd. delivered to the job, cement \$1.21 per bag, and asphalt \$98.00 per ton in place. This job may be classed non-typical, in that material costs were high and site conditions extreme in certain respects. Most jobs, however, have limiting features and it is important to recognize them in order to select linings which are adapted to the conditions encountered. It is dangerous to classify this or that type of lining as lower cost lining.

PREFABRICATED membrane required most fine grading ahead of time, gave better service than sprayed-on counterpart. Sprayed asphalt went on unrolled subgrade having such rough areas that distributor-mounted spray bar had to be replaced by hand-operated rig.



Traffic, gummy blue clay obstruct —

Storm drain project

Stolte, Inc., crew pushes work on job to install 2,200 ft. of reinforced concrete pipe and box culvert to replace 45-in. line



HEAVY TRAFFIC, streets crowded with various underground utilities, and the gummy blue clay that underlies much of the San Francisco Bay region are the run-of-the-mill obstacles facing Stolte, Inc., on its storm drain job in Oakland, Calif. The \$240,000 contract is for replacement of an outmoded storm drain with some 2,200 ft. of 66- and 63-in. I.D. reinforced concrete pipe and box culvert, plus installation of about 500 ft. of miscellaneous connections to side systems, all along the east shore of Lake Merritt.

The replacement work, which had been planned by Oakland for some 20 yr., was decided upon after it was found that the old line, a 45-in. I.D., concrete pipe, monolithically cast in the trench with no reinforcing steel some 50 years ago, was not large enough to handle the flow during heavy storms. It had been patched and partially replaced from time to time but was still considered inadequate. Also, it had cross-connections with sanitary sewers so that sewage backed up into the storm drain in times of high water.

The job, which began early in February and is scheduled to run for 150 working days, was being handled in two sections when visited. The "upstream" section starts just above the intersection of E. 21st St. and Park Blvd. Here box culvert, which will total 306 ft. when completed, was being installed in an 8½-ft.-deep by 14-ft.-wide trench which runs in a

roughly north-south direction along the east side of Park Blvd. and cuts into the sidewalk. Plans call for the eventual widening of Park Blvd. so the culvert will be completely under the street.

WHAT IS LEGALLY known as an "attractive nuisance" was formed by an open sump on the Stolte, Inc., job described on these pages.

Until the new storm drain can be completed to its terminal outfall into Lake Merritt, the 14-ft. deep sump must remain open to contain whatever water drains down the portion of the pipeline which has already been laid. If a heavy storm should occur before the construction is finished, water would leave the sump through the original (45-in.) storm drain by way of a corrugated iron pipe which connects with it temporarily until the job is finished.

This pool, naturally enough, attracts all of the children, and many of the grownups, in the neighborhood. It also worried Stolte's legal experts, since the company would be held legally responsible if all reasonable precautions were not taken to pro-

At this point, where the new storm drain starts, street catch basins will drain into it. The drain will eventually extend north to MacArthur Blvd., however.

It was necessary to use the culvert in this section of the job to avoid conflict with a 36-in. water main which runs down Park Blvd. The culvert will pass over the top of the water main, which couldn't be shut off because it furnished the water supply for residents of the area. Then the new drain veers off in a wide curve to the south.

Excavation of the culvert trench caused no trouble, and no shoring was needed because it was cut into firm soil. The pour, over a fill of 1½-in. drain rock, was made in bottom and top sections. Movable forms 8 ft. long were set in place, then ¾-in. reinforcing steel was placed. The interval was decided by design engineers in accordance with the normal earth pressure loads and to allow for surcharge loads after estimating the amount of heavy trucking expected to pass overhead.

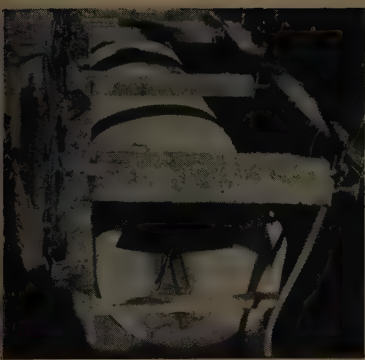
Culvert inside dimensions are 3 ft., 9 in. high by 6 ft. wide, and a 64-ft. section is poured at one time. Although the specifications call for a 6-sack mix with 1½-in. maximum size aggregates, using pozzolan, much of the pour was made with a 7-sack mix, both for extra smoothness and to enable the crews to strip the forms faster. Slump is figured at 3½ to 4 in. Transit-mix concrete is furnished by Pacific Coast Aggregate Co.

The box culvert will angle across Park Blvd. and end at an old brick arched manhole, to be replaced by one of reinforced concrete, at the inter-

tect passers-by from falling into the excavation.

A chickenwire fence around the hole, plus a sign saying "no fishing, no swimming," contributed by a civic-minded resident of the neighborhood, serves to keep all but the most adventurous youngsters out of trouble.





GROUND WATER is being pumped out of the trench, before backfilling starts, through the hose which passes just behind trench jack (right). The 8 x 8-in. cross braces help hold back the gummy blue clay.

section of Newton Ave. with Park Blvd., where the new pipeline begins. This section of the line runs down the west side of Park Blvd. for about a half block, then curves to the west and cuts down an abandoned street-car right-of-way for a block and a half until it hits E. 18th St. The new pipeline had been installed and back-filled in this section but not yet fully compacted or surfaced. Some rolling and compacting was done, however, by a tractor and loaded trucks passing over the area. Nearby buildings and houses along here made for a tight squeeze when the area was filled with working equipment. Tentative plans call for a street to be placed in the right-of-way eventually.

The second working area starts at the edge of Lake Merritt. Construction was about halfway along on E. 18th St., between Lakeshore Blvd. and 2nd Ave. when the job was visited. Here a 15-ft.-deep by 8-ft. 6-in. wide by 350-ft.-long trench was open and being worked by a 25- to 30-man crew. Excavation in this area, originally a finger of Lake Merritt, is complicated by the presence and pressure of the sticky blue clay.

Timber bearing piles, 35 and 36 ft. long, have been driven all along the line of the new storm drain at 8-ft. intervals. Some 300 of them are called for along the entire pipeline. Then 18- to 20-ft. lengths of 4 x 12-in. timber sheet piling were driven at 1-ft. intervals to hold back the clay. Major excavation of the trench was done by backhoe, and clamshell buckets were used to do the finer excavating, aided by men equipped with good, old-fashioned hand shovels.

After the trench was partially excavated, 8 x 10-in. walers were placed at a depth of about 5 ft. In addition, 8 x 8-in. cross braces were placed at 10-ft. intervals and held firmly in place by trench jacks.

When the trench was cut to the required depth, a 12-in. blanket of 1½-in. drain rock fill was laid on the bottom. Then a 12-in. slab of concrete

was poured on top of it and left to cure for 7 days. Concrete cradles were poured on top of the slab, and after they had been cured all was ready for the pipe to be laid. The bearing piles had been cut off at grade and were set to penetrate 3 in. into the slab in order to bear the combined weight of slab and pipeline.

The pipe sections, which are 8 ft. long and weigh 6 tons each, have bell and spigot joints. They are placed in the trench so that each pipe joint is supported by a set of cradles and bearing piles. The contract calls for 834 ft. of 66-in., and 1,073 ft. of 63-in. I.D. reinforced concrete pipe, furnished by American Pipe & Construction Co. Only 350 ft. of trench is kept open at one time because material limitations make it impracticable to work more length at one time, according to the job superintendent.

Trouble left its calling card once in the form of horizontal earth pressure from the blue clay. It became so heavy it sheared off about 6 ft. of each timber sheet pile in a trench length of about 50 ft. Bill Cole, the job superintendent, drove new sheets, braced them with additional 8 x 8-in. walers, and went merrily on his way.

Many automobiles use the area constantly, since Park Blvd., Lakeshore Dr., and E. 18th St. are all main traffic arteries leading into downtown Oakland from suburban residential areas. Traffic is controlled pretty well by means of detours around the active construction areas. Where necessary, 12 x 12-in. timber mats bridge the trenches.

A big shopping center next to the open trench complicated matters even further, what with women drivers backing out of their parking slots in the direction of the excavation. None



AN UNUSUAL sort of sidewalk superintendent is "Boots," who stops to chat with Louis Loper, general foreman of the box culvert section. The sign saying "Pets & Pals" in the background is strictly a coincidence.

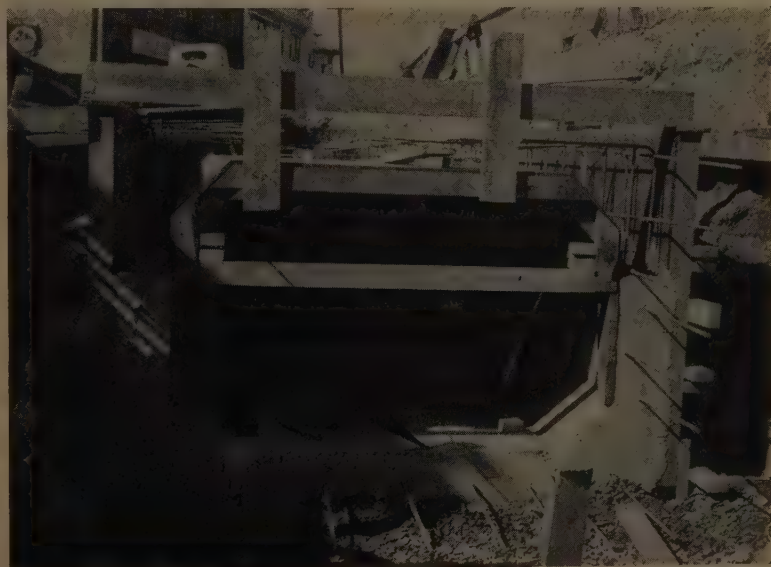
has succeeded in driving into the trench so far, but some of them are pretty resourceful so the workmen are keeping their eyes peeled until work in this area is completed.

Other troubles have been encountered in the form of frequent contact with underground lines of various utilities, which abound in this section of Oakland. Good maps of the lines were furnished, however, and representatives of the utilities concerned have been very cooperative in coming to the job and helping locate the lines when asked to do so.

Trees and bushes formed a pleasant parkway strip in the area where the trench now yawns. Bill Cole tried to find a gardener to take care of the shrubbery while the work was going on but was told it would be cheaper to throw the stuff away and buy new

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PREPARING INSIDE form for the top pour on a section of box culvert is Charlie Clovis, a carpenter on the Stolte, Inc. job. The culvert is filleted on the corners for extra strength.





Reducing first cost and maintenance with . . .

Precast concrete for schools

***Population increase places financial burden on school district—
Solution of cost problem provided with tilt-up walls and pre-
stressed beam for center roof support—Design meets California
requirements for schools***

WHEN A SCHOOL district has an enrollment increase from 2,672 to 7,567 in about four years it presents problems in design which are in proportion to the demands of the school board to keep building costs to a minimum, with proper regard for adequate safety and required facilities. These problems are common to many rapidly growing communities in California and other states in the West. The increase mentioned has occurred in the Torrance Unified School District, Torrance, California, and the solution of using precast concrete walls and prestressed roof beams to reduce first cost and maintenance is described in this article.

School construction program

The school board has been very successful in holding the construction costs of its new facilities to a minimum throughout its entire building program. The first units constructed were of conventional types of construction. In January, 1951, the school board commissioned our firm to prepare plans for two new elementary schools. Following our recommendation, the school board decided to use precast concrete construction for two schools, Madrona elementary, and Riviera elementary. The decision to use precast construction was based on the board's desire to utilize new types of construction which might provide them with more economical construction costs than they had received in the past. Also the board felt that concrete walls would reduce maintenance costs as compared to the many stud and stucco buildings they were occupying.

Plans were prepared and bids taken on the first two schools in August

By J. L. PETERSON

G. F. Schreiber and J. L. Peterson
Architect and Engineer
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1951. Geo. W. Carter Co. of Los Angeles was low bidder and was awarded the contract. Construction began September 1951 and classes were first held at the Madrona School in April 1952.

Satisfied with both the construction costs and the finished products obtained in these two schools, the board commissioned the same firm to prepare plans for two additional precast concrete elementary schools, Evelyn Carr elementary and Howard Wood elementary, plus a classroom addition to Madrona School. Basic design and layout was repeated on these projects. Bids were taken on these new projects in February 1953. Winter Construction Co. of Los Angeles was low bidder on Evelyn Carr and Howard Wood schools, and Hudson Construction Co. of Los Angeles was low bidder on the Madrona addition. Both firms were awarded contracts and construction is now under way.

Unit costs of these five contracts are shown in the accompanying tabulation. Enclosed square feet in each project is computed to the exterior wall lines. Number of classroom equivalents is computed by dividing the enclosed square feet in the project by 960 which is the area of the standard classroom, computed to the inside wall lines. Square foot cost is computed by adding to the enclosed square foot area the sum of one-half of the area of covered passages.

Construction contracts include buildings complete with mechanical

and electrical equipment; curbs, gutters, sidewalks, flagpole, and off-street parking; asphalt paved play areas, and asphalt paved volley ball and basket ball courts. Cabinet work included in the construction contract is held to a minimum as the school board feels that it can build or buy cabinet work more economically itself. Much of the cabinet work installed in the classrooms is movable to provide flexibility. Included in the construction contracts are sink cabinets, clay carts and cabinets, and chalk and tack boards.

Design features

All of the walls in these buildings are constructed of precast concrete. Interior stud and plaster partitions of the administration buildings have the only plaster used on the entire project. Classroom buildings consist of a series of 28-ft. wide by 35-ft. long classrooms with precast concrete used for exterior walls and for interior cross walls. All classroom buildings are 29 ft., 4 in. wide by 165 ft., 4 in. long.

Precast concrete walls are designed as bearing walls supported by continuous footings. Exterior and interior walls are a full 8 in. thick and are designed to carry all roof live and dead loads as well as the horizontal wind and seismic loads. Seismic and wind loads are transmitted by the walls to the roof diaphragm consisting of 1 x 6-in. diagonal wood sheathing. The diaphragm transmits its load to the precast concrete shear walls which are individually stable under the shear load applied to each wall. Shears from the walls are transmitted to the floor slab by dowels for the exterior walls and by 2 x 2 x 4-in. shear slots spaced at 18 in. for the cross

walls. Concrete used for all precast work is designed for an ultimate strength of 2,500 psi.

By using bearing walls it was possible to obtain flush interior and exterior surfaces in all classrooms. Since the bearing walls take all vertical and horizontal loads no columns were required. The precast concrete walls were butted together and a 1-in. joint between adjacent walls was grouted from the top and dry packed from the side. Details of the joints between walls are shown.

Construction sequence

The first step in the construction sequence, after site grading and fine grading, was to excavate for the footings. All footings were dug with a trenching machine, thus eliminating practically all hand excavation. Concrete was then poured against the earth bank, eliminating wood form work for the sides of the footings. The 4-in. deep groove for the slot in the middle of the footing was made with a simple wood form suspended from above.

The second step was to pour the 5-in. concrete floor slabs on earth to within 2 ft., 10 in. of the outside wall line. Reinforcing bars were extended out from this cold joint which lap dowels extending out from the precast concrete walls. Floor slabs were cured with one layer of Hunt process.

The third step was to put down all the exterior forms for the precast concrete walls. The top form for all walls was designed to be left in place and used as the top plate of the erected wall on which the roof rafters are placed. Door frames were then installed inside the wall form. All door head and jamb sections were made from 8-in. steel channel sections. Architectural projected steel sash was then placed inside the wall forms. A second layer of curing compound was applied to the concrete floor slab surfaces which would receive concrete. Following this all of the reinforcing steel, steel weld plates and anchors, electrical conduits, plumbing vent pipes, plumbing openings, fire hose



VACUUM LIFTING of interior wall slab with truck crane from casting bed. Walls were erected at the rate of 16 sections per day.

cabinets, and any other miscellaneous items were placed inside the wall forms. Concrete was poured in the forms from transit mix trucks. Tops of the walls are water cured to facilitate application of paint.

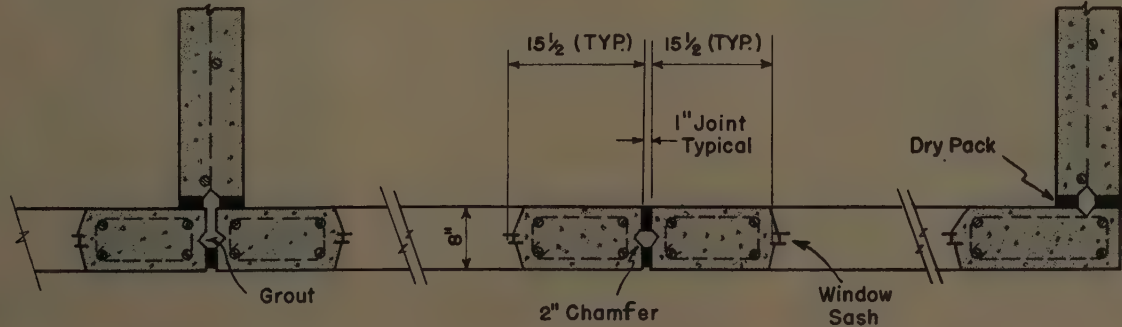
Additional casting area

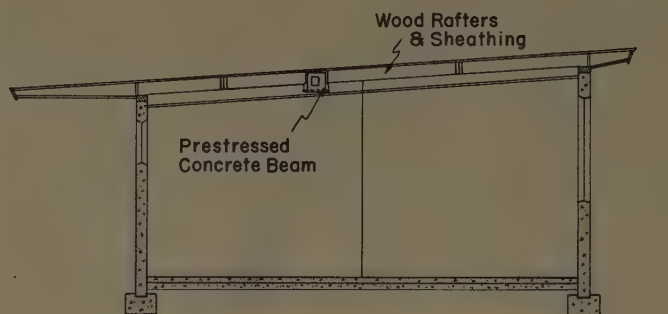
Because of the large number of precast walls required in the classroom buildings the floor area of the buildings is not large enough to provide

casting area for pouring the walls. Therefore 2½-in. thick concrete casting slabs are poured on grade to be used as pouring platforms. These slabs are located and designed to fit into the site plan and become a permanent part of the school plant. The school board uses these casting slabs for various school activities.

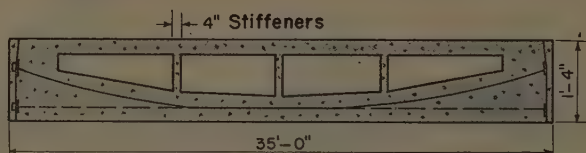
The drawings prepared by the architect-engineer show a recommended wall casting layout and erec-

DETAILS of joints between precast wall slabs showing the use of 8-in. walls eliminating columns, and providing smooth walls inside and out. Dry packing of the joints was done after the roof was placed to allow maximum time for wall to take shrinkage.

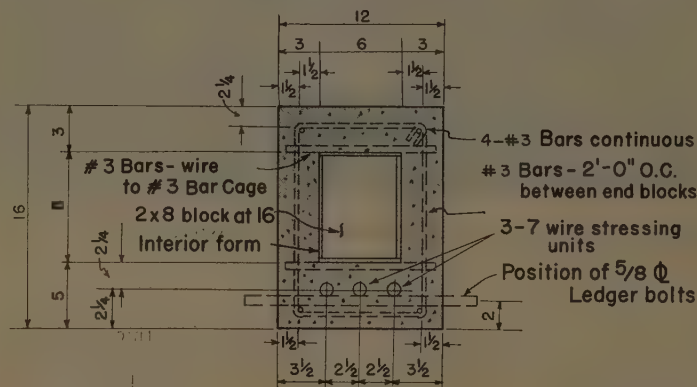




CROSS SECTION OF CLASSROOM



ELEVATION OF BEAM



PRESTRESSED BEAM DETAILS

© E

LOCATION, general shape and design details of prestressed roof beam used to support the inside ends of the rafters along the full length of the building near the center line of the classrooms. These beams were cast and post-tensioned in separate yard and trucked to the site.

tion sequence. It is necessary to prepare these drawings to calculate the size of the casting slabs required. Interior cross walls are stacked 2 or 3 high to keep the area of the casting slabs to a minimum. Two or three cycles of pouring and erecting walls are required to erect all of the walls. Exterior walls are poured with the exterior side of the wall up and the surface is given a rough broomed finish to provide a textured surface. This rough surface makes it impossible to stack another wall on top. Cross walls are given a steel trowel finish to permit stacking.

To provide accurate and efficient construction of the large number of wall units the architect-engineer pre-

pared detailed shop drawings of all precast units. Each wall unit was given an individual number and a drawing was prepared showing all dimensions of the wall as well as all reinforcing steel, inserts, weld plates, and other items which were placed in the wall before pouring.

Method of lifting

Specifications permitted either vacuum lifting or point pick-up for the walls. The Geo. W. Carter Co. elected to use vacuum lifting, and C. D. Wailes Corp. erected all the walls of the Riviera and Madrona schools, using a vacuum lifting mat specially designed for the job. Part of the walls were erected with a 45-ton modified

Lorain truck crane supplied by Hesse Crane Co. All of the walls were erected from the outside of the buildings. Because of the heavy rains which occurred during the erection of the Madrona and Riviera schools the ground became too soft to permit the operation of the heavy rubber tired truck crane, consequently a North-west 95 crawler crane was used for the remainder of the job. Both cranes erected walls at the average rate of 16 per day. Wet grounds slowed up the rate of erection. Weight of the walls ranges from 8 tons to 19 tons. Maximum height of walls is 14 ft., 11 in. and maximum width 29 ft., 4 in.

Panel joinery

No difficulty was encountered in sealing the vacuum lifting mat's rubber gasket against the rough broomed finish of the exterior walls. After the walls were lowered to their proper place on the footings they were braced by pipe column braces which were fastened to the top wood plate of the wall by a lag screw which was installed prior to erection. Braces were anchored to the floor by means of cinch anchors drilled in the concrete floor. Braces have turnbuckles for fine plumbing of the walls after the crane is unhooked.

Grouting of the diamond key between walls (see drawing) is done before the roof framing is erected. Dry packing the joint is done after the roof is completed and just before painting in order to give the walls the maximum time for curing so that the majority of the shrinkage of the wall will have occurred. Immediately after erection the 2-ft., 2-in. strip of concrete is poured between the walls and the floors. This connects the walls to the floor slab which acts as a stiff diaphragm. As soon as possible the downward face of the wall is lightly wet sandblasted to remove the compound, providing a good surface for painting.

Two types of beam

Roof framing is simply and economically accomplished by cantilevering the roof rafters over the longitudinal exterior walls, bearing them on top of the wood plate which was used as a form, thus forming a covered passageway on one side and an overhanging eave on the other. The opposite ends of the rafters are supported on a longitudinal beam running the full length of the building near the middle of the classrooms. The ends of these beams rest upon the cross partitions which act as bearing walls supporting the concentric load. The Madrona and Riviera schools used glued laminated wood beams and the Evelyn Carr and Howard Wood schools were designed with prestressed concrete beams.

The prestressed concrete beams consist of a hollow box section, 12 in. wide and 16 in. deep. See drawing for

Concluded on page 94

RUN-OFF FORECASTS

1953 water supply in the West

Surveys of Western snowpack show meager supply in Southwest, virtual drought in New Mexico—No margin in Northwest—Reservoir storage generally normal at start of spring run-off, but must be cherished by careful operation throughout 1953

PUBLIC AND PRIVATE power utilities, contractors, and all others interested in Western water supply, run-off and stream flow are now receiving the most accurate and comprehensive information to be had on prospective water supplies through a recently coordinated forecasting program by the several agencies involved.

Under this new cooperative arrangement, which became effective January 1, 1953, the U. S. Weather Bureau, U. S. Soil Conservation Service, and California Department of Public Works continue to issue their respective water supply forecast and snow-survey water forecast publications after prior collaboration among the respective agencies.¹ The Weather Bureau's "Water Supply Forecasts for the Western United States" published monthly from January through May, now contains all of the forecasts made by all three agencies.

Coordinated early season evaluations of potential flood hazard on snow-melt rivers, which are presented in the respective publications in years of heavy snow cover, draw upon snow-survey and precipitation data. Weather Bureau river district offices

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Irrigation Engineer

AND

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U. S. Department of Agriculture

will continue to prepare and issue short range forecasts of river stages. The Soil Conservation Service will continue to make available to Soil Conservation District farmers, irrigation districts and others, operational advice based on these outlooks and forecasts.

The water supply outlook for Western states as viewed by these agencies is much less promising than last season. Threatening water shortages are foreseen for numerous areas, particularly in New Mexico, southern Utah, southern and central Nevada,

¹The Soil Conservation Service is the Federal coordinating agency of snow surveys conducted by its staff and many co-operators, including the Bureau of Reclamation, Forest Service, National Park Service, Geological Survey, various departments of the several Western states, irrigation districts, power companies, and others.

The California State Division of Water Resources conducts and coordinates snow surveys in that state, while the British Columbia Department of Lands and Forests, Water Rights Branch, has charge of the snow surveys in that province.

The U. S. Weather Bureau makes West-wide water supply forecasts at more than 320 gauging stations, such forecasts being estimated principally on the basis of measurement of precipitation. The Weather Bureau forecasts are for the water year (October-September inclusive), whereas snow survey forecasts are always for the irrigation season only.

THE AUTHORS do some of the work themselves. Clyde Houston (left) is pictured assembling one of the coring tubes driven into the snowpack to measure its depth. Weighing core sample permits computation of snow density. R. A. Work (right) holds tape at one of the permanent snow course markers. Measurements are made at 25- to 100-ft. taped intervals between markers.

and parts of Arizona and Colorado. The following state-by-state inventory gives a more detailed accounting of irrigation season run-off prospects, as reported to the Soil Conservation Service by the snow surveys.

ARIZONA

Only two major winter storms three months apart covered Arizona last winter. These two big storms brought about normal rainfall for the period October-March to southern Arizona but only 72% of the seasonal normal to northern Arizona. Snow cover has been below normal most of the winter. Above normal winter temperatures and heavy evaporation losses further reduced the northern Arizona snow pack. Because of snow pack losses, and total deficiency of snow cover it is forecast that flow of the Salt River will equal only 50% normal for April-May. Flow of the Verde River for the same period is not expected to exceed 35% of the 10-year normal, 1941-50, and flow of the Gila seems likely to equal only 15% normal for the same period. Inflow into the Salt-Verde system peaked about March 21; irrigation requirements then began to exceed streamflow.

Fortunately, fairly substantial water reserves have been accumulated on the Salt-Verde system, not quite as good as last year but at least better than the past ten year average. Roosevelt reservoir now stores 1,049,000 acre-feet compared with 682,000 acre-feet last year and 652,000 acre-feet average for the 10-year period 1941-50. However, important San Carlos reservoir on the Gila River now stores



water only to 1% of capacity, with dismal prospects for further inflow. Last year San Carlos stored 160,000 acre-feet on April 1, 12% of capacity. Storage on April 1, 1953 was only 14,500 acre-feet.

In recent years increasingly efficient water management is being practiced by farmers and irrigation companies in Arizona. It seems evident that the sharpest sort of water management will be called for in Arizona in 1953.

Flow of the Colorado River into Lake Mead for April-September will be about 60% of normal or near the minimum flow experienced since the reservoir was completed.

BRITISH COLUMBIA

Precipitation last fall was far below normal throughout the Province. Consequently, the soil mantle in almost all areas will require considerable priming from the snow pack. This factor has been taken into consideration in the run-off predictions.

Run-off in the Main Columbia and West Kootenay river basins is expected to very nearly equal the average for 1941-50. The run-off in the East Kootenay basin is not likely to exceed 90% normal, but in the Okanagan and Similkameen drainage the

run-off April-August will be even more below normal. For instance, the run-off into Okanagan Lake is forecast at only 55% of the average for 10-year period 1941-50. Irrigators and other water users are warned that water supplies in this area may be deficient and they are advised to store as much as possible.

The snow pack in the Skagit Basin in B. C. is also well below the average of the past six years and run-off is not expected to exceed 75% of the past six-year average.

CALIFORNIA

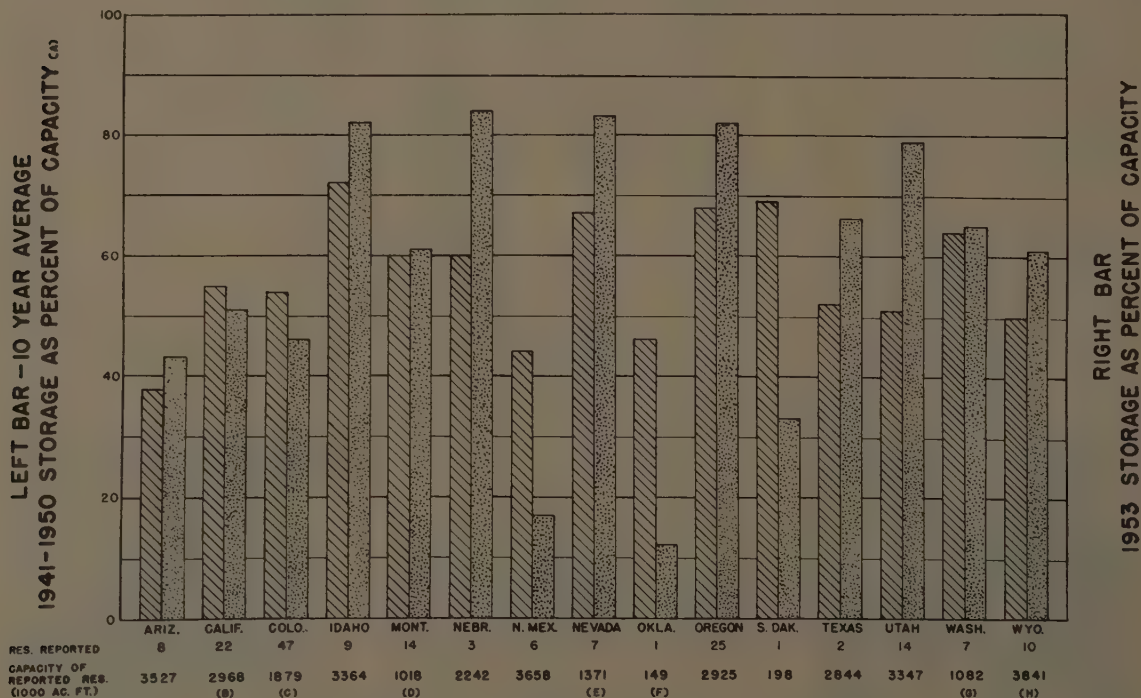
Water conditions in California are generally unsatisfactory except in the Klamath and Upper Sacramento basins. Deficient precipitation during February and March resulted in far less than normal increments of addition to the snow pack, the water impounded in reservoirs, and the water levels of the groundwater basins. The outlook for California based on the availability of surface water to meet irrigation demands during 1953, although generally unsatisfactory, does not appear to be critical except in portions of Southern California and the southern San Joaquin Valley. Power output in the state will not be adversely affected by the deficiencies

in surface water supply due to the high degree of integration among major hydro and steam electric plants.

The snow pack throughout the Cascade Mountains and the Sierra Nevada is considerably less than that of one year ago. Water content varies from 120% of normal in the Upper Sacramento River watershed to about 60% of normal in the southern Sierra Nevada. Normal precipitation conditions for the remainder of the season will produce normal or above normal snow melt run-off in the north coastal area and the Sacramento River watershed above Shasta Dam. Snow melt run-off for San Joaquin Valley streams will vary from 45% to 75% of normal. Under the assumption of no additional precipitation during the remainder of the season, the indicated snow melt run-off during the April-July period would be near normal in the north coastal area and from 25% to 70% of normal in the Central Valley area.

COLORADO

The flow of all streams originating in mountain areas in Colorado will be below normal for the 1953 season. Critical shortages of water are expected on the Arkansas, Rio Grande and the southern tributaries of the



RESERVOIR STORAGE AS OF APRIL 1, 1953

Explanation: (a) Most state averages for reported reservoirs are for full 10-year period, but in a few cases reservoirs having shorter records are included. (b) Does not include Millerton or Shasta reservoirs (combined capacity 5,020,500 acre-feet); April 1 combined storage 4,061,100 acre-feet. (c) Does not include John Martin reservoir (capacity 655,000 acre-feet); April 1 storage 20,000 acre-feet. (d) Does not include Fort Peck reservoir (capacity 19,000,000 acre-feet); April 1 storage 12,750,000 acre-feet. Does not include Flathead Lake (capacity 1,791,000 acre-feet); April 1 storage 641,000 acre-feet. Does not include Hungry Horse reservoir (capacity 3,500,000 acre-feet); April 1 storage 719,700 acre-feet. (e) Does not include Lake Mead (capacity 27,217,000 acre-feet); April 1 storage 17,764,000 acre-feet. (f) New reservoir in 1945. (g) Does not include Roosevelt Lake (capacity 5,220,000 acre-feet); April 1 storage 2,183,000 acre-feet. (h) Does not include Boysen reservoir (capacity 820,000 acre-feet); April 1 storage 557,000 acre-feet.

South Platte. Actual flow will range from about 80% of normal on the Upper Colorado River to 40% of normal on the Rio Grande and San Juan.

In irrigated areas on the South Platte and tributaries a shortage of water is expected except on the Cache la Poudre, Big Thompson and lower South Platte. On these streams supplemental water will be available from the Colorado-Big Thompson project. Even normal water supply is usually inadequate for the highly developed South Platte irrigated area. Storage in smaller irrigation reservoirs is about the same as a year ago but below the average of past years. On the Arkansas River the outlook is very poor. Streamflow there will be below normal; there is practically no reservoir storage and precipitation has been deficient at valley elevations for several months. The soil is dry.

The water supply outlook for the Rio Grande and tributaries in Colorado is poor but better than for the very dry years of 1950 and 1951. Reservoir storage carried over from the high flows last year is above normal. Valley soil moisture is fair and groundwater for sub-irrigation is at high levels. Streamflow will range from 40% to 60% of normal.

West of the Continental Divide there will be some shortage of water on smaller streams and on the Dolores and San Juan tributaries. Colorado-Big Thompson reservoirs may be used to partially regulate flow on the Upper Colorado. Soil moisture conditions in irrigated areas in western Colorado are fair to good.

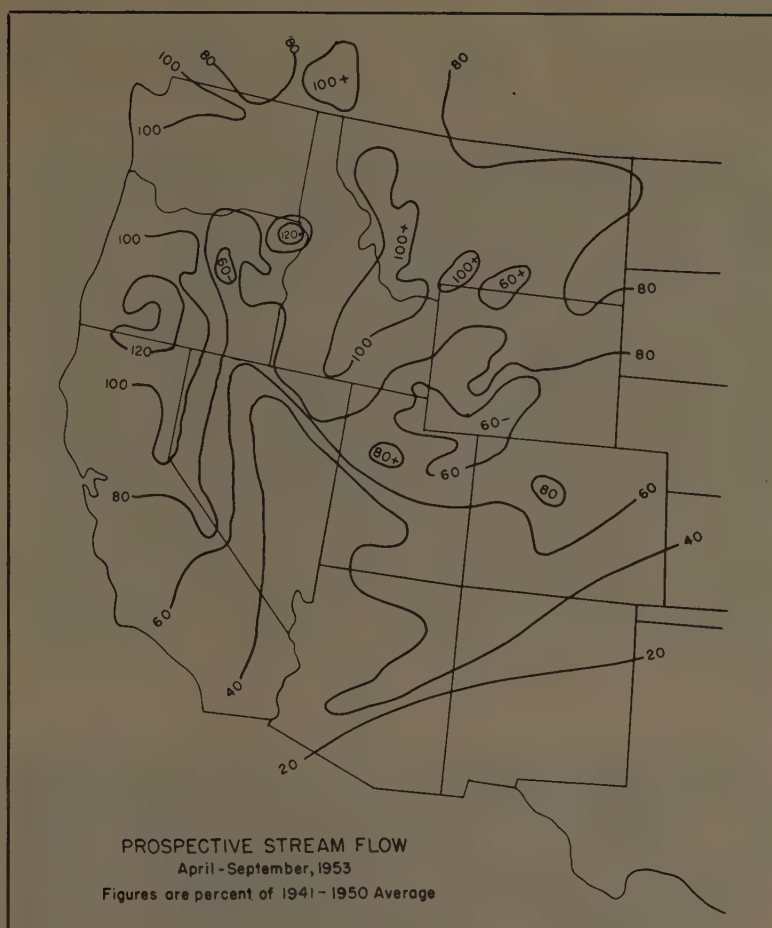
IDAHO

The snow pack over most of Idaho is normal or nearly so. The snow line, in general, is high and low altitude snow courses are generally slightly proportionately lower in snow cover than the courses higher in the mountains. Recent rain over the lower part of the river basins has partially erased the dry soil conditions found last fall before the snow began to accumulate. April-September streamflow is expected generally to be 95% normal. Reservoir storage for the state is 14% above average for this time of the year. Reservoir operators started to store water early in the winter, foreseeing this as the first year for more than five years when the water supply would be unlikely to exceed normal.

MONTANA

Snow cover on the Upper Columbia Basin is good. At present, the Flathead Basin has about an average snow cover, while the Clarks Fork Basin is slightly above average. A good water supply for irrigation and other uses should result throughout the basin.

Snow cover east of the Continental Divide on the Upper Missouri River Basin averages about 85% normal. The soil is not frozen under the snow,



and the soil is generally dry to damp. Only in a few places was wet soil encountered on the watersheds.

Snow density is generally high for April 1st. The snow is loose and granular. These two factors indicate that an early run-off is possible with the dry soil absorbing considerable water for soil priming.

Farming operations in areas below reservoirs should have a good water supply for most of the season, while those areas using water from unregulated streams are likely to find themselves short of water for irrigation purposes during late July and August.

NEVADA

Snow-stored water ranges from good in the central Sierra to fair in northeastern Nevada and poor in the central and southern part of the state.

U. S. Geological Survey reports October through March streamflow along the Humboldt and eastern Sierra above normal. Groundwater levels are also reported as slightly below normal.

Reservoir storage on April 1 averaged 83% of capacity and 120% of the past ten-year average.

1953 snow water run-off will be normal or below for all streams in the

state. The southern half of Nevada can expect very little if any snow water run-off. Along the Humboldt tributaries, streams can expect 50 to 75% of normal while the main stem will flow only about 30% normal. Run-off into Nevada from the east central Sierra will range from 70% normal in the south to normal in the north.

NEW MEXICO

The water supply outlook for the Rio Grande and its tributaries in New Mexico is for gravely deficient flow in 1953. The overall statewide water supply is likely to be the least in the past 25 years.

Soils in irrigated areas along the Rio Grande are very dry. El Vado Reservoir is empty in compliance with the Rio Grande Compact and probably will not be able to store water this year. The irrigation supply for the Middle Rio Grande irrigated area will be extremely limited.

Elephant Butte and Caballo reservoirs now contain 420,000 acre-feet. This is four times that stored a year ago at this date. However, the total of storage plus expected inflow into the reservoirs will not exceed 60% to 70% of the normal demand.

OREGON

Oregon's 1953 water supply outlook, dependent on mountain snow cover, is "fair" to "good" with serious deficiencies to be expected only in the smaller streams heading in low elevation watersheds. Water content of mountain snow cover averages 109% of normal state-wide on 124 measured snow courses, although only 70% of last year at this date. Reservoired water in 25 reporting reservoirs is 120% of average and will "save the day" for water users in many areas otherwise facing irrigation deficiencies. Effects of last year's long summer and fall drought have been largely eased by heavy winter precipitation and resultant mountain snow cover. Crop-land soils have an excellent moisture content.

SOUTH DAKOTA

Reservoir storage in the Black Hills area of South Dakota is down substantially from last year and about one-half of average. Snow cover is

slightly above normal. Soil moisture conditions in irrigated areas are reported as fair to good.

UTAH

With the exception of a peculiarly narrow belt of normal run-off prospects running across the state from the Salina Creek-Fish Lake area to the La Sal mountain area near Moab, another small area in the Farmington-Bountiful vicinity and a strip draining into Wyoming from the high Uintahs, all other parts of the state can expect below average run-off during this irrigation season.

In southwest Utah run-off of the main and east forks of Sevier River above Piute reservoir, the Escalante, Virgin and Beaver rivers and Coal Creek near Cedar City, will be of severe drought proportions comparable to that of 1951, with run-off expectancy varying from 20% to 45% of the 1941-50 average. Run-off prospects for the Beaver River are the poorest since 1934.

Prospective run-off for Strawberry

and Whiterocks rivers and Ashley Creek in the Uintah Basin, ranges from 50-60% average.

Run-off for all other streams of the state will range from 60% to 80% of the 10-year average. Very fortunately, holdover storage in 14 principal reservoirs now rests at 79% of capacity equalling 156% of the 10-year average. This means that water users in central and northern Utah, having storage rights, will have sufficient water during the irrigation season whereas water users depending solely upon natural flow rights can expect definite shortage of water.

WASHINGTON

Snow surveys on the headwaters of the Columbia River in Canada and other major contributing rivers in the U. S. indicate a lower than normal water supply for this season. The flow of the main stem of the Columbia is forecast for the lowest flow in eight years if a normal spring melt season ensues. Water stored in smaller reservoirs (Roosevelt Lake excluded) is normal for this time of the year. New reservoirs, notably Hungry Horse, on the upper reaches of the main rivers will fortunately increase the water supply available for power or irrigation during the normal low flow period.

WYOMING

Summer streamflow in most but not all of Wyoming is expected to be well below normal for the 1953 season. On the Green River the 1953 flow is forecast at 52% of normal, the least since 1940. Since irrigation along the Green River is limited to mountain meadows, local water supply should be adequate.

Although inflow to Seminoe Reservoir on the North Platte will be much less than normal in 1953, adequate irrigation water supplies in eastern Wyoming and western Nebraska are assured for this season. As a result of above normal flow the past few years there is now stored in the four major reservoirs along the North Platte in Wyoming 1,600,000 acre-feet. This is practically the same as a year ago but well above the average.

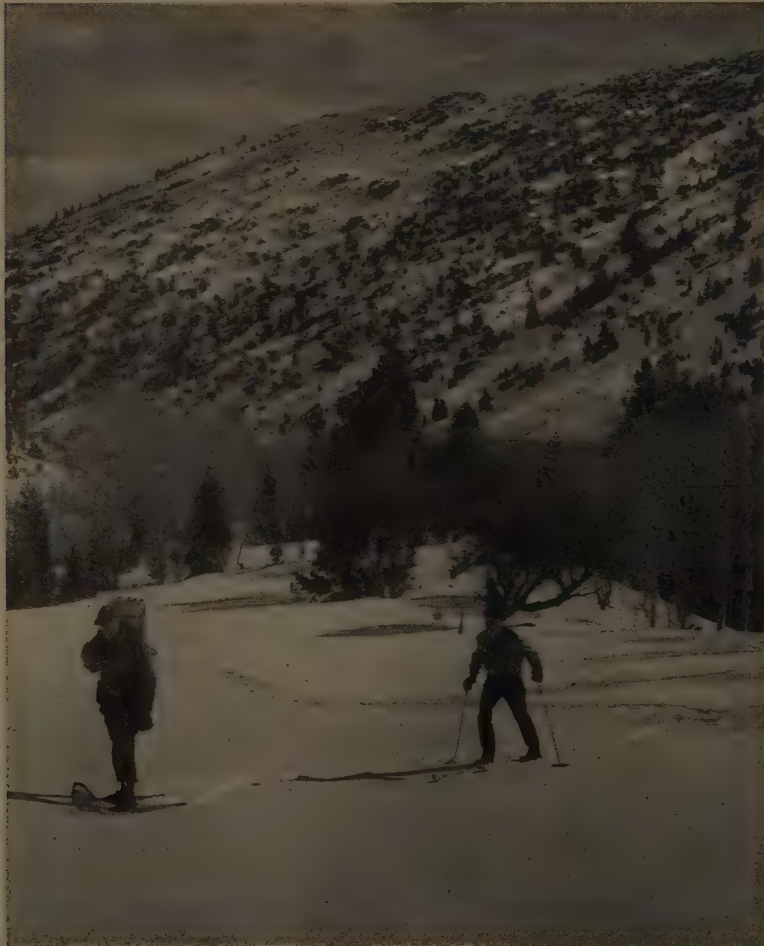
On the Laramie River and other smaller North Platte tributaries irrigation water shortages may be expected because carryover storage is not available.

The 1953 snow pack over the Wind-Big Horn River basins averages 75% to 80% of average.

Those areas operating under reservoir-regulated streams should have a fair water supply for this coming season, but farm areas depending for water upon unreservoired streams can expect late season shortages.

Water users in western Wyoming along the Snake and its tributaries are assured of an average water supply although reservoir storage is 6% below normal.

40,000 man-miles is the annual total traveled by teams contributing to the cooperative snow survey network that covers 12 Western states. Snow courses are measured by state and federal agencies, also by both private and public water and power producers.



Lining the Gaviota Gorge Tunnel

Curvature and superelevation posed problems in lining form design — Special rubber-mounted rig resulted, worked uphill in 16-ft. jumps — Details of concreting presented

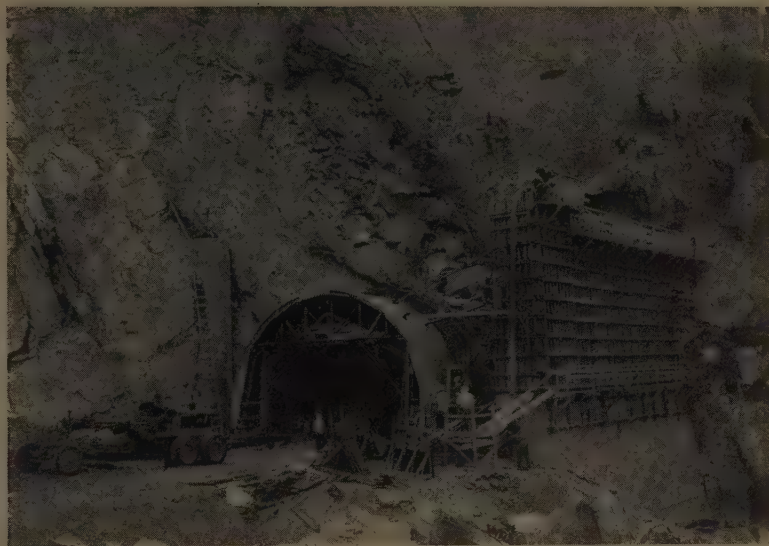
CONSTRUCTION of the Gaviota Gorge tunnel moved a step closer to completion recently when the last section of reinforced concrete lining was placed. The tunnel project, when finished, will provide a limited access freeway on a 8.3-mi. portion of U. S. Highway 101 in Santa Barbara County, California. Work on this section began in May 1950 and is scheduled for completion in the fall of 1953 at an estimated cost of \$3,300,000.

The tunnel is 435 ft. long between portals. It was driven through the Gaviota sandstone formation by first driving a top heading and placing arch supports through the entire length of the bore, then removing the bench section and placing plumb posts to support the arch ribs. The tunneling operation was reviewed in *Western Construction* for March 1952, pp. 79-81. Tunnel excavation was begun in November 1951 and completed on March 31, 1952.

Form design

The tunnel is on a 1,200-ft. radius curve with the roadway section super-elevated 10% to provide for a design speed of 60 mph. on the plus 4.47% grade. The tunnel lining is 18 in. thick in the cut-and-cover section of the tunnel, 24 in. thick in its steel supported section and 36 in. thick in its timber supported section.

To achieve continuity in the surface of the tunnel lining, specifications limited the lining form to a length of 16 ft. With overall form dimensions specified by the plans, dimensions of the structural members of the form were designed from a stress analysis. This analysis considered not only the total load of wet concrete imposed on the form during the placing of the lining, but also the rate of pour and the temperature of the concrete at the time of placing.



WIND-UP of the work finds form in position for pouring extended portal structure to protect traffic from rock falls. Note concrete pipeline into retaining wall forms at right. Backfill behind this wall will provide cushion over tunnel barrel.

By JOHN E. WITTE

Resident Engineer
California Division
of Highways

AS THE TECHNIQUE of pumping concrete into place behind tunnel lining forms becomes an almost universal construction practice, so has the Pumpcrete machine become an almost standard fixture on many jobs. The operation of such a machine is old stuff to long-time tunnel men.

But to others not so familiar with tunnel concrete work, this article on the Gaviota Gorge highway tunnel should be especially helpful. Nearly 3,000 cu. yd. of concrete went into this job, and all of it was pumped into position, including portals and protective structures outside the tunnel proper. The Double 180 Rex Pumpcrete is described, both as to its mechanics and as to its job function for Rhoades-Shofner. The author has contributed a valuable chapter to construction literature for young men of the industry.—Editor.

The steel lining form was designed by William H. Schutte for the contractor, Rhoades-Shofner Construction Co. of Los Angeles. The form consists of a crown section and two side panel sections mounted on a gantry frame and supported by gantry trucks with 12-in. rubber-treaded wheels. The $\frac{3}{8}$ -in. skin plate is welded to steel ribs. These ribs constitute the upper members of structural steel trusses which are hinged to the gantry frame. The crown section is moved vertically by means of four 20-ton hydraulic jacks mounted on telescoping gantry legs. The side panels are moved laterally by means of jack screws. The crown and side panels are adjusted to line by use of steamboat-type ratchet jacks. The form is moved up the tunnel grade by means of a pulley system using either an Ingersoll-Rand air tugger or a Caterpillar D8 tractor as the prime mover.

Concrete reinforcing

Prior to moving the lining form into the tunnel, reinforced concrete curb, gutter and tunnel-arch footing sections were placed to line and grade along each side of the tunnel to carry the form. The lining reinforcing steel, which was placed from scaffolds, consisted of two layers of $\frac{5}{8}$ -in. bars at 24-in. centers along the arch line and two layers of $\frac{3}{4}$ -in. bars at 24-in. centers placed longitudinally. The bottom layer of steel was 3 in. from the lining surface and the upper layer was 16 in. above the concrete surface.

After the form had been moved in-



JOB FEATURE was Pumpcrete, which pushed 3,000 yd. of concrete into tunnel lining and auxiliary structures. Permanent set-up was about 250 ft. south of south portal, included two 250-bbl. cement silos, aggregate bins, 100-ton batcher, and a 1-yd. mixer.

to position and adjusted to line and grade, it was secured in position by placing $\frac{3}{4}$ -in. bolts through the bottom flange of the side panels into pre-cast tie holes in the arch footing. The gantry trucks were secured by placing wedges between the wheels and the truck frame and by securing a cable tie from the gantry frame to steel dowels in the arch footings. Blocking was placed between the bottom flange of the side panels and the haunch line of the footings to transmit the loading imposed on the form by the wet concrete to the footings. The form was placed to line and grade with a tolerance of $\frac{1}{8}$ in. Electrical conduit, pull boxes, magnetic contactor and transformer vaults, grout pipes and tunnel weepers were bolted in their prescribed positions to the outer surface of the form—either to be completely encased or to have their access covers flush with the surface of the lining.

Working areas

A timber platform was placed on the lower members of the crown section truss to provide a working area during the placing of concrete in the side panels and for operating form vibrators. Tubular steel scaffolds with timber decking were placed adjacent to the ends of the form to serve as working areas during the placing of timber bulkheads and for handling the arch pipe and air tuggers during the placing of the concrete above the form.

The design of the concrete used in the tunnel lining was based on three factors: workability, pumpability and strength. The concrete had to be workable in order that the tunnel supports and reinforcing steel would be completely encased with the concrete and to insure a minimum of

voids between the lining and the rock surface of the tunnel bore. A high degree of pumpability was essential in order to obtain the maximum efficiency from the concrete pump and minimize the chance of a plugged line. The concrete was found to have maximum pumpability and workability when the slump was between 4 and 5 in. A water cement ratio of 0.53 was used to secure the desired slump. Tests on the concrete at 28 days indicated an average compressive strength of 3,900 psi.

Pumpcrete operation

Lining concrete was discharged directly from the mixer into the remix hopper of a Double 180 Rex Pumpcrete. The purpose of the remixer was to blend the incoming batch with the previous batch in order to provide uniformity and to prevent segregation in the concrete before it was delivered to the pump.

On this tunnel job, as on others, the Pumpcrete played an important role in the successful conduct of lining operations. For this reason, it is believed that a description of the mechanics of the Pumpcrete will be of interest. Pumpcrete system has been defined as a method of transporting concrete through pipelines by means of direct-acting pumps. The mixed concrete is discharged from the mixer into a remix hopper and then successive charges are drawn from the remix hopper into a cylinder and expelled by a piston into the pipeline. Each charge forced into the line pushes all the concrete in the line forward and, as the concrete is relatively incompressible, a nearly equivalent amount is ejected from the end of the line. The pipeline is entirely filled at all times except when starting.

The Pumpcrete is a heavy duty,

single-acting horizontal pump much like a piston-type water pump. The outlet connection is directly in line with the horizontal cylinder, and the remix hopper of the pugmill type is mounted above the cylinder head chamber.

Both inlet and outlet valves are mechanically opened and closed in timed relation to the movements of the piston. They are mechanically actuated from double-acting cams on the crank shaft through oscillating arms or "banjos," thence by valve rods to the valves. Springs in the valve rods provide the necessary relief to prevent damage to the operating mechanism.

The cycle of operation is as follows: On the suction stroke of the piston the inlet valve opens (outlet valve closed) and the charge of concrete is drawn from the overhead hopper through the valve into the cylinder. On the pressure stroke the outlet valve is open (inlet valve closed) and the charge of concrete in the cylinder is pushed from the cylinder into the connecting pipeline.

Synchronous impulses

The metal piston never comes into direct contact with the concrete nor with the metal cylinder walls. A replaceable rubber piston end pushes the concrete. The piston skirt and cylinder wall back of the rubber piston-end are continuously rinsed with washwater. The rubber piston-end keeps the washwater out of the concrete.

After the concrete leaves the pump it moves through the pipe in synchronous impulses but at all times the pipe is completely filled and there is no tendency to segregate or disarrange the structure of the concrete mixture. There is a tendency, due to the troweling action of the inside of the pipe, to bring a slight surplus of grout to the outside of the concrete stream. This is helpful to pumping as the grout is the only part of the concrete that can act as a lubricant. Due to the remixing action of the pump itself and freedom from segregation in the pipeline, the concrete reaches the end of the line as a more uniform mixture than it was at the hopper of the pump.

Siamese section

Combining the two streams of concrete from the double cylinder Pumpcrete involves the use of a Siamese pipe section with an enlargement at the junction of the two incoming pipes so that the area at the point where the streams are completely merged is $1\frac{1}{2}$ to 2 times the area of either of the incoming pipes. To reduce this to normal pipe size requires the use of a tapered section.

The pipe line from the pump was placed on cribbing along the invert of the tunnel to a point just beyond the forward end of the form. There it was elevated, by means of a 180-deg. segmented pipe section, to the elevation

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1029L

of the crown section of the form. From the elbow the arch pipe was suspended horizontally by chains secured to the tunnel supports.

The first phase of the arch lining operation was to place concrete behind the side panels. From crown section height, the Pumpcrete pipe discharged into metal-lined telescopic chutes which in turn discharged the concrete through hinged access doors in the side panels. The concrete was vibrated by immersion type vibrators supplemented by form vibrators. After the concrete had reached the elevation of the bottom of the access doors the chutes were withdrawn and the access doors closed and secured with metal wedges.

Slick line

The pipeline was then elevated to the top of the form and connected to the arch pipe. In the timber supported section of the tunnel the arch pipe was connected to a section of light gauge pipe called a "slick." The slick line was placed through an opening in the timber bulkhead and along the top of the form to a point 3 ft. from the opposite end of the form.

In the steel supported section of the tunnel where head room was restricted, the use of a Siamese slick line was necessary. The Siamese slick line was in the form of an elongated "Y" with the regular 7-in. line branching into two parallel flattened sections of 6-in. light gauge pipe at a point outside of the bulkhead. The Siamese slick line was equipped with an air slugger 2 ft. back of the junction, and an air slugger in either leg of the "Y". The air sluggers consisted of compressed air connections tapped into the line and used to control the direction of the discharge, and to push the concrete away from the discharge end of the pipe in order to fill the furthestmost recesses of the form first.

As the concrete progressed to the top of the form, the discharge end of the slick line became buried in the concrete, after which the slick was

withdrawn at a rate which provided for continued submergence of the outlet to insure complete packing of the arch. Both the single slick and the Siamese slick were withdrawn from the form by removing short segments of the regular arch line and pulling the slick back to the new connection.

Several sections of the lining were placed by pumping the concrete through the crown section of the form rather than through the bulkheads. To place the concrete by this method, it was necessary to cut a hole in the skin plate of the form, insert a short section of slick line through the sleeve of a special flat plate valve welded to the form, and then connect the slick to a vertical riser of the regular pipeline. The form was filled by straight pumping pressure supplemented by an air slugger placed at the bottom of the riser pipe.

Hopper becomes pump

When the pour had advanced to a point where concrete remaining in the hopper, and in the line, was sufficient to complete the pour, the remaining concrete in the hopper was pumped into the line, a shut-off pin type valve in the line near the pump was closed, and the Siamese connection and the tapered section were removed. The Pumpcrete hopper was then cleaned out and converted to a high pressure water pump by the addition of inlet water valves above the inlet concrete valves and outlet water valves beyond the outlet concrete valves.

The converted pump was then connected to the pipeline by a Siamese washout assembly and a section of pipe containing two go-devils, with a wad of excelsior and burlap ahead of and behind each go-devil. A go-devil is a dumbbell-shaped unit with rubber cups at each end. The cups fit closely in the pipe with the cups turned towards the pump, the seal being the same as in a simple plunger pump.

The hopper of the Pumpcrete was then filled with water, the pin valve opened and the pumping begun.

Water pressure propelled the go-devils, which in turn pushed the concrete in the pipe. As the go-devils advanced, the last concrete was forced out of the end of the line into the form. At the same time, the water back of the go-devils rinsed out the pipe.

As the go-devil approached the form, the slick line was completely withdrawn and the pour "keyed-off." The riser pipe was then lowered to the tunnel invert, where the go-devil and the water behind it were discharged.

Specifications provided for removal of the lining form as soon after placing the concrete as working conditions permitted. However, should there be any evidence of sagging, cracking or other damage to the concrete, the form was to remain in place until removal was authorized by the engineer. This provision permitted the contractor to schedule the placing of one section of the lining per day. The form was usually removed within 12 hr., but on one occasion it was removed after 8 hr. without any indication of failure in the concrete arch. Bulkheads were removed as soon as possible to provide for the removal of keyway forms, cleaning of the construction joint and installation of a 16-gauge galvanized sheet metal water stop.

7-day water cure

The form was removed by first retracting the form jack screws, bringing the bottom flange of the side panels clear of the arch footings. This clearance allowed the crown section to be lowered about 6 in. by releasing pressure in the four 20-ton hydraulic jacks supporting the crown section on the gantry frame. The form was then moved to the next location.

The new section of lining was water-cured for a period of 7 days by a system of garden type sprays tapped into a 1½-in. water line suspended from the pull boxes cast in the crown of the arch.

Concluded on page 121

TUNNEL LINING FORM seen inside (left) and out (right). Smooth travel was assured by having concrete arch footings, curbs, and gutters poured before lining was started. Light tubular scaffolding added working space at ends of form for handling bulkhead work and maneuvering concrete pipe and slickline.



Precast construction of a whole Marine base means —

A
WHALE
of
a
lot
of
LIFTING



Gross of nearly 90,000 tons of precast concrete units handled by vacuum—Special equipment built for economical production and erection—Central yard casts uniform roof panels, while variety of wall panels are cheaper to cast at the site

CONSTRUCTION men have long talked in terms of cubic yards of concrete, square feet of forms, and tonnage of steel. Now, with the ever wider use of precast concrete construction, they talk in numbers and tonnages of panels, square footage of roof and wall panels.

That's how it is at the Marine Corps Training Center now under construction at Twentynine Palms, California, by Twaits-Morrison-Knudsen-Macco, joint venturers. Designed by Neptune & Gregory, architects and engineers, with John K. Minasian as consulting structural engineer, this entirely new base has made extensive use of precast wall and roof construction. Additional buildings now being started also utilize precast rigid frames and precast columns, some of them 50 ft. or more in height.

Considering only roof and wall panels, some sizable quantities are involved. Wall panels are poured at the building site, using the floor slab as a casting bed. Limits in floor area require that about half the panels be stacked after a short cure, in order to make room for the rest of the panels. Thus, wall panels are handled about 1½ times, including erection.

Roof panels are mass produced at

a central casting yard. They are stockpiled there after curing and stripping. When needed for installation they are loaded on flat-bed semis, transported to the building site, and there set into place. Roof panels, therefore, are handled three times—all with vacuum.

The first contract involved 117 precast buildings. (Subsequently awarded work includes some 40 buildings, not all of concrete.) Using the figures for panel handling given above, here are the gross handling quantities for 117 buildings:

This, in any man's language, is a whale of a lot of lifting, and the efficiency with which it is being done—and the almost perfect safety record—is a source of pride to those associated with the project. The ratio of area to

tonnage is exceptionally high, illustrating economical usage of materials for the 20-ft. spans involved.

Wall panels are mostly 5 in. thick (6 in. for panel heights over 20 ft.). They are cast of lightweight Rocklite concrete. Steel reinforcement includes intermediate grade bars. Forming includes provisions for doors and windows, etc., with steel window frames installed after erection. The concrete is internally vibrated.

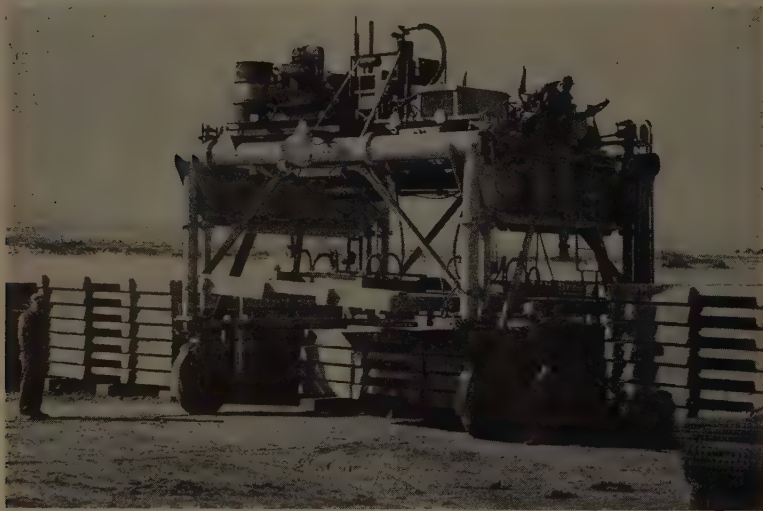
Roof panels are cast at a central location for two reasons. First, they are lighter elements. Also, they are the same for virtually all buildings, unlike the wall panels, which have various forming requirements for overall dimensions, and for door and window openings.

For the most part, the roof panels are 11 ft., 2 in. wide, and either 20 or 22 ft. long. They are of the waffle type, having 4 longitudinal ribs 8 in. deep with cross ribs 5 in. deep spaced at about 4-ft. centers. The thin-shell slab is only 1¼ in. thick.

The roof panels have bar reinforcing in the main ribs, and welded wire

MATERIAL HANDLED AT TWENTYNINE PALMS

	Total handling operations	Total square footage handled	Tonnage
Roof panels	17,268	3,450,000	57,000
Wall panels	4,902	1,091,300	30,000
	22,170	4,541,300	87,000



PRODUCTION LINE (top) of steel molds is fitted with re-bars and mesh before casting roof panels. Aggregates are produced locally by contractor, batched in Conveyco-equipped plant in background. The Monster (center) can stack 'em 7-high, using vacuum mats and electric hoists beneath a 12-ft. clearance. Machine can easily be restored to original status. Out of the stockpile, roof panels (left) are handled by vacuum-fitted truck crane. View shows frame for 4 individual lifting mats; also the waffled panel surface created by and of integrally cast ribs.

mesh in the slabs. Vibrating screeds span the molds after pouring, and some internal vibration is done in the main ribs. Conventional rock concrete is used in the waffled roof panels, which weigh about 32 lb. per sq. ft. (The heaviest panel was just under 4 tons.)

About 60 steel molds are used for roof panel production. In practice, therefore, a casting cycle puts out some 12,000 sq. ft. of panel area. Tar-paulin covers on the molds close them in for 7-hr. steam cure, after which the panels are allowed to "soak" until it is time to strip and stockpile them in preparation for another casting cycle, some 12 hours later.

After studying the construction operations involved for the Marine Corps job, the contractors made tests of forming, curing, and erection techniques. The following equipment and procedure resulted.

Panel handling at various stages of production and construction requires 5 different vacuum mat arrangements. Perhaps the most unusual is found on a lumber carrier that was remodeled by The Conveyor Co. for stripping and stockpiling roof panels.

Enter the "Monster"

Starting as a Hyster CP straddle truck, the rig was widened by $5\frac{1}{2}$ ft., giving a clear width of 15 ft. Also, the road clearance was increased from $6\frac{1}{2}$ to 12 ft. Hydraulic power steering was added in anticipation of the heavy panel loads. By now the machine had lost enough of its original identity to qualify for a new name, the "Monster." Even so, the extras have been designed for easy removal and restoration of the Monster to its original state.

For handling panels, two vacuum mats are provided, suspended from 3-ton electric hoists. The hoists can be moved laterally by hydraulic cylinders in order to balance their load properly. To run the hoists, a 10-kva. generator was mounted on the Monster; and to operate the vacuum mats, vacuum pumping equipment was also installed.

In operation, everything is done by push button. The Monster straddles the panel form, lowers its mats and hooks on by vacuum, strips the panel, and moves out to stockpile. Its high clearance permits it to stack the panels 7 high, with 2 x 4's between panels for a 14-day air cure. Round trip time has been worked down to about 8 or 10 min.

For handling roof panels out of stockpile, a truck crane was fitted with vacuum equipment. Four vacuum mats were mounted on a frame in such a way as to retain some individual freedom of movement. This eases the task of sealing on to any surface. From the suspended mat frame a vacuum hose connects to the crane boom about half-way out, then runs to the vacuum pump mounted over the crane weight box. As with

Evils of low temperature— intermittent engine operation

- Exhaust smoking
- Oil screen plugging
- Crankcase and valve chamber sludge
- Sticking valves and plugged oil rings
- Rapid wear of critical moving parts

"You havin'
troubles
too?"

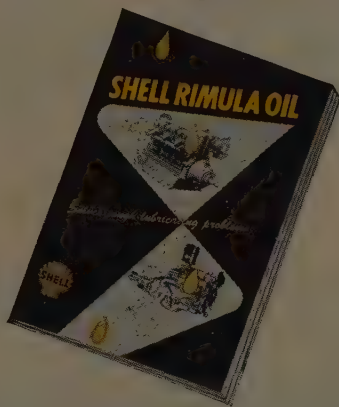
**"Read about the oil that
laughs at 'em!"**

THE engines that do our modern moving and shifting chores around the plant take more of a beating than meets the eye. Delivery trucks are a good example. They idle much of the time . . . start and stop and work and loaf, week in and week out. That's the service that brings on the complaints listed.

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For further information on the cost-cutting advantages of Shell Rimula Oil, write Shell Oil Company, 50 West 50th St., New York 20, N. Y. —or, 100 Bush St., San Francisco 6, California.

SHELL RIMULA OIL





BARRACKS WALLS are stockpiled after casting on floor slab, which isn't big enough to cast all panels at once. Unlike the roof, wall panels come in many varieties, and exceptions exist within each variety.



PANELS (above) come before frames on this barracks. Note adjustment on braces used to plumb the wall during erection. Wall panels (below) come in all shapes and sizes, with unsymmetrical openings as shown here.



all the mats on the job, vacuum is controlled by a single valve. This is faster than mechanical hooking on, and the distribution of vacuum lift allows handling of panels without resort to strongbacks or to extra panel reinforcement.

Hauled by semi-trailer to the construction area, roof panels are then handled one more time. This time the rigs are crawler cranes, equipped with vacuum pumps, hose, and mats in the same way as the truck crane.

Wall panels require some shuffling and stacking to gain space for further casting at each building site. This operation is performed with the still-green panel held flat. A truck crane is employed for the work, having a special mat frame on which mats can slide to fit around various openings in the non-uniform panels.

Panel maneuvers

A tilting or rotating type of vacuum mat is used for wall panel erection. (Operation of this mat was covered in detail in *Western Construction*, August 1951, pp. 84-85.) With the panel in a vertical position, a locking device drops into place and the panel may be safely maneuvered to final position. Diagonal braces make up to inserts in the panel and in the floor to hold the panel erect. Using a Northwest 95 crawler crane, the rigging crew has been setting wall panels at the rate of 52 per day.

An additional mat frame variation has been fabricated to handle a special situation. Precast columns of a theater building are close together and stand out, as pilasters, from the wall surface. Also, at the top a beam or coping projects 24 in. To fit high slender panels into these recessed locations, the new vacuum assembly will have a special mat and lifting arm.

Structural support in the Marine Corps base buildings consists of rigid frames or columns. Most of the rigid frames have been cast in place until now. As a result, forms for these frames have been the support for precast wall and roof panels before the frames were poured. Precast frames are now being undertaken, but because of their shape and weight will be handled mechanically rather than by vacuum.

Navy directs project

The project is under the direction of Comdr. W. M. Enger, CEC, USN, resident officer in charge of contract. Lt. Comdr. J. P. Mapes and Lt. Comdr. John R. Anderson are assisting resident officers.

For the contractors, a joint venture of Ford J. Twaits, Morrison-Knudsen Co., Inc., and Macco Corporation, D. G. (Bud) Hall is project manager. J. F. McKee is building superintendent. C. D. Wailes Corporation of Los Angeles, West Coast licensee for Vacuum Concrete, Inc., furnished the lifting equipment and assisted on the precast and lifting work.

Now—more production than ever with the new **10-SPEED TERRA COBRA 142**

NEW OPEN BOWL

35 MPH

**17.5 CU. YD.
CAPACITY**



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- SPEED** to 35 MPH with loads that really pay off
- 10-SPEED TRANSMISSION**—properly matched speed and power for all load and haul conditions
- SHORTER TURNS** that permit big production capacity in close quarters
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- GIANT 24-00 x 25 TIRES** for ample flotation and traction
- FAST EASY LOADING** with true hauling bowl principle
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- "LIVE" CONTROL** of scraper functions with power independent of master clutch
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- RUGGEDNESS** that's engineered from the ground up, proved in the dirt for less downtime
- SIMPLICITY** unmatched for easier, faster service—fewer parts to wear or repair
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The new Wooldridge Terra Cobra 142 is the first to offer the advantages of ten forward speeds in a **BIG CAPACITY** two-wheel tractor self propelled scraper. This means power and speed matched to every part of the toughest jobs—with engine operating at peak efficiency up difficult grades or highballing at top speed over long smooth haul roads. With maneuverability of short turns and high ground clearance, the Cobra is a most versatile machine for all types of jobs—and assures higher profits by keeping busy every hour of the day. Built-in ruggedness and simplicity pay off in minimum downtime and lower maintenance costs for more profitable production. Before you buy, compare the combination of high production features found only in the new Open Bowl Terra Cobra 142.

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HOW IT WAS DONE...

Kaiser Engineers makes topsy turvy pour

CONFRONTED with the problem of digging and concreting a 70-ft. deep "looping" pit at the new \$25,000,000 tin plate mill at Kaiser's Fontana, Calif., steel plant, Kaiser Engineers decided to reverse the usual procedure and do it from the top down.

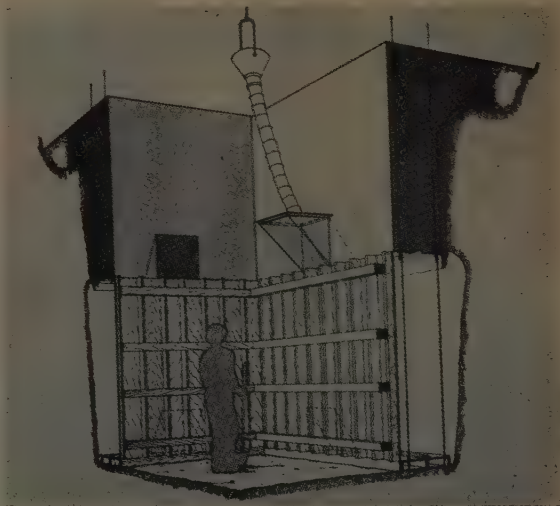
This topsy-turvy construction method was necessary because building footings around the pit location had already been poured and there was a limited working area. The pit, 8 x 20½ ft., is used to play out 36-in. wide sheet steel headed for the electrolytic tinning line. This permits continuous tinning while a new coil is being placed and butt welded to the previous strip.

Since the upper 21 ft. of the pit was above basement excavation level, this part of the work was done by conventional form methods. The other 49 ft. was built in seven sectional concrete pours, three of 8 ft., three of 7 ft., and one of 7 ft., 9 in.

The first 8 ft. were excavated by use of a clamshell bucket, with the final walls being hand-trimmed. The upper portion slopes out to form a natural concrete wedge. At the bottom a shiplap soffit and a 2 x 6-in. keyway were placed. Vertical reinforcing bars were placed extending 5 in. through the soffit, and the inside forms were built. Six wedge-shaped blockouts, 2 ft. wide by 2 ft. high, were built in the soffit, two on each side and one in each end, to provide pour-pockets for the next section. Care was taken to avoid pouring directly against the soil.

Since successive pours were scheduled every third day, the forms were removed as soon as the concrete was sufficiently cured to allow excavation for the next step to start. For each step, the soffit was again placed and rein-

LOOKING STRAIGHT down into the hole, the cameraman caught a Kaiser Engineers crew setting forms for another pour on this topsy turvy project to construct a pit from the top down.



AN ELEPHANT TRUNK, 6-in. diameter, is used to pour the concrete on the top-to-bottom construction of a 70-ft. "looping" pit at the Kaiser Steel plant. The concrete is placed well into the hopper to provide a head to insure tight joints between pours.

forcing steel was attached to the bars sticking out of the above section by a 5-in. lap weld. Hoppers were installed opposite the six blockouts and the concrete was poured through a 6-in. diameter elephant trunk. The pour was made well into the hopper to provide a head to insure tight joints between pours and to jut against the upper portion of the earth bank. To help seal each joint, 2½ grams of aluminum powder was used for each sack of cement to cause expansion at sealing points.

The concrete head in the hopper was sliced off with a piece of plywood while still green, and the blockout openings were patched as the forms for each step were removed.

Inventor does his level best

YOU CAN take the guesswork out of construction jobs by using the new 360 way Degree Level, according to its inventor, A. A. Rouse, an Orange, Tex., general contractor.

The level is gravity-operated by means of a lead weight which pulls the degree wheel around and enables the user to read the number of degrees it varies from the horizontal instantly. Thus it can be used to figure any degree on rafters, enable a plumber to lay every sewer joint on the same angle, eliminate guesswork in conduit bends for the electrician, and be invaluable for the carpenter and bricklayer, Rouse says.

Easily carried around in a large pocket, the level is 15 in. long by about 2½ in. wide. The main body part is made of Hycar Durez rubber, and a clear Styron plastic window is used to protect the wheel, which can be read from either side, free from dirt or injury.

A working model is being turned out by a Houston firm.

YOU hold the watch!



If you want to know whether you're getting the most out of your earthmoving rigs, here's how to find out.

On your own job, under any conditions you choose, *time* the work cycle of a Cat® DW21 Tractor and No. 21 Scraper against any other make of similar equipment. Or, if you're using four-wheel tractors, make the same comparison with a DW20 or a DW10 unit. Check the yardage handled in an hour—or a day.

We have enough confidence in the big yellow Caterpillar rigs to believe they'll sell themselves in

any such test. And your dealer is ready to give you a demonstration. Fair enough? Call him today.

Caterpillar Tractor Co., San Leandro, Cal.; Peoria, Ill.

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**NAME THE DATE...
YOUR DEALER
WILL DEMONSTRATE**

HOW IT WAS DONE...

Use of precast slabs sparks one-day building erection record

ERECTING THE WALLS and roof framing of a 50 x 140-ft. building in 8 hr. required careful advance planning but no extra work, according to George M. Heiskell, head of the George M. Heiskell Construction Co., contractor for the job in Phoenix.

The first step in the preparation consisted of pouring the concrete foundation and footings for the whole building. When this had set, the floor slab was coated with a special sealing compound.



THREE CRANES cooperate to raise a prefabricated building in one working day. A crane on each side lifts a wall section into place while the third stands by with a roof truss to be welded to the walls by steel connecting plates.

Arizona Republic photo

Next, forms for the side and end wall slabs were placed on the floor. Reinforcing steel was placed and the slabs were poured in two sizes, 16 x 16 ft., and 16 x 18 ft., both 4 in. thick. The ends of the steel bars were left protruding so they could be welded to the next slab. The larger slabs weighed 9 tons each.

Nuts were imbedded in the wet concrete for the placing of eyebolts, and each side wall panel was poured in the place where it was to be raised. It took three weeks for the concrete to set.

In the meantime, roof trusses were framed and placed at a convenient spot. Angle and top connections were formed in the wall slabs to receive the roof frame knee supports.

The actual 8-hr. job, which required three large cranes and a crew of eight men, then started. One crane worked on each side of the building, hooking onto the side wall slab eyebolts and pulling them upright, when each was welded into place. At the same time, the third crane picked up a roof truss and lifted it into place, where it was welded by steel connecting plates. The process continued until the entire structure had become a solid unit.

Considerable costs were saved by completing the erection process in one working day, Heiskell said.

Color-blind pilots confused by taxiway marking scheme

COLOR-BLIND PILOTS are advised to avoid the Tucson, Ariz., Municipal Airport unless they want to run into trouble in large quantities.

This state of affairs came about when F. M. (Mike) McLean, superintendent of maintenance for the Tucson Airport Authority, wanted to know why taxiways couldn't

be designated by color rather than by meaningless and confusing numbers. No one could answer his question, and everyone consulted thought it was a good idea, so Mike and his crew went to work.

"What do you figure on doing, painting the taxiways?" asked Manager Bob Schmidt.

"We could paint short lead-in centerlines in color," but I was figuring on using reflectorized markers like we've got now marking the edges, only changing from red to blue, green, yellow, or whatever color we decide on," Mike replied.

After several months of experimentation, a triangular, flat-surfaced marker was decided upon. It is simple to make, easy to install, and rugged looking. The reflecting material, placed on each side of the triangles' flat surfaces, is Scotchlite No. 227, kelly green; No. 228, marine blue; No. 229, yellow; and No. 232, red. The surfaces are 22-28 gauge scrap aluminum and steel. The vertical column is 3/4-in. lather's channel iron attached by 3/16-in. stove bolts. Unit cost varies with production, but 300 units can be made and installed for 68 cents a marker.

So today the taxiway system at the Tucson Municipal Airport is identified by color. Pilots are told to use taxiways blue, yellow, or green, rather than the old 2, 2A, 4, 8, 9, or 10. Other taxiways, which aren't used so much and where conflict is impossible, are marked in red as they were before. This is for edge marking rather than identification.

Modified scraper turns out more work with less men

CUTTING DOWN on the use of both men and equipment while doing more work has resulted from an idea of Anderson Brothers Corp., which modified a 275-hp. Euclid scraper into a pipeline padding machine.

The modification was made on a job to pad 150 mi. of 24-in. pipe being laid in rocky country. It consists of a power-driven screw which feeds material out of a chute on the side. It was made by welding the apron shut, installing the feed screws in front of and above the cutting edge, and extending the chute out the side. The feed screw is chain-driven from a gasoline-powered engine mounted above it to the top of the scraper bowl. The scraper is top-loaded with a front-end loader.

Choice of a Euclid scraper was made because its independently actuated hydraulic ejector makes it possible to feed a steady and closely controlled flow of material to the screw.

Before this rig was put into operation, the padding crew consisted of 35 men and 7 dump trucks. Now 15 men and 1 truck cover more footage per day with the new rig.

PADDING PIPELINES has been simplified by use of this converted Euclid scraper, which feeds material through the chute by means of a power-driven screw. A loader fills the scraper.



bituminous mixing in OKLAHOMA...

EDARAPIDS EQUIPMENT

of the points that make us a satisfied Cedar Rapids owner are:

"E" Rate of production of 135 Tons per hour even under adverse conditions.

Versatility as to starting and stopping on City work and changing type of specifications mix with practically no delay. This is very important on a City plant that furnishes Hot Mix Asphalt Concrete, Hot Asphalt or Hot Mix Cold Lay Maintenance Asphalt, all during same day.

Our records show that our maintenance cost for the first 10,000 Tons has been 3.1 cents per ton.

During the first year of operation we were never down, over two hours, due to plant failure.

MODEL "FA"

Rate of production on first job of 84 Ton per hour

No information available yet on maintenance, but if it continues at its present rate, it will be comparable to the Model "E"

We feel that our combination of big production "E" and high portability will put us in good shape to bid on big jobs that would require 90 to 100 tons per hour or small jobs where 60 to 90 tons per hour would be sufficient.

Very truly yours,

IMPERIAL PAVING COMPANY

By

John W. Kelly
Member of Firm



**VERSATILE
BITUMINOUS MIXING
OPERATION IN
OKLAHOMA for
IMPERIAL PAVING CO.**



Cedarapids

Built by
IOWA

**FOR
PROFITABLE
PRODUCTION
OF ASPHALTIC
CONCRETE**

AFTER a survey of various plants and important bituminous mixing operations, Imperial Paving Co., of Oklahoma City, chose a Cedarapids 4000-lb. all-electric Model E. As a result of their last season's production of 120,000 tons of asphaltic concrete, at a 135 ton per hour clip . . . with only two hours downtime . . . they purchased a Cedarapids Model FA all-electric batch type plant for operation on smaller jobs at Altus, Oklahoma. According to John W. Kelly's letter shown above, Imperial Paving is ready for any size bituminous concrete job that comes along.

Why don't you check around your territory to watch bituminous mixing plants in operation? Talk to Cedarapids owners about profitable production, versatility, low maintenance . . . then see your Cedarapids distributor for recommendations on the best plant for your job.

IOWA MANUFACTURING COMPANY

Cedar Rapids, Iowa, U. S. A.

PRECAST CONCRETE FOR SCHOOLS

... Continued from page 74

details. Concrete for the beam has $\frac{3}{4}$ -in. maximum size aggregate and is designed for a 28-day compressive strength of 5,000 psi. The State Department of Architecture required a trial mix to be designed and tested in the laboratory prior to actual pouring of any beams. The department believes that laboratory test results are usually higher than field tests, and as a result has required laboratory test cylinders to give a minimum strength of 6,000 psi. Jay Helsley of Construction Laboratories, Inc., is designing and testing the concrete.

Wires used in the beam are $\frac{1}{4}$ -in. diameter "American Super-Tens Wire" as manufactured by the American Steel and Wire Co. Wires are cold drawn-stress relieved super-tens (uncoated) wires. Ultimate strength is approximately 245,000 psi. and a maximum design stress of 145,000 psi. is used. Load carried by the beam consists of 450 lb. per lineal foot applied load and 150 lb. per lineal foot dead load of the beam, totaling 600 lb. per foot.

Stressing procedure

The Prestressed Concrete Corp. will fabricate the beams in its shop and truck them out to the job site ready for erection. Wires are assembled in units consisting of seven wires with a 5 x 5 x $\frac{1}{2}$ -in. steel bearing plates and a 2-in. diameter stressing washer threaded through the wires at each end. Ends of the wires are headed with a button head which will bear against countersunk holes in the stressing washer. The seven wires are coated with a special gilsonite base mastic, consisting of asphalt, asbestos, graphite, and an amine type rust inhibitor and then wrapped with sisal kraft paper before setting in the forms. The gilsonite base mastic prevents any bond or friction from developing between the wires and the concrete.

Interior forms consist of cardboard

stapled to wood blocks spaced at 18 in. These forms are suspended from the reinforcing steel cage. The 7-wire units are wired to the ledger bolts and to the vertical stirrups. Exterior forms will be plywood. Concrete will be poured with a 4-in. slump and internal vibrators used. The beams will be water cured.

After the concrete has attained the proper design strength final stressing will be performed by jacking from one end with a hydraulic jack which screws around the stressing washer and pulls out the wires, thus stressing 7 wires at one time. Stress in the wires will be double checked by elongation and by the actual load applied by the jack. In order to minimize creep of the wire a stress of 110% of the required stress will be applied to the 7 wire units and held for 2 minutes before releasing to 100% of the required design stress. Steel shims are then inserted under the stressing washer and the jack removed. Wires are not grouted but remain unbonded to the concrete. The $\frac{4}{2}$ -in. end block of concrete is poured to cover the end anchorages of the wires and when that concrete has cured the beams are ready to be trucked out to the job.

Building details

Classroom buildings are entirely concrete even including the toilet partitions. These partitions consist of 3 in. of concrete poured inside a 3-in. steel channel frame. This partition is erected and welded to a steel plate which has been poured in the precast bearing wall.

One of the major considerations in evaluating the serviceability of a school building is the cost of maintenance and upkeep. Many school districts are operating on limited budgets and school officials find it difficult to secure enough funds to properly maintain and repair their school plants. A satisfying feature of these

precast concrete schools has been the reduction of maintenance costs required for their upkeep. The solid concrete walls with steel channel door frames are not damaged by the heavy use given to crowded school facilities. Janitorial maintenance is held to a minimum in the classroom buildings because all the walls are smooth and flush on both sides.

A substantial saving in the operating budget of the school has resulted from the reduction of the fire insurance rate given to these precast concrete schools. The insurance rate was set at \$0.668 per \$100 valuation compared to \$1.46 per \$100 valuation for the district's wood and stucco buildings.

Savings in construction cost of the classroom buildings were realized by the elimination of several trades and sub-contractors usually required for these types of buildings.

Personnel

Plans for these buildings were checked by the State Division of Architecture and approved by Harry Bolin, Supervising Structural Engineer, of the Los Angeles office. Plans were checked by Larry Bull of Mr. Bolin's staff. Buildings were designed to meet the requirements of Title 21 of the State Division of Architecture.

Layout, site planning, and building design for these schools was carried out with the active cooperation and collaboration of Dr. J. Henrich Hull, Superintendent of Schools, and Emmett W. Ingram, Assistant Superintendent and Business Manager of the Torrance Unified School District.

At the present time plans are being prepared by the same architect-engineer for another precast concrete elementary school and for a precast concrete high school for 1,500 students. Basic design and layout is again being repeated for these projects.

The Riviera and Madrona schools were constructed under the direction of James Warner, superintendent, and Jack Cain, project manager, for Geo. W. Carter Co.

Cost analysis for precast concrete school buildings

ITEM	MADRONA	RIVIERA	EVELYN CARR	HOWARD WOOD	MADRONA ADDITION
	1 Admin. Bldg. 1 Kindg. Bldg. 2 Classroom Bldg.	1 Admin. Bldg. 1 Kindg. Bldg. 3 Classroom Bldg.	1 Admin. Bldg. 1 Kindg. Bldg. 1 Shop 4 Classroom Bldg.	1 Admin. Bldg. 1 Kindg. Bldg. 3 Classroom Bldg.	1 Classroom Bldg.
Buildings furnished					
Buildings occupied	1952	1952	Now under construction	Now under construction	Now under construction
Enclosed square ft. (Including no covered passages)	13,638	18,766	26,718	18,829	4,849
Number of equivalent classrooms....	14.2	19.5	27.83	19.61	5.05
Contract price	\$176,887	\$247,617	\$318,766	\$233,795	\$57,500
Cost per classroom equivalent	\$12,457	\$12,698	\$11,454	\$11,922	\$11,386
Enclosed sq. ft. plus $\frac{1}{2}$ area of covered passage.....	15,864	21,441	31,065	21,790	5,510
Cost per sq. ft.	\$11.15	\$11.55	\$10.26	\$10.73	\$10.44

CARBIDE INSERT? or MULTI-USE?

LOCATION: Schuylkill Expressway, Lower Merion Township, Pennsylvania.

OPERATING CONDITIONS: Drilling ordinary ground, hard mica schist, hard granite.

Why Talbott-Myers Construction Corp. used both TIMKEN® multi-use and carbide insert bits on new expressway

TALBOTT-MYERS Construction Corporation, Winchester, Kentucky, have tested all makes of rock bits, but when it came to excavating 873,000 cubic yards of rock for Pennsylvania's new Schuylkill Expressway, Timken® interchangeable multi-use and carbide insert bits were picked for the job.

Timken multi-use bits are the most economical for ordinary ground. With correct and controlled reconditioning, they give lowest cost per foot of hole when full increments of steel can be drilled.

In hard mica schist and granite, Talbott-Myers switched to Timken carbide insert bits. They're best for highest speed through hard and abrasive ground. They're also most economical for extremely deep holes, constant gage holes, small diameter blast holes.

Timken multi-use and carbide insert bits are interchangeable in each thread series—for instance, as many as eight different type Timken bits all fit the same steel! Both Timken multi-use and carbide insert bits are made from electric furnace Timken fine alloy steel, have special shoulder unions that protect threads from drilling impact, are quickly and easily changed.

To find out which bit type is best for your job—whether multi-use, carbide insert or both—call on the Timken Rock Bit Engineering Service. Write The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".



Timken threaded multi-use rock bit



Timken threaded carbide insert rock bit

TIMKEN

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

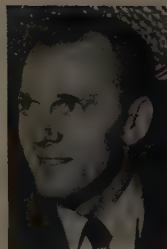
REPORTS

FROM THE COURTS

By

HOWARD S.
BURNSIDE

Attorney at Law
Registered
Professional Engineer



Fire damage case reversed

A case reported earlier in these pages¹ has recently been reversed by the Supreme Court of California. The case involved a verdict of \$97,437 when a liquidated damage provision for \$25 in a fire detection system lease was found invalid by a jury as a question of fact.

The first report of this case pointed out that assessment of damages for a breach of contract must be impracticable or extremely difficult; otherwise the liquidated damage provision will not be upheld. It was on this issue that the judgment was reversed. The higher court found as a matter of law that the provision was valid, and that the judgment for plaintiff could be reduced to \$25.²

A dissenting opinion deplored the practice of the court in reversing, as a matter of law, a fact question determined by a jury and chided the majority opinion as straining at gnats "to find a reason why the sum of \$25 might bear some relation to any possible loss."

¹Western Construction, January 1953, p. 98.
²Atkinson v. Pacific Fire Ext. Co., 40 AC 197, Feb. 6, 1953.

Contractor unpaid until airport program held legal

It can happen that a contractor and public officials responsible for executing public works will unwittingly become involved in questions of law which only the courts can decide. Pipes v. Hilderbrand¹ is such a case.

The City of Fresno contracted with Pipes and others for the construction of hangars at the Fresno Air Terminal and at the same time leased the buildings to a private aviation firm, the lease to commence when the buildings were completed. Work was started, and when the contractor sought payment of the first installment due him under his contract the Commissioner of Finance refused to prepare the necessary papers. The contractor then brought suit to enforce payment.

The chief objections to authorizing payments raised by the Commissioner in his defense of the suit were that the City did not have authority to appropriate public funds to construct buildings and lease them to a private firm for private gain. Also, it was argued that the appropriation of pub-

lic funds expressly for erecting buildings to be leased by a private firm was an extension of credit to, or in aid of, a private corporation. The objections were not valid in the opinion of the court. This scheme of constructing and leasing was found to be a public purpose when carried forward as part of the comprehensive plan of development of the municipal airport. Thus, there was not an attempt here to use public funds for a private purpose in violation of the state constitution.

It is noteworthy that the contractor who apparently proceeded under his contract in good faith and was obliged to sue to get his first payment was not allowed to recover his attorneys' fees in this proceeding on the theory that the Commissioner made a defense in good faith. It seems unrealistic to say the contractor must stand the cost of establishing the legality of part of the municipal airport program so he can collect money fairly due him, but such is the practical result of this decision.

¹Pipes v. Hilderbrand, 243 P. 2d 123.

Compensation benefits for company officer

The deceased was president of a small construction company in full charge of the corporation. He also acted as superintendent of construction for the company, which was engaged in highway and other heavy construction. His duties included the discharge of executive functions as well as work on the jobs in operating heavy machinery, equipment and trucks. He was killed while driving a pickup truck on one of the jobs.

The widow was denied benefits under the Wyoming Workmen's Compensation Law because the deceased was an officer and director of the company. The decision was appealed and the question for determination was whether the deceased was a workman within the meaning of the Compensation Act.

Employment on the work of the company was classified as extra hazardous. The deceased was paid by the company for time actually spent on the job. His wages were reported to the Workmen's Compensation Department and proper fee paid.

On the appeal the Supreme Court of Wyoming reversed the lower court, holding that the widow was

entitled to a proper award, and pointed out that the Act then in effect was to be liberally construed to accomplish its benevolent purpose.¹

This decision is in accord with what is termed the dual capacity doctrine; that is, one may be an officer of a company, but if he is engaged in the duties of a workman and is paid as an employee he is not denied the compensation benefits simply because he is an officer. Subsequent to this accident the Wyoming Act was amended and this decision coincides with the spirit of the amended Act.

¹Lichty v. Lichty Construction Co., 243 P. 2d 151.

City liable on re-sale of surplus pipe

In Brown v. Village of Deming, New Mexico,¹ the Village had purchased a large quantity of pipe, in place in the ground, from the War Assets Administration for \$8,700.00. The rules of this federal agency allowed a 40% discount if the pipe were to be used to extend the municipal water and gas systems and was not sold for five years.

Soon afterward the Village advertised the pipe for sale and sold it to Brown for \$30,000.00. The bill of sale on this transaction guaranteed, in effect, that the Village had full title to the pipe. Brown then proceeded to remove the pipe from the ground. When he learned of the restrictions in the sale to the Village he shut down his operations because it appeared that the Village did not in fact have full and clear ownership of the pipe as the bill of sale indicated. Through negotiation and by paying the purchase price of the pipe to the United States Treasury, Brown was later able to proceed with removal.

Brown then sued the Village for his loss of profits. His contention was that the Village had warranted its title to the pipe, that the Village did not in fact have full title, and that this breach of its warranty caused him to lose a tidy sum. He testified that the value of the pipe at the time of shutdown was \$66,721 in the used pipe market. During the extended negotiations after his shutdown, the used pipe market dropped considerably and he lost accordingly. The jury returned a verdict in favor of Brown and against the Village.

¹Supreme Court of New Mexico, 243 P. 2d, 609.

WESTERN CONSTRUCTION NEWS

MAY 1953

®

Sierra snow fighters have easy year

SNOW REMOVAL in California this winter was a dull job to crew members who had fought 1952's heaviest snowfall since records were first kept in 1890.

Last year's snow was almost 800 in. (*Western Construction*—May 1952, p. 66-68), as compared with a total of 346 in. which had fallen by early April of 1953. This year only 100 extra men were hired, as compared with the 285 extras on the job at one period last year. And last year the rotary plows worked three times as many shifts as in a "normal" year.

The longest any highway was closed this year was for 12 hr., and then only because of stalled vehicles or poor visibility. Compare this figure with 1952, when U. S. Highway 40 was blocked for 28 straight days, the City of San Francisco passenger train was trapped near Donner Summit for 3 days, and 4 major snowstorms hit the area during the winter. In one 3-day blizzard, more than 8 ft. of snow fell while a 100-mi.-per-hr. wind whipped it into drifts 35 ft. high.

Special snow equipment is stationed on 3,200 mi. of the 14,000 mi. of California's highways each winter. This year there were 42 rotary plows, 222 push plows, and many graders available.

Interior budget cuts cause Alaskan protest

BUDGET CUTS of almost 9% less than the \$607,251,400 recommended by President Truman in January for the Interior Department were recommended by Secretary Douglas McKay, who asked for \$553,105,100 for his department for the fiscal year starting July 1.

McKay said he couldn't break down his proposed budget at this time (early April) to show how the \$54,146,300 reduction affected his department, although it was reported that a big part of the cut had been applied to the Bureau of Reclamation.

Howls of pain from Alaskan Delegate (in the U. S. House of Representatives) E. L. Bartlett revealed where part of the cut was made, however. He said the Bureau of the Budget is proposing \$24,600,000 for

construction activities in Alaska as compared with the \$46,992,000 proposed in the Truman budget.

"I intend to seek restoration of these items," he said. "If these cuts go through, it means that the orderly improvement of our transportation facilities and the building of our communities through the public works program will suffer a severe setback. I cannot understand why Alaska should be called upon to take appropriation reductions of this magnitude."

Bartlett said the cuts include a \$5,000,000 reduction for Alaska public works, and a slice of \$3,800,000 from highway work. An item of \$13,592,000 for rehabilitation of the Seward-Portage line of the Alaska Railroad and a \$4,498,000 project for improving the docks at Seward were eliminated entirely, he said.

Meanwhile Chairman Jensen (Rep., Iowa) of the House Appropriations

Subcommittee which handles Interior Department funds, told a reporter that most of McKay's proposed cuts are "very well taken." He predicted that his group will make additional reductions, specifically in department personnel, before sending the bill to the full committee and House floor (expected late in April).

More Seattle engineers?

A **CITY ENGINEERING** staff expanded by 33 persons has been recommended by the Seattle City Council Finance Committee. The larger staff, to handle street-maintenance, traffic-signal, garbage-disposal and other duties would have added to it four civil engineers, a junior traffic engineer, four engineering aides, an abstractor, a traffic signalman, street-maintenance and garbage-disposal foremen, and laborers.

THE STEEL ELBOW pictured is one of 32 being fabricated at U. S. Steel's Consolidated Western Steel Division, San Francisco. Made of 1-in. steel plate and weighing 86 tons each, the elbows will serve as penstocks at Chief Joseph Dam. The one which is shown is 25 ft. in diameter and 58 ft. long, and was assembled to check measurements. The same plant is also turning out more than 2,500 tons of straight pipe sections for the penstocks, which will channel river water 238 ft. down to turbines in the powerhouse.



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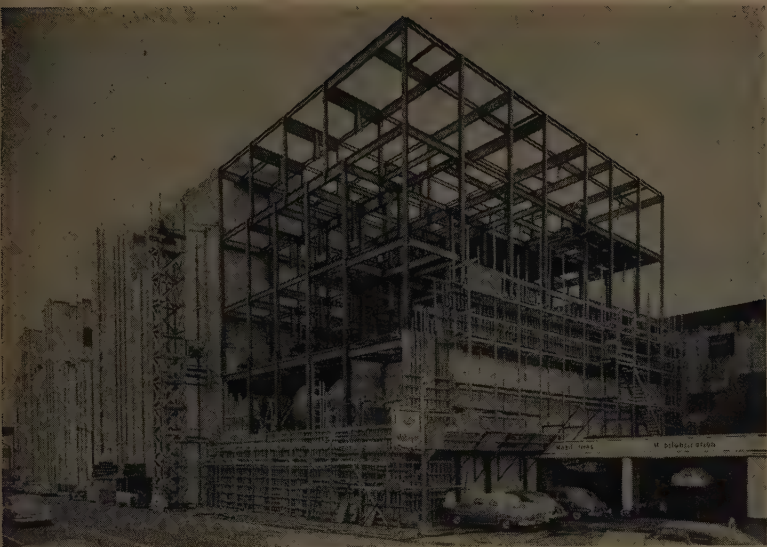
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SPOKANE 1, Washington.....Construction Equipment Co., W. 1208 Ide Avenue



600 TONS of structural steel are going into this stock house building now under construction for the San Francisco Brewing Corp. in San Francisco. The new 5-story structure will house "cellars," or glass-lined tanks under strict temperature and sterility control where the beer will be aged. The steel is produced at Bethlehem Pacific's Alameda Fabricating Works, and is erected by the company's erection division. Cahill Construction Co., San Francisco, is general contractor, and Ray N. Moore, also of San Francisco, is the structural engineer.

Upper Colorado bills reach Congress

THE PROPOSED billion-dollar plus Upper Colorado River storage project graduated in status from possible to probable early in April when two similar bills to authorize it were offered in the U. S. Senate and House of Representatives.

Members of the Upper Colorado River Compact Commission came to Washington to help work out the bill, sponsored jointly by 10 Western Senators, which would provide for hydro-electric and irrigation development on the Colorado River and its tributaries north of Arizona.

The main power and storage dams would be located at Flaming Gorge in southwestern Wyoming, Glen Canyon in southern Utah, Navajo in northern New Mexico, Curecanti in western Colorado, and Echo Park in northwestern Colorado. The Echo Park site, which is in the Dinosaur National Monument, has aroused protest from various conservationist groups, who claim that the reservoir would destroy sites of great scenic and historic interest.

Included in the overall scheme would be 17 participating projects for storage and irrigation. Purpose of the plan is to create a system of reservoirs for water storage to prevent floods, generate electric power, provide irrigation water, and provide recreation facilities.

The proposed power plants will have a capacity of about 1,622,000 kw., according to Sen. Clinton Anderson

of New Mexico. He added that an estimated 2,400,000 kw. of power would be needed in the 11 Western states by 1980. Cost of the project will have been paid back within 50 years after the last unit is completed, he added, and the federal government will continue to receive net profits from the project of at least \$25,000,000 a year.

Included in the bill are provisions to carry out the San Juan transmountain diversion plan, which would bring additional water into the Rio Grande.

Reservoir clearing job 7 months ahead

CLEARING of the reservoir behind Albeni Falls Dam in Idaho has put the contractors seven months ahead of schedule, according to Maj. James F. Grafton, resident engineer at the Pend Oreille River multi-purpose project.

Although the \$1,077,000 contract, let on January 14, 1953, to J. H. Trisdale, Inc., and subcontractors LeBoeuf & Dougherty and Kenmore Marina, calls for completion of the work by June 1, 1954, it will probably be finished a year ahead of schedule, Grafton said.

The work, carried on through a mild winter, included a peak labor force of 450 men using 147 bulldozers, 194 chain saws, and numerous tugs and powerboats. More than 6,000 snags, pilings, and other navigation hazards were removed. Since most of

the trees felled in the reservoir are cottonwoods, they had little salvage value.

A further idea of the magnitude of the job is given by the fact that 850 separate agreements had to be made by the Corps of Engineers with owners of property along the new lake-front to leave designated trees, pilings, fences, and docks alone.

Carnival marks opening of Alaskan Way Viaduct

DANCING GIRLS, a blaring band, marching by the police drill team, and speeches marked the opening to public travel of the new \$8,000,000 Alaskan Way Viaduct in Seattle early in April.

A system of one-way streets has been devised to direct traffic on and off the new roadway, and directional signs and traffic signals have been installed at main intersections. City Engineer William E. Parker reported that some minor work, about \$18,000 worth, remains to be done. The speed limit will be 45 mi. an hr. on the viaduct and 30 mi. an hr. on the approach ramps, he said.

The project was built by MacRae Brothers, Seattle.

New storm sewers planned for Phoenix

BUILDING storm sewers in Phoenix, Ariz., at the rate of \$1,000,000 a year for the next three years has been proposed by R. G. Baker, the city engineer.

The lack of storm sewers came up in a discussion by the City Council of the heavy load placed on the city's sanitary sewer system during the summer months by refrigeration-type coolers. Home and small-business refrigeration units, being installed at an accelerating rate, are overtaxing the capacity of some sanitary sewer lines by discharging waste water into them, it was pointed out.

"It rains so seldom here, and the actual damage is so low you can't afford to go all out," Baker said. "You have to strike a medium between no flood protection at all and a system large enough to handle any possible flood."

The city has an ordinance against discharging cooler water into the sanitary sewer lines, but it has never been enforced, according to Dario Travaini, superintendent of water and sewers. He proposed that operators of cooling units larger than three-ton capacity should be required to re-use the water, both from the standpoint of relieving the load on the sewer lines and because the water supply is expected to be short in the city this summer. Domestic water facilities are being expanded but are not expected to be ready by summer, he said.

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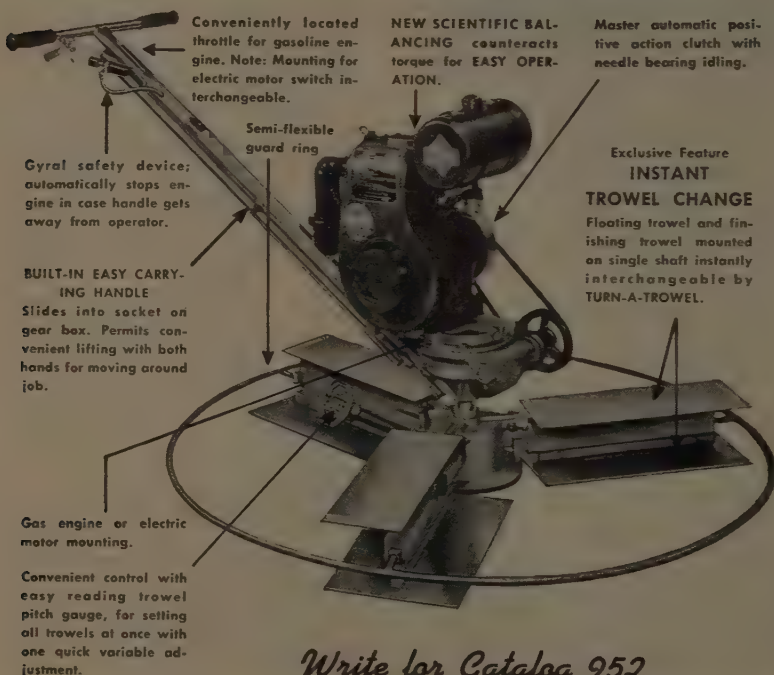
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Hungry Horse enters final phase

THE LAST PHASE of construction on Hungry Horse Dam in Montana, drilling and grouting to fill any voids which may have developed under the 6,000,000-ton weight of the world's fourth largest concrete dam, is expected to be completed early in May.

Selby Drilling Co. crews have been working three shifts a day, seven days a week, drilling holes into bedrock and forcing cement and water down them. Their final action will be to force cement and water under pressure into the 1,000 mi. of 1-in. cooling pipe embedded in the nearly 3,000,000 cu. yd. of concrete which makes up the huge structure.

Only the cableway towers and a repair shop remain standing at the dam-site of all the the construction fixtures used to build the structure. Cableway No. 3 was the last to come down.

Water storage in Hungry Horse reservoir increased from 706,850 to 718,220 acre feet in March as the water level rose 3 ft. It was rising at the rate of 2 ft. a day early in April because of melting snow at lower levels which added to the flow.

Visitors are now allowed to see the dam from the vista point at any time. Since the project was first started in 1948, nearly 1,000,000 persons have come to see the huge Hungry Horse rise.

STRONG MAN ACT by Joe Koenke, president of Skookum Co., Portland. The block he is balancing weighs in at a mere 2,685 lb., and is one of the specially-built units manufactured for Canadian Bechtel Corp. for use in construction of an Imperial Oil Co. refinery near Vancouver, B. C. The blocks are capable of lifting 300,000 lb., while smaller sizes weighing 875 lb. will lift 60-ton loads.



By **CLIFFORD S. CERNICK**, Anchorage

JOB RUSH: A heavy influx of job-seekers from the United States is beginning to pour into Alaska despite warnings from employment officials here that the current job picture is glum. Employment offices here warn statesiders seeking Alaskan jobs: **Stay put until the construction season gets into full swing**—then inquire through local employment offices as to Alaska's job picture.

Construction tempo in Alaska now is gradually picking up and is expected to hit a peak in July and August. Meanwhile hundreds of construction workers in Anchorage, Fairbanks and other major communities are marking time waiting for the expected work boom to get into high gear.

SOME JOBS GOING BEGGING: Paradoxical as it may seem, more than 150 jobs are going begging in Alaska—but skilled men are needed to fill them. The Alaska Road Commission wants survey crews in classifications all the way from chainman to party chief. Right now, there are

no takers though the jobs pay from \$3,500 to more than \$5,000 annually under civil service ratings. So ARC is recruiting help in the states. Anyone interested in an ARC job might write his Juneau headquarters for more details.

LABOR HARMONY seems the order of the day in Alaska, and there's hope now that strikes and walkouts won't cramp the Alaskan construction effort as in years past. Indication of the new spirit of accord between labor and contractors in Alaska is recent signing of an agreement between Associated General Contractors and carpenters. Carpenters got a wage boost of 22½ cents an hour, retroactive to January 1. They are a key construction craft and other unions are indicating they'll follow suit.

FREEZE UNFROZEN: With the unthawing of Alaska's government-ordered construction freeze, the outlook for large contract awards is brighter than ever. A green light has

been given to more than \$68,000,000 in defense construction projects "frozen" earlier by the Bureau of the Budget pending a study as to essentiality of the work. This means heavy construction activity in Alaska at last will move full speed ahead. Sub-contractors, labor, businessmen, and equipment dealers both in Alaska and stateside will feel benefits of this relaxation of restrictions. Contractors with Alaska schedules now are rolling up their sleeves for what they consider will be the biggest construction year in the territory's history.

BIGGEST CLOUD on the horizon for Alaska's construction industry is the possibility of West Coast shipping tieups. Last year civilians and military suffered anxious moments when walkouts threatened to choke off needed supplies. Majority of Alaska's supplies—both civilian and military—come the water route, with only a negligible trickle coming overland up the Alaska highway. Alaska construction men are watching closely the Coast shipping situation—a vital factor affecting success and volume of completion for this year's construction effort.

NOT ALL DEFENSE: It's not all government money that's turning the wheels of construction in Alaska. A sizable volume of work is going ahead on commercial buildings and housing

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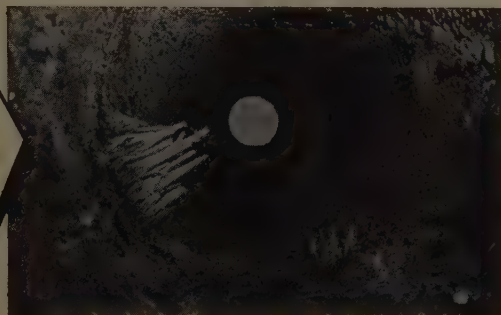
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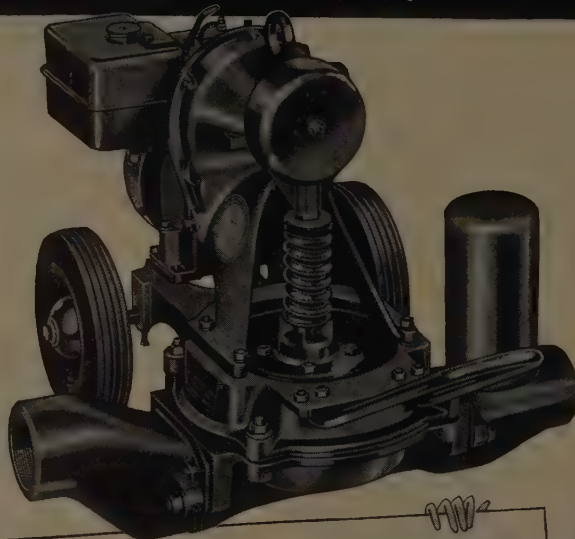
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in major cities. This year, work will start in Anchorage on a \$4,900,000 housing project consisting of 400 homes. Anchorage is the construction hub of all Alaska, with the lion's share of both civilian and military construction being pushed within a 50-mi. radius of this city, which has a population of nearly 50,000.

A heavy volume of military construction and development of Alaskan bases as key units in the overall defense setup has strained facilities of both Anchorage and Fairbanks to the bursting point. Major headaches for city fathers still are utilities and housing. Recreational facilities are not all they should be, with movie-going and bowling representing the chief pastimes of Alaska's population.

Cities in Alaska are still spending millions keeping up with the rapid growth confronting them. Typical utility projects include an \$800,000 water distribution project for Fairbanks, for which preliminary planning has been completed, and a huge new telephone expansion program in Anchorage, expected to amount to several million dollars.

NEW LOOK: City planners also are beginning to give attention to slum clearance programs, particularly in Fairbanks and Anchorage. Majority of Alaska's early housing construction was sub-standard, much of it the "shack" type. However, new Alaska houses are well-designed, well-built and are in the \$15,000 to \$25,000 bracket. One construction man in Anchorage has built a home costing more than \$150,000. Housing costs are high as viewed by persons in the United States but not at all unreasonable when considered in relation to inflated Alaskan wage scales.

SUPPLEMENTING Alaska's defense construction activity this year, as in years past, the gold-mining industry still is chugging along despite what's considered here as a "low" gold-price. The Fairbanks Exploration Co. is moving thousands of tons of ice which have locked gold dredges solidly in their ponds near Fairbanks through the winter. FE employs about 600 men in the Fairbanks operation. Bulk of gold dredging in Alaska now is in the Fairbanks-Nome area.

Alaskans also are looking hopefully to the growth of new industries to cushion the shock of the eventual decline in defense construction. New industries probably will center in the territory's abundance of natural resources. Construction of a \$56,511,000 pulp and newsprint plant near Juneau has been proposed by the Georgia Pacific Co. of New York, and the Pacific Northern Timber Co. of Portland is planning a \$4,502,570 sawmill and pulp chip plant near Wrangell. Alaska is considered the "last frontier" for many natural resources, principally timber and minerals.

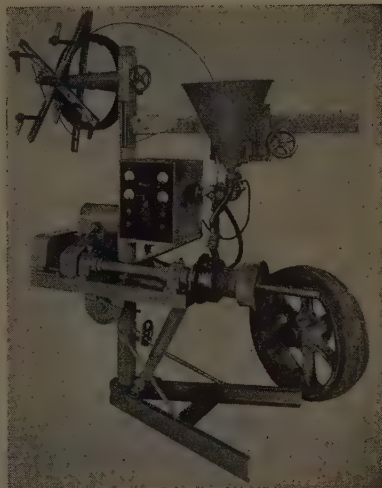
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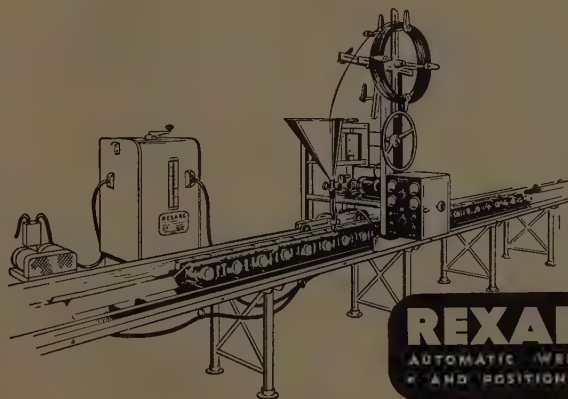
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AGC, APWA recommend uniform contract use

A JOINT COMMITTEE of the American Public Works Association and The Associated General Contractors of America has recommended the use of a uniform contract for municipal engineering construction projects (excluding building construction) in municipalities throughout the country.

The newly-formed committee, at its first meeting in Chicago January 28, agreed that one should be prepared and submitted to its parent associations for their approval. It further

agreed that the "Suggested Form of Contract for Engineering Projects," 1952 edition, prepared jointly by the American Society of Civil Engineers and the AGC should be studied by the committee and "consideration given to adapting it for use by municipalities."

The committee, set up in October, 1952, has as its purpose the consideration of matters in municipal construction of interest to municipal and general contractors, public works officials and others, and is expected to submit appropriate recommendations for approval to its parent organizations, from time to time.

The committee also stated that

"salaries paid construction engineers employed by municipalities are not sufficient to enable the municipalities to maintain staffs of competent and trained personnel necessary to administer important construction programs" and requested that the parent associations pass appropriate resolutions urging that engineers employed in administering municipal construction be paid salaries "commensurate with their responsibilities and with salaries paid by private industry."

Other matters considered at the meeting and the position taken by the committee were:

Inspection—The committee agreed that for various reasons inspection on municipal construction is too often unsatisfactory and requested the APWA and the AGC to adopt resolutions recommending that all municipal construction and inspection be under supervision of a registered professional engineer, and further, that preferably both functions be under the supervision of the same engineer or engineering department.

Day labor—Believing that the taxpayers' best interests are not served by municipalities engaging in extensive day labor (force account) construction programs, the committee requested its respective associations to adopt resolutions recommending that, when it is in the best interests of the municipalities, all construction be accomplished through the medium of open, competitive bidding by qualified contractors, and further recommending that, for comparison purposes, municipalities keep adequate, comprehensive cost records on construction work done by municipalities, and that such cost records be open to inspection by proper public parties.

Furnishing of materials and equipment—Feeling that the contractor should not be expected to assume full responsibility for construction projects when the municipality furnishes the material and equipment, the committee requested that the APWA and the AGC pass resolutions recommending that on each municipal construction contract the materials and equipment to be incorporated in the project be furnished by the contractor, except when it is clearly contrary to the best interests of the municipality to do so.

Army OKs Waldo work

APPROVAL by the Secretary of the Army, who granted a right-of-way through the Fort Baker military reservation, has opened the way for construction work on the proposed \$7,500,000 project to widen the Waldo approach to the Golden Gate Bridge in Marin County, Calif.

The plans, which include a one-way tunnel, must be submitted to the Bridge Board of Directors for approval before construction can start, possibly by July 1.

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SAFETY

Fisher establishes safety department

INDUSTRIAL RELATIONS and safety has become a major interest in the Fisher Contracting Co., which became the first construction company in Arizona to establish both its own industrial relations department and a full-time safety program.

Jack Grady, formerly associate secretary of the Industrial Council, Inc., in Phoenix, has been appointed manager of the new department. The safety office, which will operate as a part of industrial relations, will be headed by Ray Wells.

Grady explained that the safety record of the construction industry in Arizona has not been good because of the nature of the business, which causes more frequent and severe industrial accidents than are found in any other major industry.

"We're inaugurating this safety program—and Fisher Contracting Co. is eager to lead the way in this field—to correct this situation," he said.

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:

Leo McQueen, 26, was fatally injured on March 24 near Ely, Nev., when a large piece of construction equipment at the Kimberly Pit backed over him.

ACCIDENTAL DEATHS and serious injuries on the West's construction jobs are reported each month in the interest of promoting safety-on-the-job.

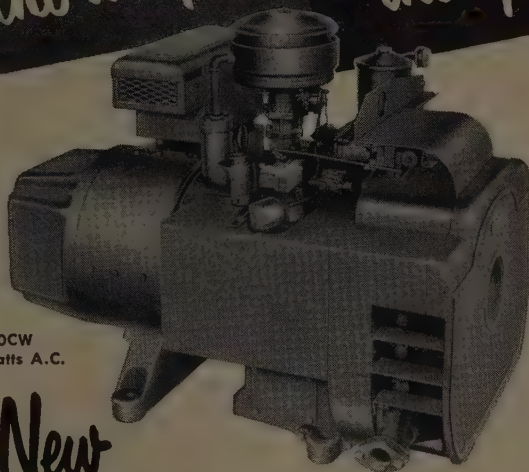
Robert Stice, 22, an apprentice carpenter working for Pettifer, Clarke & Horn Construction Co., was drowned at Drop 2 in the All-American Canal 35 mi. east of El Centro, Calif., when a section of scaffolding upon which he was working came loose and plunged him into the water.

James Franks, 18, suffered second- and third-degree burns over much of his body March 25 in San Francisco when a drill he was using to break pavement penetrated an underground conduit carrying high-voltage electrical cable. He was enveloped in flames when the juice shot up the drill and arced. Fellow workers in the Pacific Gas & Electric Co. crew beat the flames out with their coats.

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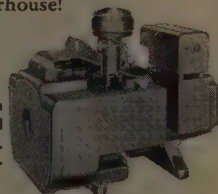
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Road builders' clinic held at WSC

AN UNEXPECTED reward was received by William A. Bugge, director of highways for the State of Washington, when he spoke on "Highway Picture for 1953" at the Fourth Annual Road Builders' Clinic held at Washington State College in Pullman late in March.

Bugge was given the first certificate of recognition ever issued by the student chapter of the American Road Builders' Association for "outstanding performance in the interest of better highways." The students sponsored the meeting under the auspices of two units of Washington State Institute of Technology—the Division of Industrial Services and the Department of Civil Engineering.

Other speakers and their topics were A. A. Anderson, chief highway consultant, Portland Cement Association, "Status of the Proposed National Test Road Program"; Herbert C. Higgins, secretary of the Washington State Highway Commission, "Highway Safety"; J. Gordon Fenton, plant engineer for Central Pre-Mix Co., "Paving Mixtures"; Dr. Curtis Warren, civil engineer, "Air Entrainment in Concrete," and Dr. Harold S. Davis, structural engineer, "The Prepacked Placing Method and

High-Density Concrete," both from the General Electric Co.

Second-day speakers included Robert H. Lochow, state paving engineer, Portland Cement Association, "Simplified Design of Concrete Pavements"; Carl Minor, material engineer, Washington Department of Highways, "Pavement Joint Practices"; B. Loyal Smith, Walla Walla county engineer, "Bridge Problems on County Roads"; C. M. Howard, engineer, Concrete Products Association of Washington, "The Development and Use of Concrete Pipe in Highway Construction"; Sen. W. C. Raugust, Odessa, "What Lies Ahead for Washington Highways," and Prof. R. G. Hennes, University of Washington, "Highway Research Council."

Spring affects builders at Palisades Dam

SPRING this year found contractors on Idaho's Palisades Dam anxious to resume their operations. Weekly payrolls on the job are expected to reach \$160,000 this summer at their peak.

Work scheduled for this year on the \$76,000,000 project, marked for completion by 1956, will include placing between 2,500,000 and 3,000,000 cu. yd. of material in the dam; 65,000 cu. yd.

of concrete in the power and outlet tunnels, stilling basin, power plant substructure, and miscellaneous structures; excavation of the spillway tunnel; completing the relocation of 20 mi. of Highway 26; and excavating 1,300,000 cu. yd. from the reservoir basin.

Bids have been asked for the relocation of 5½ mi. of the highway from Big Elk Creek to Indian Creek and for the construction of approaches, abutments, and piers for a highway bridge across the Snake River at Alpine.

SP tunnel relined

TIMBER REINFORCEMENT in the Southern Pacific's 2,000-ft. tunnel through Dorris Hill near the Oregon-California state line is being replaced by a new concrete lining. Morrison-Knudsen Co., Inc., has about 60 men on the job under the supervision of Palmer M. Lee.

2,000,000 cars on road

MORE THAN 2,000,000 cars have passed over the Denver-Boulder toll turnpike in Colorado in the year and a quarter it has been open to the public, according to Mark U. Watrous, state highway engineer.

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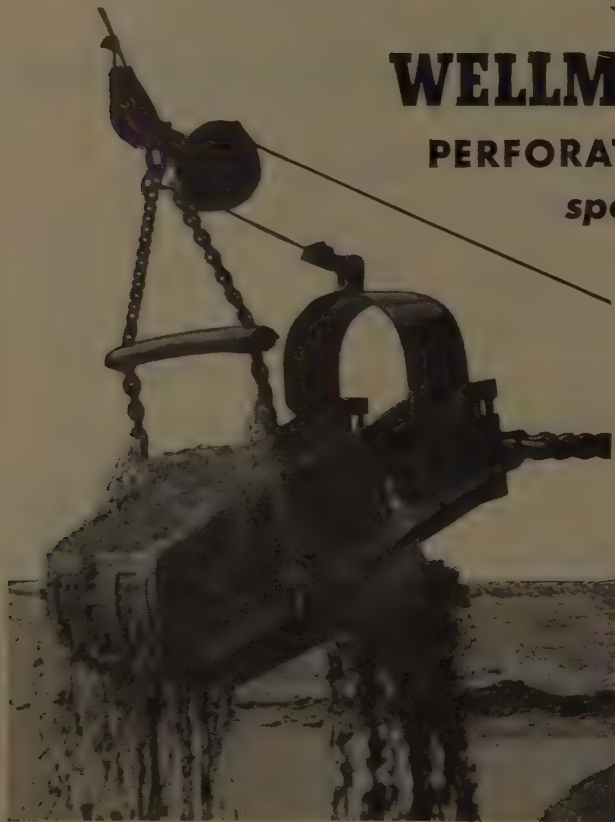
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Excavating for the new Alcoa Plant in Borger, Texas

JOB-ENGINEERED FINANCE PLANS

Here Dean Skinner equipment bites into Texas soil with a heavy 3' x 3' cut. Contractor Skinner excavated 6,000,000 cubic yards of clay and shale for the new Alcoa Plant at Rockdale, Texas.

Mr. Skinner recently called on C.I.T. Corporation to arrange a loan to satisfy working capital and equip-

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NEW BOOKS

SIMPLIFIED DRAFTING PRACTICE—Healy and Rau

The recent General Electric Co. survey on time-consuming and expensive practices in drafting offices created so much interest that two members of the GE organization made a comprehensive study of drafting procedures throughout the company. This book tells what they found out. Their recommendations, mostly contained in the chapter headings, are: simplification; eliminating such unnecessary work as extra views, lines, elaboration, repetition, and crosshatching. They encourage the use of freehand drawing, provided accuracy is retained; take up the use of symbols and such mechanical aids as photography and drafting machines, and advocate the use of standard abbreviations and arrowless dimensioning. The last half of the book is what amounts to a course in simplified drafting, giving examples of drawings, legible lettering, use of instructions, use of forms and related routines, and explaining various types of reproduction processes. The appendix consists of a series of conventional drawings compared with how they would look if they had been drawn according to the new, simplified style. Published by John Wiley & Sons, Inc., New York. 156 pages, 8½ x 11¼. Priced at \$5.00.

STABILIZING CONSTRUCTION: THE RECORD AND POTENTIAL —Colean and Newcomb

Various hypotheses have been offered to explain the past and anticipated fluctuations in the construction industry economy. Economists Miles L. Colean and Robinson Newcomb have analyzed the theories behind the factors involved which determine those unstable conditions. It is commonly observed that the fluctuations are born by the peculiarities of the industry itself and that forces released by its instability contributed seriously to the ups and downs of the economy as a whole. What are these theories and what do they offer to provide more stability to the construction industry? In brief, this study tests "such theories in the light of the characteristics of the products of construction, the processes of getting things built, the kinds of business and labor organizations used in these processes, and the economic and governmental influences that are brought to bear upon their operation." A work which should not fail to interest contractors and others associated with the construction in-

dustry, it contains over 150 pages of appendices, said to be the most complete coverage of basic data anywhere available on the subject. Published by McGraw-Hill Book Co., Inc., New York, 331 pages, 6½ x 9½. Priced at \$6.00.

SCALE MODELS IN HYDRAULIC ENGINEERING—Allen

Many kinds of scale-model experiments, now commonly accepted as important aids to hydraulic engineering design, are discussed in this book, written by a professor of engineering at the University of Aberdeen, Scotland. It takes up in detail the subject of dynamical similarity and its general implications in fluid mechanics, and describes some scale-model experiments with weirs, spillways, sluice gates, bridge piers, dams, and the like with which the author is familiar. Problems in the subject are split into two broad classes, one involving the flow of water between or over fixed boundaries and the other dealing with erosion and accretion. Modern experiments in both fixed and erodible boundary problems are described. The laboratory study of wave-phenomena is reviewed, and both the tidal and non-tidal portions of rivers are discussed. Formulae, drawings, and photographs are used to clarify points of discussion. Published by Longmans, Green and Co., New York. 415 pages, 5¾ x 8¾. Priced at \$8.00.

Books reviewed in this section are made available by J. W. Stacey, Inc., retailers of technical books (stores at San Francisco and Denver). You may obtain a copy of any book reviewed this month by sending an order to J. W. Stacey, Inc., c/o Western Construction, 609 Mission St., San Francisco 5, California. C.O.D. orders will be accepted.

TABLES AND FORMULAS FOR FIXED END MOVEMENTS OF MEMBERS OF CONSTANT MOMENT OF INERTIA—Rogers

Here's a valuable labor-saving manual for finger-tip information, one which will give structural design engineers solutions of fixed end moments for rigid frames and continuous beams. Arranged for easy readability, these tables furnish the fixed end movements for practically all possible loading conditions without the solution of any formulas. Each condition is separately indicated with a loading diagram, mathematical formulas, tables of fixed end moment coefficients, and charts. Author Paul Rogers is a widely-experienced consulting engineer. Published by Frederick Ungar Publishing Co., New York. 95 pages, 6¼ x 9½. Price \$3.75.

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**AN EASY WAY TO
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WEIGHING 44 TONS**

THE WISE CONTRACTOR is prepared for emergencies. The River Construction Company, laying pipe across the Trinity River, faced an emergency when a speeder LS 85 dragline slipped into 58 feet of water. This equipment was valuable and urgently needed on the job. The problem was to get it out and get it quickly. Let Mr. B. C. Hall, spread superintendent, tell how he rescued this heavy piece of machinery: "The only solution was to hook up two cables from two Carco winches and lift the speeder out. Those two Carco winches brought out that 44-ton dragline like it was a pail of water from a well. On construction work, the Carco winch can't be beat for long life, pulling power and all-around efficiency."

Rescue work is only one of the many uses of a Carco winch. You'll find them valuable, too, in pulling or lifting pipe, in towing heavy equipment, in loading or unloading cars, in a variety of jobs on pipeline and heavy construction work.

Remember, you can expect greater value from the leading producer, and get it from Carco, first in winch production. PACIFIC CAR AND FOUNDRY COMPANY, Renton, Washington. Branches at Portland, Oregon, and Franklin Park, Illinois.

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ENGINEERS ON THE MOVE

A long term of service with the Bureau of Public Roads was recently terminated by the retirement of **Thomas H. MacDonald**, head of the department since its inception in 1919. The 72-year-old commissioner immediately left to accept a post as advisor at Texas A. & M. College. At

Thomas H. MacDonald, retired head of the Bureau of Public Roads



the time of the announcement, MacDonald stressed the need for better highways, a mere 24% of which he considers adequately serves present-day highway demands. He was immediately replaced by **Francis V. du Pont**, who served 23 years as chairman of the Delaware State Highway Commission.

Arthur W. Brown, regional chief of cadastral engineering for the Bureau of Land Management in Colorado and Utah, recently retired. From 1920 to 1947 he was located in Denver, and from that date until his retirement he was at the Salt Lake City office. **Leo M. Peterson**, Denver, has been appointed as temporary replacement. Brown's retirement ends more than 40 years in U. S. government service.

Dewey Murrow of F. R. Hewett Co. was elected president of the Spokane Chapter, Associated General Contractors. Fellow-officers are **Lafe Materne**, vice president, **James Crick**, second vice president, and **Verne Warren**, secretary-treasurer. Directors are **Frayne McAtee** and **Jack Clifton**.

Danforth E. Apker has been appointed permanent city building official of Anchorage. The position is one which he held in an acting capacity following the resignation of **Ray Mathews** last September 15.

An association of 28 years with the Los Angeles district office of the Portland Cement Association was terminated recently with the retirement of **Paul E. Todd**. Before joining

the Association, Todd was long city engineer of Whittier, Calif.

P. Renwick (Rennie) Green, an employee of the California Division of Highways for 40 years, recently retired. Since 1933 he was chief draftsman for District No. 3 with headquarters in Marysville.

G. L. McLane recently retired from the Bureau of Public Roads after 34 years of active service. He was district engineer at the Phoenix office since 1929, and was succeeded by **Baird M. French**, who formerly held the same post at the Bureau's office in Seward, Alaska.

Francis Fox has replaced **Thomas T. Buell** as superintendent for the California Division of Highway's district at Truckee. Buell has been transferred to the Nevada City-Grass Valley district, and Fox was formerly foreman at Sonora junction.

The Seattle Engineers Club has elected **Bennett M. Saunders** to the presidency for 1953. Saunders is field engineer for the Seattle offices of the Portland Cement Association. He succeeds **Roy L. Gardner**.

Ned P. Clyde, **Richard J. Woodward** and **Arnold Olitt**, partners in the soil and foundation engineering firm of Clyde & Associates, Oakland, Calif., announce a change in the firm name to Woodward, Clyde & Associates.

President of the American Concrete Institute for 1953 is **Henry L. Kennedy**, manager, Cement Division, Dewey & Almy Chemical Co., Cambridge, Mass.

Tony Alston was elected to the presidency of the American Society of Civil Engineers' chapter in Fairbanks, Alaska. Other new officers are **Chuck Behlke**, vice president, and **Jim Rowledge**, secretary-treasurer.

The Tacoma Chapter, Associated General Contractors, has elected **L. B. MacDonald** president for 1953. Other new officers are **P. F. Stevens**, vice president, and **R. H. Hartman**, treasurer. Members of the Building Division board of directors, **T. W. Anderson**, **Robert Earley**, and **W. E. Geotting**, were re-elected, as were mem-

bers of the Highway Division board of directors: **J. D. Shotwell**, **J. A. Woodworth**, **A. S. Macdonald**, **Lige Dickson** and **George A. Mason**.

Macdonald, who served as vice president last year, succeeded **J. A. Harrison**. The latter automatically became a member of the board of directors. **C. W. Todd**, secretary-manager, is aided by **Mae C. Liebel**, assistant secretary.

Don L. Cooney of Seattle, head of Don L. Cooney, Inc., has succeeded **T. H. Youell** as president of the Mountain Pacific chapter, Associated General Contractors.

Robert E. Quoidbach, Quoidbach Construction Co., has replaced **Amos Peters** as president of the Longview-Kelso (Wash.) Contractors Association. Other new officers are: **K. T. Henderson**, vice president; **Sam Steiner**, secretary; **Charles Hansen**, treasurer; **J. B. Mack**, trustee, and **Harry Calbm, Jr.**, executive secretary.

Charles Smith has been appointed road superintendent of Nevada County, Calif. He had been employed by the federal government for more than 20 years as an access road construction superintendent.

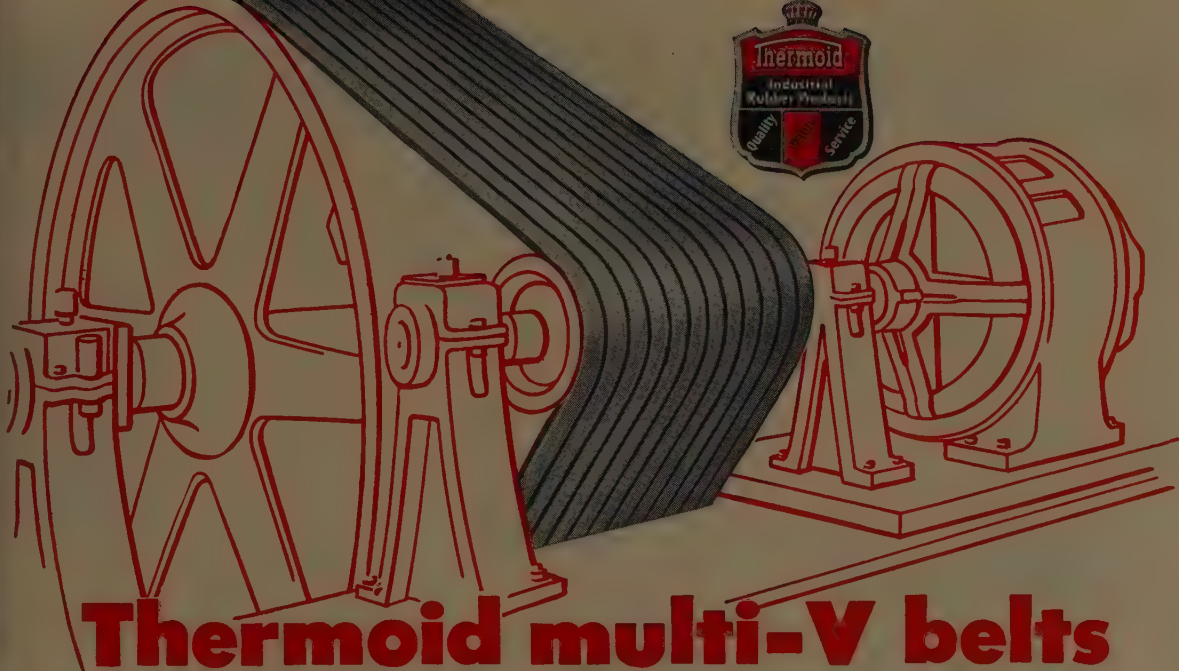
DeCoy Larsen, an assistant materials engineer for the Bureau of Reclamation, has been transferred to the Madera Construction Division of the Central Valley Project at Friant, Calif., from the Cachuma Project at Goleta, Calif.

Tom V. Durkin has been reelected president of the Walla Walla (Wash.) Valley Contractors Association. Others chosen at the group's annual meeting were **Les Ritchie**, vice president; **L. K. Jones**, secretary-treasurer, and **Lester Keen**, **Gordon Gilmore**, **Eldon Woodhall**, and **Jones**, board members.

Alfred Rear, resident bridge engineer with the Oregon State Highway Department at Reedsport, has been named city manager of Reedsport to replace **Byron Serfling**, who resigned to enter private business.

Col. Fremont S. Tandy, former chief of the U. S. Coast and Geodetic Survey at Panama will replace **Col. William H. Mills** as Walla Walla district engineer for the Corps of Engineers. Col. Mills will leave for France this month on a new engineering assignment.

Lowell J. Stephenson of Oakland, Calif., has been designated project engineer on the design and supervision of construction of Section 8 of the Garden State Parkway in New



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Jersey. His previous assignment was as resident engineer on Section 6 of the New Jersey Turnpike. Stephenson is a construction engineer for the O. J. Porter & Co. firm of consulting engineers.

Six U. S. Bureau of Reclamation representatives are in Formosa to study the possibility of building the highest concrete dam in the Far East at the request of the Chinese Nationalist government, according to Douglas McKay, Secretary of the Interior. The project would add 20,000 kw. to that nation's power capacity. Members of the group are E. R. Dexter, Design and Construction Division, Denver; Charles F. Content, regional geologist, Billings, Mont.; James Quann, drill foreman, Grand Coulee Dam; W. A. Dexheimer, assistant chief construction engineer, formerly at the Snowy Mountain Project in Australia; Paul Sharkey, regional hydrologist, Amarillo, Tex.; and Claude T. Jamison, engineering geologist, Missouri River Basin Project.

A long-term program of waterflow, geologic, and soil investigations leading to the development of water and power resources in Ethiopia is being conducted by a five-man team from the Bureau of Reclamation. Team

members are Tom C. Clark, area engineer of the Weber Basin Project, Utah, project manager; Erle N. Menelley, supervising hydrologic engineer at the Spokane, Wash., area office, hydrologist; Keith E. Davis, Wolf Point Field, Mont., soil scientist; William T. Walters, engineer in the Office of Foreign Activities at Washington, D. C., acting field engineer; and Dallas B. Watkins, who transferred from a Technical Cooperation Administration assignment in South America, chief, engineering surveys.

The Metropolitan Engineers, Inc., 140 W. Second St., Salt Lake City, is a new firm which will handle all types of engineering but anticipates specializing in the field of city engineering and planning. Roger W. Sheridan, David L. Sargent, James R. Barton and Harold S. Carter form the affiliation.

Two long terms of service with the Bureau of Reclamation ended recently with the retirements of Leo J. Foster, design and construction division consulting engineer, and Laurence R. Smith, chief of the central supply services branch. Foster's 48 years is said to have established the Bureau's longest service record. Smith was an employee for 36 years.

CALENDAR OF MEETINGS

May 21-22—Western Section, Institute of Traffic Engineers, annual convention at University of Washington, Seattle.

June 17-19—American Society of Civil Engineers, spring meeting at Casablanca Hotel, Miami Beach, Florida.

June 22-26—American Society for Engineering Education, annual meeting at University of Florida, Gainesville.

Sept. 14-16—Associated General Contractors, mid-year board meeting at Edgewater Beach Hotel, Chicago.

Oct. 7-9—Western Association of State Highway Officials, annual meeting at La Fonda Hotel, Santa Fe, New Mexico.

Oct. 15-18—Region 12, Associated Equipment Distributors, annual conference at Gearhart Hotel, Gearhart, Oregon.

1954

March 14—Associated General Contractors, 35th annual convention at Statler Hotel, Los Angeles.

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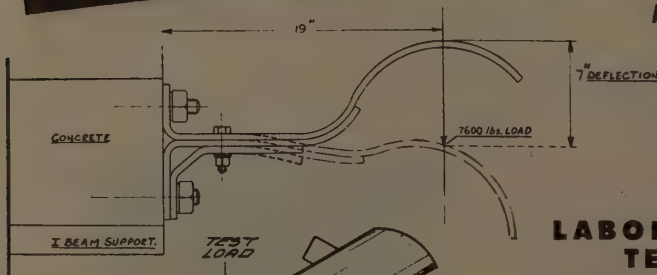
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Insuring Greater Safety Lower Maintenance Cost

New Guard Rail Panel has twice as much arch as former design ... will stand 2 1/4 times as much load before buckling.

New U.S. HG 26 Supporting Post, made of heat-treated Chrome Vanadium Steel has 3 leaves securely anchored to concrete base. It can absorb more energy from impact because it YIELDS without breaking.



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1. The U.S. HG 26 Highway Guard Post deflected 7" under 7,600 lbs. without permanent distortion.
2. A section of two new deep arch design panels, bolted together, required in excess of 90,000 lbs. load to tear them apart.
3. The new panel, resting on V blocks spaced 10 ft. apart, resisted a center load of 1,750 lbs. before permanent buckling. The former shallower panel, tested in the same manner, took a permanent deformation at only 795 lbs. load.



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DEATHS

Clyde W. Wood, well-known California contractor, died suddenly at Huntington Hospital, Pasadena, Calif., March 31. He was 62 years of age.



Clyde
Warren
Wood

Wood was founder of Clyde W. Wood & Sons, Inc., general contractors, and Wood Manufacturing Co., manufacturers of roadbuilding equipment, both of North Hollywood, Calif. He came to California in 1910, and to Los Angeles in 1935. In the general contracting business for more than 30 years, he constructed highways, canals, dams, bridges, tunnels and airports throughout California and the West. Wood was one of the joint venture builders on Shasta Dam.

He was a member of the American Society of Civil Engineers and past president of both the Southern California and Northern California Chapters of the Associated General Contractors. Both the construction and manufacturing business will be carried on under the supervision of sons now active in the business.

J. Gordon Turnbull, 62, nationally-known construction engineer, died April 1 in Los Angeles. His career began in Portland where he designed several major buildings and pioneered in construction of many hydroelectric and power transmission projects in the Pacific Northwest. He then went to Seattle, where he designed the Government locks linking Puget Sound and Lake Washington. He was president of J. Gordon Turnbull, Inc., which he founded in 1941. He was responsible for the planning and design of Richland, Wash., and part of the design of the nearby Hanford atomic works.

Frank Blessing, 64, retired inspector of public works for the San Francisco Water Dept., died April 3 in San Francisco.

John T. McGrew, 58, engineer with the Bureau of Reclamation, died April 4 in Yuma, Ariz.

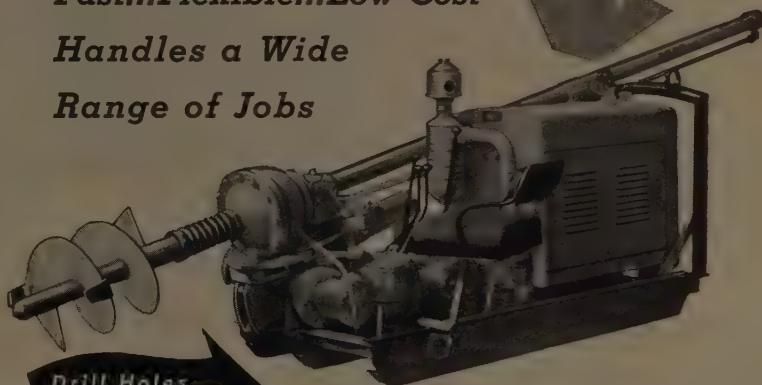
Roman Golish, 70, retired contractor and builder, died April 6 in Los Angeles.

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BD-11



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Drilling 45° hole for pole anchor.

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SUPERVISING THE JOBS

At Parks Air Force Base, Calif., various buildings are going up under the supervision of **Charles Champion**, project manager for **Stolte, Inc.** **Roger Griffin** is field engineer; **William Adams**, carpentry superintendent; **Frank Jacklin**, **Cliff Edman**, and **Olden C. Lee**, carpentry foremen, and **Frank Contardi** and **Rex Clingsmith**, labor foremen. Resident engineer is **John C. Kuhta**.

R. B. Strube is superintending construction of a new telephone building in **Walnut Creek, Calif.** **Manson Bros.** holds the contract. **I. L. Swartz** is cement finishing foreman for **George Green**, the subcontractor for cement work.

Harry J. Saddler, superintendent, and **W. P. Wells**, foreman, are heading construction of feeder roads in **Adams County, Wash.**, for **P. L. Saddler**, contractor.

First major unit of a freeway going through **Placerville, Calif.**, is beginning under the leadership of **B. V. Fredrickson**, project manager for **Fredrickson & Watson**, which holds the \$294,999 contract. **Lloyd Ericson**, superintendent, and **Ernie Adams**, engineer and timekeeper, also are on the job.

A bascule bridge, between **Bay Farm Island** and **Alameda** in the **San Francisco Bay**, has been going up since **July 1951** and is expected to be

J. A. Smith ran the job of pushing a pipeline through **Arizona's desert** (see page 57).



LOOKING OVER the Stolte, Inc., job to replace an outmoded storm drain with reinforced concrete pipe (see page 70) are (from left) Robert Bowen, pile-driving foreman, Bill Cole, superintendent, and Ed Strangard, Oakland construction inspector.

finished in **June 1953**. **C. T. Morton**, project manager, heads the work for **Stolte & Harrelson**. **G. W. Fink** is general superintendent, assisted by **Frank Gendrich**. **Harold Curry** is carpentry foreman and "**Whitey**" **Halager** is labor foreman. **R. O. Valentine** superintends for structural steel and machinery sub-contractor **Judson Pacific-Murphy**. Steel foreman is **Bill McCausland**.

E. M. Beebe is superintendent for a **Carl N. Swenson Co., Inc.**, contract for foundry construction in **Oakland, Calif.** Assistant superintendent is **A. W. Heidel** and **Paul D. Bean** is office manager. Carpentry foremen are **Paul T. Strom**, **Jimmy Dugan**, **Arne Long**, **Walter Hunsford** and **S. A. Hockanson**. **Norman Petersen** is labor foreman and **Bruce R. Gause** is field engineer.

A warehouse for **Owens-Illinois Glass Co.** is going up in **Oakland** under a \$1,200,000 contract held by **Monson Bros.** **Johnny Egyed** does the superintending and **Emil Larson** and **Pete Troelsen** are carpentry foremen. **S. J. Blair** is supervising engineer. **Judson Pacific-Murphy**, which holds the subcontract for reinforcing and structural steel, has **Edward Ryan** superintending.

R. G. Webster, general superintendent, heads work on a large grading and paving job in **Oakland, Calif.**, for **Ball & Simpson**. Foremen are: **L. B.**

Ferdig, shop; **J. V. Bostick**, grade, and **Ken Clark**, labor. **L. D. Mosier** is purchasing agent and **Thelma Webster** is office manager.

Ted Wunderlich of **McCammon-Wunderlich Co.** is project manager on grading and excavation at **Bel-Aire Estates, Tiburon, Calif.** **Jack O'Leary** is grade foreman.

Project Manager **Harold Paul** is heading the job for **Harris Construction Co.'s** contract for constructing the million-dollar **Roosevelt High School** in **Fresno, Calif.** **Anton Johnson** is general superintendent and **Cyrk Stiles** is assistant superintendent.

Funderburk Construction Co. has a job to grade and oil mat surface $1\frac{1}{2}$ mi. of the **Pacific Coast Highway** near **Roseburg, Ore.** **Jens Jensen** is superintendent.

Curley Coleman is supervising construction of a road in **Umpqua National Forest, Ore.**, for **Funderburk Construction Co.**

In **Siskiyou County, Calif.**, **Andrew Cathey**, superintendent, and **Tex Murphey**, master job mechanic, will be found at the site of road work going on under contract to **Eaton & Smith**.

Superintendent **Earl Wilcox** represents **Kiely Construction Co.** on a short paving job in **Powell County, Mont.** **Crusher** and plant foreman is **C. R. Pilcher**.

W. G. (Burney) Bell, superintendent, and **Red Russell**, Bell's assistant, are located in **San Mateo, Calif.**, at the site of 2.1 mi. of road and overpass construction on **Highway 101**. Others on the job are: **Joe Stockton**, job engineer; **M. H. Griggs**, struc-

SUPERINTENDING a canal construction job west of **Grand View, Idaho**, for the **Eagle Construction Co.** is **Edsall Woodall**.



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Hydraulically operated loader is mounted and used without interference from mower. It's like having two tractors for the same modest investment.



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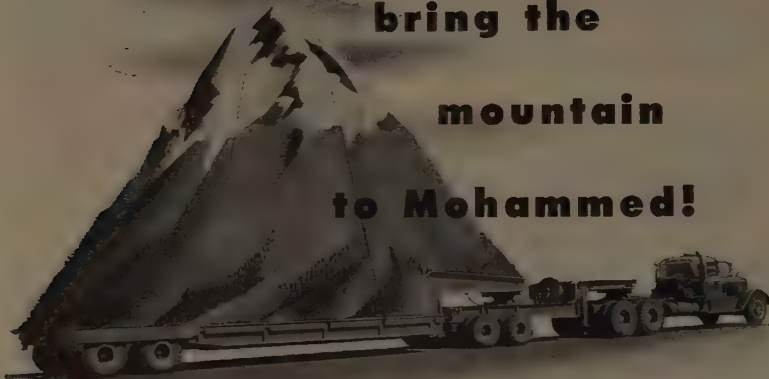
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to Mohammed!



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UTILITY

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Los Angeles 54, Calif.**

tures foreman; S. W. Hall, curbs and gutters foreman; W. E. Kinney, excavation foreman; Leo Zilich, concrete foreman; Otto Haas, master mechanic, and E. J. Moon, office manager. Piombo Construction Co. holds the \$1,600,000 award.

Carl Daniels is project manager for Stolte, Inc., at Fort Ord, Calif., where the contractor is completing construction of permanent troop spaces. Ray Sutton is general superintendent; Vern Ask, assistant superintendent; B. M. Klus, inspector; Myrl McArthur and J. H. Williamson, general foremen, and Kenny Johnson, labor foreman.

C. H. Trigg of C. H. Trigg Construction Co. is putting in a concrete tennis court for Yuma (Ariz.) Union High School.

E. W. Jarrell does the supervising for C. H. Trigg Construction Co., which now has approximately 1,000 homes under construction in Yuma, Ariz.

W. F. O'Neill is project manager for Blaw-Knox Co.'s award for a \$40,000,000 chemical processing plant for the Atomic Energy Commission at Richland, Wash.

Superintendent for England & Roth Construction Co., which is doing 7 mi. of road work in Johnson County, Wyo., is Hubert M. Roth. J. R. England is office manager and Donald F. (Bud) England is foreman.

Reports from Ladd Air Force Base in Alaska list Richard Hix, project manager for Grove, Shepherd, Wilson & Kruege, Inc., heading construction of a hospital. Henry Brown, inspector, represents the Corps of Engineers. Other men on the job are Donald A. Clark, engineer; Raymond E. Young, carpenter foreman; Robert H. Rouse, labor foreman, and Victor G. Foss, office manager.

Two other jobs at the base are under contract to Peter Kiewit Sons' Co. and Fred J. Early, Jr. William Seitz and Frank Fleshman superintend. C. W. Guinn and Floyd Gamill are also on the job. William Phillips and Frank Wright are Corps of Engineers inspectors.

In the vicinity of San Jose, Calif., Joseph L. Farrell is heading a \$2,500,000 contract for Granite Construction Co. The big job is for 8½ mi. of grading and concrete paving. Other key personnel are: Les Pettit, general foreman; William Jensen, structural foreman; Anthony Bruno and Wallace Gibeson, grade foremen; James Gather, concrete foreman; Stanley

Sharp, labor foreman; H. G. Wentworth, pile driver foreman; Mike Metzger, truck foreman; Frank Toles, master mechanic, and William Diehl, office manager. Work started last October and is scheduled for completion in June 1954.

Granite Construction Co. also is doing pile driving on the San Jose-Warm Springs road. Bob Begg superintends, Frank Cooley is general foreman, and Jack Barnhill is concrete foreman.

W. C. Ehrich represents Tombley & Huck in the capacity of superintendent over construction of 24 classroom buildings which are going up at Fort Ord, Calif. Cecil Brophy is assistant superintendent and Lloyd Waller is office manager.

Superintendent R. F. Calou, assisted by G. A. Brown, heads the construction of four bridges in Santa Clara County, Calif., for Fredrickson & Watson. This job will soon be completed. E. I. Adams is field engineer; L. A. Marks, resident engineer; R. K. Plummer and W. H. Thompson are carpentry foremen; W. D. Wilcoxon, paving foreman; C. D. Stanhope, grade foreman; J. F. Pires, labor foreman; George Chaves, master mechanic.

Earthwork and site preparation beginning for construction of new buildings on the UCLA campus is headed by Jack Prince, project manager, and Ray Westmyer, superintendent. M. S. Meacham & Sons is contractor.

John Williams is superintendent for Carl N. Swenson Co., Inc., on a \$1,246,000 award for building concours at the San Francisco Airport.

Now that winter is over, road work is beginning in the Northwest. At one job in Crook County, Wyo., A. M. Willis is job superintendent for grading, draining and miscellaneous work for Peter Kiewit Sons' Co. E. A. Kay is general superintendent and Ed Wang is clearing and pipe superintendent.

Jack Cook, superintendent; Doyle Weigener, engineer, and Walter Trout, office manager, head work on a sewer collection system at Englewood, Colo., for Schmidt Construction Co., contractor.

Ken Baird is superintending road work in Lincoln County, Wyo., for Woodward Construction Co.

In Alaska, George M. Benner is heading work to improve the Cordova

DAVEY Super Chief

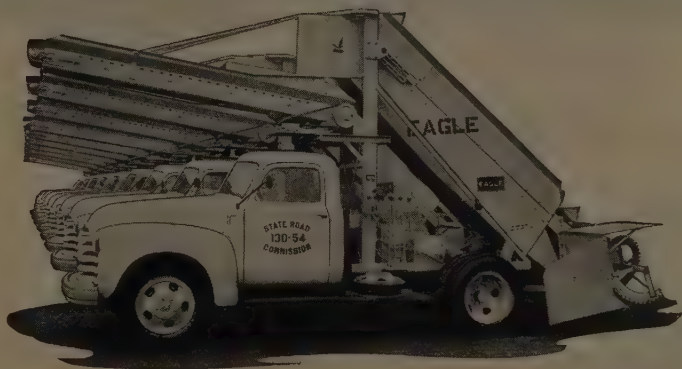
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water system. Carson Construction Co., Inc., a Montana firm, has the contract.

All packing, crating and shipping for Ladd and Eielson Air Force Bases in Alaska is being handled at Fairbanks by P. M. Construction Co. Ray Loeske is project manager and Clem Hogue is general superintendent. Duration of the \$262,000 contract is for one year, beginning this past February 1.

C. B. Carter, project manager, is heading the erection of steel arch forms for permanent barrack installa-

tions at Fort Ord, Calif. H. F. McClelland, general superintendent, is assisted by M. B. Archer. Del E. Webb holds the contract.

Jim Glass is superintending construction of a sewage disposal plant for Millbrae, Calif. Oscar Huffman is carpentry foreman for the \$450,000 contract held by Peter Sorensen.

Granite Construction Co. men under the supervision of Project Manager Bud Parrish are putting in a road at Melones, Calif. The state is represented by Engineer Win Names.

Assisting Parrish are: Tom Bradley, Ray Geimer; Mark Sholar, excavation foreman; Rudolph L. Larson, office manager, and Johnnie Clark, carpenter foreman.

R. J. Gordon is supervising hospital construction at Edwards Air Force Base, Calif., for Alliance Construction Co. Ralph G. Rasmussen is carpentry foreman and L. T. Files is labor foreman.

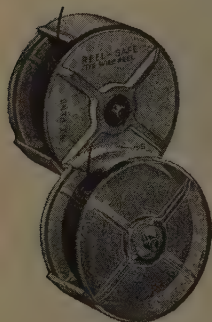
A concrete cooling plant with fiber glass insulation on walls, floor and roof is being constructed for the wholesale butchers in Modesto, Calif., by Fiber Glass Engineering & Supply Co. Project Manager Jones and superintendent Hansen, who are aided by Harry H. Hawkins, assistant superintendent, and Jerry Hawkins, foreman, are heading the job.

C. I. Latimer, general superintendent, and Glenn Tabler, assistant superintendent, are heading engine repairs and construction of assembly shops at Edwards Air Force Base for McDonald Bros., contractor. D. W. Sandman is office manager. The subcontractors, for plumbing, A. B. Jones Co., and for electricity, Sampson Electric Co., have Robert Lipton and Joe Billingslea superintending.

M. G. Curtis, project manager, and Rex B. Stuart, superintendent, are heading the job for the relocation of Track Road in Benton and Yakima counties, Wash. Curtis Gravel Co. has the \$529,090 contract.



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Columbia flow diverted from McNary powerhouse

INCREASED FLOW on the Columbia River caused Army engineers and contractors to push completion of the spillway bays at McNary Dam to divert the water from the powerhouse by raising each bay on the Washington side of the river several feet.

Col. Fremont S. Tandy, Walla Walla district engineer, said there would be a "marked fluctuation in the discharge of the river past the dam" during the period when a head was being built in the pool behind the dam to force water over the spillway.

He said he expected the range of flow past the dam to vary from 100,000 cfs. to about 40,000 cfs. During the process, the Bonneville Dam would be "starved" for two days and might have to draw down on its pool. The McNary navigation lock, closed for several months, will be opened when the water goes over the spillway (expected around the middle of April). Then the pool will gradually be allowed to fill until it reaches a 310-ft. level behind the dam.

GAVIOTA TUNNEL

... Continued from page 82

The crew assigned to the mixing and pumping of the concrete consisted of a master mechanic, a crane operator, an oiler, a batch plant operator, a mixer operator, and a Pump-concrete operator and oiler. The placing crew consisted of a foreman; two carpenters, who constructed and maintained the bulkheads; four internal vibrator operators; one form vibrator operator; and two men who operated the air sluggers and helped handle the slick line.

About 2,800 cu. yd. of concrete were placed in the tunnel lining, with individual pours ranging from 80 to 132 yd., depending upon the section being lined and the amount of over-break. The concrete was placed at the average rate of 22 yd. per hr., with a maximum of 26½ yd. per hr.

Weepers to drain

The completed tunnel will accommodate two traffic lanes 12 ft. wide, with combination sidewalks, curbs, and 2-ft. gutters. Tunnel weepers 3 in. in diameter and 6-in. diameter footing weepers will drain water from behind the lining into drain galleries on either side of the tunnel. Subsurface water which percolates from the tunnel invert will be conducted to the drain galleries through a 6-in. layer of pervious base placed below the 10-in. concrete pavement.

Portal structures will be constructed of reinforced concrete using rough form lumber in contact with the concrete and recess strips to present the appearance of sandstone blocks. The exposed surfaces of the portal structures will be stained a buff color in order that the simulated sandstone blocks will blend in with the surrounding sandstone formation. The portal structures are to be back-filled with selected material.

Lighting and landscaping

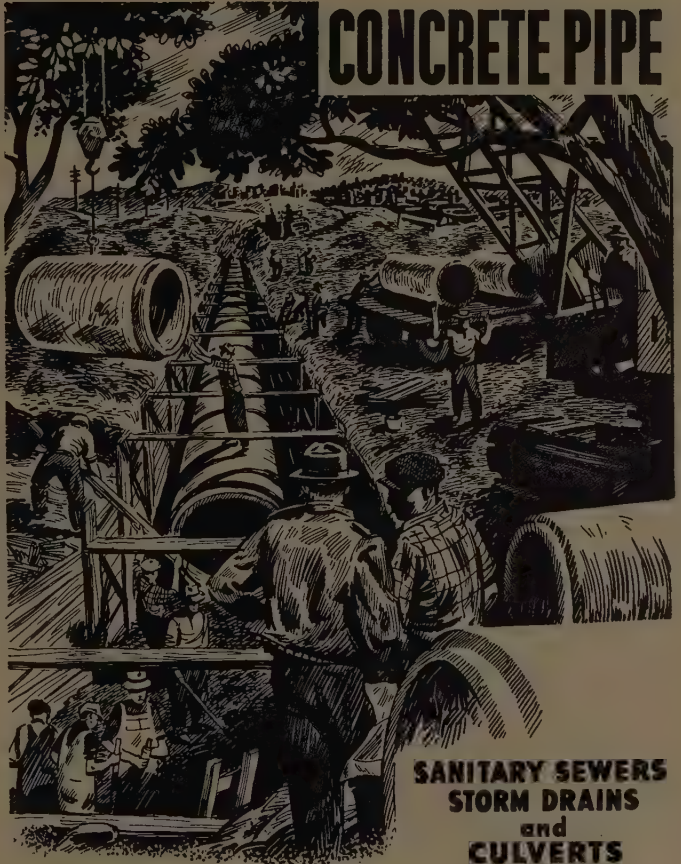
Installation of the lighting system and the landscaping of the area south of the tunnel will be done under separate contracts.

Construction of the Gaviota Gorge tunnel is being administered by E. J. L. Peterson, district engineer for District V of the California Division of Highways. C. I. Brown is assistant district engineer (operations), and M. F. Masters is district construction engineer. The author is resident engineer, assisted by Dean Felton, William Altus, Lowell Kraatz, and Kenneth Taylor.

Contract for construction of the tunnel, including lining, is held by Rhoades-Shofner Construction Co. of Los Angeles. A. A. Mathews is chief engineer for the contractor, and W. A. Ripley is project superintendent.

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CONTRACTS

Summary of bids and awards for major Western projects

Alaska

- \$1,042,790—**Boen-Koon Construction Co.** and **Edge Cummins Construction Co.**, Seattle—Award for seven 2-story frame 8-family quarters bldgs. with outside utilities, Eielson Air Force Base; by C. of E.
- \$5,844,300—**L. E. Baldwin, Inc.**, 1103 No. 36th St., Seattle—Award for 47 eight-family quarters bldgs., Elmendorf Air Force Base; by C. of E.
- \$10,521,750—**Peter Kiewit Sons' Co.**, 1300 Aloha St., Seattle, and **Fred J. Early, Jr., Co.**—Low bid for arctic indoctrination and training school facilities, Big Delta; by C. of E.
- \$2,629,361—**Manson Construction & Engineering Co.**, and **Oseberg Construction Co.**, 821 Alaskan Way, Seattle—Low bid for Beaver Falls hydroelectric expansion, incl. 4,500 ft. of tunneling, a rock-fill conc.-lined dam, penstocks, powerhouse addition, etc.; by Ketchikan Public Utilities.
- \$1,027,141—**S. Macri Construction Co.**—Low bid for crashboat facilities, Kodiak Naval Base; by U. S. Navy.
- \$347,391—**Elka J. Morris**, Fairbanks—Low bid for outside electrical systems, Ladd Air Force Base; by C. of E.
- \$243,685—**Morrison-Knudsen Co., Inc.**, 603 Hoge Bldg., Seattle—Low bid for 8 bridges on Richardson Hwy.; by Alaska Rd. Comm.
- \$11,514,006—**Patti-MacDonald Construction Co.**, 1340 Admiral Blvd., Kansas City, Mo., **Wyatt & Kipper Engineers, Inc.**, and **Thoragard Plumbing & Heating**—Award for powerhouse at Elmendorf Air Force Base; by C. of E.
- \$253,261—**Newbery Electric Corp.**, 1038 Venice Blvd., Los Angeles—Low bid for outside electrical distribution system, Fort Richardson construction area; by C. of E.
- \$911,398—**Newbery Electric Corp.**, 1038 Venice Blvd., Los Angeles—Award for power tie line for powerhouse project at Elmendorf Air Force Base; by C. of E.

Arizona

- \$339,235—**Fisher Contracting Co.**, 2201 S. 19th Ave., Phoenix—Sole bid for 3¼ mi. of grading and draining, U. S. 66, beginning 16 mi. west of Ashfork, Coconino County; by St. Hwy. Dept.
- \$782,110—**Fisher Contracting Co.**, 2201 S. 19th Ave., Phoenix—Award for conc. parking apron, appurtenances, Luke Air Force Base, Phoenix; by C. of E.
- \$2,368,478—**Morrison-Knudsen Co., Inc.**, and **R. A. Westbrook**, 411 W. 5th St., Los Angeles—Award for apron and taxiway, Davis-Monthan Air Force Base, Tucson; by C. of E.
- \$167,166—**Newbery Electric Corp.**, 2146 E. Washington St., Phoenix—Low bid for Group IV, utilities and site development, Yuma Test Station; by C. of E.
- \$315,869—**Dale F. Payne, Contractor**, 2345 W. Thomas Rd., Phoenix—Low bid for about 5.8 mi. of grading, aggregate base, bitum. plant-mix, and seal coat, 8½ mi. east of Sentinel, Phoenix-Yuma hwy.; by St. Hwy. Dept.
- \$586,452—**Vinnell Co., Inc.**, 1145 Westminster Ave., Alhambra, Calif.—Low bid for grading and draining about 4.9 mi. on the Ashfork-Flagstaff hwy.; by St. Hwy. Dept.
- \$296,460—**Vinnell Co., Inc.**, 1145 Westminster Ave., Alhambra, Calif.—Award for reconstructing 5 mi. of Ash Fork-Flagstaff hwy. beginning 3 mi. east of Ash Fork Junction; by St. Hwy. Dept.
- \$172,605—**L. M. White Contracting Co.**, Box 6008, Tucson—Low bid for grading, draining, and placing select material on 2.1 mi. betw. Superior and Ray on the Superior-Winkelman hwy.; by St. Hwy. Dept.

California

- \$748,310—**Guy F. Atkinson Co.**, Box 259, Long Beach—Award for Los Angeles River channel improvement, South Gate, Los Angeles County; by C. of E.
- \$361,820—**Ball and Simpson**, 685 Delaware St., Berkeley—Low bid for grading and placing imported borrow on 0.3 mi. betw. 0.4 mi. north of Petaluma Creek and Petaluma Creek, Sonoma County; by Div. of Hwys.
- \$154,795—**J. S. Barrett**, 1300 Coast Hwy., Newport Beach—Low bid for Sections 1 to 6 of Laguna Beach County Water District; by same.
- \$139,503—**Baun Construction Co.**, 324 Princeton Ave., Fresno—Award for 5.7 mi. of plant-mixed surf. over existing pavement, and existing shoulders to be reconstructed, beginning 1.5 mi. north of Watsonville, Santa Cruz County; by Div. of Hwys.
- \$713,573—**Bishop-Younger-Bradley Co.**, 405 Sansome St., San Francisco—Low bid for bridge and 1.4 mi. of approaches at Ten Mile River, Mendocino County; by Div. of Hwys.
- \$247,925—**Collins Electric Co., Inc.**, P. O. Box 867, Stockton—Low bid for modification and extension of electric power facilities, sub-stations A & B, Travis Air Force Base; by C. of E.
- \$165,662—**Condict Co.**, 806 Hearst Ave., Berkeley—Award for constructing reinf. conc. bridge and approaches across Little Sur River, about 20 mi. south of Monterey on St. Sign Rt. 1, Monterey County; by Div. of Hwys.
- \$1,439,530—**John Delphia**, Box 607, Patterson—Low bid for Big Carson Dam, Lagunitas Creek below Alpine Dam, San Rafael; by Marin Municipal Water District.
- \$837,145—**Fredericksen & Kasler** and **Peter Kiewit Sons' Co.**, Edwards, Calif.—Award for roads and streets, Edwards Air Force Base; by C. of E.
- \$555,555—**Fredericksen & Watson Construction Co.**, 873 81st Ave., Oakland—Low bid for grading a 4-lane divided hwy. on U. S. 99 betw. Boulder Creek and Project City, and constructing a bridge across Churn Creek, Shasta County; by Div. of Hwys.
- \$8,201,567—**General Construction Co.**, **Pacific Bridge Co.**, **The Shea Co.**, 2801 W. Mission Rd., Alhambra, and **Henry J. Kaiser Co.**—Low bid for Schedule I, Donnell Dam, Tri-Dam Project; by Oakdale Irrigation District and South San Joaquin Irrigation District.
- \$7,119,487—**General Construction Co.**, **Pacific Bridge Co.**, **The Shea Co.**, 2801 W. Mission Rd., Alhambra, and **Henry J. Kaiser Co.**—Low bid for Schedule II, Donnell tunnel and penstocks, Tri-Dam Project; by Oakdale Irrigation District and South San Joaquin Irrigation District.
- \$1,251,544—**General Construction Co.**, **Pacific Bridge Co.**, **The Shea Co.**, 2801 W. Mission Rd., Alhambra, and **Henry J. Kaiser Co.**—Low bid for Schedule III, Donnell powerhouse, Tri-Dam Project; by Oakdale Irrigation District and South San Joaquin Irrigation District.
- \$218,680—**John C. Gist Co.**, 2909 C St., Sacramento—Low bid for Schedule VI, Goodwin Dam revisions, Tri-Dam Project; by Oakdale Irrigation District and South San Joaquin Irrigation District.
- \$2,114,000—**M. H. Golden Construction Co.**, 3485 Knoll St., San Diego—Low bid for additional training facilities (2nd increment), Naval Training Center, San Diego; by U. S. Navy.
- \$138,809—**J. E. Haddock, Ltd.**, 3538 E. Foothill Blvd., Pasadena—Award for about 2.1 mi. of widening and plant-mixed surf. on PCC base and existing pavement, Valley Blvd., Los Angeles County; by Div. of Hwys.
- \$6,557,202—**Macco Corp.**, **Morrison-Knudsen Co., Inc.**, Box 450, Boise, Idaho, and **River Construction Corp.**—Low bid for Schedule V, Tulloch Dam and powerhouse, Tri-Dam Project; by Oakdale Irrigation District and South San Joaquin Irrigation District.
- \$987,997—**Morrison-Knudsen Co., Inc.**, 411 West 5th St., Los Angeles—Award for preparation of roadbed for relocation of main railroad line, approx. 24.73 mi. in Kern County; by Atchison, Topeka & Santa Fe Railroad Co.
- \$132,688—**Osborn Co.**, 3200 E. Edgecliff Lane, Pasadena—Award for about 2 mi. of plant-mixed surf. on cement-treated base and existing pavement, Foothill Blvd., Los Angeles County; by Div. of Hwys.
- \$160,500—**Pacific Electric Co.**, 743 Columbia St., San Diego—

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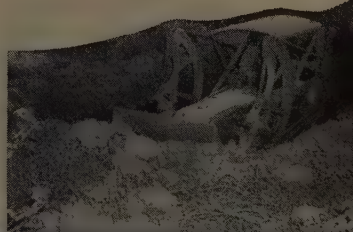
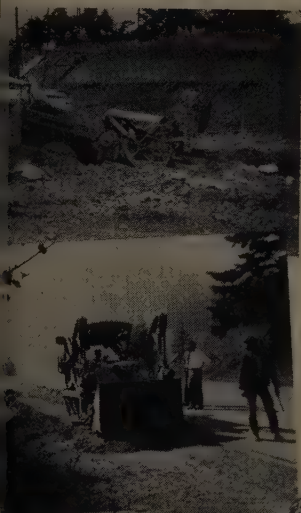
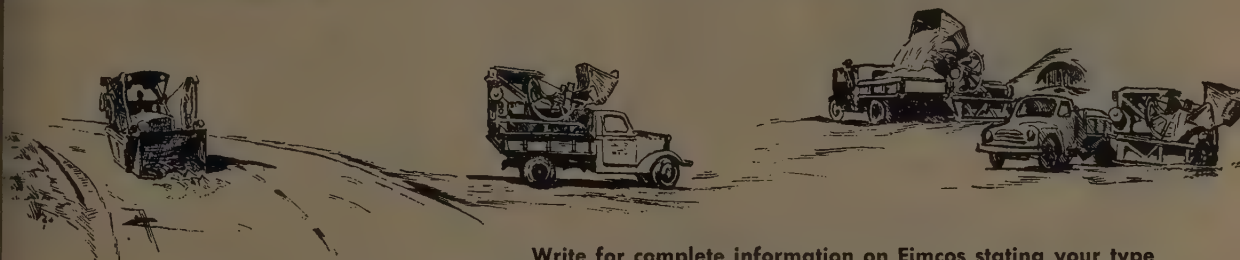
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- Built-in relief valve.
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- Mounts any convenient location.
- Use singly or in series—interconnect with standard pipe nipples.



Model 400 (shown) operates double acting cylinders; Model 300, single acting cylinders. Capacity 16 g.p.m.; pressure to 1250 p.s.i.

LIST

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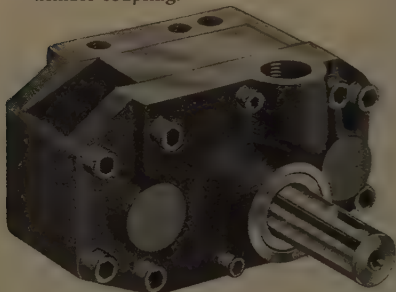
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Model KJ (shown) has pump capacity of 12 g.p.m. Shipping wt. 22 lbs. Model KJH, 8 g.p.m., shipping wt. 20 lbs. Both develop 1000 p.s.i.

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MAin 2783

Low bid for renovating electrical distribution system, Marine Corps Recruit Depot, San Diego; by U. S. Navy.

\$328,680—Scott-Buttner Electric Co., Inc., 896 W. Grand Ave., Oakland—Low bid for modification and extension of electrical distr. system, Travis Air Force Base; by C. of E.

\$135,589—Arthur B. Siri, Inc., 1357 Cleveland Ave., Santa Rosa—Low bid for 1.8 mi. of widening and surf. on St. Sign Rt. 29 betw. Oakville and Rutherford, Napa County; by Div. of Hwys.

\$225,685—Stolte, Inc., 8451 San Leandro St., Oakland—Low bid for water supply and storage modifications, McClellan Air Force Base; by C. of E.

\$855,435—Taylor, Sloan & Solomon, 1034 8th Ave., San Diego—Award for sanitary sewer trunk main, water trunk main, water storage tank, San Diego; by City.

\$261,441—A. Teichert & Son, Inc., Box 1113, Sacramento—Award for grading and surf. 3.1 mi. of secondary county rds. on Pacific Ave. betw. 500 ft. no. of Hammer Lane and Calaveras River bridge, San Joaquin County; by Div. of Hwys.

\$659,580—J. H. Trisdale, Inc., Box 779, Redding—Award for 7.8 mi. of grading and a bridge nr. right abutment of Shasta Dam; by Shasta County.

\$1,215,180—Ukropina-Polich-Kral and John R. Ukropina, 201 E. Las Tunas Dr., San Gabriel—Award for 4 mi. of grading and PCC paving and a reinf. conc. bridge, betw. Yolo Causeway and Tower bridge, Yolo County; by Div. of Hwys.

\$2,588,202—United Concrete Pipe Corp., Box 425, Baldwin Park—Low bid for earthwork, pipelines, and structures, incl. pumping plants, Unit 2, Friant-Kern Canal distr. system, Central Valley Project; by USBR.

\$159,778—Victor Weidmer, P. O. Box 532, Penryn—Low bid for a reinf. conc. bridge approach and detour across Putah Creek about 4 mi. northeast of Middletown, Lake County; by Div. of Hwys.

\$6,587,130—R. A. Westbrook, Morrison-Knudsen Co., Inc., and Ford J. Twaits Co., 411 W. 5th St., Los Angeles—Low bid for runway and airfield pavement, Directive No. 6, Edwards Air Force Base, Edwards; by C. of E.

\$2,009,470—Williams & Burrows, Inc., 18 W. Orange Ave., South San Francisco—Award for administration bldg., shop, etc., Capuchino High School Unit No. 4, San Bruno; by San Mateo High School District.

\$7,926,673—Winston Bros. Co., 1532 S. California Ave., Monrovia, and Al Johnson Construction Co., Minneapolis, Minn.—Low bid for Schedule IV, Beardsley Dam and powerhouse, Tri-Dam Project; by Oakdale Irrigation District and South San Joaquin Irrigation District.

Colorado

\$228,850—G. E. Blanchard, 4615 E. 6th Ave., Denver—Low bid for 8½ mi. of grading, structures and paving, State 113 so. of Peetz to Nebraska state line; by St. Hwy. Dept.

\$9,000,000—George A. Fuller & Co., 597 Madison Ave., New York—Award for 23-story office bldg., plaza and transportation bldg., and 2 more floors to Sears-Roebuck bldg., Denver.

\$222,960—L. H. Kilgore, Denver—Low bid for rebuilding a portion of East 4th St. viaduct on State 96, Pueblo; by St. Hwy. Dept.

\$110,750—Western Foundation Construction Co., and C. F. Stirn, 1654 Broadway, Denver—Low bid for earthwork, structures, and surf. Pole Hill access road, Estes Park-Foothills power aqueduct, Colorado-Big Thompson Project; by USBR.

Idaho

\$2,154,620—American Elin Corp.—Low bid for four 30,000-kva. generators for Palisades power plant; by USBR.

\$499,620—S. Birch & Sons Construction Co., Ford Bldg., Great Falls, Mont.—Low bid for 5½ mi. of road relocation nr. Palisades reservoir; by USBR.

\$1,573,062—Kloepfer & Gramkow, 416 S. 6th St., Boise—Low bid for various bldgs., Mountain Home Air Force Base; by C. of E.

\$123,800—Mountain State Construction Co., Municipal Airport, Pocatello—Award for North Side interceptor sewer, Pocatello; by City.

\$211,890—Quinn Bros. & Robbins, 703 S. 16th St., Boise—Award for 2.7 mi. of plant-mixed bitum. surf., Boise Valley hwy., Ada County; by St. Dept. of Hwys.

\$4,583,030—**Utah Construction Co.**, 142 E. 3rd South St., Salt Lake City—Award for first phase of ground testing facilities, incl. assembly and maintenance area, admin. bldg., etc., Arco; by AEC.

Nevada

\$1,000,000—**Haas & Haynie**, 275 Pine St., San Francisco—Award for parking garage, Reno; by Nevada Parking, Inc.

\$132,380—**George E. Miller**, Box 1728, Reno—Low bid for utilities extension, Nellis Air Force Base, Las Vegas; by C. of E.

New Mexico

\$1,594,539—**Allison & Haney**, 1412 N. Broadway, Albuquerque—Award for water transmission and water feeder lines, Albuquerque; by City.

\$483,719—**O. D. Cowart**, Albuquerque—Award for 7.8 mi. of grading, and rd.-mixed asph. surf. on U. S. 70 and 80, Luna County; by St. Hwy. Dept.

\$405,690—**Jackson Construction Co.**, 203 N. 9th St., Rocky Ford, Colo.—Low bid for 1953 emergency repair program, incl. levees, excavation, river bank protection, etc., Middle Rio Grande; by C. of E.

\$263,647—**Peter Kiewit Sons' Co.**, Box 8787, University Park Sta., Denver, Colo.—Award for 18 mi. of grading and rd.-mixed asph. surf. on U. S. 85, San Miguel County; by St. Hwy. Dept.

\$208,709—**Harry Trotz**, Lovington—Award for 133.7 mi. of rolling and sealcoat on various highways in several counties; by St. Hwy. Dept.

Oregon

\$161,885—**Acme Construction Co.**, Box 306, Eugene—Award for 1.64 mi. of grading, a 90-ft. conc. bridge and 5.14 mi. of paving, Molalla Junction-Marquam section of Cascade hwy. north of Marquam, Clackamas County; by St. Hwy. Comm.

\$139,643—**Babler Bros.**, 4617 S.E. Milwaukie Ave., Portland—Award for 75.9 mi. of re-oiling on 7 hwy. in central Oregon; by St. Hwy. Comm.

\$155,315—**Central Heating Co. and F. L. Somers**, 865 Olive St., Eugene—Award for 1.23 mi. of grading and paving and furnishing 3,000 cu. yd. crushed material in stockpiles, Jacksonville Grade unit, Provolt-Jacksonville section of Medford-Propolt hwy., Jackson County; by St. Hwy. Comm.

\$593,135—**Coos Bay Dredging Co., Inc.**, Box 217, Coos Bay—Award for 2.17 mi. of grading and paving, South unit, Elbow Lake-Gardiner section of Oregon Coast Hwy., Douglas County; by St. Hwy. Comm.

\$3,085,410—**Donald M. Drake Co.**, 1600 N.W. Savier St., Portland—Award for general contract, 14-story teaching hospital, University of Oregon Medical School; by State.

\$141,398—**Larson Construction Co.**, Box 120, Astoria—Award for a 300-ft. reinf. conc. bridge and ½ mi. of grading, Nehalem hwy., Clatsop County; by St. Hwy. Comm.

\$166,515—**Tom Lillebo**, Reedsport—Award for a 514-ft. reinf. conc. and steel truss bridge crossing North Umpqua River on North Umpqua rd., Douglas County; by St. Hwy. Comm.

\$218,535—**John A. Logan**, 12355 S.E. Steele, Portland—Award for erecting structural steel on 2 bridges, and surf. betw. same, Clackamas River rd.; by BPR.

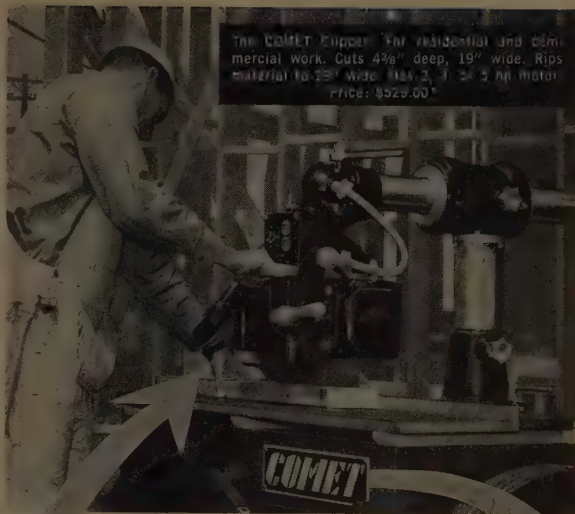
\$4,945,530—**McNutt Bros. and C. J. Montag**, 7805 N.E. Halsey St., Portland—Award for Dexter Dam and powerhouse, Look-out Point Project, Lane County; by C. of E.

\$124,405—**Midland Constructors, Inc.**, 3332 E. Florence St., Huntington Park, Calif.—Low bid for Detroit substation foundations and structures, and part of Detroit-Albany 230-kv. line, Marion and Linn counties; by BPA.

\$294,205—**Power Line Construction Co.**, Pocatello, Idaho—Award for 124 mi. of rural distr. lines, Grant and Umatilla counties; by Columbia Power Cooperative.

\$208,610—**Smith & White**, Pier 65, Seattle—Low bid for Schedule 4, McNary-Big Eddy 300-kv. transmission line; by BPA.

\$199,880—**Warren Northwest, Inc.**, 9860 N.E. Hancock Dr., Portland—Award for 12 mi. of pavement resurf., Spring Creek Hill-Lobert section of The Dalles-Calif. hwy. about 29 mi. north of Klamath Falls; by St. Hwy. Comm.



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\$423,485—Warren Northwest, Inc., 9860 N.E. Hancock Dr., Portland—Award for 92nd Ave.—Fairview section of the T. H. Banfield Expressway east of Portland; by St. Hwy. Comm.
\$279,020—Warren Northwest, Inc., 9860 N.E. Hancock Dr., Portland—Award for 9.37 mi. of paving, Hayesville School, Battle Creek Junction unit, Salem by-pass sect. of Pacific Hwy., Marion County; by St. Hwy. Comm.
\$178,900—J. G. Watts Construction Co., 4538 S.W. Macadam, Portland—Award for 1.8 mi. of grading, a small bridge and slide removal along 3½ mi. of Jackson Creek rd., Douglas County; by BPR.

\$159,520—Western Electrical Construction Co., 1233 N.W. Lovejoy, Portland—Low bid for Chemawa 115-kv. substation; by BPA.

Utah

\$1,647,240—W. W. Clyde & Co., and Jacobsen Construction Co., 421 W. 13th South St., Salt Lake City—Award for 100 igloo-type ammunition magazines and 2 blocks of bitum. surf., Tooele Ordnance Depot, Tooele; by C. of E.

\$743,167—Strong & Co., Springville—Award for construction at Silver Creek junction, Wasatch County line; by St. Rd. Comm.

\$710,822—Floyd S. Whiting, Box 158, Murray—Low bid for draining, grading, and surf. 5.9 mi. of U. S. 30-S and 189 betw. Echo and Emory, Summit County; by St. Rd. Comm.

\$127,785—L. A. Young Construction Co., Richfield—Award for 14 mi. of asphalt-surf. rd., Dixie Natl. Forest, Washington County; by BPR.

Washington

\$4,078,785—Aluminum Co. of America, Wenatchee—Low bid for furnishing 1,358 mi. of steel-reinf. aluminum cable to be used in construction of McNary-Ross, Chief Joseph-Snohomish and Snohomish-Richmond Beach 345-kv. lines; by BPA.

\$1,033,465—Guy F. Atkinson Co., Box 593, South San Francisco, Calif.—Award for Skagit River bridge in Mount Vernon; by St. Hwy. Comm.

\$179,655—N. A. Degerstrom, E. 15 32nd Ave., Spokane—Award for 2.9 mi. of grading and bitum. surf., P.S.H. No. 3, Dragoon Creek to Denison, Spokane County; by St. Hwy. Comm.

\$420,675—Duncan Construction Co. and Commercial Builders, Inc., Box 302, Moscow, Idaho—Low bid for Block 44 (six) pumping plants nr. Moses Lake, Columbia Basin Project; by USBR.

\$219,010—Freigang Construction Co., 10310 Gravelly Lake Dr., Tacoma—Award for sewage treatment plant with clarifier, filter, digesters, operating house, lift stations, etc., Toppenish; by City.

\$1,397,500—Hall-Atwater Co., 605 13th Ave., Seattle—Award for 21 magazines and 3 storage bldgs., Bangor; by U. S. Navy.

\$414,742—Harrison Bros. Co., 225 Wakefield Dr., Tacoma—Award for clearing, draining, and grading 5.5 mi. of State No. 1, Maytown to Tumwater, Thurston County; by St. Hwy. Comm.

\$141,150—F. R. Hewett & Co., Box 46, Parkwater—Award for 14.4 mi. of light bitum. surf., S.S.H. No. 3-D, Walla Walla County; by St. Hwy. Comm.

\$860,845—Peter Kiewit Sons' Co., Box 491, Longview—Award for clearing, grading, and paving 4.9 mi. on State No. 8, Sleret Ave. to Fisher Rd., Clark County; by St. Hwy. Comm.

\$1,799,605—Long Construction Co., Box 1291, Billings, Mont.—Low bid for 74 mi. of laterals, 8½ mi. of precast conc. pipe lines, and misc. structures, Area E-5, East Low Canal laterals, nr. Warden, Columbia Basin Project; by USBR.

\$3,364,025—MacRae Bros., 2733 4th Ave., So., Seattle—Award for Chehalis River bridge, incl. a 271-ft. bascule span and three 271-ft. steel girder spans, Aberdeen; by St. Hwy. Comm.

\$250,854—McLaughlin, Inc., Box 1824, Great Falls, Mont.—Award for rolling and paving 26.5 mi. on several hwy., Spokane County; by St. Hwy. Comm.

\$120,000—Northwest Precote, Inc., 7343 E. Marginal Way, Seattle—Award for resurf. and seal-coat paving at Renton Municipal Airport; by Boeing Airplane Co.

\$149,100—Pacific Highline Contractors, Eugene, Ore.—Award for new construction and improvements on 77 mi. of power lines; by Columbia County Rural Electrical Assn.

\$218,880—Pacific Sand & Gravel Co., Box 628, Centralia—Award for 7.76 mi. of cement-treated base and asph. conc. paving, P.S.H. No. 12, Deep River east, Wahkiakum County; by St. Hwy. Comm.

\$144,786—Quigg Bros., Aberdeen—Award for stockpiling about 45,000 tons of crushed stone surf. and mineral aggregate on State hwy. Nos. 9, 9-C and 13-A, Bernard Creek to Stevens Creek, Grays Harbor and Pacific counties; by St. Hwy. Comm.

\$233,400—L. D. Shilling Co., Inc., Box 906, Moses Lake—Low bid for earth blanketing, Sta. 1836 to 1973, Potholes East Canal, Columbia Basin Project; by USBR.

\$203,865—L. D. Shilling Co., Inc., Box 906, Moses Lake—Award for grading and resurf. 14½ mi. of county roads, Franklin County; by St. Hwy. Comm.

Wyoming

\$695,000—Stanley H. Arkwright, Inc., 1200 6th Ave. No., Billings, Mont.—Low bid for grading, base course surf., stabilization, and misc. work, 8½ mi. of Green River-Rock Springs rd., Sweetwater County; by St. Hwy. Dept.

\$276,430—Boatright-Smith, Box 703, Rawlins—Low bid for 6.9 mi. of grading, base course surf., stabilization, and misc. work, Rawlins-Medicine Bow rd., Carbon County; by St. Hwy. Dept.

\$166,935—Knisely-Moore Co., Box 77, Douglas—Low bid for base course surf., oiling, and misc. work on about 11½ mi. at various locations in Niobrara County; by St. Hwy. Dept.

\$267,855—Lichty Construction Co., Box 1068, Riverton—Low bid for grading, base course surf. and stabilization, and misc. work, 6.9 mi. of Rawlins-Medicine Bow rd., Carbon County; by St. Hwy. Dept.

\$138,955—Wyoming Improvement Co., Denver, Colo.—Low bid for grading, base course surf., oiling, and misc. work on 10½ mi. of Newcastle-Deadwood, So. Dak., rd., and stockpiling of crushed gravel surf. at Four Corners Junction, Weston County; by St. Hwy. Dept.



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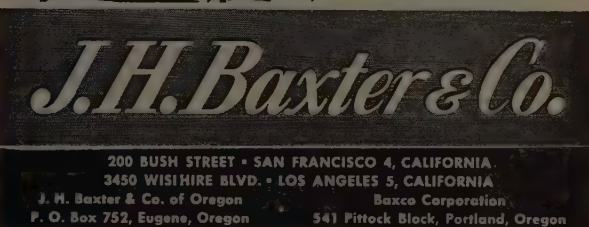
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... Continued from page 71

plants for replacement when the job was finished. As a result, many of the workmen have some trees and plants in their backyards which they didn't have to pay for. A good solution all the way around.

The outfall end of the pipe at Lake Merritt, which was placed first in this section of the job, was beveled on a slope to prevent easy access by youngsters. A normal pipe section, jutting out over the lake, would have been an irresistible attraction for the kids to play walk-the-plank or follow-the-leader. And drownings resulting from some over-eager youngsters falling into the lake might easily have occurred. As an additional safeguard, a rock wall, which lines the eastern shore of the lake, will be rebuilt to fill the gap caused by the construction excavation when the other parts of the job are finished.

Outfall excavation was protected by a cofferdam of steel sheet piling, 35-ft. lengths of Type M-116 section. Two pumps, 2 in. and 3 in. in size, are operated when needed to dewater seepage from the lake into the excavated area. A channel will be dredged through the shallow water at the lake's edge to clear the outfall into the deeper sections before the job is finished.

Excavated material, considered not adequate for backfill, is disposed of by hauling it 6 mi. to waste areas at the Oakland Airport on the eastern edge of San Francisco Bay. Backfill material is provided by barging river sand from Antioch, at the northern end of the Bay, to the Oakland Estuary, which runs between Oakland and Alameda. It is trucked to the job from the Estuary dock.

Equipment used on the job includes a Northwest 1½-yd. backhoe, which does the major excavating. Pipe placing and piledriving is handled by a Lima ¾-yd. crawler crane with a 3,200-lb. drop hammer for driving the timber sheeting. The bearing piles are driven with a No. 2 Vulcan hammer rigged to the Lima. The Lima is also rigged with a ¾-yd. clamshell bucket for additional excavation work. Final excavating is done with a ¾-yd. clamshell bucket rigged on a 10-ton P & H truck crane. A Hough Payloader handles backfill and miscellaneous excavated materials, and eight Auto-car 10-yd. trucks haul dirt to and from the job. A D-7 Caterpillar tractor was used for preliminary rolling and compaction of backfill.

Personnel on the job are, for the City of Oakland, John Morin, construction engineer, and Ed Strangard, construction inspector. Stoltz men are Morris McClure, utilities manager; Bill Cole, superintendent; Louis Loper, general foreman; Robert Bowen, piledriving foreman; and William Ruiz, pipe foreman.

UNIT BID PRICES

Selected abstracts for Western projects

Dam

Dexter Re-regulating Dam and powerhouse

Oregon—Lookout Point Project—C. of E. McNutt Bros. and C. J. Montag & Sons, Portland, submitted a joint low bid of \$4,945,530 before the Corps of Engineers for construction of Dexter Re-regulating Dam and powerhouse. Entire contract covers construction of the earth-fill dam, concrete spillway structure, powerhouse and non-overflow dam, and access features, plus furnishing and installing apparatus specified to be furnished by the Government; at a location about one mi. downstream from Lowell, Ore., on the Middle Fork of the Willamette River. Unit bids submitted were as follows:

	(1)	(2)	(3)	(4)	(5)
(1) McNutt Bros. and C. J. Montag & Sons	\$4,945,530				
(2) Morrison-Kiewit-Macco	4,989,881				
(3) Guy F. Atkinson Co.	5,593,904				
(4) Jones-Grove, Shepherd, Wilson & Kruger				\$6,287,514	
(5) Government estimate				4,109,757	
Lump sum, diversion and care of water	\$451,000	\$144,550	\$590,000	\$777,000	\$117,000
130,500 cu. yd. uncompacted fill and waste	.72	1.02	.80	1.05	.66
62,000 cu. yd. excav., rock	3.70	3.50	3.50	3.75	2.35
25,000 sq. yd. foundation clean-up	3.30	4.50	2.00	4.00	3.80
650 cu. yd. excav., trench	5.50	3.80	8.00	9.00	2.60
157,000 cu. yd. compacted fill, impervious	1.06	1.11	1.60	1.27	.76
574,000 cu. yd. compacted fill, random gravel	.77	.55	.80	.75	.62
10,000 cu. yd. backfill	1.10	2.68	2.00	2.50	1.58
36,000 cu. yd. filters	2.54	3.82	4.20	3.30	2.00
250 M. gal. sprinkling	5.50	4.50	1.50	4.00	2.30
200 roller hr. addtl. rolling for compaction	16.50	12.00	20.00	21.00	11.80
7,500 cu. yd. dumped-stone revetment	2.85	4.45	1.75	5.00	3.00
1,100 lin. ft. drilling 3-in. drainage holes	1.25	1.05	1.75	3.50	1.05
18,210 lin. ft. drilling and grouting anchor bars	1.75	3.30	1.50	1.85	1.52
54,300 bbl. cement, portland	5.00	5.45	4.75	5.00	5.13
15,700 cu. yd. concrete, mass	23.40	30.50	20.04	28.50	18.50
615 cu. yd. conc. in non-overflow dam above elev. 680	39.40	53.20	40.00	41.20	36.20
14,800 cu. yd. concrete in powerhouse	42.00	35.20	40.00	44.25	32.90
4,680 cu. yd. concrete in spillway piers	32.00	37.15	40.00	49.75	31.75
650 cu. yd. concrete in spillway bridge deck	60.00	87.00	90.00	140.00	94.15
9,600 cu. yd. concrete in spillway stilling basin	25.50	32.00	27.00	28.50	18.00
8,100 cu. yd. concrete in gravity walls	30.50	30.00	27.00	31.75	22.85
85 cu. yd. conc. in transformer walkway slabs	30.00	68.00	50.00	41.60	27.90
13,500 lb. furn. and install grout and drain pipe and fittings	.70	.78	.70	.77	.54
2,700 lin. ft. furn. and install 8-in. half round C.M.P.	1.50	3.03	2.00	3.00	2.60
150 lin. ft. furn. and install porous conc. drain tile, 6-in.	1.00	14.10	7.00	2.00	4.90
68 lin. ft. furn. and install open-joint clay pipe, 8-in.	1.25	1.50	10.00	2.50	4.00
1,230 lb. furn. and install catch basins and drains	.75	.64	1.00	.77	1.10
350 lin. ft. furn. and install perf. corr. metal pipe, 8-in.	3.80	3.50	5.00	5.00	2.80
1,600,000 lb. furn. and install struct. carbon steel, non-embedded	.115	.127	.11	.13	.113
471,500 lb. furn. and install embedded struct. carbon steel	.23	.275	.30	.36	.25
40,800 lb. furn. and install corr. resisting clad steel	.24	.30	.35	.39	.40
1 job furn. and install intake trash racks	.74	.717	1.00	.86	.77
2 ea. furn. and install intake bulkhead	\$11,000	\$17,846	\$20,000	\$17,000	\$16,000
2 ea. furn. and install draft tube bulkhead	\$10,500	\$15,680	\$20,000	\$18,500	\$15,360
7 ea. furn. and install tainter gate	\$6,500	\$4,822	\$8,500	\$8,650	\$5,340
2 ea. furn. and install gate seal heaters	\$38,000	\$50,449	\$55,000	\$64,000	\$38,350
1 set furn. and install spillway stop log	\$1,500	\$95.00	\$2,500	\$2,100	\$25.00
1 ea. furn. and install intake bulkhead lifting beam	\$43,000	\$42,259	\$60,000	\$57,400	\$51,260
1 ea. furn. spillway stoplog lifting beam	\$4,000	\$3,566	\$5,000	\$3,375	\$2,240
1 job furn. and install trash rack for fishway water supply conduit	\$6,000	\$4,219	\$10,000	\$4,800	\$4,400
1 job furn. and install bulkhead and lifting beam for fishway water supply conduit	\$1,000	\$1,665	\$1,500	\$1,550	\$1,360
1 ea. furn. and install picketed lead lifting beam	\$2,500	\$2,293	\$4,000	\$2,890	\$4,100
24,000 lb. furn. and install ferrous metal handrail	\$1,500	611.00	\$2,500	700.00	\$1,400
9,200 lb. furn. and install metal hatchcovers, gratings and grilles	.80	.779	.75	.90	.72
53,900 furn. and install misc. metal work	.50	.67	.60	.50	.40
28,000 lb. furn. and install crane rail	.42	.736	.60	.52	.44
1 job powerhouse railroad	.22	.338	.35	.27	.20
7,600 lb. cast-iron	\$2,500	\$2,550	\$4,000	\$1,600	900.00
1 job install Gov't-furn. turbine embedded parts and generator found'n bolts	.50	.672	.65	.62	.49
1 job furn. and install metal flag pole	\$20,000	\$22,439	\$25,000	\$56,500	\$11,360
1 job furn. and install formed steel roof deck and aluminum wall panels	\$3,000	\$1,250	\$1,500	\$1,400	925.00
1 job misc. architect'l features in the powerhouse	\$20,000	\$12,100	\$15,000	\$13,400	\$11,900
1,130 lin. ft. furn. and install rubber water stops	\$35,000	\$6,875	\$20,000	\$18,250	\$11,700
160 lin. ft. furn. and install metal grout stop	2.50	5.15	3.25	4.00	3.35
1 job erect Gov't-furn. 100-ton bridge crane	2.00	16.00	3.25	3.00	17.25
1 job test Gov't-furn. 100-ton bridge crane	\$7,000	\$9,550	\$20,000	\$15,500	\$10,400
1 job furn. and install spillway gate hoist mch'y	\$400.00	\$10.00	\$3,000	\$1,400	345.00
1 job furn. and install water supply and treatment equip.	\$165,000	\$140,000	\$200,000	\$221,000	\$185,000
	\$6,000	\$7,388	\$15,000	\$11,000	\$7,570

(Continued on page 132)

Workhorse **SECO's** ON THE JOB



at Shippingport Sand & Gravel Company
Shippingport, Penna.



WELL KNOWN PRODUCER MAKING BIG TONNAGES OF GRAVEL SIZED RIGHT TO MEET PENNA. SPECS.

Meeting state and other specs. to a T is an important reason why Shippingport Sand and Gravel Company enjoys such a fine reputation with their many customers. At the modern Shippingport, Penna. plant of Shippingport Sand and Gravel Company of Youngstown, Ohio, these Seco vibrating screens are winning the acclaim of the operators for accurate sizing and big production. These rugged screening workhorses (one 5 x 10' single deck scalper and two 5 x 10' double deck Seco's) take the load effortlessly and efficiently to produce a number of sizes including Penna. shot, Penna. 1B, Penna. 2B and minus 1/8" sand. Whatever specs. your sizes have to meet, regardless of the number of sizes, it will pay you to investigate Seco vibrating screens for your job. Send for Catalog No. 203.

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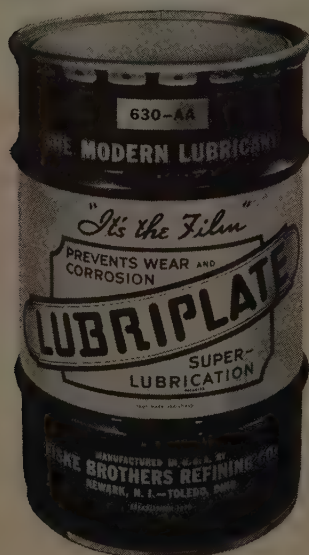
"NO MORE LUBRICATION TROUBLES"

—says
STEPHENS-ADAMSON
MFG. CO.
Conveyor Mfr., Aurora, Ill.

"LUBRIPLATE Lubricants satisfy the 'one-shot' requirements of our conveyor idlers. LUBRIPLATE effectively lubricates each bearing in turn and flows through the hollow shaft to the next bearing. We do not know of a single case of bearing trouble through faulty lubrication where LUBRIPLATE has been used."

For nearest LUBRIPLATE distributor, see Classified Telephone Directory. Send for free 56-page "LUBRIPLATE DATA BOOK"... a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE COSTS.



UNIT BID PRICES CONTINUED

	(1)	(2)	(3)	(4)	(5)
1 job furn. and install septic tank and sewage treatment equip.	\$1,000	\$1,263	\$1,000	\$5,500	950.00
1 job furn. and install 4 vertical turbine pumps	\$9,000	\$5,366	\$12,000	\$6,800	\$7,540
1 job furn. and install lubricating oil transfer and storage equip.	\$3,500	\$4,615	\$3,000	\$3,500	\$3,300
1 job furn. and install elect. unit heaters and appurtenances	760.00	934.00	\$2,000	\$2,200	650.00
1 job furn. and install ventil. fans and appurt.	500.00	732.00	600.00	\$2,000	700.00
15,300 lb. furn. and install cast-iron pipe and fittings up to and incl. 6-in. size	.50	.71	.65	.65	.47
18,260 lb. furn. and install cast-iron pipe and fittings over 6-in. size	.40	.65	.50	.55	.41
2,700 lb. furn. and install steel pipe and fittings up to and including 2½-in. size	.50	.68	.90	.65	.67
9,800 lb. furn. and install steel pipe and fittings over 2½-in. size	.42	.61	.75	.55	.47
150 lb. furn. and install miscel. valves up to and including 2½-in. size	.50	2.30	4.00	3.50	5.60
265 lb. furn. and install std. brass pipe and fitgs.	1.50	1.90	2.50	2.25	2.10
1,650 lb. furn. and install cast-iron valves (3, 4, 6, 8 and 10-in. size)	.60	.73	1.25	1.10	1.10
1 job furn. and install 12-in. sluice gate and valves and appurtenances	.60	.80	1.20	.80	.79
1 job furn. and install 12-in. sluice gate and appurtenances	400.00	385.00	\$5,000	330.00	260.00
5,000 lin. ft. furn. and install ¾-in. galv. conduit and fittings	1.06	1.40	1.75	2.00	1.25
6,200 lin. ft. furn. and install 1-in. galv. conduit and fittings	1.15	2.04	1.90	2.50	1.38
650 lin. ft. furn. and install 1¼-in. galv. conduit and fittings	1.40	2.52	2.50	3.75	2.00
3,400 lin. ft. furn. and install 1½-in. galv. conduit and fittings	1.70	3.13	2.50	4.25	2.05
2,300 lin. ft. furn. and install 2-in. galv. conduit and fittings	2.30	3.95	4.50	5.00	3.35
50 lin. ft. furn. and install 3-in. galv. conduit and fittings	4.00	6.60	6.00	16.00	4.50
150 lin. ft. furn. and install 3½-in. galv. conduit and fittings	5.00	7.45	8.00	11.00	5.00
20 lin. ft. furn. and install 3-in. fiber or asbestos-cement conduit and fittings	5.00	2.10	5.00	4.00	4.15
250 lb. furn. and install embedded elect. cabinets and special boxes, galv. sheet steel	2.25	2.45	2.50	1.90	1.85
1,100 lb. furn. and install special galv. cast-iron boxes	3.00	1.65	3.00	2.80	2.00
12,500 lin. ft. furn. and install No. 12 AWG single conductor wire, 600-volt insulation	.10	.14	.40	.14	.15
2,600 lin. ft. furn. and install No. 10 AWG single conductor wire, 600-volt insulation	.14	.18	.50	.18	.17
1,900 lin. ft. furn. and install No. 8 AWG single conductor wire, 600-volt insulation	.24	.275	.55	.25	.23
200 lin. ft. furn. and install No. 6 AWG single conductor wire, 600-volt insulation	.30	.44	.60	.38	.40
250 lin. ft. furn. and install No. 4 AWG single conductor wire, 600-volt insulation	.40	.60	.70	.60	.42
450 lin. ft. furn. and install three conductor No. 12 AWG cable, 600-volt insulation	1.50	.81	3.50	2.00	.42
450 lin. ft. furn. and install three conductor No. 10 AWG cable, 600-volt insulation	1.50	1.14	3.80	2.25	.52
2,400 lin. ft. furn. and install one conductor 19/25 AWG 1000-volt insulation	.16	1.53	.40	.50	.20
1,800 lin. ft. furn. and install No. 12 AWG single conductor wire, 100-volt insulation	.15	.20	.25	.45	.40
75 lin. ft. furn. and install three-conductor No. 10 AWG wire, 1000-volt insulation	2.00	1.33	4.00	1.40	.85
3,600 lin. ft. furn. and install one conductor No. 10 AWG 1000-volt insulation	.18	.80	.40	.47	.33
14,000 lb. furn. and install bare copper ground conductor and ground rods	1.50	3.32	2.00	2.15	1.11
1 job furn. and install bridge crane trolley feed rail	\$1,110	\$1,305	\$5,000	\$1,600	\$1,360
11 ea. furn. and install 200 watt RLM std. dome fixture with pendant hood, Benjamin Cat. No. 7643 or approved equal	15.00	24.50	12.00	25.00	18.90
10 ea. furn. and install 100 watt RLM std. dome fixture, ceiling mounted, Benjamin Cat. No. 9641 or approved equal	13.75	19.10	12.00	19.00	16.50
20 ea. furn. and install vapor-proof fixtures flush-mounted, Crouse-Hinds Cat. Nos. VGR-1129 and GRV 1493, or approved equal	14.00	30.00	12.00	19.00	26.10
13 ea. furn. and install vapor-proof fixtures, surface-mounted including outlet box, Crouse-Hinds Cat. Nos. GRV 34 and VGR 1139, or approved equal	25.30	28.00	14.00	19.00	29.50
16 ea. furn. and install 750 watt high bay fixture, Holophane No. 690-AL, or approved equal	66.00	50.50	50.00	72.00	44.25
11 ea. furn. and install vertical surface lighting fixture, surface-mounted, Holophane Cat. Nos. E-797-2 and 797-2-0° or approved equal	46.50	48.50	50.00	52.00	37.00
3 ea. furn. and install local lighting fixture, surface-mounted, Holophane Cat. No. E-796-0° or approved equal	25.00	18.00	20.00	35.00	26.50
24 ea. furn. and install fluorescent lighting fixt., surface-mounted, Columbia Cat. No. FHG-240-M13, or approved equal, with lens and wiring to adjacent fixture	72.75	46.20	40.00	56.00	45.50
9 ea. furn. and install recessed sidewalk lighting fixture, Crouse-Hinds Cat. No. KL330, or approved equal with cover	20.40	14.65	20.00	31.00	31.00
4 ea. furn. and install Type RCD-8 recessed lighting fixture, Crouse-Hinds Cat. No. 4494A, or approved equal, with lens	51.50	32.50	50.00	150.00	82.50

(Continued on page 134)

Why the **LIMA** Type **604** develops the greatest capacity per lb. of weight



Main machinery of LIMA Type 604, showing position with relation to center of rotation.

← CENTER OF ROTATION

Lima Type 604 Shovel equipped with a 23 ft. boom, 18 ft. dipper handle and 1½ yard dipper. Note that more than 2/3 of the cab and all of the main machinery are well back of the center line of rotation for maximum counterbalancing effect.

● The LIMA Type 604 shovel, crane and dragline is engineered to produce greatest capacity with minimum weight. This is achieved by placing as much weight as possible *behind* the center of rotation—eliminating the need for excessive counterweight. Hook rollers on which the machinery base revolves eliminate strain from the center pintle—permitting continuous, safe operation at full capacity.

The simple, compact design of the main machinery, using the fewest number of shafts to accomplish the various operations, further contributes to efficient, trouble-free service.

These are only a few of the features which make the LIMA 604 a favorite with owners and operators. The Lima Line includes shovels ¾ to 6 yards, Cranes 20 to 110 tons and Draglines variable.

SALES AGENTS—Our Seattle Office, 1932 First Avenue South, Seattle 4, Washington; Feenaughty Machinery Co., 112 S.E. Belmont St., Portland 14, Oregon; Feenaughty Machinery Co., 600 Front St., Boise, Idaho; Smith Booth Usher Company, Division of Western Machinery Company, 2001 Santa Fe Avenue, Los Angeles 54, California; Modern Machinery Co., 2943 First Avenue South, Seattle 4, Washington; Philpott Equipment Company, 569 Dexter Horton Building, Seattle, Washington; Shriver Machinery Company, P. O. Box 1270, Phoenix, Arizona; Bay Cities Equipment, Inc., 2606 Cypress Street, Oakland 7, California; Cheyenne Truck & Equipment Co., 621 Central Ave., Cheyenne, Wyoming; Acme Iron Works, Culebra Ave. at Expressway N.W., San Antonio, Texas; Cascade Industrial Supply, 515 Market Street, Klamath Falls, Oregon; Contractors Equipment & Supply, P. O. Box 456, Albuquerque, New Mexico; Modern Machinery Company, 4412 Trent Avenue, Spokane 2, Washington; Faris-Moritz Equipment Company, 1095 South Jason Street, Denver, Colorado.

LIMA
SHOVELS • CRANES
DRAGLINES • PULLSHOVELS



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Construction Equipment Division
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Construction Equipment Division

just nail 'em in...
pour your concrete



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WATERSTOPS

Concrete shrinkage can't cause leakage between pours when you're protected by ribbed and grooved polyvinyl plastic Labyrinth Waterstops in the joints.

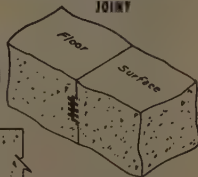
Economical? You bet...No special forms, no metal fins to bend or tear...no maintenance cost, AND...

INSTALLATION COST IS VIRTUALLY ZERO!



FOUR RIB LABYRINTH WATERSTOP IN VERTICAL CONSTRUCTION JOINT

FOUR RIB LABYRINTH SHOWN IN FLOOR SLAB



COMPLETED JOINT

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For Further Information and Sample—Clip the Coupon!
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Send full information and sample.

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UNIT BID PRICES CONTINUED

	(1)	(2)	(3)	(4)	(5)
16 ea. furn. and install Type VCD-6 recessed lighting fixture, Crouse-Hinds Cat. No. 43394, or approved equal, with lens.....	66.00	48.75	70.00	84.00	105.00
4 ea. furn. and install bracket type lighting fixture, Holophane Cat. No. 420, or approved equal, with lens	30.70	25.50	40.00	35.00	34.50
1 ea. furnish and install wall lighting fixtures surface-mounted, Holophane Cat. No. U-818, or approved equal, with lens	52.00	37.20	60.00	93.00	52.00
16 ea. furn. and install wall lighting fixtures, recessed, Holophane Cat. No. U-826, or approved equal, with lens	53.00	35.20	40.00	61.00	42.00
13 ea. furn. and install pedestal mounted floodlight, Crouse-Hinds Type ADE-14 and ADE-16 or approved equal, with mounting bracket and plug	165.00	164.00	100.00	135.00	220.00
3 ea. furn. and install pole mounted floodlight, Crouse-Hinds Type ADE-16, or approved equal, with pole and plug	127.00	97.25	250.00	185.00	225.00
1 ea. furn. and install 25-kva dry type transformer, 480 to 120/240 volts	515.00	366.60	500.00	640.00	733.00
1 job furn. and install unwatering pump and sump pump controls	\$1,000	468.00	750.00	\$1,800	756.00
1 ea. install Gov't-furn. power center CQ1.....	850.00	445.00	\$3,000	\$1,900	560.00
1 ea. install Gov't-furn. power center CQ2.....	750.00	445.00	\$2,500	\$1,450	560.00
1 ea. furn. and install lighting cabinet CR1.....	190.00	213.50	500.00	275.00	180.00
1 ea. furn. and install lighting cabinet CR2.....	192.00	212.10	600.00	320.00	180.00
1 ea. furn. and install lighting cabinet CR3.....	440.00	360.50	\$1,500	600.00	480.00
150 lb. furn. and install surface-mounted sheet metal cabinets	3.00	3.80	1.50	1.30	3.00
3,000 cu. yd. base course	3.10	1.90	3.00	7.00	3.05
750 cu. yd. leveling course	3.40	3.80	3.00	8.00	3.80
400 cu. yd. pond stabilization course	5.50	7.80	3.50	9.00	3.05
725 cu. yd. conc. in fishway and holding ponds.....	60.00	80.00	120.00	84.00	64.90
96,750 lb. furn. and install welded steel pipe for fish facility	.42	.40	.50	.55	.34
1 ea. furn. and install 20-in. gate valve and box	\$1,900	\$1,473	\$1,250	\$1,900	\$1,435
1 ea. furn. and install 18-in. gate valve and box	\$1,500	\$1,120	\$1,250	\$1,400	\$1,200
1 ea. furn. and install 16-in. gate valve and box	\$1,200	821.00	700.00	\$1,100	750.00
1 ea. furn. and install 12-in. gate valve and box	550.00	466.00	400.00	650.00	415.00
1 ea. furn. and install 8-in. gate valve and box.....	250.00	208.00	250.00	400.00	280.00
1 ea. furn. and install 4-in. gate valve and box.....	100.00	82.00	125.00	140.00	70.00
1 job domestic water line	500.00	484.00	\$1,000	\$1,100	440.00
1 job pond sprinkler system	\$2,500	\$2,100	\$5,000	\$11,000	\$6,500
1 job furn. and install weirs, stop-logs, traps and grilles	\$2,000	\$1,170	\$3,500	\$2,500	\$1,425
1 job fishway screens	200.00	450.00	200.00	\$1,000	270.00
1 job drainage assembly Pond No. 1	\$1,500	953.00	\$1,500	\$3,150	\$1,650
1 job drainage assembly Pond No. 2	\$1,700	\$1,083	\$2,000	\$3,150	\$1,730
1 job fishway access bridge	\$5,500	\$6,850	\$7,000	\$6,125	\$5,200
1 job trough shelter, living quarters and utilities	\$22,000	\$12,000	\$15,000	\$13,800	\$8,630
1 job electric serv. and flood lighting system, for fish facilities	\$2,155	\$1,720	\$3,000	\$2,700	\$1,730
1 job field erect, paint and test Gov't-furn. 20-ton gantry crane	\$5,000	\$2,930	\$10,000	\$10,575	\$5,550
5,300 cu. yd. roadway and railroad excav., common	.84	1.00	1.30	1.40	.60
7,200 cu. yd. roadway and railroad excav., rock.....	2.11	2.16	4.00	5.65	2.00
170 lin. ft. 18-in. diam. corr. metal pipe, in place	9.55	7.70	20.00	7.00	5.10
1 job track laying	\$19,800	\$10,300	\$22,500	\$18,500	\$9,225

Airport

Strengthening runways at Lowry Air Force Base

Colorado—Lowry Air Force Base—C. of E. Western Paving Construction Co., Denver, was low among 20 bidders with \$881,613 submitted before the Corps of Engineers for the strengthening of runways at Lowry Air Force Base in Denver. Unit bids were submitted as follows:

(1) Western Paving Construction Co.	\$ 881,613	Alexander Construction Co.	\$1,322,626
(2) Midwest PreCote Co.	1,001,770	Jay W. Craig Co.	1,343,850
(3) The Weitz Co., Inc.	1,021,685	Francis R. Orshek, Inc.	1,403,504
(4) Tecon Corp.	1,061,194	W. Hodgman & Sons	1,410,725
(5) McCarthy Improvement Co.	1,080,587	Northwestern Engineering Co.	1,436,070
— S. Birch & Sons Construction Co.	1,103,583	S. J. Groves & Sons Co., Inc.	1,453,216
— Megarry Bros.	1,176,788	Peter Kiewit Sons' Co.	1,542,541
— C. E. Lytle Co. and Green Construction Co.	1,227,706	J. H. N. M. Monaghan &	1,585,683
— McLaughlin, Inc.	1,243,771	Schmidt Construction Co.	1,673,092
— P. A. Bradbury Construction Co.	1,260,756	(6) Government estimate	1,478,703
— Colorado Constructors, Inc.	1,300,982		

	(1)	(2)	(3)	(4)	(5)	(6)
5,000 cu. yd. excavation	1.20	1.00	1.65	1.50	1.70	.90
Lump sum, adjust exist. railroad to grade	\$18,000	\$16,000	\$18,500	\$17,500	\$18,500	\$14,700
9 ea. adjust exist. drop inlet to grade	85.00	100.00	95.00	100.00	70.00	40.00
9 ea. cover exist. drop inlet	40.00	35.00	50.00	50.00	35.00	45.00
52 ea. adjust exist. box drain to grade	34.00	35.00	40.00	65.00	30.00	30.00
5 ea. adjust exist. manhole to grade	51.00	35.00	80.00	75.00	60.00	25.00
3,180 lin. ft. adjust exist. continuous dr. to grade	1.65	2.00	1.95	2.50	1.45	1.60
132,000 gal. bituminous tack coat	.15	.15	.16	.10	.21	.30
68,660 ton bituminous binder course	5.10	5.60	6.06	6.78	6.63	8.80
48,890 ton bituminous surface course	5.43	7.10	6.00	6.78	7.43	10.80
1,764,000 gal. asphalt cement AP-1	.10	.105	.13	.10	.096	.15
Lump sum, top soiling	\$7,000	\$10,000	\$2,000	\$15,000	\$10,350	\$5,230
Lump sum, seeding	\$11,000	\$10,000	\$11,800	\$7,500	\$12,000	\$4,200
79 ea. adjust exist. high intensity light to gr.	65.00	125.00	80.00	100.00	58.00	50.00
59 ea. adjust exist. med. intensity light to gr.	47.00	60.00	55.00	75.00	41.00	25.00
23 ea. adjust exist. elect. handhole to grade.....	64.00	50.00	75.00	75.00	56.00	30.00

Continued on next page



Model
5-C-720



Model 3-A-65

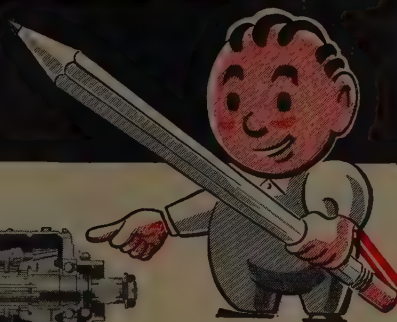
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Model 10-B-1120



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UNIT BID PRICES CONTINUED

Bridge and Grade Separation

Reinforced concrete Fox Island Bridge

Washington—Pierce County—State, Manson Construction & Engineering Co., Seattle, was awarded a contract by the Washington State Highway Commission on the basis of a low bid of \$1,031,476 for construction of the reinforced concrete Fox Island Bridge. Included in the contract are pre-cast concrete piles and timber piles, approaches, drainage structures, structural excavation and asphalt paving. Unit bids were submitted as follows:

(1) Manson Construction & Engineering Co.	\$1,051,476	(4) M. P. Butler	\$1,339,138
(2) General Construction Co.	1,071,603	(5) Morrison-Knudsen Co., Inc.	1,793,148
(3) Anderson Bridge Construction Co. & Roy T. Early Co.	1,198,945	— Guy F. Atkinson Co.	1,933,349

	(1)	(2)	(3)	(4)	(5)
2,350 cu. yd. structural excavation	5.00	5.00	15.00	20.00	5.30
2,310 cu. yd. concrete, Class "A"	75.00	116.00	90.00	68.00	219.00
1,160 cu. yd. concrete, Class "F"	63.00	62.50	60.00	68.00	95.70
4,475 cu. yd. concrete, Class "H"	35.00	28.60	25.00	68.00	20.00
925,000 lb. steel reinforcing bars	.11	.115	.12	.127	.12
175,000 lb. structural carbon steel	.20	.225	.21	.21	.19
3,900 lin. ft. timber handrailing	4.00	2.00	3.00	3.80	6.85
1,820 lin. ft. furn. precast conc. piling, 18-in. octagonal	7.00	6.35	7.00	8.00	7.00
1,380 lin. ft. furn. precast conc. piling, 20-in. octagonal	8.00	7.40	8.00	10.00	7.90
42 ea. driving precast conc. piles, 18-in. octagonal	70.00	74.00	150.00	150.00	285.00
28 ea. driving precast conc. piles, 20-in. octagonal	80.00	75.00	175.00	150.00	285.00
4 ea. furn. and driving precast conc. test piles	800.00	\$1,100	\$1,000	\$1,000	\$1,250
4,500 lin. ft. furn. timber piling, creosote treated	1.50	1.85	2.00	1.50	1.85
56 ea. driving timber piles, creosote treated	30.00	23.50	100.00	34.00	85.00
15.5 M.B.M. timber and lumber, creosote treated	350.00	355.00	400.00	400.00	500.00
100 lin. ft. drill and case 6-in. well	8.00	8.00	10.00	20.00	8.50
Lump sum, water pumping equipment	500.00	495.00	\$1,000	\$1,410	900.00
Lump sum, electrical system	\$5,000	\$14,250	\$6,000	\$7,050	\$8,500
Lump sum, toll house and equipment	\$3,500	\$5,200	\$5,000	\$5,500	\$7,000
Lump sum, clearing and grubbing	\$1,500	\$1,250	500.00	\$8,500	\$2,200
23,860 cu. yd. unclassified borrow	1.00	.70	.83	1.00	1.55
29,920 cu. yd. special borrow	2.00	2.05	2.24	1.50	1.90
110 cu. yd. structural excav. for culverts	4.00	4.30	5.00	4.00	13.00
1,340 cu. yd. excav. toe trench for riprap	3.00	2.15	1.50	3.00	1.15
4 days mechanical tamper	80.00	100.00	50.00	50.00	140.00
15.6 stas. 100-ft. finishing roadway	50.00	37.00	10.00	20.00	40.00
20 M. gal. water	10.00	11.00	3.00	5.00	16.00
40 cu. yd. gravel backfill for foundation	6.00	7.40	6.00	6.00	9.00
4,480 ton selected roadway borrow	2.00	3.10	2.20	3.50	2.30
820 ton crushed stone surfacing top course	4.00	4.95	3.25	6.00	5.40
0.4 m. preparation, constr. and finishing	\$2,000	\$3,100	\$1,000	500.00	\$3,400
18.0 ton asphalt cement, MC-3	80.00	92.00	75.00	85.00	100.00
160 cu. yd. furn. and placing crushed cover stone	5.00	6.20	6.00	5.00	6.00
150 lin. ft. plain conc. culvert pipe, 12-in. diam.	4.00	4.30	2.50	2.00	6.00
201 lin. ft. std. reinf. conc. culv. pipe, 18-in. diam.	5.00	5.55	4.50	4.50	9.00
2,689 lin. ft. std. beam guard rail, Type No. 1, Design No. 6	4.00	4.65	3.25	4.00	6.00
14,530 cu. yd. loose riprap, Class "C"	4.50	4.90	5.00	4.50	6.40
1,460 lin. ft. one course conc. sidewalks and curbs	3.00	2.85	2.50	4.20	7.60
Lump sum, shoring and cribs	\$240,000	\$175,000	\$350,000	\$320,000	\$574,000

Water Supply

Sunset Supply Line with 61-in. I.D. cylinder coal tar-lined and coated steel pipe

California—San Mateo County—San Francisco Water Department. M & K Corp., San Francisco, submitted a low bid of \$935,912 before the San Francisco Water Dept. for construction of Schedule II, Sunset Supply Line, Burlingame to Millbrae section and a portion of Millbrae to Baden section (in San Mateo County), using 61-in. I.D. cylinder coal tar-lined and coated steel pipe. Unit bids submitted were as follows:

(1) M & K Corp.	\$ 935,912	— Ukropina-Polich-Kral	\$1,154,928
(2) Peter Sorensen	1,096,960	— Wunderlich & Coast Pipe Line Contractors	1,247,794
(3) McGuire & Hester	1,127,841	— Vido Artukovich Co.	1,252,868
(4) P. & J. Artukovich & Miller Co.	1,142,603	— Engineer's estimate	1,198,475
(5) E. T. Haas Co.	1,153,155		

	(1)	(2)	(3)	(4)	(5)
19,000 lin. ft. F&I 61-in. I.D. 3/4-in. steel pipe	30.40	28.00	29.90	31.30	31.00
1,272 lin. ft. F&I 61-in. I.D. 7/16-in. plate steel pipe	31.00	32.00	32.15	35.00	36.00
2,900 lin. ft. F&I beveled courses in steel pipe	4.00	16.50	10.60	12.00	8.00
300 lin. ft. removal of pipe from trench and relaying	5.00	12.00	6.70	10.00	15.00
325,000 sq. ft. coal-tar lining steel pipe	.14	.15	.14	.18	.16
326,000 sq. ft. coal-tar coating steel pipe	.15	.17	.15	.20	.16
325,000 sq. ft. felt wrapping coated steel pipe	.12	.13	.16	.16	.08
23,000 lb. F&I steel pipe or pipe specials not included in other items	.40	.50	.80	.40	.60
4,400 lb. F&I cast and forged steel flanges and fittings	.70	.93	1.00	.80	.65
500 lb. F&I miscel. steel work	.50	1.00	.85	.60	.70
11 manholes F&I manholes on pipe	500.00	644.00	\$70.00	500.00	400.00
20 valves F&I 2-in. gate valves	25.00	34.00	33.00	30.00	28.00
1 valve F&I 4-in. gate valve	40.00	55.00	56.00	60.00	50.00
2 valves F&I 6-in. gate valves	70.00	97.00	84.00	80.00	77.00
28 valves F&I 8-in. gate valves	110.00	160.00	145.00	120.00	126.00
8 valves F&I 6-in. gate valves, beveled geared	160.00	202.00	200.00	140.00	140.00

(Continued on next page)

loads and hauls 16-cu. yds. per trip!

**COMPLETES 1,000-FT. CYCLE EVERY 2½ MINUTES
AVERAGES 350-CU. YDS. PER HOUR!**

Look at the heaping 16-cu. yd. load of soft topsoil in this standard 2C500 Heiliner . . . whose rated heaped capacity is 13-cu. yds.! Under these favorable conditions, this rig moved 3200-cu. yds. a day of cornfield topsoil, making a round trip of 1000-ft. every 2½ minutes . . . figures verified by work studies made at the job site. This exceptional pay load performance is piling up the profit for Coleman Construction Company of St. Albans, West Virginia. They're using three 13-yd. Heiliners to prepare the railroad site and approaches for a new plutonium diffusion plant in Ohio.

The bonus pay loads and fast cycle time you get with Heiliners are your assurance of profitable production under *the most difficult*, as well as easy job conditions.

Double the utility of your Heiliner with an Interchangeable Bottom Dump Wagon

For roadbuilding, mine strip-ping, heavy construction, or any earthmoving job where big production of shovel loaded material is a factor, you can double the utility of your Heiliner 800 prime mover by using both the Heiliner scraper and the Heiliner dump wagon *interchangeably*. From every standpoint . . . big capacity, high operating efficiency, rugged construction, low-cost operation and maintenance . . . your investment in these easily interchangeable units will pay big dividends. You can bid confidently on more different types of work and handle them at a profit, without a big investment in other pieces of equipment.

Get complete information about Heiliner interchangeable units before you start your next contract . . . see your Heil distributor for details about Heiliner Wagons.



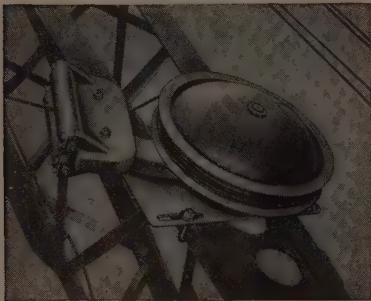
Heiliner 800 two-wheel tractor and 20-cu. yd. Bottom Dump Wagon. Extra heavy-duty wagon has fool-proof clam type doors which open fast and clean, with the unit moving or standing. There's no bogging down, because doors don't drop below hopper body level.

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UNIT BID PRICES CONTINUED

	(1)	(2)	(3)	(4)	(5)
2 assemb. constructing 2-in. air bleeder assembly	40.00	70.00	140.00	40.00	80.00
3 assemb. constr. air release valve assemb., Type 1.....	60.00	113.00	180.00	180.00	150.00
6 assemb. constr. air release valve assemb., Type 2.....	75.00	124.00	180.00	200.00	150.00
1 assemb. constr. air release valve assemb., Type 3.....	100.00	147.00	200.00	220.00	150.00
9 assemb. constr. 8-in. vacuum valve and air release valve assemb., Type 1	120.00	215.00	350.00	200.00	300.00
2 assemb. constr. 8-in. vacuum valve and air release valve assemb., Type 2	120.00	215.00	350.00	210.00	300.00
3 assemb. constr. 8-in. top blowoff assemb.	105.00	195.00	225.00	400.00	300.00
1 assemb. constr. 8-in. bottom blowoff assemb., Type 2	120.00	154.00	225.00	450.00	200.00
2 assemb. constr. 8-in. bot. blowoff assemb., Type 2A	121.00	205.00	225.00	460.00	250.00
8 assemb. constr. 8-in. bottom blowoff assemb., Type 4	130.00	205.00	225.00	470.00	200.00
1 assemb. constr. 8-in. bot. blowoff assemb. Type 4A	130.00	205.00	225.00	480.00	250.00
5 assemb. constr. 9-in. bottom blowoff assemb., Type 5	60.00	86.00	170.00	490.00	150.00
30,000 cu. yd. pipe trench excav. and backfill, Class 1.....	1.60	2.25	5.00	3.00	6.00
17,200 cu. yd. pipe trench excav. and backfill, Class 2.....	1.00	2.50	2.15	2.50	3.00
400 cu. yd. struct. excav. and backfill	3.00	5.50	5.00	5.00	6.00
75 trees removing certain trees, 4-in. to 12-in. diam.....	10.00	20.00	9.00	15.00	10.00
80 trees removing certain trees covered by other items.....	50.00	80.00	65.00	20.00	40.00
7,000 cu. yd. furn. sand for backfill	1.00	3.60	1.75	1.75	4.00
1,150 cu. yd. repaving roads, streets, sidewalks, curbs and gutters with portland cement concrete	15.00	40.00	21.30	15.00	25.00
50 cu. yd. repaving roads, and streets with asphaltic conc. or water bound macadam	10.00	25.00	19.00	16.00	22.00
90,000 sq. ft. repaving roads and streets with asphaltic wearing surface	.10	.27	.15	.18	.15
285 cu. yd. concrete work for structs.	40.00	60.00	50.00	70.00	50.00
28,100 lb. furn. and placing reinf. steel	.10	.15	.13	.18	.13
3,300 lb. furn. and installing steel frames and covers for valves and manhole boxes	.60	1.00	.45	.70	.50
1,300 lb. F&I steel bolts, nuts, washers and gaskets	.70	.75	.45	1.20	.50
2,500 lb. F&I steel castings not covered by other items.....	.40	1.00	.45	.50	.60
35,000 lb. installing gate valves furn. by City	.07	.035	.07	.10	.07
18,300 lb. F&I cast iron pipe, fittings, manhole frames.....	.40	.50	.28	.60	.35
1,000 lb. F&I corr. metal pipe culverts	.25	.60	.30	.20	.35
225 lin. ft. pipe encasements under and betw. structs.....	50.00	139.00	78.00	100.00	125.00
1.0 M.B.M. F&I Douglas fir lumber	200.00	400.00	235.00	270.00	200.00
1.0 M.B.M. F&I redwood lumber	325.00	400.00	300.00	310.00	250.00
1,000 lb. F&I structural steel	.30	.60	.45	.50	.20

Streets and Highways

Heavy grading and crushed stone surfacing in Washington

Washington—Thurston County—State. A low bid of \$496,366 submitted before the Washington Highway Commission won an award for Northwest Construction Co. to construct 4.702 miles of Primary State Highway No. 1, Maytown South. Unit bids submitted were as follows:

(1) Northwest Construction Co.	\$496,366	— Fiorito Bros.	\$536,829
(2) R. A. Heintz Construction Co.	502,563	— N. Fiorito Co.	539,686
(3) Thomas Scalzo Co.	510,912	— Peter Kiewit Sons' Co.	602,839
(4) P. L. Saddler	519,051	— Lige Dickson Co.	661,378
(5) Goetz & Brennan	519,682		

	(1)	(2)	(3)	(4)	(5)
89.4 acres clearing	300.00	300.00	300.00	300.00	300.00
90.5 acres grubbing	300.00	220.00	300.00	300.00	300.00
Lump sum, clearing and grubbing	\$1,000	\$6,000	\$7,000	\$38,390	\$15,000
493,920 cu. yd. common excav. incl. haul of 600 ft.	.30	.30	.30	.30	.32
1,530 cu. yd. common trench excav. incl. haul of 600 ft.....	1.50	1.00	1.50	2.00	2.50
16,940 cu. yd. excav. of unsuitable matl. incl. haul of 600 ft.	1.00	.30	.40	.50	.60
153,670 cu. yd. common borrow incl. haul of 600 ft.	.28	.30	.28	.30	.30
1,000 cu. yd. stripping borrow and surfacing pit incl. haul of 600 ft.	.30	.30	.20	.25	.25
695,280 cu. yd. stas. overhaul	.01	.015	.01	.01	.015
2,882 M. cu. yd. stas. overhaul	5.00	3.00	4.50	3.50	4.40
3,385 cu. yd. structure excav.	2.50	2.50	2.50	2.00	3.00
718 day tamping roller	50.00	70.00	50.00	1.00	40.00
90 day pneumatic tired roller	60.00	50.00	60.00	1.00	50.00
105 day mechanical tamper	40.00	35.00	40.00	1.00	45.00
29,060 lin. ft. slope treatment, Class A	.15	.15	.15	.15	.15
248.3 stas. (100 ft.) finishing roadway	15.00	10.00	15.00	15.00	12.00
2,000 M. gal. water	3.00	2.00	2.00	1.00	2.00
60 cu. yd. gravel backfill for foundations	6.00	3.00	3.00	1.00	3.00
630 cu. yd. gravel backfill for drains	7.00	6.00	6.00	3.00	6.00
134,560 tons selected roadway borrow	.40	.50	.55	.80	.45
770 ton turn. and placing cr. stone surfacing top course	3.50	2.70	3.75	3.00	4.00
1,560 ton turn. and placing cr. stone surfacing base course	3.50	2.70	3.75	3.00	4.00
492 cu. yd. concrete, Class A	50.00	51.00	50.00	50.00	50.00
81,420 lb. steel reinforcing bars	2.11	1.15	2.32	1.15	1.12
1,780 lin. ft. perf. corr. metal drain pipe 12-in. diam.....	3.00	3.00	3.50	3.00	3.50
234 lin. ft. plain conc. culv. pipe 12-in. diam.	1.75	2.00	1.75	2.50	2.00
1,941 lin. ft. stand. reinf. conc. culv. pipe 12-in. diam.....	2.45	2.50	2.50	3.00	2.75
1,155 lin. ft. stand. reinf. conc. culv. pipe 18-in. diam.....	4.00	3.75	4.00	4.00	3.50
825 lin. ft. stand. reinf. conc. culv. pipe 24-in. diam.....	6.00	5.75	6.50	6.50	5.75
16 lin. ft. stand. reinf. conc. culv. pipe 36-in. diam.....	12.00	10.00	11.00	20.00	30.00
222 lin. ft. stand. reinf. conc. culv. pipe 48-in. diam.....	16.00	15.00	17.00	17.00	16.00
32 lin. ft. extra str. reinf. conc. culv. pipe 36-in. diam.	31.00	25.00	60.00	20.00	30.00
320 lin. ft. bit. coat. corr. metal culv. pipe No. 16 ga., 8-in. diam., Type No. 2	3.00	2.50	2.50	3.00	3.00
45 only catch basins	100.00	100.00	100.00	65.00	100.00
4 only concrete inlets	65.00	75.00	60.00	50.00	90.00
49 only reinf. conc. right-of-way markers	7.00	5.00	6.00	6.00	7.00
12 cu. yd. hand placed riprap	30.00	25.00	20.00	50.00	25.00
25 day furn. and operating gangplow and tractor	70.00	85.00	60.00	20.00	60.00
25 day furn. and operating heavy duty power grader with scarifier	80.00	75.00	80.00	20.00	90.00
25 day furn. and operating hvy. tandem disc and tractor	80.00	75.00	60.00	20.00	60.00
25 day furn. and operating pulverizer and tractor	80.00	90.00	70.00	20.00	65.00

1460 ft.

it took a B-G
**Runabout
 Ditcher**
 only 8 hours to
 dig 1460 feet of
 coral rock.



see your B-G distributor
 or write

Barber-Greene
 AURORA, ILLINOIS, U. S. A.

PRESTRESS AT FRESNO

... Continued from page 67

initial stress value, stressing is attempted from the other end as well, with the first jack still in place. A certain force will be recorded when the second jack has just barely pulled its anchor cone loose. This force will be smaller than the original prestressing force exerted at the other end. The difference is small, and it represents the value of friction among the wires and their metal sheath. On the Fresno job, the value was 2% of the initial force, or about 3,000 psi.

The friction loss is converted to inches of elongation and is then taken up on the original jacking end after the second pack has been relaxed again. Also added is about 0.2 in. of elongation to compensate for deformation of the cones. These cones are tapered affairs that wedge in tapered sleeves. They pull together slightly and deform a little under the stress.

All factors—initial stress, plus friction, plus deformation—add together to give the value known as jacking stress. When the corresponding elongation has been achieved, the wires are anchored and the jacks removed. On the Fresno job, total elongation was 4.12 in.

The trial method for determining friction on the first beam is taken as the proper value for subsequent stressing. Thus, on the Fresno work, the remaining 9 beams were stressed continuously to 4.12 in. and anchored without further question. This is not haphazard. There is a valid checking method, the pressure gauge attached to the hydraulic jacking system. This gauge is not accurate enough over the wide pressure range to allow its use for determining stress and when to anchor. But it is correct to within a few per cent.

For instance, extra friction may be encountered due to some concrete having accidentally slopped into a sheath during the beam pour. Without a pressure gauge, this wouldn't be noticed as extra friction during the stressing operation. Pressure would merely be increased as necessary to get the required elongation. But the gauge is a telltale—it indicates that excessive pressure is being used to achieve a given degree of elongation. Stressing crews soon learn to look for this phenomenon. It is followed eventually by a sharp twang and a lowering of pressure when the localized cause of friction is broken. Stressing then proceeds as before.

Such a thing can happen toward the end of the operation, when it is impractical to "break loose" the extra bind. When this is the case, gauge pressure is used as a guide and anchoring is done somewhere short of the optimum elongation. At these times, stressing is performed from both ends of the beam, and it is continued to give a good margin on the

gauges. This compensates for gauge inaccuracy and assures that the desired stress is in the cable, regardless of the fact that unexpected friction has prevented the usual elongation.

This sort of thing happened three times on the Fresno job. Gauge pressures for anchoring in these instances were about 5,200 psi., where the more usual 4.12-in. elongation corresponded to a gauge pressure of only about 4,900 psi. (It should be noted that although the gauge registers psi., a difference in piston area means that the prestressing force is about 10 times greater. A gauge value of 5,000 psi. corresponds to a total of about 500,000 lb., which reduces to something under 200,000 psi. in a given 12-wire cable.)

Transverse prestressing was delayed several days for two reasons. One was that the longitudinal cables had to be grouted in first. End-block concrete, which could then be placed over the grout holes and anchors, added substantially to the mass of concrete at these locations. This was necessary, since the path of transverse prestressing through the end blocks lies very close to the surface. A delay of 5 days was required between end-block concreting and transverse stressing.

Also, time had to be allowed for dry-pack to set up after placement between abutting top flanges and diaphragms of the beams. Top flanges were formed with a slight batter, creating a tapered slot to receive the dry-pack. Stirrup-shaped forms of sheet metal bridged between diaphragms to hold the dry-pack there, where transverse sheaths pass from one beam to the next.

For performing the beam erection, two truck cranes were rented. The one in the underpass was a 25-ton Link-Belt Speeder HC-90, with a 50-ft. boom. It was rented from Penner & Blohm of Fresno. The other crane was a 20-ton Lorain Moto-Crane with a 40-ft. boom, rented from Cal Crane Co. of Avenal.

Concrete for the beams, as well as for the abutments, was supplied by Stewart & Nuss, Inc., of Fresno. It was a point of interest to local engineers that such good concrete resulted from a mix using San Joaquin aggregates.

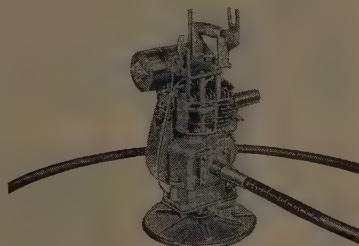
The entire project is under Walter P. Joens, resident engineer for the California Division of Highways, bridge department. Joens' assistant is Thomas J. Bezouska, designer of the structure. Approach construction is being handled by District VI of the Division of Highways. P. B. Stearns is district design engineer, and C. T. Wagner is highway engineer on the job.

D. B. Winniford is superintendent for Thomas Construction Co., and George Borovich is general foreman. James R. Libby represented the Freyssinet Co. For bridge erection W. D. "Whit" Whitley was boss rigger.

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NEW LITERATURE

501

Tells about big shots

Big shots and how to make them are described in two new booklets put out by the **Hercules Powder Co.** The first, "Hercules Explosives and Blasting Supplies," lists all of the company's explosives and blasting supplies. Included is a tabular summary listing the properties of the company's high explosives and a page index to a complete description of each type. The other booklet, "Hercomite and Gelamite Explosives," tells the advantages and properties of these two explosives. The Hercomite series are ammonium nitrate dynamites, while the Gelamite series are semigelatins, designed to replace gelatin or gelatin extra explosives economically.

502

Motor graders described in two languages

If you don't speak English, a combination Spanish-Portuguese edition

of a new catalog published by the **W. A. Riddell Corp.** is available. The dual language catalogs deals with the design, construction, and performance features of the Warco 4D series motor graders. The booklet starts with a short history of the corporation, which has been designing and building heavy duty machinery since 1854, then takes up in detail the new 4D series, available at 85 hp. for general duty and 100 hp. for heavy duty. Action pictures, text, and diagrams show the machine's versatility, full-rotating saddle, and extra-high front, and illustrate how the blade, entirely cab-controlled, reaches every working position from 90 deg. on one side to 90 deg. on the other without manual adjustment. Clip the coupon for your free copy.

503

Euclid publishes guide to preventive maintenance

An impressive 22-page booklet in full color has been published by the

Euclid Road Machinery Co. as a guide to preventive maintenance of earth-moving machinery. The introduction tells about a study which found that most failures in a well-designed and properly-built machine were the result of wear, shock, or overloads. It also was found that failures due to wear could be stopped by proper lubrication, proper adjustment, and replacing worn parts before they cause other parts to fail. Shock failures could be stopped by proper driving, good haul roads, and tightening all parts to eliminate vibration. Overloading stresses load-carrying parts of the machine beyond their capacity, causing eventual failure. The booklet then discusses exactly what to do at 100, 500, 1,000, 2,000, and 4,000 hours to maintain each piece of equipment. Suggested maintenance forms are pictured and discussed. Clip and mail the coupon for your free copy.

504

Steel building products described by Bethlehem

An illustrated booklet describing a wide range of steel building products has just been published by **Bethlehem Steel Co.** It tells about structural shapes, open web steel joists, long-span steel joists, concrete reinforcing bars, concrete forms, beth-co-loy sheets, galvanized sheets, beth-co-weld pipe, and fabricated steel construction. Featured are specifications for each product and design tables showing the total safe loads in lb. per sq. ft. for joists at various spacings.

505

Type TU Peerless pumps

Any questions you might have about Type TU 2-, 3-, 4-, or 5-stage Peerless pumps are probably answered in a new 12-page color pamphlet published by the **Peerless Pump Division, Food Machinery and Chemical Corp.** The various pumps are shown in photograph, drawing, cut-away, and blueprint form, and each includes complete tables of dimensions and parts lists. Individual parts are also pictured and described.

506

Pressure grouting machine

Literature is now available on a pressure grouter and concrete gun manufactured by **C. L. Ballard.** The 16-page booklet, containing pictures, charts, and drawings, tells how the grouter can be used for fluid grouting, plastic grouting, inert grouting, soil stabilization, sealing, drypack concrete, and other construction odd jobs. It was developed to provide contractors, engineers, and builders with the most practical equipment for the convenient, safe, and economical placing of mortar, concrete, and similar material compositions, by pneumatic pressure, according to the introduction. It is of decided advantage where great costs of cofferdams, pumping,

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or hoisting of materials can be avoided.

507

Cat bulldozer line catalog tells all

A comprehensive catalog telling all about the Caterpillar bulldozer line has been put out by the Caterpillar Tractor Co. It is fully illustrated with pictures of each type of blade in action in various job situations and two-color pictures of each blade attached to a tractor, making it easy to distinguish all the attachments. It also includes specifications, cutaway views of the parts, and testimonials from satisfied users. Such bulldozer attachments as brush, root, and rock rakes, treedozer, and stumper are also discussed.

508

Catalog on scaffolding

A 4-page color folder on Superior's complete line of scaffolding for building constructors, including detail drawings and installation set-up pictures, has been published by the Superior Scaffolding Co. Technical data on various items are also provided.

509

Spring steel brooms described

A new 2-color brochure describes spring steel road drags, drag frame sections, angle bars, and all-steel heavy-duty brooms. It also tells about steel-head spring steel hand brooms, widely used by road and park maintenance and highway construction contractors. Published by Kinney Spring Steel Broom Co.

510

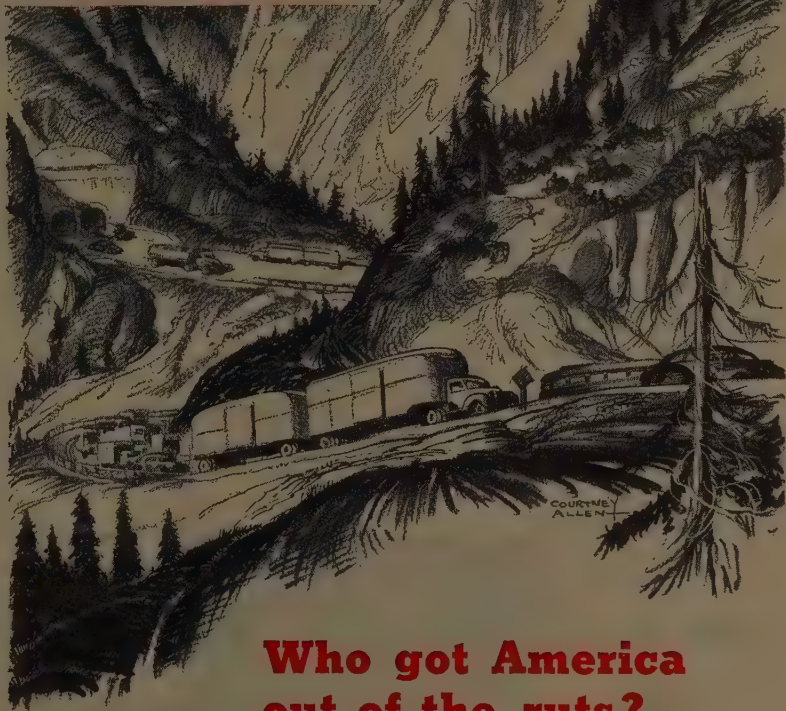
New tool for sand producers

"The DorrClone—a new tool for sand producers" is a four-page, two-color leaflet which tells how the DorrClone operates and its application in the wet sand preparation flowsheet. The leaflet describes it as being a compact, cylindro-conical classification unit utilizing centrifugal force in place of gravity. It is suited for fine sand recovery and will produce a clean, de-slimed sand at almost any desired mesh of separation. Major advantages include high capacity for its size, low installed cost, no moving parts, and extremely simple installation. Published by The Dorr Co.

511

Sauerman hoists shown in new catalog

A new catalog gives full information on Sauerman hoists for operating power scraper excavators and storage machines, slackline cableway excavators, and tautline cableways. The cover shows a montage of various uses for the hoists. The 26-page booklet, divided into five parts, then takes up in detail scraper storage, scraper excavating, brake and clutch



Who got America out of the ruts?

For the pioneers, cross-country travel was back-breaking, slow and laborious. Today, travelers and truckers, agricultural and industrial products, roll easily over thousands of miles of arterial highways. The outstanding building ingenuity and tremendous drive of America's contractors have smoothed the way across rugged mountain barriers, plains and deserts.

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controls, tautline cableway, and slack-way cableway roller bearing hoists. It contains many pictures and diagrams. Published by **Sauerman Bros., Inc.**

512

"The tractor with air steering"

"The tractor with air steering" is how the new **Oliver Corp. OC-18** heavy-duty tractor, with a 133 draw-bar hp., is described in an 8-page color booklet. Included are application photographs, diagrams, and sketches, as well as complete specifications.

513

Membrane concrete curing

An eight-page folded leaflet describes the advantages of using the **Hunt Process** of concrete curing. It tells where the process should be used, describes the necessary equipment, and gives general recommendations as to procedure and which of the four types to use where. Pictures and drawings show the membrane applying equipment in action. Published by **Hunt Process Co., Inc.**

514

All about roller chains

A new 54-page book on **Baldwin-Rex** roller chains and sprockets has

been published by **Baldwin-Duckworth Division of Chain Belt Co.** It describes the inherent advantages of roller chains and illustrates all the sizes handled by the company. One section of the book is a treatise on "how to select standard roller chain drives," including formulas; tables of dimensions, strengths, weights, and prices; and illustrated examples. Another section covers the characteristics and prices of stock sprockets. Also given is information on proper maintenance of chain drives.

515

Inside story of torque converter

The inside story of the **General Motors Torque Converter**, now included in many **GM** diesel engine models, has been published by the **Detroit Diesel Engine Division.** It is illustrated with cutaway drawings, curves showing the horsepower characteristics of engines so equipped, and photos of torque converter units at work in typical construction and other installations. The operating principles of the unit are fully explained.

516

Steel adjustable framing

A new 44-page catalog has been published by **Flexa Steel Products,**

Inc., to give basic information about the line of channels and fittings used in its system of all-steel adjustable framing. It consists of a series of tables and dimensioned drawings on the standard channels and their physical properties, standard **Flexa** nuts, standard 2-, 3-, 4-, 5-, and 8-hole fittings, standard fixture hanging components, standard beam clamps, standard brackets, pipe clamps and porcelain insulators, and concrete inserts.

517

Cat motor grader attachments

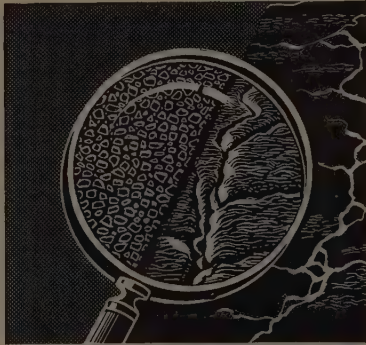
All attachments for **Caterpillar** motor graders are described in an eight-page booklet published by the **Caterpillar Tractor Co.** Each is pictured and has its special uses described. The following attachments are listed: long blade, shoulder finisher, blade extension, hydraulic steering booster, large front tires, scarifier, bulldozer, odometer, lighting system, all-weather cab, radiator shutter, cab heater, snow plow stub wing, snow wing, and snow plow, V-type.

518

Where to buy lumber

The 1953 edition of "Where to Buy" has been published by the **West Coast Lumbermen's Association.** It shows recent personnel and address changes

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of mills, listing sawmills, remanufacturers, fabricators, wood pipe and tank manufacturers, glue-laminating plants, and wood preservation plants. It gives detailed information on capacities, equipment, special services, species and lumber items manufactured, and maximum sizes available in rough and surfaced timber columns.

517

Cat HT4 shovel

An informative folder, which highlights the mechanical features and specifications of the Caterpillar HT4 shovel, has been published by the Caterpillar Tractor Co. It pictures the shovel at work and suggests other operations. Special features of the machine and its parts are given with color lines leading to each part described. Included are cutaway views and a table of specifications.

520

Liquid level gauges

Nine sheets covering the complete line of liquid level gauge valves for both tubular and flat gauges have been released by Jerguson Gage & Valve Co. They give complete specifications with illustrations showing cross sections, roughing dimensions, and standard and optional connections.

521

New V-belt catalog

A new fractional horsepower V-belt catalog for servicing light duty applications has been announced by Raybestos-Manhattan, Inc. It lists

belts according to the new industry-standard numbering system. Various types of machines are listed together alphabetically by company or trade names for convenience in determining the proper belt.

522

Automatic welders, positioners described

Two leaflets tell the story of the Sight Feed Generator Co. and its products briefly and concisely in pictures and words. The first, "32 feet of Profit," describes the line of Rexarc automatic welders and positioners, giving specifications and suggested setups for various types of welding. The other shows the plant production facilities.

523

Diamond gravel plant, jaw crushers described

Two new equipment bulletins in color have been released by Diamond Iron Works, Inc., producers of rock crushing and aggregate producing equipment. Bulletin No. 600 gives six pages of facts and specifications on the 11 sizes of Diamond jaw crushers. It contains cutaway views and several charts. Bulletin No. 1000 gives specifications on the new 100 series of three portable single-pass gravel plants.

524

Hose coupling shop

The Champ hydraulic hose coupling shop is described in a four-page leaflet put out by Champ Industries. It pictures all the machinery included

in the small shop, which contains everything needed to couple 3/4-, 3/8-, 1/2-, 3/4-, 1-, and 1 1/4-in. single- or double-braided hose. It has a hose cut-off and skinning section and a hydraulic press section, all mounted on substantial work benches. Included are a stock of hydraulic hose and couplings. A complete set of press-on adapters is also available.

525

STEEL FRAMEWORK—A 12-page catalog containing Lightsteel framework actually erected for residential and industrial buildings (also *Western Construction*—April 1953, p. 96) has been published by Penn Metal Company, Inc. The full range of products is shown, including single and double studs, joists, track, and bridging. Also shown are framing details for the assembly and welding of Lightsteel structural sections and framing details for doors, windows, roofs, and clear spans. Tables of physical and structural properties, loading tables, and full specifications are included.

526

OIL, GAS BURNERS—Thirteen distinctive features of the Pac-o-matic oil and gas burners are described in an eight-page booklet published by the Coen Co. The Coen Pac-o-matic Burner, says the booklet, is an integral factory-assembled unit including, in addition to the oil, gas, or combination burner, a complete automatic combustion control system, complete flame failure and safety controls, and, if desired, the fuel oil pump and heater set.

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More information on any of the items in this section may be obtained by using coupon on page 143.

527

New shovel rig added to Caterpillar line

Caterpillar tractors with Trackson front-end loaders are an old story. Now there's a new one, and it's all Caterpillar: the No. 6 shovel, which became available in the West just last month. The new rig is the first one to be built from the ground up as a single-purpose Caterpillar shovel unit since the company acquired its former allied manufacturer, Trackson Co., over a year ago.

The No. 6 shovel is a 2-yd. hydraulically controlled front-end shovel mounted on a modified D6 tractor. We wondered where the D6 leaves off and the modification begins, so we checked in with Caterpillar's San Leandro plant to get some answers to questions that go beyond the specification sheet.

First thing we found out was that putting a front-end loader on a conventional crawler doesn't make the best shovel. There just isn't the stability in a tractor designed for a variety of work. At least, not the stability needed in a shovel. So, Caterpillar has lengthened the frame of the D6 by one track roller. Now there are seven. Also, the equalizer spring between track frames has been removed and replaced with a solid bar. The new rig stands four-square as a result.

The shovel and its hydraulic control system are arranged a little differently, too. In the first place, it's all built in. The shovel frame is bolted and welded to the tractor permanently. The lift arms for the shovel are of box construction, and a cross brace has been put between the lift arms for greater rigidity.

The operator has been given a lot of thought on the No. 6. He sits up higher and farther forward for good visibility. Controls for the shovel bucket and lift arms have been put where they can be worked with one hand. The starting engine controls have been put in easy reach too. Without leaving his seat, the operator can start the starting engine, and he can engage the clutch of the starting engine and the flywheel pinion.



THE HIGHEST dumping clearance yet attained by a Caterpillar shovel, 8 ft. 7½ in., is shown here as the No. 6 reaches way up and out.

There's no highway clearance problem with the No. 6 shovel. Its overall width is 96 in. That's the bucket itself. The rig has a low overall height too, but it can reach up to a maximum dumping clearance of 8 ft. 7½ in. That's the highest yet for a Caterpillar shovel.

And the hydraulic operation means a lot. Down pressure for digging. Precise control of dumping, so that a full load of rock doesn't knock the bottom out of a truck. The lift control can be engaged and forgotten while the operator maneuvers the shovel for dumping—the control automatically kicks out at maximum lift.

The justification for all the special treatment is this: Caterpillar found out that people who put a loader attachment on a tractor usually leave it there for the life of the rig. For them, it's always a shovel. So, why not build the machine that way in the first place, with no compromise among various possible uses?

The No. 6 shovel is powered the same as a D6. Same 66 drawbar hp. It has five speeds forward and four in reverse. The total weight is up about 5 tons from a bare D6. The No. 6 shovel has a shipping weight just under 29,000 lb. The initial price of the new machine is \$16,500, f.o.b. Caterpillar Tractor Co., Peoria, Illinois.

Accessory attachments are being readied for the No. 6. Even a good shovel can be versatile! There will be a quarry bucket, a heavy duty bucket, removable teeth for the standard bucket, and a bulldozer blade. Eventually a scarifier and a lift fork attachment will be added.



SCOOPING UP a load of dirt right next to the bank, the new Caterpillar No. 6 shovel demonstrates its ease of mobility.

The lift cylinders are located above the tracks where they can't get clogged with dirt, and the hydraulic system has been moved clear to the rear, behind the operator. Everything is easier to get at, but there's another angle, too. With the hydraulic system at the rear, it doesn't interfere with the radiator. The No. 6 shovel stays cool. The hydraulic system is bigger: it has a 35-gal. oil reservoir.

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Speedy stockpiling possible with auger-type attachment

An auger-type stockpile loading attachment, claimed to pour forth a constant stream of free-flowing stockpiled material at volume rates of up to 10 cu. yd. per min., is



available for the Athey Model 3 Force-Feed Loader. Designated the Bulldozer Moldboard-Auger Feeder, it may be purchased either as original equipment on the loaders or as an easily-installed attachment. The latter includes a bulldozer-type moldboard which extends across the loader to provide a 90-in. width of gather, and it has a positive hydraulic down pressure on reversible cutting edges. A special feature is the pair of side boards at each end of the moldboard. They may be reversed (as illustrated) for loading from windrow or set for stockpile loading when their function is to prevent material from building up before the front wheels. This new equipment is used for loading such materials as coal, gravel, crushed stone, coke, dry chemicals, or any free-flowing stockpiled material. Manufactured by Athey Products Corp.

529

Elevating grader attachment makes the most of a Galion

Casting, stripping overburden, loading and shaping shoulders, and terracing can now be done at an estimated capacity of 1,000 to 1,800 cu. yd. an hour with the new multi-purpose B & L heavy-duty elevating grader attach-



ment for the Galion motor grader. The heavy-duty carrier, which has a belt width of 42 in., is 16 ft. long. One or two 3-ft., easily attached extensions are available at slight extra cost. It can be folded into traveling position from the grader cab without removing any bolts or pins. Its 30-in. diameter disc is made of special alloy steel and has adjustable settings. Shear bolts on the disc holder and braces keep the frame from bending when the disc hits

solid rock or other objects. The new equipment, designed for easy attachment to the grader, has a shipping weight of approximately 8,000 lb. Finger tip hydraulic controls of the standard grader are used for operating the elevator attachment except for the belt drive, which comes with the carrier. Manufactured by Barnard & Leas Manufacturing Co.

530

Lever action scrapers introduced by Euclid

Lever action design used in connection with an improved and simplified hydraulic system is the special feature of a complete line of scrapers introduced by the Euclid Road Machinery Co. Levers replace cables and sheaves formerly used to multiply the stroke of hydraulic jacks actuating the bowl lift, apron lift and roll-out ejector. The jacks for the bowl lift and apron lift are mounted vertically and have been incorporated in the torque tube. This, together with the lever arrangement, lowers the height of the scraper nearly two ft., providing a clean appearance and making it easier to top load with shovels and draglines. Approximately 90 ft. of control cable is eliminated. All four jacks are identical in construction and are fully interchangeable. They are single stage hoists.

The new line includes the standard 15.5-cu. yd. scraper, the 18-yd. twin-power unit and a new 12-yd. model. All



three are powered by either Cummins or General Motors engines. They employ hydraulic booster steering, Euclid planetary-type double-reduction-drive axles, and have independent control of all scraper actions. Cutting blades are made in four identical sections and are reversible and interchangeable with each other.

531

A goliath among trucks, Dart's 60-tonner is designed for off-highway use

The special requirements demanded by the rugged off-highway use of heavy-duty trucks inspired the unique design of Model 600, Dart Manufacturing Co.'s new giant-sized 60-ton truck. Two Buda Super Diesel engines totaling 700 hp. are mounted amidship of the truck's underbelly, one on either side, making for accessibility and ease of maintenance. By means of a unique fluid drive, power from the engines is directed to each of its two rear



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Blaw-Knox Steel Forms on the Whitney Dam.

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Blaw-Knox engineers, backed by over 40 years' experience in solving tough and unusual concreting problems, are trained to simplify forming methods. They get to the heart of your problem *before the final plans are drawn*—then recommend the exactly right forms for the job, and suggest simplified operating procedures that cut costs by eliminating unnecessary operations.

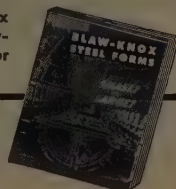
On your next engineered construction job, consult Blaw-Knox *first*, for recommendations and estimates before submitting your bids. There's no obligation for the expert Blaw-Knox Consultation Service that assures faster, less expensive concrete placing. Write, wire or phone for information.



SPECIAL TRAVELING STEEL FORMS were used to speed a tough tunnelling problem in treacherous rock. In a 7200-ft. railroad relocation bore, a reinforced concrete lining was placed at a rate of 150-ft. a week. It required only 6 to 8 hours to move the retractable steel forms. This is a typical example of Blaw-Knox forms designed to meet unusual conditions.

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Get complete details about Blaw-Knox Steel Forms and the consultation service that is available to any contractor without obligation.



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FORMS**

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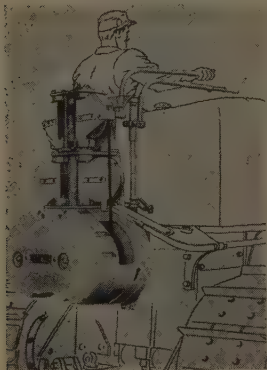


planetary axles. The front axle is turned by hydraulic power on a center bearing cushioned by captive air in a hydraulic-air strut. Twin double-acting hydraulic boosters provide 56,000-lb. steering effort. The mammoth machine's net weight is 96,000 lb., and its gross vehicle weight is 240,000 lb. It is also available in 20- to 40-ton models.

532

Power control unit available for A-C heavy-duty tractors

A power control unit designed for high capacity and easier cable control, with adequate line pull for the most severe operating conditions, is the Baker PCU-75 which can be rear-mounted on Allis-Chalmers Model HD-15 and HD-20 and similar capacity tractors. It combines a multiple disc clutch (claimed to actuate within a shorter distance than other type clutches) with a rugged, simplified brake design. Horizontal swing-action hand levers may be adjusted for length, angular position and height for the operator's convenience. Overall design is compact and streamlined, with completely enclosed parts and absence of obstructions which might impede oper-



ator safety and efficiency. The clutches are covered to keep out dirt, grit and moisture. Performance specifications show that line speeds reach 710 fpm. with full drum at 1,700 rpm. Capacity is 225 ft. of ½-in. diameter cable. Manufactured by Baker Manufacturing Co.

533

Gradation control units available for Barber-Greene's 840 asphalt plant

In answer to the demand for screening units appropriate in size to the capacity of the Model 840 asphalt plant,



Barber-Greene Co. has come up with Models 863 and 864 gradation control units, providing three or four bin screening and separation of the aggregate after drying.

performance proves it...

the new **HOLT heavy-duty** DOZER does more...costs less

a smaller tractor does a bigger job

It's a fact—the Holt Heavy-Duty Dozer is built to take rough use and do tough jobs *better* than dozers costing up to \$600 more.

You'll find that the Holt Heavy-Duty Dozer, on a crawler tractor of up to 65-horsepower, will allow that tractor to put more power to the job than with any other dozer of comparable size.

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HOLT DOZERS are the fastest selling dozers in the west; see your dealer or write direct for literature.

The HOLT HEAVY-DUTY DOZER fits
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INDEPENDENT DISTRIBUTORS

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Normally set up for 3-bin separation, Model 864 is designed especially for use with the Model 840. Operating above the mixer, it receives the aggregate via an enclosed bucket elevator from the dryer. The entire unit, including its structural members, is of sectionalized construction for easy erection and transportation. The Model 863 is mounted on a rubber-tired chassis and can be towed behind a truck for easy transportation. In operation it is identical with the Model 864. It operates in conjunction with the new Model 843 mixer. Accessory units available for both units include fines feeders and auxiliary fourth bins.

534

Loading problems facilitated by folding gooseneck trailer

A trailer which unfolds to form its own loading ramp for the transportation of 75-ton units is an ingenious means to facilitate the loading and unloading of heavy equipment. The big machine is the Martin FO75M Folding Gooseneck trailer. A winch-equipped truck lifts the



folding neck and the load is ready to go in a one-man, five-minute operation. In transit, the low platform is reported to offer a stable support which keeps the heavy equipment riding snug and secure. The trailer has a 12- x 24-ft. platform and an overall length of 43 ft., and is available in single and tandem axle models with capacities from 12 to 100 tons. Manufactured by Martin Machine Co.

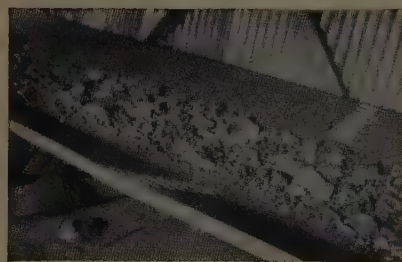
535

New lubricator services conveyor trolley wheels on the fly

Automatic lubrication of conveyor trolley wheels with a simple flick of a switch is now made possible by using a new Alemite lubricator. The unit, which delivers a pre-set, constant shot of either oil or lubricant to each trolley wheel on each side of the conveyor system, is built on a section of I-beam 37 $\frac{3}{4}$ or 40 in. long which is fitted into the conveyor track at any convenient spot. The only requirements are that it must be within reach of the house air line and a 115-volt, 60-cycle electrical outlet, and there must be 22 in. of head room over the top of the I-beam. As each wheel reaches the lubricator, a coupler clamps the lubricant fitting on its hub and forces the required amount of lubricant into the fitting at a pressure of from 800 to 1,000 lb. Wheels can be spaced yards apart, at irregular intervals, or as close as 8 in. on centers. The new lubricator, sold as a unit complete with a section of track, includes the lubricant reservoir and right- and left-hand assemblies with protective covers and anchor plates. Alemite's Oil Mist system can be installed as an accessory to lubricate chain linkage and knuckle joints automatically. Manufactured by Stewart-Warner Corp.

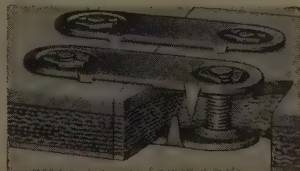
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White Mfg. Co.

Indiana

Swiveling headache ball provides load control

An angular contact, ball-bearing swivel which provides load control on weight-lifting equipment is a feature of the new Miller Overhauling Weight, or headache ball, which is



often necessary as added weight for single hoisting lines. Three races of ball bearings insure that the swivels turn freely under the heaviest loading and prevent loads from spinning or getting out of control. In addition,

twisting forces on the wire rope are eliminated, lines last longer, and the danger of their breaking is greatly lessened. The new weights come in five sizes: 7-in. diameter ball, 62 lb.; 9-in. ball, 128 lb.; 10-in. ball, 165 lb.; 11¼-in. ball, 200 lb.; and 13-in. ball, 322 lb. All sizes may be had with latched hook at a slight additional charge. Manufactured by General Machine & Welding Works.

537

Optoplane designed to aid jig alignment

Designed to facilitate jig and fixture location and alignment is the Optoplane, a new industrial transit manufactured by W. & L. E. Gurley. It is expected to have numerous applications in heavy construction. The Optoplane establishes horizontal and vertical planes necessary in locating and setting up jigs for sectional assembly and permits jig alignment and coordination within tolerances of thousandths of an inch. It does not have a vertical circle or horizontal limb, however. Specifications are: Telescope—11½ in. long, magnifying 22X, 1.31-in. aperture, 4-sec. resolution, 1.3-deg. field of view, minimum focus 3 ft. Level vials—reversion telescope level 6 in. long, sensitiveness 30 sec., plate levels 3 in. long, sensitiveness 60 sec. The transit weighs 9¼ lb.

Double pumps available for mobile applications

Two double pumps, series V-2200 and V-3200, are available for mobile applications where two independent hydraulic power sources are required.



They are especially applicable to materials handling equipment and road and construction machinery for applications such as power steering in addition to the usual needs. Both series are compact and each consists of two vane-type pumps in a single housing, driven by a common shaft. Series V-2200 is available in ten sizes with any combination of 2-, 5-, 8- or 11-gpm. delivery units. Series V-3200 is available in 16 sizes with a choice of a 2-, 5-, 8- or 11-gpm. at the small end and a 12-, 15-, 18- or 24-gpm. at the other. Manufactured by Vickers, Inc. Their design is in accord with Vickers' standard line of pumps.

ADDITIONAL CLASSIFIED

See Also Pages 160, 161, 162

FOR QUICK SALE

2 U-D8 Angle Dozer, 24-25 winch; 100-hp. Patrol, only 1100 hours; ¾-yd. Lima 5AH available; 105 C. P. Compressor & misc.; RB11 International Winch truck; 16-18 yd. Hell dump body; 800-amp. welder and miscellaneous.

WANTED: ¾-yd. moto crane.

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Concrete vibrator offered in a 21-lb. package

A self-contained one-man concrete vibrator, said to be the first of its kind ever perfected, is a new product of



the Mall Tool Co. The 5-hp., 21-lb. gasoline engine of this Mall 2MGV unit can be supported by the fingers alone, and as such its size makes it applicable for faster, easier narrow form vibrating from catwalks.

540

Reflective curing paper developed

A curing medium has been developed to help balance the atmospheric conditions affecting the process of concrete curing. The manufacturer, the Sisalkraft Co., now offers a special reinforced curing paper which is bleached white on one side to reflect solar heat. Available in any width up to 26½ ft., the blankets can be re-used a minimum of 15 times under ordinary job conditions and a 72-hr. curing period.

541

Five small turbocharged engines on the market

The advantages of turbocharging, a means of obtaining higher specific output from a diesel engine, have been applied to five small sized diesel engines manufactured by Waukesha Motor Co. These models (with displacement ratings) are: (1) 135-DXBS (426 cu. in.); (2) 148-DKBS (779 cu. in.); (3) WAKDS (1,197 cu. in.); (4) NKDS (1,905 cu. in.); (5) LRDS (2,894 cu. in.). The three smaller sizes are applicable to transportation or industrial service and the two largest can be used as complete power units for industrial service. All engines incorporate the manufacturer's spherical fuel combustion chamber and use American Bosch injection equipment suited to the engine size. The use of turbochargers is said to produce substantial power increases and greater fuel economy.

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FIRST CHOICE . . .

of contractors by a wide margin, are Marlow pumps . . . built to meet the tough and exacting requirements of the job.

Marlows' have the features that contractors demand.

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- *Faster, and more dependable priming* even at high suction lifts.
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- *High efficiency and low fuel cost.*

All contractors' pumping needs are more dependably handled with just two types of Marlows — Marlow Self-Priming Centrifugals for high capacity pumping — Marlow Mud Hogs for muddy, sandy and trash laden water.

Buy Marlow and get the best in pumping performance. For complete information see your Marlow dealer or write for "Marlow Contractors Pumps" bulletin C-52.



Marlow manufactures the world's largest line of contractors' pumps.

313

MARLOW PUMPS

Other factories in France and England

RIDGEWOOD, NEW JERSEY

Branch Plants: DeQueen, Arkansas
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Distributors and Dealers everywhere

Trailer hoist aids Brik-Toter effectiveness

Designed to increase the effectiveness of the Brik-Toter is the new Model 20 Trailer Hoist, manufactured by the Mar-Rail Conveyor Co. The balanced trailer and winch assembly enables one man to raise and operate the Brik-Toter quickly and easily. A trailer hitch makes towing easy. The new hoist is optional equipment for all 15-, 20-, and 24-ft. Brik-Toters.

Cable control unit available for heavy-duty tractors

The Wooldridge Model WD-2 is an extra heavy-duty cable control unit designed for use with tractors of 130 hp. or more, specifically for the Caterpillar D-8, Allis-Chalmers HD-20 and HD-19, and International Harvester TD-24. The manufacturer's Model WE-2 is used on tractors under 130 hp. It is said to employ a simplified power train comprised of only one worm gear and wheel. Double drums of 10-in. barrel diameter are actuated by multiple disc clutches and large surface self-energizing brakes, claimed to provide fast, smooth action under all operating conditions. The compactly-designed equipment has full universal fairleads and large sheaves, anti-friction tapered roller

and ball bearings. Line speed at 1,000 rpm. input is rated at 343 ft. per min. with bare drum and 542 ft. per min. with full drum. Each drum has a cable capacity of 1/2-in. x 235-ft. or 9/16-in. x 186-ft. Cast alloy steel case and heavy-duty design throughout provides extra ruggedness. Manufacturer is Wooldridge Manufacturing Co.

Sight sense added to electronic detective

Diagnosing sick machinery by sight as well as sound is made possible by a new audio-video model of the Elec-Detec, known as Model V. The new unit includes a milliammeter for checking sound impulses visually by

use of a highly stable germanium crystal diode in the circuit. It enables the operator to "see" as well as hear the location of the source of trouble in bearings, pistons, gears, ratchets, cams, clutches, and other moving parts. Manufactured by Anco Instrument Division, American Name Plate & Manufacturing Co.

You can't twist a Kant-Twist clamp

Made from new metal alloys which enable it to produce the same gripping or clamping strength as comparable clamps, the new Saxton Kant-Twist clamp is 65% lighter, according to the manufacturer, Centinela Industrial Supply Co. Features of the new clamp are positive parallel action of the cantilever jaws, screw and head fabricated from one-piece alloy steel, and torque-converting, spring-bearing trunnion. The inch-square head has a right-angle drilled hole for quick-spin adjustments.

Right angle drive permits drilling in tight corners

The new team of R.C.S. Korner King, a right-angle drive attachment, and R.C.S. Super Speed Bits, offered in a kit of 10, can increase the versatility of any heavy-duty, 1/4-in. electric drill, according to the manufacturer,

No Caps In the Hole

when you use Primacord . . . the detonating fuse that provides real blasting safety. With Primacord in direct contact with every cartridge, even in deck loads, complete detonation of an unlimited number of holes in round eliminates the danger of unexploded caps and powder in the muck pile. Easily hooked up, Primacord delivers maximum safety with lowest cost per round.

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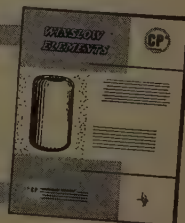
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R.C.S. Tool Sales Corp. It triples the range of drills by adding two more speeds to their operation, and the compact design allows drilling in otherwise impossible locations—between joists and studs or in tight, cramped corners. Special shaft extensions for the bits permit penetration of any thickness and alignment of holes through any series of obstructions. They feature curved cutting blades to do a faster and better boring job. The Korner King converts ¼-in. capacity drills of 2,000 rpm. to 1,000 rpm. with 80% more power.

547

This fluid pump needs no lubrication

The Dudley V-9 Model 100 Pump employs an entirely new principle, says the manufacturer, **Eastman Pacific Co.** It has nine sleeves which ex-

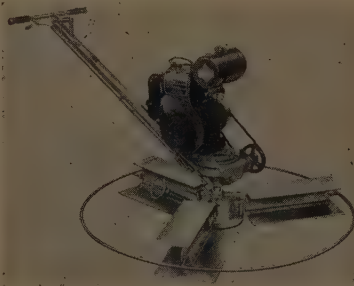


tend into each of two cylinder blocks whose angular relation to each other causes a telescoping cylinder effect when the cylindrical blocks are rotated. There are no connecting rods, cams, or springs, and no lubrication is required. Weighing 5 lb. with bronze body, 2½ lb. with aluminum body, the pump delivers from 2.4 to 7.2 gpm. at pressures from 9 psi. (20 hd. ft.) to 433 psi. (1,000 hd. ft.). The shaft seal is designed to take inlet pressures to 200 psi. Operating temperature range is from minus 60 deg. F. to plus 165 deg. F.

548

New Turn-A-Trowel for safe and easy operation

Scientific balancing for easier operation and a gyral safety device are the star features of the new Master Turn-A-Trowel, a machine obtainable



either in 34- or 48-in. sizes. The rotary concrete finisher, long known for its instant change of rough to finish trowel, is said to facilitate operation with less than half the effort because of its scientifically balanced head. In

Your Water Treatment Problem

**and how to
handle it**

A booklet covering the essentials of water analysis, filtration, softening, scale removal, cost reduction by recirculation, cooling tower efficiency.

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(1) Wires of finest steel in a (2) construction specially designed for universal dragline service give Tuffy (3) extra flexibility . . . make it (4) extra easy to handle. You'll find Tuffy Draglines (5) spool better and (6) ride better on grooves. And you get (7) maximum abrasive resistance since Tuffy materials are toughened to withstand more abrasive wear! Time and again, Tuffy Draglines stand up under more days of service and move far more yardage than the best previous average obtained by many operators . . . operating in dry dirt, wet dirt, sand, gravel, rock and minerals! To order, just ask for the length, the size and the name—TUFFY DRAGLINE!

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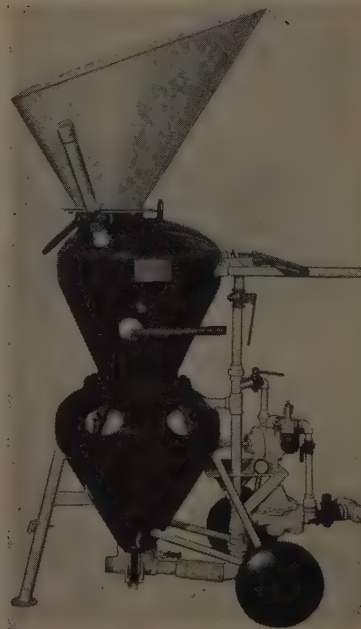
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addition, the gyal safety device shuts off the engine automatically in case the machine gets away from the operator. It may also be used as a grounding switch for stopping the engine when work is completed. Manufactured by Master Vibrator Co.

54V

**Redesigned Blastcrete gun
is easier, faster to load**

Redesigning of the new Model PM-1 Blastcrete Gun is said to provide easier, faster loading, and better, surer control of material flow and air pressure. It is also constructed to meet ASME code requirements. The



gun is said to be suitable for handling materials with up to 6% moisture, thus eliminating the necessity of protecting materials against normal atmospheric moisture. Other performance statistics state that it places 1 to 5 cu. yd. per hr. or approximately 1 1/4 cu. yd. per hr. per 100 cfm. of air, and it can handle all cementitious materials for construction and all refractory materials as well as many lightweight aggregates. It can be used for swimming pool construction, joining wall sections in tilt-up construction, cement block surfacing, waterproofing masonry, bank stabilization, ditch and reservoir lining, mine tunnel stabilization, and timber fireproofing. Performance is guaranteed by manufacturer, Blastcrete Equipment Co., Inc.

550

**Cleaning spray
applied with pressure gun**

The First Universal Cleaner, applied by a hand-sized, air-pressure-charged, pressure spray gun is said to remove grease, oil, wax, gums, dirt, dye, ink, cutting soap, and light car-



stays

**with Scraper Longer
in Tough Going!**



**"No Other Rope Even Comes
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Says an Iowa Contractor
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More and more operators of scrapers are switching to Tuffy Scraper Rope . . . and there are good reasons why! Tuffy is so designed to resist drum crushing caused by rope cross-overs—flexible enough to withstand sharp bending and hug sheave grooves. Tuffy's good slack line behavior helps it hold up better under the shock of load impact on slack line—a condition multiplied in scraper service. Remember, Tuffy is easy to order; just specify length, diameter and "Tuffy!"

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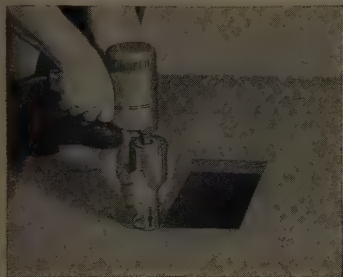
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on from metal, plastics, rubber, porcelain, composition, concrete, or wood on complete safety when used according to directions. Manufactured by Kelite Products, Inc.

551

Small saw attaches to drill for power

The new Acro saw, which attaches to electric or air drills for power, has a specially designed wobble-shaft ar-



rangement which converts the rotary action of the drill to a fast reciprocating motion. Ball bearings reduce vibration to a minimum. The unit, which fits both 3/4-in. and 1/2-in. drills, attaches directly to the drill spindle or may be secured in the drill chuck. Saw blades with special teeth are available for cutting stainless steel, monel, or other metals, as well as wood or plastic. Power filing is accomplished by inserting a file instead of a saw blade. The unit weighs less than 4 lb. and cuts with a rapid, 3/8-in. stroke. Manufactured by Acro Tool & Die Works.

552

Hot stuff flows freely through new spray heater

The new Circa-Flo Pressurematic adds a gearless, centrifugal pump, designed to handle the most abrasive liquid, to the line of hot spray heaters manufactured by the Spee-Flo Co. It



is powered by an explosion-proof motor which moves the hot material in continuous circulation from the heater to the spray head and return, providing a constant hot spray temperature at the gun as well as increased mobility with large fluid hoses for wide spray application. The new unit is rated at 7 gal. per hr. at 160 deg. F. for the Pressurematic 300 series and at 14 gal. per hr. at 160 deg.

F. for the Pressurematic 600 series. Full heat is reached in 5 to 10 min.

553

Low truck bed facilitates loading operations

Advantageous loading, hauling, and unloading of heavy cable reels and other construction equipment is afforded by the Walter Low-Bed Truck, Model CL, which has a 10-ton nominal capacity, positive front wheel drive, 6-cylinder motor, and a platform only 2 ft. high. The large tires have ample traction to negotiate slippery or soft ground conditions. About 50% of the total load is carried on the driving tires. Other features include

hydraulic power steering, a forward-mounted cab which provides greater platform and loading space, a short hood in front of the wheels which permits easy accessibility to the motor, and the Walter Automatic Torque Proportioning Differential. Manufactured by Walter Motor Truck Co.

554

Horsepower rating upped on Cummins engines

The horsepower rating of the HR-BB-600 and HRBBI-600 engines, manufactured by the Cummins Engine Company, Inc., has been increased from 175 to 180 at 2,000 rpm. with no increase in engine weight.

DAREX AEA

Get all the
"on-the-job"
PROOF!

**LOW-COST
MORE DURABLE
CONCRETE**

**MORE UNIFORM
MORE WORKABLE**

— at mixer
— at point of
placement

*The only catalyzed
air entraining
agent specifically
formulated for
your concrete job!*

Proof plenty. Look at big concrete jobs with multiple, intricate forms, heavily reinforced. Contractors used low slump concrete and needed workability. Answer—DAREX AEA because of low cost and outstanding uniformity, not only at mixer but at point of placement.

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Darex AEA Distributors for Dewey & Almy Chemical Co. in 11 Western States, Alaska and Hawaiian Islands.



Darex is another Dewey & Almy product doing a better job for less

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ABOUT DAREX:**

Pacific Coast Aggregates, San Francisco; Blue Diamond Corporation, Los Angeles; C. E. Mitcham, Salt Lake City; Baker-Thomas Lime & Cement Co., Phoenix; Ray Corson Machinery Co., Denver; Mason's Supply Co., Portland; Miller-Richardson, Helena; Hawaii Builders Supply Co., Honolulu.

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Watts & Co.**
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SEATTLE, WASHINGTON

NEWS of DISTRIBUTORS AND FACTORY BRANCHES

Cummins enlarges L. A. plant

The Los Angeles plant of Cummins Service and Sales has been remodeled and enlarged to give faster and more efficient service. A new building has been added to rebuild engines on a production-line basis. Another new building has been added to permit engines to be tested while others are be-



ing repaired. The repair department has been reorganized and 47 mechanics placed on duty, some on a second shift to take care of emergency night work. The parts department now carries a supply of more than 7,500 different parts, the largest stock of Cummins parts in the world outside of the factory, according to Gene Power, parts manager.

Isaacson names sales mgr.

R. M. Beauchamp has been named sales manager for the newly-formed International dealership by R. W. Isaacson, president of Isaacson Truck Co., Seattle, Wash.

Tempo to handle Super Slugger tools

Tempo Products Co. has been appointed national sales distributors for Super Slugger electric hammers and other tools. The Tempo organization, headed by John R. Kaiser, has representatives and distributors in all parts of the country. Robert R. Elliott is sales manager.

White picks Pack

Howard L. Pack has been picked as regional service sales manager of the White Motor Co.'s Pacific Coast Region, according to Wilson D. Patterson, White's regional manager. Pack, who started with the Sterling organization in 1929, was placed in charge of Sterling activities in San Francisco when the White and Sterling branches there were merged.



Howard L. Pack,
regional service
sales manager
for White Motor
Co.

Appointed Centralia manager

Olvin Kreie has been appointed Centralia, Wash., store manager by Frank Murphy, president of Murphy-Campbell Co., distributors of Caterpillar equipment for the west-central counties of Washington. Kreie brings a world of experience in handling heavy equipment to the job, since he grew up driving Cats in the Oklahoma oil fields and has been equipment superintendent for construction firms building air fields and other projects in Turkey, Afghanistan, and Alaska for the last four years, said Murphy.

Goodall has phone service

A new telephone call and follow-up service has been established in Spokane, Wash., by the Goodall Rubber Co. for the convenience of its customers in the area. Tex Brown, of the company's Seattle branch, has been placed in charge.

W. B. Rushing dies

W. B. Rushing, 52, manager of the Los Angeles branch of the E. H. Edwards Co., died recently, the company announced. He had worked for the Edwards Co. since 1927, serving in the Los Angeles branch since 1930.

AED meet in October

THE ANNUAL conference of Region 12, Associated Equipment Distributors, will be at the Gearhart Hotel, Gearhart, Oregon, October 15 to 18 inclusive.

Two dealers to handle Brik-Toter conveyors

Mar-Rail Conveyor Co. of Rhode Island, manufacturers of Brik-Toter construction conveyors, has appointed Gridley Equipment Co. of Los Angeles and Star Machinery Co. of Seattle to handle its products in the West.

Oil Well Supply Div. appoints 2 in Calif.

Two appointments have been made in the California area by the Oil Well Supply Division of U. S. Steel Corp. Rex Malone, manager of the Long Beach store, has been named district representative in California. Fred L. Wilkinson, an Oil Well field representative, succeeds Malone as store manager.

Johns-Manville regional mgr.

J. B. Jobe has been named regional construction manager of the Los Angeles region by Johns-Manville Corp. The new post, one of six throughout the country, was created to handle the increased demand for commercial and industrial insulations and to meet the need for special technical skills required in installation and application of the firm's products.

Hale joins Western Traction

Edward F. Hale has been appointed special representative to sell equipment manufactured by Standard Steel Works, Cleaver-Brooks Co., and other firms represented by Western Traction Co., according to John Jorgensen, the president. Other personnel changes include the promotion of T. A. Herbert to assistant manager and the transfer of Leonard Gross from the office to the sales field. He will cover the peninsula south of San Francisco.

Truck-trailer show comes to L. A. June 18-21

The Fourth Annual Truck, Trailer, and Equipment Show will be held in the Pan Pacific Auditorium in Los Angeles June 18-21, according to W. K. Stevenson, general chairman of the show. "We are giving priority on the most desirable space to our previous exhibitors, and we urge all interested manufacturers and distributors to contact us at once for definite commitments for the 1953 show," Stevenson said.

New sales mgr. named by Pyramid Steel Co.

L. R. Fletcher, formerly sales manager with Continental Asbestos & Refining Co., has been appointed sales manager of the Welding Steels Division, Pyramid Steel Co. He will coordinate and direct all distribution and sales activity of the new division, which will handle a complete line of maintenance and special-purpose welding steels with nation-wide distribution.

Bessler Korea-bound

Ray Bessler, Spokane, Wash., Caterpillar Tractor Co. service representative in Idaho, eastern Washington, and western Montana, has been assigned to help the U. S. Corps of Engineers improve service methods and the training of Engineer personnel in operating and maintaining Caterpillar equipment in Korea. He will spend from three to six months there.

Heil names sales rep.

John Mains, branch manager of the H. R. Wilson Equipment Co., Casper, Wyo., has been appointed sales representative for Heil Road Machinery Co. He will handle questions and service problems for customers in Colorado, Utah, Wyoming, Montana, and southeastern Idaho.



John Mains,
sales representative
for Heil
Road Machinery
Co.

U. S. Rubber names Ort

Chester W. Ort has been named assistant divisional manager of the Western Division, U. S. Tires Division, United States Rubber Co. Ort, who has been district manager at Portland, will establish headquarters in San Francisco, where he will pay special heed to the distribution of off-the-road tires. E. S. Morgan, Seattle district manager, will replace Ort in Portland. His spot, in turn, will be filled by D. E. Kennedy, present assistant district manager at Los Angeles.

Trailmobile opens branch in San Francisco

The new San Francisco branch of Trailmobile, Inc., opened early in April under the management of William A. Boykin. Other staff members include George McCloud, parts manager; Charles Cox, service manager, and Charles V. Tarris, office manager. Territory to be covered includes the Monterey peninsula, area around San Jose, San Francisco Bay Area, and north as far as Eureka. The new office is a complete factory branch with sales, service, and parts departments.

A. J. Duff retires, joins Air Rentals

A. J. Duff retired after spending 23 years as a special representative of the Gardner-Denver Co. in Colorado, Wyoming, and New Mexico. He will spend his new-found leisure by acting as a consultant to the newly-organized Air Rentals, Inc., of Denver, Colo. Air Rentals will handle equipment of Gardner-Denver Co., H & L Tooth Co., E. H. Edwards Co., Alloy Steel and Metal Co., Michigan Power Shovel Co., Novo Engine Co., and Brooks Equipment & Mfg. Co.

Lockwood appoints agent

William A. Matzke of Seattle has been appointed distributing agent in the Northwest for products of the newly-formed Lockwood Resins Co. The firm produces plastic base protective coatings, said to provide high-efficiency sealing of plywood used for concrete forms. William C. Lockwood heads the firm, whose main office is in Pasadena, Calif. Distributors, dealers, and agents are being selected to represent the company in every major city in the West. Warehouse stocks are kept in Seattle, Portland, San Francisco, and Los Angeles areas.

Superior Scaffolding rep.

Jim Creed has been appointed field representative of the Superior Scaffolding Co. He will cover sales in the West Coast area.

Plexolite distributor

Bettcher Plastics Co. of Portland has been appointed distributor of translucent Plexolite for the state of Oregon by the Plexolite Sales Co. of Los Angeles.

NEWS of MANUFACTURERS

New LeTourneau sales mgr.

John W. Schoen, a former sales executive with the LaPlante-Choate Co., has been appointed vice president and general sales manager of R. G. LeTourneau, Inc., in place of R. E. McCluskey, who recently resigned.

Harnischfeger ups two

William S. Burdick, a veteran of more than 20 years' service with P. & H. in engineering design and sales, has been appointed vice president in



Burdick



Hawkinson

charge of engineering by Harnischfeger Corp. W. E. Hawkinson, Jr., who has been the corporation's district representative in southeast Asia and the Pacific area for the last two

RENT

these cost-reducing forms for concrete

Cost records from job after job prove that Economy's system of Form Engineering and Rental Service means substantial savings in TIME—MATERIAL—MONEY for GREATER PROFITS.

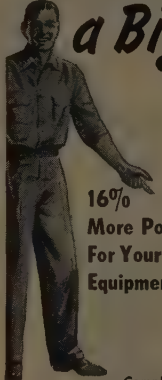
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HEAVY-DUTY Air-Cooled ENGINE

The NEW Model VG4D ^{25 to 36} H.P.

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TO FIT THE JOB

MORE

Power

TO FIT THE MACHINE

16% More Power For Your Equipment

Complete Power Unit with Clutch Reduction.

Another engineering achievement . . . the NEW Model VG4D V-type 4-cylinder Wisconsin Heavy-Duty Air-Cooled Engine, increasing the power range to 36 hp. — a power gain of more than 16% over the VP4D, former top engine in the line.

The NEW Model VG4D is an exceptionally smooth-running, even-firing engine. Its light weight and compactness in design simplify the problem of engine installation on modern equipment where weight and space limitations are important factors.

Every one of the traditional Wisconsin 4-cylinder features are built into this new model. These include, to name a few, tapered roller main bearings, dynamically balanced forged crankshaft, mirror finish on crank pins, Stellite-faced exhaust valves and valve seat inserts and honed cylinders for long, dependable, heavy-duty engine life.

The Model VG4D engine is definitely Tops in Performance, delivering a maximum of power per pound of engine weight, at minimum operating and maintenance costs.

We invite your request for complete detailed specifications.



WISCONSIN MOTOR CORPORATION

World's Largest Builders of Heavy-Duty Air-Cooled Engines
MILWAUKEE 46, WISCONSIN

years, has been named sales manager of P. & H.'s Excavator Division.

Burdick has been credited with substantial contributions to the development of the firm's excavator line.

Shield changes name

To describe more accurately the enlarged scope of its activities, the name of Shield Coatings Corp. of Verona, N. J., has been changed to Shield Chemical Corp.

Mack officials hit pay dirt in West

E. G. Ewell, vice president and general sales manager, and T. J. Zeller, vice president and chief engineer of Mack Motor Truck Corp., struck pay dirt when they visited the West Coast recently. They found that Mack's operations had increased so much that approval was given for new and larger sales and service headquarters in Salt Lake City and Seattle and the acquisition of more land in Portland.

Beatty products to be made in East

Beatty Scaffolds, Inc., of San Francisco has announced the affiliation of four eastern industrial firms to manufacture some of its products. They are Snyder Tank Corp. of Buffalo, N. Y., and Birmingham, Ala.; Otepeco, Inc., London, Ohio; Beatty Bleacher Division of Safway Steel Scaffolds, Inc., Detroit, Mich.; and



COMPLETION of the structural steel framework of the Colorado Fuel and Iron Corp.'s new seamless steel tube mill at Pueblo, Colo., was announced by A. F. Franz, president of the corporation. The new mill, covering more than 10 acres under one roof, is scheduled to start production in the early fall of this year. It will produce approximately 150,000 to 175,000 net tons of seamless tubing annually. More than 625,000 cu. yd. of earth were moved while preparing the site. The finished project will contain more than 10,000 tons of structural steel and 30,000 cu. yd. of concrete. Ten overhead cranes, having a capacity of from 10 to 20 tons each, will play an important part in the new mill's production setup.

Beatty Midwest Grandstand Corp., Milwaukee Wis.

U. S. Steel promotions

Two San Francisco employees of the Columbia-Geneva Steel Division of United States Steel Corp. have received promotional transfers, it was announced. James W. Rimmer, manager of market development, was named manager of sales for the Salt Lake City sales office. James B. Black,

Jr., manager for sales of bar and semi-finished bar products, was appointed assistant manager of sales for the Denver office.

Refin Co. names new president

Louis L. Potomac, president of Alsynite Company of America, has been elected president of Refin Co. by the board of directors in connection with the company's expanded program of manufacturing glass-fiber reinforced thermosetting plastic pipe. Refin is located on the West Coast.

Raymond picks president

George F. Ferris, a director, vice president, and general manager of Raymond Concrete Pile Co. since 1946, has been elected president of the company to replace William V. McMenimen, retired. McMenimen, a director and vice president of the company since June 1918, served as chairman of the executive committee of Contractors, Pacific Naval Air Bases, during World War II. He is now chairman of the executive manage-

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Sprockets for Mill and Roller Chain



YUBA-Schrock sprockets are flame cut from steel plate. Patented cam-generated action produces sprocket teeth guaranteed to fit standard mill or roller chain with wearing qualities equal to sprockets made by other manufacturing methods. "Special" sprockets with "non-standard" number of teeth readily cut to order without penalty charges. Most emergency orders filled in 24 hours.

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BETTER SERVICE and enlarged repair facilities for Wild surveying instruments are available since the Henry Wild Surveying Instruments Supply Co. of America, Inc. moved into its new building (shown below) in Port Washington, N. Y. The instruments are designed and engineered in Switzerland for precision performance. The line includes transits, theodolites, levels, topographic instruments, photogrammetric equipment, cathetometers, drawing instruments, magnifiers, and microscopes.



ment committee of Construction Management and Engineering Associates of New York and Paris, a combination of those contracting firms formed to manage the U. S. Air Force construction program in France. He will continue in this capacity.

New sales mgr.

W. F. Teague has been appointed sales manager of the Industrial Product Division, Gustin-Bacon Manufacturing Co. He will direct sales of the company's pipe couplings for the entire United States.

Maginniss appointment

Lloyd E. Flanders has been appointed sales manager and assistant general manager of the Maginniss Power Tool Co., manufacturers of concrete vibrators and generators as well as other construction industry tools.

Baker-Lull v. p.

Richard T. Tiebout, manager of government sales for Baker-Raulang Co., was given additional duties recently when he was named vice president of Baker-Lull Corp., manufacturers of hydraulic loading and materials-handling equipment.

Changes at Rucker Co.

Wayne Harmon, a long-time engineering consultant, has been named assistant chief engineer by the Rucker Co., manufacturer and distributor of hydraulic and pneumatic components and power systems. C. J. Niven, a field engineer in the Los Angeles and Oakland offices, has been appointed manager of Rucker's branch office in Seattle.

Spokane builders lament award to Chicago firm

DESPITE voluminous protests by members of the Spokane, Wash., Construction Council, the Spokane City Council has refused to cancel the contract it awarded to the Chicago firm of Greeley & Hansen to design Spokane's sewage disposal plant.

The City Council submitted a written statement as to why it took the action it did. It said that all engineers interested were given an opportunity to appear before the council and present their qualifications, and then went on:

"Our investigation and the recommendation of the city engineer convinced us that Greeley & Hansen was not only eminently qualified, but also had actual experience in constructing hundreds of such plants."

Local contractors had asked that the contract be cancelled, the obligation to the Chicago firm be paid off, and the award be given to a local engineer. Estimated cost of the project is \$4,700,000.

Demolition crews ready area for Denver center

DEMOLITION CREWS of the Barnett Co. were busy in downtown Denver during April, razing old landmarks while clearing the way for several modern buildings in a new shopping center.

Plans for one of the new buildings, the \$15,000,000 Boettcher Center skyscraper, have been revised to include three additional stories, making it a 23-story tower, one of the tallest in the West.

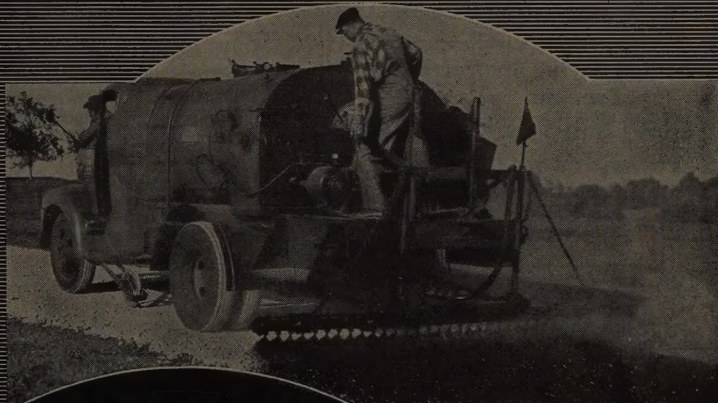
The building, to be built of glass and aluminum, will provide more than 400,000 sq. ft. of completely air-con-

ditioned office space, according to Robert G. Morgan, a Boettcher Center official. It will be set back from each street it fronts on by a 25-ft. landscaped area, and will be separated from the other new buildings in the center by a landscaped plaza.

A new Union bus station, to be four stories tall, will include facilities for selling airline tickets, offices, a large restaurant, and several shops.

The two-story Sears-Roebuck building will be the only structure in an area of several blocks not torn down.

NO TIME LOST! LOADING OR LAYING ITS LOAD



**A STANDARD STEEL
PRESSURE DISTRIBUTOR
GIVES EQUAL CIRCULATION
THROUGHOUT
THE SPRAY BAR FOR A
UNIFORM SURFACE
FROM CURB TO CURB
FOR LONGER WEAR**

STANDARD STEEL PRESSURE DISTRIBUTOR

The Model 424 can be loaded in quick time for a "fast get-away". A two-way cleaning system guarantees a clean spray bar at the end of the day. First, the material is sucked out of the bar and back into the tank. Then by turning one small valve, cleaning solvent is released into pump and spray bar (without contaminating the asphalt in the tank). No time lost in tinkering — no time lost in loading — Standard Steel 424 keeps going all day long far ahead of the "gravel gang"

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Space is sold as advertisers' inches. All advertisements in this section are 1/4 in. short of contracted space to allow for borders and composition.

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FOR SALE

- 1—Colby Mdl. 240 Revolver Crane, 45-Ton Cap., 135 Ft. Boom.
\$40,000.00 Loaded on Cars
 - 1—Noble Mdl. CA-154 Concrete Aggregate Batch Plant with Conveyors and Winter Heating Plant.
\$35,000.00 Loaded on Cars
 - 2—Gardner-Denver 500 CFM Port. Air Compressors. Hours used 3440 & 2113
\$6,000.00 Each
 - 1—43' x 111' Steel Pontoon Barge
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 - 1—Transit Mix Truck, 4 1/2 Cu Yd. Cap., mounted on Ford F-8 Chassis \$7,000.00
- You are invited to inspect equipment at Rock Island Dam, approximately 12 miles south of Wenatchee, Washington.

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- 1—D8 Cat. 8R Series Complete w/LeT. PCU.
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- 1—D7 Cat. Trackson Loader 3T Series Complete w/1/2 cu. yd. Rock Bucket & 1—2 cu. yd. Material Bucket.
- 1—TD 24 Int. w/Bucyrus-Erie Dozer & PCU.
- 1—TD18 Int. w/Dozer & PCU.

MOTOR GRADERS:

- 6—Cat. 12 Motor Graders Complete w/6—13.00 x 24 Tires, Wide Scarifier & Hydraulic Steering Booster.

SCRAPERS:

- 2—Model LP. LeTourneau Carryalls.
- 4—Super C Tournapulls.

TAMPERS:

- 1—Kay-Brunner 60" Sheepsfoot Tamper (Double) Meets Bureau of Reclamation Specs.
- 1—Southwest 60" Sheepsfoot Tamper (single).

RIPPERS:

- 1—K30 LeT. Ripper.

EUCUIDS:

- 6—Model 49FD — 10 cu. yd. End Dump Euclids.
- 11—Model 71FDT—17 cu. yd. Bottom Dump Euclids.
- 13—Model 9FDT—25 FDT—43 FDT—13 cu. yd. Bottom Dump Euclids.
- 3—5000 Gal. Euclid Water Wagons.

SHOVELS & DRAGLINES:

- 1—Northwest 80D Combination Shovel & Dragline, Serial No. 12672.
- 2—Northwest 6 Combination Shovel & Draglines, Serial No. 8312.
- 1—Lorain L82 Combination Shovel & Dragline, Serial No. 14649.
- 1—Lorain MC416 Motor Crane.
- 1—Shovel Front w/4 cu. yd. Esco Bucket for 1201 Lima.

DRAGLINE BUCKETS:

- 1—3/4 cu. yd. Owen Clam Bucket.
- 2 1/2—3—3 1/2 & 4 cu. yd. Hendrix Perforated Dragline Buckets.
- 3 & 4 cu. yd. Esco Dragline Buckets.

CONCRETE BUCKET:

- 7—Gar-Bo 2 yd. Manual Operated Heavy Duty Concrete Buckets.

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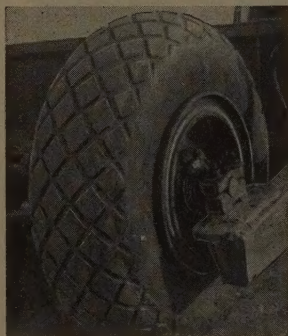
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on all types of heavy equipment

Airplane tires are made of real rubber, exceptionally strong for stress and impact; more serviceable because of flotation effectiveness, more rugged construction and LOWER INITIAL COST.

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(No CMP Allowment required)

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Shipped New — Used Only One Job

CARNEGIE	MP-101	MP-102	TEES
Length	Pcs.	Pcs.	Pcs.
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Also quantity 35 ft. and shorter—Quick Shipment. Regardless of job, location. Write, Wire or Phone
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Johnston Stainless Welding Rods

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BACKFILL, uncompacted

Experimental suicide?

There was a long history of suicides from the Colorado Street bridge in Pasadena, California, before the famed Rose Bowl city did something about it. They put up a 7-ft. woven wire fence along the bridge and topped it with barbed wire. The roadway took on the look of a cattle chute, but the suicide rate went down, and residents in the canyon below breathed more easily.

Now the problem has arisen all over again with construction of the new Colorado freeway bridge nearby. The bridge is still incomplete, but city officials are dickering over seven different types of anti-suicide fencing. One such was pictured in the newspapers recently—7-ft. wrought iron bars with sharp points bent inward at the top.

The thing that bothers us is that current installation is termed "experimental." Traffic engineering must be taking on the heroic quality we've found associated with medical research. But who are the "guinea pigs" for this experiment?

A really expert witness

A consulting geologist got in his sticks from the witness stand recently. Stanley Bendorf appeared before a Federal Power Commission hearing to give expert testimony for his client, Pacific Northwest Pipeline Corp., which seeks to pipe natural gas into the Pacific Northwest. Bendorf's answer to one highly technical question involved considerable time and the analysis of a mathematical formula. It left the lawyers completely confused, one of them asking, "Do you get the answer in tons or barrels?"

The point under discussion was quite apparently one that the lawyers weren't qualified to evaluate, even through questioning. So it isn't surprising that they came off second best as geologists. And for asking the question in the first place, therefore, we believe they came off second best as lawyers.

No union card required

The little group of men that used to gather at the railroad station and watch steam locomotives thunder past has moved away. Young and old, they now keep a close watch on construction jobs. Power shovels and crawler tractors—especially bulldozers—attract sidewalk superintendents even in places where there are no sidewalks. But the appeal is the same:

these people would all like to try their hands at operating the equipment.

One of the equipment manufacturers has gotten the right idea. Harnischfeger Corporation is getting set for a coming machinery show, and they have announced that a P&H Miti-Mite truck crane will be on hand for the visitors to operate. This is good business, considering all the potential buyers that will be wandering around. But we'll bet that a good showing of sidewalk superintendents will be on hand too, taking their place in line.

For ourselves, now, we're holding out for the chance to tear up an unwanted acre or two with a bulldozer.

Little white lines

The new look on Washington highways this year is a white center line. Yellow paint will be reserved for in-lane striping to warn against passing on hills and curves.

We've always preferred the white paint, ourselves, but wondered at

Twenty-five years ago in Western Construction

"The U. S. Bureau of Reclamation will receive bids June 7 for the construction of the Owyhee dam, at the Hole-in-the-Ground dam site on the Owyhee River in eastern Oregon."

* * *

"The Coolidge multiple-dome dam under construction on the Gila River, near San Carlos, Arizona, for the San Carlos Irrigation Project, by the U. S. Indian Irrigation Service, is nearing completion. The contractors, Atkinson, Kier Bros., Spicer Co., have made remarkable progress..."

* * *

"A bond issue of \$4,250,000 will be submitted to the voters of Multnomah County, May 18, for the construction of the St. John's bridge across the Willamette River. M. E. Reed is bridge engineer for the county."

* * *

"Truckee River Power Co. has applied to the California Railroad Commission for permission to extend its electric service into the town of Truckee, Nevada County."

times if habit didn't have something to do with it. The Washington people say not. White really is easier to see—it reflects better.

There are other reasons for the switch. It will save money—fifty cents a gallon, perhaps \$45,000 a year. And it brings Washington in line with the practice of many other states.

Three dams, six schedules . . . twelve contractors

The Tri-Dam Project on California's Stanislaus River came up to bid at about the last possible moment for us to tell about it this month. We'd have mentioned the fact one way or another anyhow, because we'd been told that four tons of drawings and specs had been put out by International Engineering Co. This was close to 200 sets, so they must have been a hefty lot for the estimators to digest.

Apparently some people choked on it all, because April 16 found just 12 bidders or bidding ventures in the running. Here are the ones who came away happy:

General Construction Co., Pacific Bridge Co., The Shea Co. (sponsor) and Henry J. Kaiser Co.; \$8,201,567.44 for Schedule 1 (Donnells Dam), \$7,119,487.21 for Schedule 2 (Donnells tunnel and penstocks), \$1,251,544.76 for Schedule 3 (Donnells powerhouse).

Winston Bros. Co. (sponsor) and Al Johnson Construction Co.; \$7,926,673.00 for Schedule 4 (Beardsley Dam and powerhouse).

Macco Corporation, Morrison-Knudsen Co., Inc. (sponsor), and River Construction Corp.; \$6,557,202.25 for Schedule 5 (Tulloch Dam and powerhouse).

John C. Gist Co. of Sacramento; \$218,680.00 for Schedule 6 (revisions to Goodwin Dam).

Aid to the lovelorn

As if anyone needed it, here's another warning about women.

A woman turned up at our office a few months ago all set to buy a single copy of *Western Construction*. We graciously provided the magazine, but we asked in a friendly way if she wanted it for her husband. Was he a construction man?

Oh, the lady said, she wasn't married. But a girl friend of hers had once bought a copy of *Western Construction*, found out where there was a big project, and gone to work as a waitress in a nearby restaurant.

The girl friend had wound up marrying one of the men from the job, concluded our "new subscriber," and she thought she would try the same thing herself!

By THE EDITORS