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WESTERN

CONSTRUCTION

Volume 28

MARCH 1953

Number 3

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FRONT COVER

HERE'S A VIEW you're likely to see on a visit to any of many current Western jobs—the rear of a tractor-scraper unit booming by with heaped load. The one you see (almost) on this month's cover is on a road job near Roseburg, Ore., where Stevenson Construction Co. is handling 1,280,000 yd. of heavy gumbo. If you want to be up-to-date on latest earthmoving techniques, better check two articles in this issue—see pages 68 and 81.

Photo by Caterpillar Tractor Co.

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Storage is more important than land

Many Western communities are situated on or straddle the river channels downstream from storage dams. For all such towns or cities the recent experience at Redding, California, not many miles downstream from Shasta Dam, represents an object lesson and a demand for better control of land use adjacent to these flow channels.

Prior to the building of the dam, the Sacramento River developed flood flows at Redding of 200,000 cfs. With the flood control effected by the reservoir, and the capacity allotted for that purpose, the Bureau of Reclamation stated that flows could be reduced to not exceed 80,000 cfs. Obviously, there was made available for use a marginal area in the flood channel previously under threat of annual overflow. However, the real estate development acquired the customary momentum and was not checked by proper city or county control. It encroached into the channel which had been definitely announced as needed for the maximum release in the operation of the reservoir. Several seasons passed without the need for using this entire channel, but during January the river discharge above the reservoir required the release of flows up to 70,000 cfs.—less than the specified limit needed for reservoir operation. As a result some homes were flooded and other property damage occurred. Public reaction and newspaper reports provided the impression that the agency controlling the reservoir was at fault.

The fault and the answer to the basic problem rested entirely with the local authorities—either city or county—where restrictions on use or some manner of adequate zoning should have originated and been enforced. Having announced the discharge that would be required from the reservoir to carry out its intended multipurpose service, the Bureau of Reclamation had neither further responsibility nor authority to control encroaching land-use in the channel. This logic would apply equally to any agency directing the operation of a storage reservoir, whether the agency be federal, state or local. Use of water in the West is a paramount consideration for all progress, and land use must be made to conform to the requirements of reservoir use.

As storage reservoirs continue to increase in number and size on Western streams this problem will be repeated regularly, with a variety of local factors to add complexity. The lesson from Redding stands as an example of the need for enforceable restrictions covering utilization of downstream channel lands.

More funds for highways in 1953

Assurance comes from all parts of the West that funds available for highway construction will be increased during 1953 in almost every state, as predicted in our annual forecast issue. Engineering evidence of needs advanced by state highway departments is being backed up by less definite but more powerful public pressures. Legislatures are now considering the various means for adding to existing sources of revenue. Three methods most commonly being considered are: (1) increase in the fuel tax, (2) bond issues or tax anticipation warrants and (3) tolls, either for new routes or on existing structures to improve approach or nearby facilities.

By one of these methods, or a combination, added funds will be available for the use of highway departments, with corresponding allocations for county and city work. The year 1953 could well be considered as the beginning of a new and expanding era in the highway engineering and construction in the West.

Rain-making—New contractor's problem

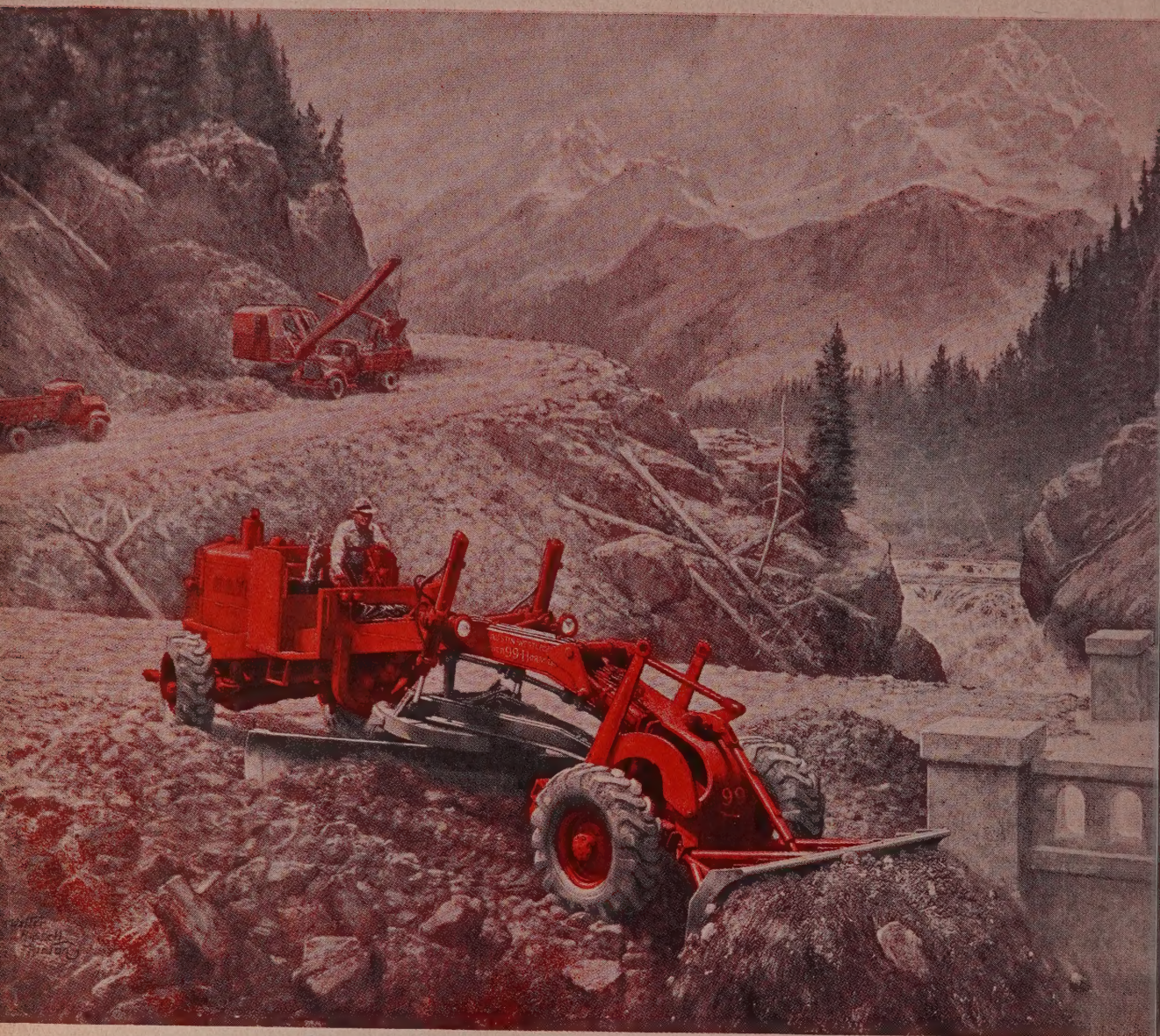
Weather is one of the important things for a contractor to reckon with. A dam job is especially susceptible to the effects of weather over a large area, and rainfall anywhere in the watershed could disrupt the construction schedule. Until recently contractors have not had to consider the factor of "man-made" weather.

The resulting questions are as varied and as complex as they are new to the construction industry. Should a contractor lose a cofferdam after a watershed had been seeded for rain, would he have a just cause for legal action? Could it be proved that the results in precipitation over the watershed, both as to total and the intensity for a period of time, were different from what *might* have occurred as a natural action of the weather?

One of *Western Construction's* authors this month, Ray K. Linsley, Jr., suggests that an ability to answer questions such as these may be the key to a contractor's successful protection of his position in the face of any extension in present efforts at rain-making.

The author admits lack of legal precedent in such matters, and his suggestions of the precautionary measures available for contractors therefore appear very expensive indeed. Nevertheless the author's evaluation of rain-making is a thoughtful review of the subject. He speaks as an authority, from his position in the hydraulics department of Stanford University, following a long career in the field of meteorology and hydrology, including direction of the hydrologic services branch of the U. S. Weather Bureau. Professor Linsley's views may be considered debatable, but they constitute a valuable guide on a new subject that is vital to contractors.

in **1953** for the 16th Consecutive Year



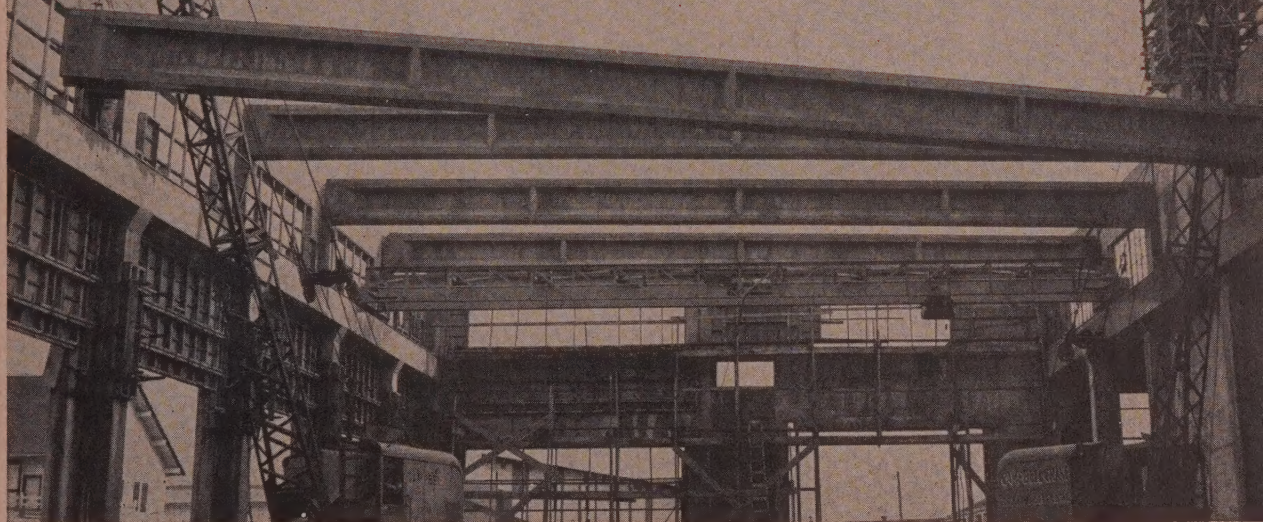
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MARCH 1953



Up go girders of new Highway Department shop. It's—

OREGON'S FIRST PRESTRESS JOB

Entirely precast roof system features seven post-tensioned girders—Freyssinet system used, wires tensioned from both ends to reduce friction losses—Familiarity from repetition speeds work

THE OREGON State Highway Commission has under construction at Salem, Oregon, a shop building for the repair of heavy equipment. The building is 161 ft. long by 80 ft. wide, outside dimensions. A clear working space 56 ft. in width and the full length of the building has been provided. This space is served by two traveling cranes that require a clearance under the roof girders of 25 ft., 8 in. above the floor level.

Design of roof system

The roof system consists of seven precast, prestressed concrete girders supported on columns and spaced 20 ft. apart. These girders, with the end walls, divide the roof into eight sections 20 ft. long and 60 ft. wide. The design of the girders was in accordance with the practice now almost universally adopted for such members. They were designed for their own weight, the weight of the roof

slab, and a 30-psf. snow load. The roof slab was also precast—but not prestressed—in panels 18 ft., 7¾ in. long by 6½ ft. wide which rest on ledges cast in the top flange of the roof girders. This roof system is, in so far as the writer knows, the first prestressed concrete project in Oregon.

The girders have an "I" section as shown in the drawing (see page 58). For 18 in. at each end, the section is rectangular, 20 x 36 in., to provide room for the cable anchorages and to brace the flanges. Stiffeners were provided at mid-span and at quarter points. The span length, center to center of bearings, is 57 ft., 7½ in., and the overall length is 58 ft., 4 in.

The concrete was made from Wil-

lamette River sand and gravel with a maximum size of coarse aggregate of ¾ in. A cement content of 8 bags per cu. yd. was used. A cylinder strength of 4,000 psi. at 28 days was specified. The actual cylinder strength at 28 days averaged 5,500 psi.

Reinforcing

The reinforcement consisted of eight cables each with 12 parallel wires 0.196 in. in diameter enclosed in a flexible metal sheath. The wire was required to have a minimum ultimate strength of 220,000 psi. The cables were laid in pairs and supported by carbon steel stirrups. Each girder required 620 lb. of wire and 680 lb. of carbon steel bars. The principal functions of the bars were to control cracking while the concrete cured and to hold the cables in position while the concrete was being placed. All bars were ¾-in., except the bars in the ledges at the top of the girder that supported the roof slabs. These bars were ⅝-in. round.

Forms

Only one set of side forms was needed as these forms were removed 36 hr. after casting. The side forms were made in four sections for easy assembling. Bottom forms were left

The contractor's comments...

"CONTRACTORS are naturally inclined to use the methods of construction with which they are most familiar. In bidding jobs, they are apt to revert to methods previously used because past experience and cost records of similar work form a base for estimate. It is therefore something of a guess the first time to estimate and bid a job using prestressed beams and precast slabs.

"However, having now had the experience of at least one job, we feel that we have learned some things, which are, briefly:

(1) It is essential that the work be laid out and scheduled to re-use forms and personnel for each operation.

(2) Special consideration is required at times, as for the 72 precast lightweight slabs on this job. The problem, of course, was to cast them accurately to dimension in order to insure proper fitting. This required very rigid and expensive forms. Three sets were

made, and by steam curing the slabs it was possible to pour six per week, and to cast the entire 72 prior to the required erection date.

(3) Erection of prestressed beams and precast slabs offered no special problems. The beams were moved in on lumber carriers. Two cranes were used to lift each into place. This was necessary, as the beams were designed for end lifting and it was not practical to use a bridge or lifting device for a 58-ft. length. Erection of the slabs was simple. Lifting rings had been cast in each corner so that by using two ordinary wire rope bridles the slabs could easily be lifted and balanced.

"The erection of 7 prestressed beams and 72 slabs was started on a Monday morning and completed by 2:30 p. m. on Wednesday, making the actual working time for erection 22 hours."

CHARLES J. JOHNSON
Parker-Johnson Company

in place as the girders were not moved until after prestressing. It is advisable to design the girder section so that concrete can be easily placed in the bottom flange. Note the 45-deg. slope of the flange top. This allowed placing of 2-in. slump concrete through the 6-in. web and around the eight cables. The end anchorages for the wire were inserted in the end girder forms, and the girder concrete cast around them. The girders were cast in the shop yard just outside the building and were kept damp for the entire time until prestressing was done.

The prestressing was done by the Freyssinet system and was supervised by Jean Muller and James R. Libby

of the Freyssinet Co., Inc. The cables were tensioned from each end, simultaneously, to hold friction losses to a minimum. Friction losses do develop. The design required a force on each cable of 47,800 lb., which corresponds to a stress of 132,000 psi. in the wire. But, to obtain the elongation for a stress of 132,000 psi. over the entire length of wire, an average force of 51,500 lb. had to be exerted on each cable. Friction losses should be sus-

END DETAILS show important features of prestressed girders. At left, note steel lifting loop cast into member for easy handling in erection. At right, tensioning jack is in operation. Opposite ends of same wires are being stressed at the same time to lower friction loss.

ceptible of calculation by the belt friction formula:

$$\frac{\text{Applied force}}{\text{Induced force}} = e^{fa}$$

Induced force

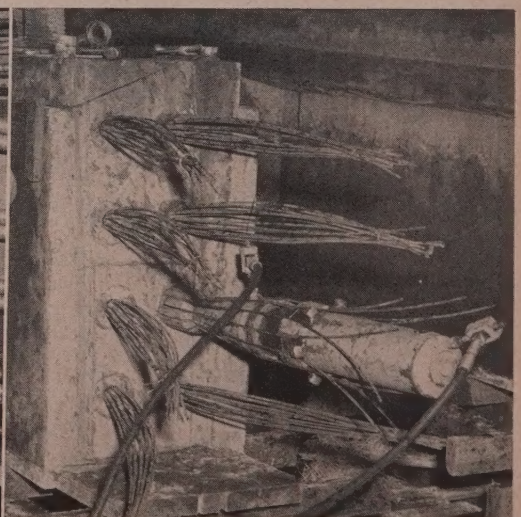
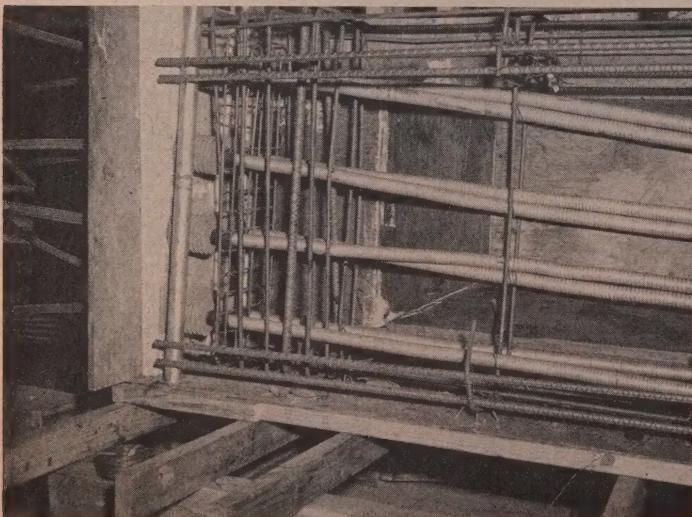
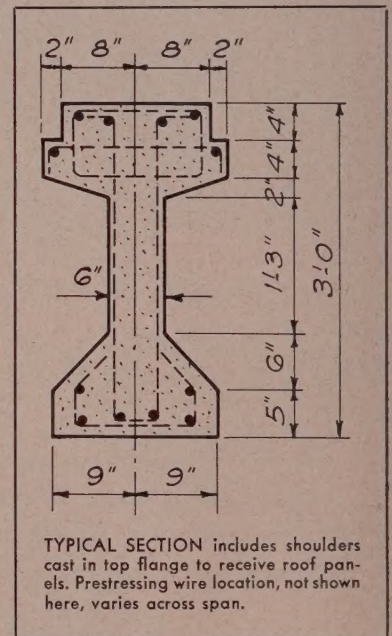
where e = Napierian base

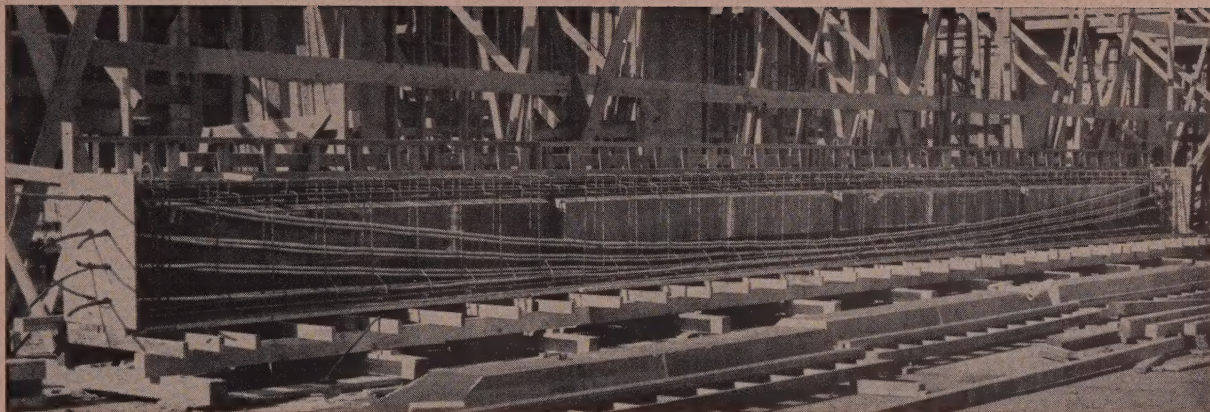
f = coefficient of friction

a = angle change in radians

On this particular job the apparent coefficient of friction was about 0.5. In estimating the angle change, changes in both the vertical and horizontal directions must be taken into account.

The tensioning was done from the top down. There was some concern that the tensioning of one cable at a time might cause a horizontal bow in the girder that would interfere with the placing of the precast roof slabs. Therefore, a tight wire was strung





STEEL AND CABLES in place, form for one girder is ready for buttoning up prior to pour. Stripped 36 hr. after pour, single set of side forms could be re-used for all 7 girders.

along the girder, but measurements did not show any horizontal deflection. The tensioning did raise the girder off the bottom forms.

After tensioning the wires were grouted by pumping grout from one end under pressure of 80-100 psi. until it ran out the opposite end. The grout was mixed with 1 part cement and 2 parts of mason's sand. The wires were cut off 6 in. from the girder ends and bent to lie parallel with the face of the concrete. They were later covered by the poured-in-place end encasement.

The contractor's crew was entirely unfamiliar with prestressing, and the crew of five men took the greater part of a day in tensioning the first girder. The remaining six girders were tensioned in 7 hr. Grouting took a crew of five men 8 hr.

The girders were cast in a convenient location outside the building. After prestressing the contractor moved them inside the building with two lumber carriers which picked them up at each end and placed them on the shop floor under their final position. They were hoisted into position by two truck cranes and set on top of the columns. The hoisting operation took 8 hr. Each girder weighed 13 tons.

Each roof slab is made up of precast sections 18 ft., 7 $\frac{3}{4}$ in. by 6 $\frac{1}{2}$ ft. Each slab is 2 in. thick, reinforced with wire mesh having No. 4 wire at 3 in. transversely and No. 9 wire at 16 in. longitudinally. The sides and ends have beams 6 in. deep and 4 $\frac{1}{2}$ in. wide cast integrally with the slab, making a total depth of 8 in. These beams were reinforced with one 1-in. round bar. Lightweight expanded-shale aggregate was used. The design anticipated 2,500 psi. with a weight of 80 lb. per cu. ft. This strength could not be obtained without the addition of hard rock sand. The final mix was 4 $\frac{1}{2}$ cu. ft. of lightweight aggregate, $\frac{1}{2}$ -in. maximum size, 50 lb. hard rock sand, $\frac{1}{2}$ lb. Pozzolith and 1 $\frac{1}{4}$ bags of cement. This mix developed a cylinder strength of 2,550 psi. at 28 days, moist-room cure. The concrete weighed 97 lb. per cu. ft.

Seventy-two panels were required. The contractor cast a concrete block on a concrete slab in the yard adjacent to the building to form the underside of the panel. Side forms were of steel bolted to the slab. After casting, a light timber frame covered with canvas was placed over the panel and steam from a portable boiler was used for rapid curing. The panels could be safely lifted off the form in 44 hr., and the forms re-used. Three of these forms were built.

The panels were placed with a truck crane. The placing of the entire roof slab took a crew of nine men 8 hr. After placing, the end and side joints were filled with grout. The finished roof will have a three-ply membrane surface.

This roof system has been very satisfactory. The prestressed girders

allow a shallow depth and are members light enough to be easily handled. The precasting of both girders and slab panels saved the cost of all falsework, which would have been a sizable item for a building of this height. The installation is an example of the combination of precasting with prestressing of structural members, which will find wider and wider use as engineers and contractors become more familiar with its possibilities.

The project is being built under the general direction of R. H. Baldock, State Highway Engineer. It was designed by C. C. Schneider and T. G. Thompson of the Bridge Division of the Oregon State Highway Department, and the construction supervised by Haven Nutting, Resident Engineer. Prestressing was supervised by Jean Muller and James R. Libby of the Freyssinet Co. Parker-Johnson Co. of Portland, Oregon, is the contractor, with W. R. Wilson as superintendent.

Northwest has its first prestressed bridges

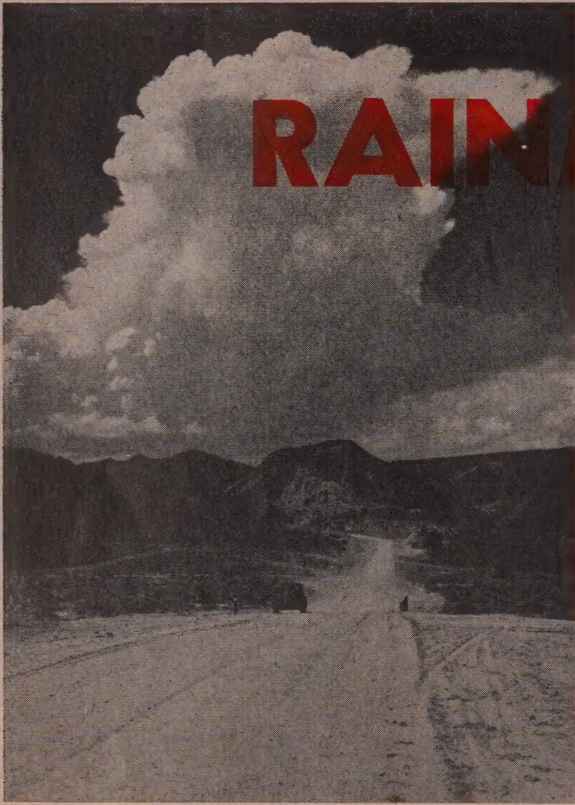
TWO PRESTRESSED concrete bridges, first of this type in the Pacific Northwest, have been completed near Aberdeen, Wash., and in the Snoqualmie National Forest. And a third is under construction near Port Angeles. According to Powell & Eldridge, Seattle consulting engineers, all three have these characteristics in common: they are built by private lumber companies on U. S. Forest lands; planned loading is H-20 S-16; length is about 125 ft., with a main span of 75 ft. and two approach spans; construction techniques are similar for each.

Exemplifying design and construction details is the first completed bridge on the Humptulips River near Aberdeen, built for the Anderson Middleton Lumber Co. Neukirch Bros. was the contractor, and Kelly B. Heffner, U. S. Forest Service bridge engineer, had general supervision of the work.

Caps and girders for the 76-ft. span

were cast at a yard in Tacoma and hauled to the site for erection on cast-in-place footings and piers. Six I-section girders, 3 $\frac{1}{2}$ ft. deep with 2-ft., 9-in. wide top flange, were placed side by side with top flanges forming the bridge deck. Prestressing in these girders consists of three 1-in. high-tension strands at the bottom and three similar strands in the web. Heavy greasing and subsequent plastic coating on the strands prevents bonding with the concrete. Hydraulic jacks maintained a tension of 82,000 lb. on each strand while the girders were being cast. At the third points and ends of the girders holes and diaphragms are provided for prestressing the bridge transversely.

Second* completed bridge in the Snoqualmie National Forest was built by Lidal Construction Co. for the Cascade Lumber Co. The Lidal firm is also building the third bridge, near Port Angeles, for the Albion Logging Co.



RAINMAKING—

IT WORRIES CONTRACTORS

There is little chance that an artificial deluge will ruin your job, but some knowledge of present-day "rain-making" is valuable—Here are facts, and some recommendations that form a handy "insurance policy" for Western contractors

By RAY K. LINSLEY, JR.

RAIN for thirsty crops! Rain where you need it and when you need it! This has been the lure of the rainmaker down through history. We have learned to build great reservoirs that store water in years of plenty so that it may be used in years of shortage. But these reservoirs are expensive. And they certainly aren't "mobile." For these reasons, and because we are continually developing new uses for water, if not actually inventing them, the hope of producing more rain at negligible cost still flourishes.

The tremendous demand for water brings other problems, however. In our complex economy, where fields of work and interest vary widely, there are probably as many people who do not want rain on a given day as there are who need it urgently. An orchardist with trees in bud stands to suffer heavy losses from the same rain that makes his neighbor's pasture grow lush and thick.

Contractors are vulnerable

Probably no single group is more seriously affected by inopportune rain than the contracting industry. The very nature of its work finds it dependent on the weather. Rain can ruin a partially completed job. At best, rain may mean a loss of working time, with expensive equipment lying idle, and perhaps a lot of clean-up work before work can begin again. Small wonder that contractors look with a wary eye on developments in rainmaking.

Here is where modern cloud seeding enters the picture. It is called "cloud seeding," or "artificial nucleation," because that is the actual process whereby the rain is "made." Experiment and observation have shown that raindrops evolve from the condensation of tiny moisture particles on some microscopic nucleus, usually dust, combustion particles, or sea salt. (See "What do we know about rain?" in boxed section on page 62.) Oddly enough, this process does not occur



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naturally unless the cloud temperature is considerably below freezing. Thus, if man can introduce a nucleating agent into the cloud so that ice crystals form at a higher temperature than is natural, he may succeed in bringing rain from that cloud.

Experiments have also shown that dry ice induces crystal formation at temperatures of about 30 deg. F., while silver iodide particles seem to be effective below 23 deg. F. The silver

iodide is thought to work because its crystal structure resembles that of ice. Dry ice, on the other hand, apparently cools the water vapor of the cloud to a point where natural processes take over. A further idea, advanced by Australian experiments, is that the discharge of water spray into a cloud top provides drops large enough to grow by collision as they fall through the cloud.

Tests have fizzled

Hundreds of tests of artificial nucleation have been made by seeding the tops of towering cumulus clouds. These are the sort of clouds typical of thunderstorms. It is possible to select a cloud that extends in altitude above the freezing level, introduce the seeding agent, and watch the results. There is little doubt that seeding agents have caused rain to fall in many cases where it would not have fallen naturally.

But the amounts of rain have been small, usually less than 0.2 in. This means little economic value, most of the rain evaporating soon after it falls. Moreover, many trials were quite unsuccessful in producing any rain.

What, then, is necessary to make for a heavy rain? Clearly the main requirement is water. The average cloud contains less than 0.002 cu. in. of water per cu. ft. of cloud. Simple arithmetic leads to the conclusion that a cloud 10,000 ft. thick contains

only about $\frac{1}{8}$ in. of water in a vertical column. This is confirmed by tests on isolated clouds. If a heavy rain is to occur, there must be a continuous inflow of moist air into the cloud.

But, this same strong inflow of moist air is exactly what is needed to bring about the lifting and cooling process necessary for natural rain. Thus, the conditions under which cloud seeding might produce heavy rain are those which are also most likely to bring natural rain. Most cloud seeding operations, therefore, are intended to increase the rainfall in natural storms rather than to bring about rain from otherwise "rainless" clouds.

More unknowns

While it is possible to watch an isolated cloud and see whether rain follows a seeding operation, it is quite another matter to decide whether there was more rainfall from a big, seeded storm than would otherwise have occurred. Cloud seeders disagree over the possibility of introducing too many nuclei into a cloud. A few pounds of silver iodide would provide sufficient nuclei for an area the size of the entire United States if all the particles were effective. It may be possible that under some conditions cloud seeding reduces precipitation. In fact, some seeding companies have accepted contracts to reduce rainfall, presumably by overseeding.

Because of the difficulty of dispersing dry ice from a plane during severe storms, most cloud seeders prefer to use silver iodide, dispersing it from generators on the ground. The usual method is to burn a mixture of silver iodide and acetone with butane or some other gas. This method introduces still more unknowns into the seeding operation. How fast does the silver iodide reach the elevation where it can be effective? Is it over the "target" area (or better, a little bit upwind) when it reaches this elevation? In fact, does it ever reach the effective elevation? Scientists and engineers who are fighting the problem of air pollution know how difficult it is to predict or trace the movement of airborne materials from a given source. Experiments in Australia and Canada have led to the conclusion that ground generators are ineffective.

How can it be measured?

There are many other technical aspects of cloud seeding which might be discussed. Most important to the commercial application of seeding is this: Can we observe and measure its effect in terms of the rainfall that occurs? We have shown that seeding is best suited to augmenting natural rain. Now, therefore, we must determine the amount of rain that would have fallen without seeding.

There is no simple, direct way of doing this. The evaluation must be accomplished by comparing rainfall

in the target area with rainfall in a nearby "control" area, which may be assumed to be unaffected by the seeding operation. The method is illustrated in a simple way by the accompanying figure, which compares monthly rainfall at hypothetical target and control stations over a period of years. (Developing a comparison of this type with any accuracy for an actual location is itself a difficult job. Suitable records are often lacking, and judgment must be of a high order.)

Resorting to statistics

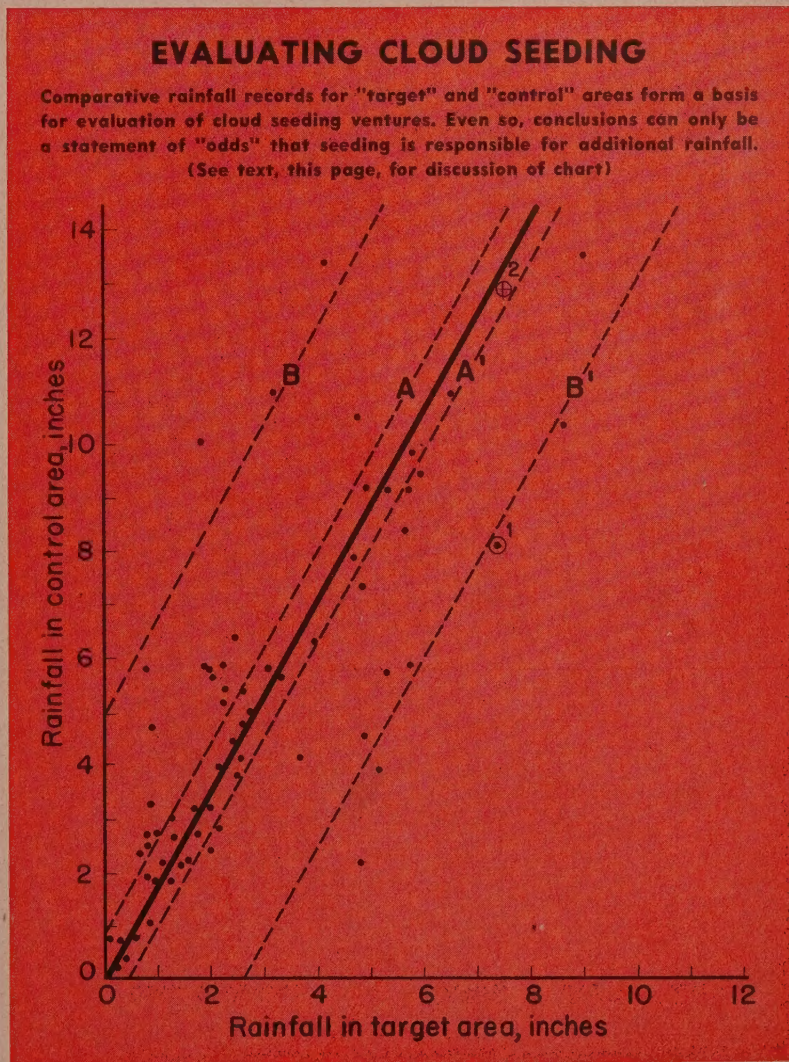
The relationship between rainfalls in the two areas is not perfect. In some cases, rainfall in the target area has been less than the mean (solid line); in other cases it has been more. The record in the target area for a month of seeded storms may very likely exceed the mean, which is a point on the curve determined by the control area record for the same month. After all, this could happen naturally. It is therefore necessary to

resort to a statistical analysis.

Further inspection of the figure reveals that most of the points are clustered near the mean curve. In the case of an infinite record, the line of "best fit" would so appear and would, in fact, have an equal number of points above and below it. A reasonably long finite record might be expected to follow this pattern, and this hypothetical record has been drawn accordingly.

Additional lines have been drawn on the figure to aid the evaluation. Lines A and A' have been drawn so that one-half of all points lie between them, and lines B and B' have been drawn to enclose 90% of all points. Only 10% fall outside lines B and B'. Since the points are equally distributed about the curve, then 25% are between the mean and line A, 20% are between line A and line B, and 5% are beyond line B. A similar situation exists for the groupings below the curve.

If Point 1 on the figure represents the record of a given month of seeding, we can say that there is only



WHAT do we know about rain?

WHAT do we really know about rain? Without some background in this phase of meteorology, we cannot practically attempt rainmaking. As a matter of fact, with some basic knowledge of rain, we will not attempt "rainmaking." Rather, we will conduct experiments in "cloud seeding" or "artificial nucleation." The term "rainfall augmentation" is also used, and it is a clue to the fact that no one claims to make rain come from a cloudless sky. To start with, however, let us learn a little about the natural rain process.

Facts

The atmosphere always contains water vapor. The quantity present over a given location may vary from nearly zero to a maximum of about 1 in. in depth. That is, if all the vapor in a column of air extending to the top of our atmosphere were converted to liquid, it might cover the bottom of the column to a depth of 1 in.

To convert this water vapor to a liquid, the air must be cooled to the temperature at which condensation begins, called the dewpoint temperature. The only way that an air mass can be cooled through a considerable depth is by being lifted to higher altitude. As it rises, it encounters lower pressures, allowing it to expand. This expansion is accompanied by cooling.

Typical conditions along the West Coast might show a surface temperature of 70 deg. F., and a dewpoint temperature of 60 deg. F. The air mass of our example must therefore be cooled 10 deg. if condensation is to occur. Since unsaturated air (air not already at the dewpoint for its water content) cools about 5 deg. for each 1,000 ft. that it rises, our air mass must rise about 2,000 ft. for condensation. This rise may be forced by the passage of the air mass over a moun-

tain range, or over a mass of colder air. Or, great bubbles of warm air may rise through surrounding cooler air like balloons. Upon being lifted in one of these ways, our air mass becomes saturated.

The cloud that begins to form about 2,000 ft. above the ground is composed of tiny water droplets, perhaps 0.0005 in. in diameter. Some 10,000 of these would fit on the head of a pin. Only a very slight upward air current is sufficient to prevent these droplets from falling toward the ground. Those that do fall evaporate before they drop very far through the unsaturated air below the cloud. Before any heavy rain can fall, the cloud particles must grow to a larger size, to a diameter of perhaps 0.025 in. This means an increase in volume of 125,000 times.

Theories

Many theories have been advanced to explain nature's way of bringing about this increase in size. The most widely accepted theory was suggested by a Norwegian, Bergeron, in 1935. He pointed out, essentially, that if ice crystals and water droplets are present in a cloud, the water droplets tend to evaporate and re-condense on the ice crystals. If there are not too many ice crystals, the end result is a relatively small number of large drops. Bergeron's theory seems to be the best explanation of the initial growth of cloud droplets. Beginning their fall after that growth, they collide with other cloud particles and continue to grow as they fall through the cloud. If the drops are big enough when they leave the cloud, they fall all the way to the ground without completely evaporating. Many times this is not the case, and the only signs of rain are streamers, called virga, that are visible below the cloud.

Since Bergeron's theory postulates the presence of ice crystals, it seems that our air mass must rise still farther, until it cools to 32 deg. F. Because the condensation of water vapor is accompanied by a release of heat, the cooling rate of our now-saturated air is less than before. Near the ground, the cooling rate for saturated air is about 3 deg. for each 1,000-ft. increase in altitude. Because of the smaller quantities of moisture present at higher altitudes, the cooling rate increases with height. Our hypothetical air mass reaches the freezing level at about 11,000 ft.

Practice

If we could explore the cloud at this level, we might be surprised to find no ice crystals present, even though the temperature is below freezing. In fact, if we were to control the rise of our cloud and watch it, we would find that no appreciable number of ice crystals appear until temperatures near -40 deg. F. are encountered. This means additional cooling of 72 deg., or a further rise to an altitude of about 30,000 ft.

How is it possible to cool water some 70 deg. below freezing without having actual freezing occur? Apparently, suitable nuclei must be present before the water droplets can turn to ice crystals. Natural nuclei are microscopic particles of dust, products of combustion, or sea salt. These natural nuclei do not become effective, however, until the water has been supercooled far below the normal freezing point.

Here is where modern cloud seeding enters the picture. It involves techniques for introducing artificial nuclei or inducing the formation of natural nuclei, in either case at higher temperatures than would be expected to permit natural rainfall in quantity. These techniques and the efficacy of today's seeding operations are described in the accompanying article.

about one chance in 20 that such results would have occurred naturally. Among natural storms, only 5%, or 1/20th, would produce such a record. On the other hand, a month of record plotting at Point 2 would be expected in one out of four times by chance—25% of the time. The actual statistical analysis is far more complicated, but results nevertheless can only be stated in terms of "odds" that a given record carries positive effects of seeding. Statistical study does not give any basis for saying positively that seeding did or did not affect rainfall.

The limitations of the statistical

approach are also emphasized by the facts that few commercial seeding operations are planned so as to make testing easy, and that few are continued for enough time to permit really adequate tests. The conditions of most seeding projects have precluded any real probability of detecting an increase or decrease in rainfall unless that increase or decrease amounts to more than 10% of natural rainfall. Furthermore, of the impartial evaluations of cloud seeding reported in technical journals, none has suggested any increase in rainfall as a result of seeding.

Thus, on the basis of present knowledge we may conclude that the functional benefits of cloud seeding (if any) are in the order of 10% or less of natural rainfall. Only carefully planned and rather elaborate experiments can lead to a more positive conclusion.

A valid determination of economic benefits from cloud seeding requires more than the statistical analysis outlined above. The nature of the operation suggests that it is least effective during the dry years when it is most needed and therefore has most eco-

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Faced with unusual problems at an Arizona site—

Mining firm builds an unusual dam

Built to augment water supply of Phelps Dodge copper milling operations, Jaques Dam on Show Low Creek has irregular plan and unique spillway to suit site geology—Earthmoving stopped by early winter, but progress on structures continues



JAQUES DAM on Show Low Creek in Arizona has been nearly completed after one season of work by Isbell Construction Co., prime contractor on the dam itself. Some 200,000 of a total of 370,000 cu. yd. of embankment were placed before a November freeze put a stop to fill operations.

The dam is located about 40 mi. south of Holbrook, Arizona, on a tributary of the Little Colorado River. With a storage of 6,500 acre feet, it will conserve floods to yield an estimated 5,000 acre feet annually that will indirectly serve the copper milling operations of its owner, Phelps Dodge Corporation.

The dam is an earthfill structure, 80 ft. high, 1,800 ft. long at the crest, with 3:1 side slopes and a 20-ft. roadway across the top at El. 6,580. Approximately 320,000 cu. yd. of earth fill and 50,000 cu. yd. of rock and

By T. T. BROOKS

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cinder filter will be required to impound 6,500 acre feet of water. Design of the dam was dictated entirely by the geology of the site, which consisted primarily of sandstones, siltstones and shales overlain near the top of the abutments by a basalt member about 20 ft. thick. Occurring under the highly fractured basalt was a layer of porous burnt soil varying in thickness from 3 to 5 ft. The wings of the dam were therefore extended along each abutment to the points where the contact was above the full reservoir level.

Except near the ends of the dam,

the fractured basalt and the underlying burnt soil will be blanketed with cinders which will act as a drain in event any seepage reaches these zones. About 9,000 cu. yd. of rock will be dumped at the downstream toe of the dam, while the upstream face will be covered with a rock blanket 2 ft. thick. The earth fill itself is composed of three zones, the upstream or semi-pervious, the center or impervious, and the downstream pervious sections.

The outlet works are all of reinforced concrete and include an intake structure 27 ft. high, a control tower 67 ft. high, about 415 ft. of conduit $3\frac{1}{2} \times 3\frac{1}{2}$ ft. inside dimension, and an outlet structure which will measure the discharge of water from the reservoir. Discharge will be controlled by a valve system installed at the base of the control tower and operated from its deck. A steel bridge will provide access from the crest of the dam to the deck of the control tower.

The spillway channel was excavated by removing the overburden with tractors and carryalls from the basalt flow around the west end of the dam. The channel formed is 220 ft. wide and about 7 ft. deep with a designed capacity of 10,000 cfs. Approximately 2,500 cu. yd. of concrete are required in the face slab and gravity sidewalls of the spillway channel.

Stripping

A contract for construction of the dam and appurtenant works was awarded to Isbell Construction Co. of Reno, Nevada, and on May 26, 1952, the work of stripping the dam foundation to bedrock was started.

A Bucyrus-Erie 54-B shovel equipped with a 3-yd. bucket and three 17-yd. Euclids were used to strip the west abutment and areas of the east abutment where large boulders prevented the use of tractors and carryalls. Otherwise, an Allis-Chalmers HD20 tractor with an 18-yd. scraper and a Caterpillar D8 pulling a 12-yd.

CONSTRUCTION of Jaques Dam on Show Low Creek has been undertaken for Phelps Dodge Corporation as a part of that organization's project to maintain an adequate water supply for the milling of copper ore at its Morenci plant in southeastern Arizona. The project involves an exchange of water among three watersheds.

By means of a pumping plant and pipeline, the excess waters of Show Low Creek will now be diverted from the Little Colorado and will instead be conveyed south over a divide into creeks tributary to the Salt River. This will assure continued feasibility of Phelps Dodge pumpage from the Black River, also tributary to

the Salt but farther upstream, to the Morenci mill. Effluent from the mill finds its way to the Gila River. Though the Gila and the Salt eventually join west of Phoenix, diversion from Show Low has become necessary in order to maintain adequate flow in the Salt above its confluence with the Gila.

All in all, the Show Low Creek project is an important feature of the Morenci Water Development Project under which Horse-shoe Dam on the Verde River (L. E. Dixon Co. and Arundel Corp., contractors) and Black River pumping plant on the Black River (Vinson Construction Co.) were completed in 1945.

—Editor.

scraper were employed in the stripping operation.

The overburden averaged 8 ft. in depth and consisted of basalt boulders embedded in hard clay. The hard rock removed in stripping was segregated and stockpiled for later use in the rock fill sections of the dam. A total of 80,000 cu. yd of material was removed in stripping.

As soon as the stripping of the east abutment had proceeded far enough to expose bedrock in the area to be occupied by the outlet conduit, the final location was chosen and excavation for the conduit was begun. The soft shales and sandstone making up the lower portion of the east abutment were easily dug with a backhoe. The excavation was made to the neat concrete lines and the outlet conduit was poured without outside forms. During the stripping the water of Show Low Creek, amounting to an average of about 10 cfs., was diverted along the west abutment in a bypass channel. When the outlet conduit was completed the water was diverted through it to allow completion of the west abutment stripping.

Concrete placement

Concrete aggregates were obtained from a deposit of sand and gravel near Snowflake, Arizona, 25 mi. from the dam. The contractor erected a screening and washing plant at the deposit and hauled the finished aggregate to the job in two 15-yd. Mack semi-trailers. A central batching plant was erected at the job site. A 4-bin batching plant loaded by a $\frac{3}{4}$ -cu. yd. Traxcavator was installed to dis-

charge into a Knickerbocker 1-yd. stationary mixer. The concrete is discharged from the mixer into two 4-yd. Dumpcretes which deliver it to the forms. Most of the concrete has been placed by means of a Northwest 25 truck crane using a 1-yd. Gar-Bro bucket. By November 15, approximately 1,800 cu. yd. of mass concrete had been placed in the spillway face slab and wing walls, and 500 cu. yd. of reinforced structural concrete had been placed in the outlet works.

Earthmoving

The stripping operation was completed on September 4, and in preparation for starting the earth fill the contractor moved in six 30-yd. Euclid bottom-dump trucks and 2 Northwest $1\frac{1}{2}$ -yd. shovels. A deposit of suitable earth for the center section of the dam was found in an open field adjacent to the highway about 2 mi. north of the dam site. A deposit of coarse-grained, soft, red sandstone was found $1\frac{1}{2}$ mi. north of the site and tests showed that this material was suitable for both the upstream and downstream earth zones. One of the Northwest shovels was placed in the impervious pit and the other in the sandstone pit to accompany the 54-B in loading material for the upstream and downstream zones of the dam. A haul road 40 ft. in width from the pits was constantly maintained by motor grader. As the sandstone used in the fill could be dug and loaded much easier after blasting, the contractor moved in a Bucyrus-Erie churn drill for drilling the sandstone.

Fill equipment included one Cater-

pillar D8 tractor pulling a 6-ft. diameter roller filled with sand and water. An Allis-Chalmers HD20 and another D8 took care of spreading the dumped material. One 4,000-gal. truck spread water on the material from the sandstone pit. As the earth from the impervious pit was found to contain almost exactly the optimum moisture, little water was required for its placement. Dumped material was spread in 12-in. layers, watered to optimum moisture, then rolled 12 passes to produce dry densities of 123, 119, and 121 lb. per cu. ft. in the semi-pervious, impervious, and pervious zones, respectively. In an effort to get the fill in before winter prevented further placement, the fill operation was placed on a 2-shift, 9-hr. basis for 6 days a week.

Sudden shutdown

On November 15, after the contractor had placed about 205,000 cu. yd. of material to bring the fill to El. 6,560, a series of unprecedented snow storms hit the area. A 12-in. snow on November 15, accompanied by near-zero temperatures and followed by an 18-in. snow fall on November 23, caused a shutdown of the fill operation. Subsequent test holes in the fill showed it to be frozen to a depth of 14 in., and low temperatures near zero persisted, precluding any possibility of continuing placement.

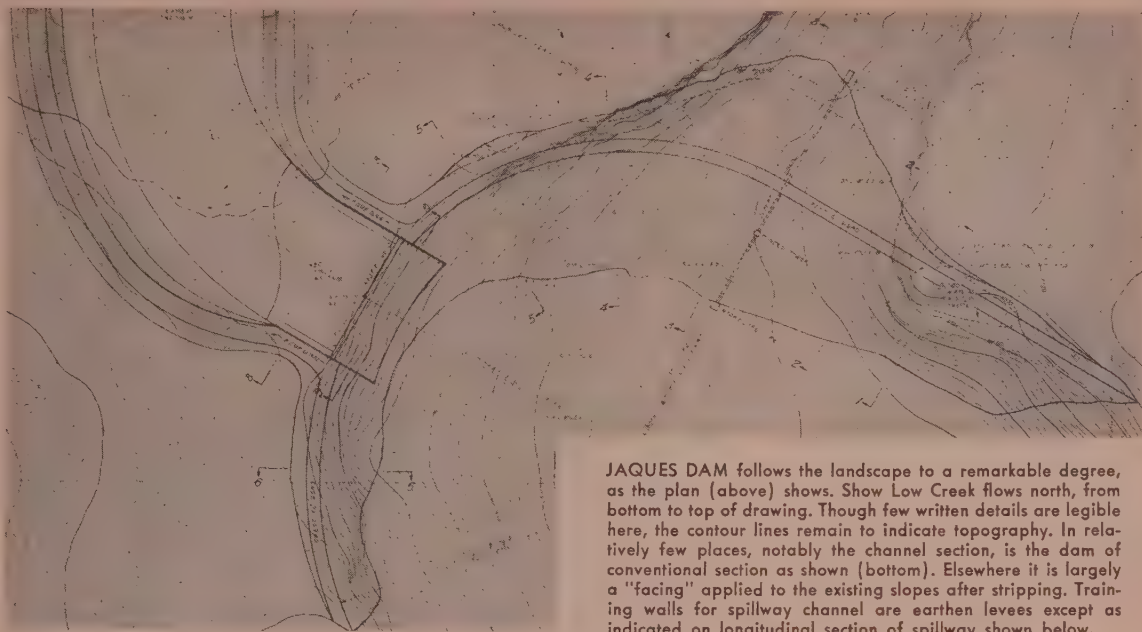
In order to protect the works against a possible flood, it was decided to excavate an emergency bypass channel to El. 6,560 through the east abutment and to place a temporary dike on top of the dam to El. 6,575.

SANDSTONE IS SHOT to supply portions of fill for dam construction. Excavation for all purposes is mostly in rugged ground, has needed blasting, backhoes and shovels.

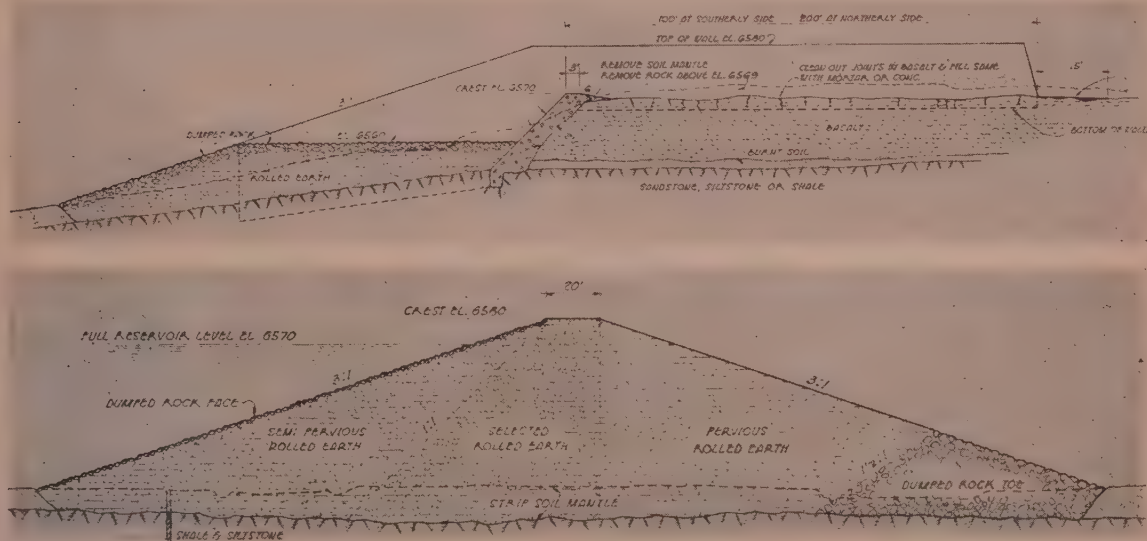
DIVERSION TOWER is completed. Bridge will connect to control house in foreground, also part of separate contract for structures held by J. H. Welsh & Son Contracting Co.

PIPELINE 4,200 ft. long, to carry water over rim, requires trenching through sandstone most of way. Blasting, backhoe and clamshell combine to do the work.





JACQUES DAM follows the landscape to a remarkable degree, as the plan (above) shows. Show Low Creek flows north, from bottom to top of drawing. Though few written details are legible here, the contour lines remain to indicate topography. In relatively few places, notably the channel section, is the dam of conventional section as shown (bottom). Elsewhere it is largely a "facing" applied to the existing slopes after stripping. Training walls for spillway channel are earthen levees except as indicated on longitudinal section of spillway shown below.



By so doing the project can store water to the 6,560-ft. elevation during the spring runoff season.

Diversion works

The pumping plant is located in the lake basin about 1 mi. south of the dam and is designed for a flow of 20 cfs., to be lifted 90 ft. through 4,200 ft. of reinforced concrete pipe over the Mogollon Rim. The contract for construction of the diversion works was let to J. H. Welsh & Son Contracting Co. of Phoenix.

Structures being built under this contract include a reinforced concrete diversion tower about 70 ft. high to house the seven pumps, a concrete

control building to contain a metering device, surge suppressor and electrical controls, an electrical substation, and a terminal structure with draft tube and measuring weir. The diversion tower is located in the lake basin while the control building is situated on the sandstone bedrock of the canyon side. The two buildings will be connected by a 100-ft. steel bridge. The bottom chord of the bridge is a 24-in. steel pipe which carries the water through the control building and into the 27-in. pipeline. Power for the project will be furnished under contract by Navopache Electric Cooperative, Inc., of Lake-side, Arizona.

Concrete aggregates for the Welsh contract were also obtained near Snowflake, Arizona. They were stockpiled at the job site, and batched through a 3-bin Binanbatch plant into two 4-cu. yd. transit mix trucks which delivered the concrete to the forms.

Forms

Steel forms are being used for all of the structures and are being supplied by Economy Form Corp. of Los Angeles. They have proved superior to conventional wood forms for the rather intricate structures. Placement of concrete in the diversion tower was accomplished by means of a

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Ease of placement, low cost, are advantages of new —

PREFABRICATED LININGS

Roofing and asphalt firms develop two types for use with or without cover — Field installations, including major reservoir at Denver, point up plus values and indicate further possible applications

THE GROWTH in use of sprayed-type buried asphalt membrane for the low-cost lining of irrigation canals and reservoirs has been rapid. In 1947, a few square yards were placed; by the end of 1952, more than 7,000,000 sq. yd. were in service in the West.

This strong trend toward prefabricated, easy-to-place linings has created much interest on the part of roofing and asphalt-plank manufacturers. Their research has been directed toward development of additional types of prefab linings with emphasis on (1) low cost, (2) low weight (to keep shipping costs down), (3) maximum pliability and toughness, and (4) water-tightness and resistance to deterioration under the severe burial conditions encountered in sub-surface linings. Attempts have been made, as described in this article, to gain these plus values without sac-

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prefabricated linings was the Johns-Manville Co. This company introduced a light-weight, asphalt-saturated-and-coated asbestos felt lining weighing about 47 lb. for a roll of 12 sq. yd. and costing about 28 cents per sq. yd., f.o.b. factory at Pittsburg, Calif. This lining was the result of many tests by Johns-Manville under the general direction of Harry Brodersen, technical director of the J-M Pittsburg plant.

First use of asbestos-type

Initial field installation of the J-M prefab lining was in April 1952 in a lateral of the Gering-Fort Laramie Irrigation District near Lyman, Neb. Several smaller installations have been made since. But the recent use of the product to line a large water supply reservoir of the American Smelter & Refining Co. at Denver, Colo., is to date the best evidence that

rificing all of the other requirements of a satisfactory prefab lining.

Two types developed recently meet these requirements and have been field tested. They are an asbestos-type lining, which uses a layer of earth and gravel to hold the prefab in place as in the sprayed-type lining, and an asphalt-plank type lining that need not be covered.

First to lower the cost factor of

ASBESTOS-TYPE PREFAB ... for Denver reservoir



EASY TO PLACE. Single-layer lining was rolled down slope into place. Joints lapped 3 in., were sealed with asphalt mastic: Private firm's labor did the job.



14,000 SQ. YD. were installed at a cost of \$0.71 per sq. yd. in place.

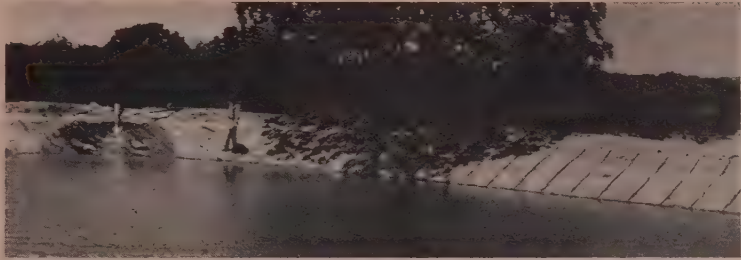


GRAVEL COVER placed to 9-in. depth was excavated from reservoir bottom.

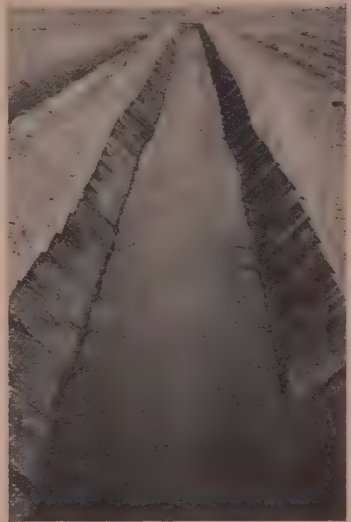
ASPHALT-PLANK PREFAB...for reservoirs and canals



ASPHALT PLANK is provided in sheets 3 ft. wide in any length up to 12 ft.



PLANK-LINED reservoir in the Southwest. No cover is required for this type.



PLANK-LINED small irrigation canal. In later installations, upper edges of lining are bent over a flat berm and covered to prevent entrance of storm water to subgrade.

big industrial users are awakening to the benefits of the new prefabricated linings.

For the reservoir more than 14,000 sq. yd. of prefab lining were installed at a completed cost of \$0.71 per square yard. Unique features of this installation were the placement of the lining by the firm's own labor, and the obtaining of gravel cover (average 9-in. depth) from within the reservoir excavation itself.

Cover on side slopes was placed directly using material excavated from the lower portion of the reservoir, while cover for the bottom was excavated and stockpiled on the berms for later covering.

The maximum depth of the reservoir is 16 ft. A single layer of prefab was used, with joints all lapped and sealed with a new asphalt mastic developed by Johns-Manville for that purpose. This job was completed in November 1952.

Development of plank-type

In the field of prefabricated linings designed to be used without benefit of cover, "Gulf-Seal" lining was developed under the direction of L. F. Bramble, President of the Gulf States Asphalt Co., South Houston, Texas. This lining consists of asphalt plank of ½-in. thickness, sandwiched between saturated and weather-coated felt. It weighs about 27 lb. per square yard, and costs, in place, about \$1.25 a square yard.

The material is manufactured and shipped in sheets 3 ft. wide and vary-

ing in length up to about 12 ft., according to order by the user. By cutting the sheets to specified lengths to fit the canal width exactly, cutting and handling in the field are minimized, with appreciable savings in cost. Sheets used for lining stock ponds, swimming pools and reservoirs are cut to optimum lengths for convenient handling. The sheets are shipped flat, crated for rail shipment or carried in the manufacturer's semi-trailers to jobs within 600-mi. radius of Houston.

A 3-in. lap is used in joints, asphalt mastic being applied to the lower sheet. The same material is used to "point up" the joint after placing. The sheets up to 12-ft. lengths are handled easily by two men.

"Plank" uses to date

Beginning with a trial installation near Cotulla, Texas, late in 1951, use of this lining has extended throughout Texas, New Mexico, Arizona and southern California. More than 40,000 square yards were placed in 1952. In many areas, this type of lining is finding favor because it can be placed quickly and conveniently, it eliminates soil cover, it eliminates the gravel blanket required for soil cover at velocities exceeding about 3 ft. per sec., and its cost is low compared to the rigid-type linings previously used.

The flexibility of the plank lining permits conformance to irregular contours during placing. It also yields to soil movements, shrinkage and swell during service. The asphalt-

coated wearing surface is indicated by tests and experience to have a very long service life. If injured or weathered by long service, it can be rejuvenated easily by light asphalt seal applications.

The weight of the lining minimizes danger of destruction through lifting of the lining with water velocities ordinarily encountered in irrigation or water-supply channels. No pins or other holding devices are used.

The heavy plank-type lining has been used extensively in the lining of stock "tanks" in Texas and New Mexico, and the lining of canals supplying these tanks. Several swimming pools have been constructed on private estates, the lining sometimes being painted white and the edges capped with a concrete rim to form very attractive, low-cost pools. The lining is finding increasing favor in many areas in the Southwest, where leakage conditions are severe, and where sandy soils do not, in general, make good cover materials over buried-type membrane linings.

The possibilities

The availability of these two types of lining is extending rapidly the use of prefabricated linings in irrigation and water supply work. Several other variations of prefabricated linings are under development by other manufacturers, and, as a result of this interest, the user may soon have a variety of selections to choose from, both in type and cost to fit his need for canal or reservoir linings.

**3,000,000 yd. in 8 months: that's the pace at Isabella,
where Macco and Morrison-Knudsen's job is one of—**

DAM BUILDING ON THE DOUBLE

By O. H. TUCKER, Project Manager, Macco Corp. and Morrison-Knudsen Co., Inc.

THE COMPLETION CONTRACT for Isabella Dam on California's Kern River went to a joint venture of Macco and Morrison-Knudsen in October 1951. Their bid was \$5,873,781. For this figure they got what was laid out by the Corps of Engineers as a 900-day job involving 4,000,000 yd. of rolled fill, 337,000 yd. of rock excavation, 212,000 yd. of site stripping, and some 18,000 yd. of plain and fancy concrete.

The job is located about 54 mi. east of Bakersfield, at the south end of the San Joaquin Valley. At the upper end of tortuous Kern River Canyon is a broad, gently sloping valley, and this is the reservoir site. The river channel lies at the north, or right, side of the valley, passing between the rocky foothills and an equally rocky knoll that juts from the valley floor.

The main dam occupies this river channel section of the site, and the auxiliary dam spans a long saddle between the rocky knoll and the southerly foothills. There were earlier contracts contributing progress to the construction of both dams. Two abutment fills had been placed for the auxiliary dam, and the diversion tunnel and control tower for the main dam were under way. Contracts for these operations were held by Rand Construction Co. of Bakersfield, Walsh Construction Co. of San Francisco, and H. C. Smith Co. of Los Angeles. Walsh had driven the diversion tunnel, 850 ft. long, to a diameter of 17 ft., and Smith had lined it to a neat diameter of 14 ft., 9 in.

The work on this part of the project had suffered from the very sort of flood that the dam will now control. Late in 1950, heavy rains that swelled every west-side Sierra stream in California brought the Kern up to a peak of 30,000 cfs. Even 12,000 cfs. would be con-

sidered a flood, and the 1950 peak carried away emergency bulkheads at the tunnel portals and surged through.

With the coming of Macco and Morrison-Knudsen, the stage was set for a fast job. The two dams are earth-fill. The auxiliary structure is 3,325 ft. long and 100 ft. high. It needed about 1,000,000 yd. for closure and to bring it to full height. The gap left from the previous work had first to be fitted with conduit and a siphon for the realigned Borel Canal, a Southern California Edison Co. power ditch that taps the Kern at an elevation inside the new reservoir area.

The main dam is shorter. It is 1,725 ft. long, but it is 185 ft. high. Its volume is about 3,000,000 yd. and no embankment had been placed.

Even with 900 days allotted—to April 1954—O. H. Tucker, the project manager, figured he could complete the job in 12 months less time "by placing adequate equipment on the job." This meant doing the 3,000,000-yd. main dam in one season. Actually, this part of the work has all been done since last August. Before that, the big spread of earthmoving equipment was concentrated on completing the auxiliary dam, while excavation and stripping prepared the main site.

With more equipment in operation and more work going on at any single time than would normally be the case, Isabella became a complex project of scheduling and coordination of effort. The following article on the work, prepared by Tucker, follows the tempo of the job. Presented in terse, almost outline form, it is the project manager's own conception of the program he has now brought to virtual completion—with a 40% discount in time.—*Editor.*

NOTICE TO PROCEED was received on November 21, 1951, and by that time the Mountain Inn at Kernville (with hotel rooms and motel cottages) had been leased and a camp set up to house and feed 100 men. The work was programmed as follows, with all First-Step operations getting under way within the first 30 days.

A. FIRST STEP

1. Excavation for the Borel Canal siphon, which passes through the auxiliary dam.

2. Construction of levees or embankments for the relocated Borel Canal.

3. Excavation for the spillway, which is in solid granite.

4. Placement of additional fill in the two abutment fills of the auxiliary dam.



TUCKER kept things moving and under control by shortwave. Job had 10 General Electric mobile units, plus sets in the office and shop.

5. Stripping to bedrock of the two main dam abutments.

6. Processing of filter blanket material (about 200,000 tons).

B. SECOND STEP

1. Before completion of Items A-1 and A-2 above, concrete and gunite work on the relocated Borel Canal was started, in January 1952. It was completed the following March 23, so that the timetable for diverting water in the canal, scheduled for April 1 could be met.

2. Filling in of the center section of the auxiliary dam was started on the day Borel water was diverted. This embankment work was finished on August 9, 1952.

C. THIRD STEP

1. Completion of the upstream cofferdam and diversion of Kern River



flow through the tunnel. The operating engineers' strike from June 1 to July 14, 1952 (affecting all construction in Southern California) had come at a time when the Kern was in flood and flowing more water than the tunnel could handle, so this did not cause any delay in the Isabella program. Diversion was made on July 15, 1952.

2. Stripping and clean-up of the river bottom. This operation presented no special problem but was a costly and laborious process as the bottom of the river was badly pitted and so uneven that equipment could not work efficiently. The result was that much of the unsuitable material had to be removed by hand. Leakage

SIXTEEN pusher-loader DW20's worked 17½ hr. a day to move as much as 25,000 yd. Pusher Cat has a special counterweight for its usual chore, pulling 70-ton compactor.

through the cofferdam was negligible and was easily handled by small pumps.

3. Upon acceptance of any sizable area in the river bottom, the fill was started and compacted at first with hand tampers. As it became larger, it was compacted by 50-ton Southwest pneumatic rollers.

4. After completion of the spillway excavation (A-3 above), the spillway concrete was started, on August 29, 1952. It was completed on December 19.

INTERMEDIATE OPERATIONS

1. As the rolled-earth fill was raised, the pervious filter blanket and riprap were brought up right behind it, so that a week after the roll fill was completed the dam itself was finished.

2. After completion of the concrete work, the necessary valve operating mechanisms were installed.

3. Other necessary jewelry such as hand rails, guide posts and fencing were fitted into the construction program.

Earthmoving

The 4,000,000 cu. yd. of embankment material was hauled with Caterpillar DW20 scrapers pulled by rubber-tired tractors. The haul was from 2,500 to 6,000 ft., with most of the dirt hauled about 4,000 ft. The DW20's were generally pusher loaded with two D8's in tandem—a very effective way of quickly loading the DW20's without excessive tire wear on the drivers of the 20's.

The material was pre-wetted with revolving sprinklers of the golf course type, using 5- and 6-in. aluminum pipe to convey the water from the pumps. Additional make-up water was added to the fill by 5,000-gal. water wagons with pumps.

Haul roads were wide and well maintained, and traffic was controlled to give a minimum of interference.

Continued on next page



HIGHLY MECHANIZED, Isabella is a "machine-made" dam. Above, fill is deposited by tractor-scraper, rough graded by tractor, passed over by tractor-drawn disc, and fine graded by motor grader. At right, relocated power canal gets layer of select material that will be fine graded. Meanwhile, bank at right is fine graded and bank at left is lined with reinforced gunite.



"Adequate equipment on the job"

HERE are the major items lined up by Tucker to knock 365 days off a 900-day contract for completing Isabella Dam.

- 1 1201 Lima dragline and crane
- 3 Northwest 80D shovels
- 10 9-11-yd. end-dump Euclids
- 2 16-yd. end-dump Euclids
- 7 8-yd. International L192 dump trucks
- 11 D8 Caterpillar tractors, with dozers and push blocks
- 1 DW20 Caterpillar tractor-dozers
- 2 DW20 Caterpillar tractors, bare
- 16 DW20 Caterpillar tractors, with scrapers

- 2 Model 12 Caterpillar graders
- 1 Ateco scraper (dragging the fill, maintaining haul roads)
- 3 Model W LeTourneau scrapers
- 1 Crushing and screening plant (assembled from various sources)
- 1 Blaw-Knox 100-ton batch plant
- 1 Koehring 34E paver
- 11 Chevrolet pickups
- 3 Chevrolet flat racks
- 1 5,000-gal. Sterling water wagon
- 2 4,500-gal. Euclid water wagons
- 3 500-cfm. Ingersoll-Rand compressors
- 5 500-cfm. Gardner-Denver compressors
- 2 550-cfm. Gardner-Denver electric compressors
- 10 Gardner-Denver wagon drills

Safety

Safety was stressed on the job from the first day, and the results show in final statistics indicating a severity of 0.16 and a frequency of 10.73, with 9 lost-time accidents for 850,000 man-hr.

This record was accomplished by (1) the employment of a trained and diplomatic safety engineer; (2) monthly safety meetings of all supervisory employees; (3) weekly "tool box," or "tail gate," talks by the supervisors to their men; (4) considerable job publicity such as signs, matches, and bulletins; and, finally, (5) the whole-hearted cooperation of job personnel.

Considering that nearly 20,000 cu. yd. of concrete was poured, and that some of the form work was 40 and 50

ft. up in the air, it is notable that neither the carpenter crew nor the concrete crew had a lost-time accident. Truly, the job slogan, "The Safe Way is the Right Way," paid off.

Personnel

The job organization was headed up by the author, with Dave Fletcher as rock excavation superintendent, Kenny Hayes and "Red" Mercer as Cat superintendents, "Red" Richmond as carpenter superintendent, Phillip Corkins as concrete superintendent, Lex Hobson as master mechanic, Gene Hargraves as office manager, and Paul Arwood as field engineer.

For the Army Engineers, H. J. Dickinson served as project engineer, Jim Chaddick as assistant project en-



DIAMOND DRILLING and grouting of core trench for main dam was done last July, preceding the 8-month "big push" that has since topped out the structure.

gineer, Floyd Childs as chief inspector, and Sam Nigro as office engineer. The project was directed by Col. C. C. Haug, District Engineer in Sacramento, and J. R. Morton, chief of the construction operation division.

A "generation-ahead" look at use of the West's surplus waters

THE UNITED Western Investigations report into the possibilities of putting the West's surplus waters to beneficial use, by long-distance diversions to areas of potential water deficiency but of great potential growth, has been sent to the Western States for review.

The report does not propose a specific plan for immediate development, but looks ahead a generation or so hence to possible means of meeting the West's water requirements for irrigation and industrial and municipal uses when more accessible sources have been put fully to use.

It cites, as an example, that large quantities of water from the Klamath River, in northern California, could, at some future time, be diverted as far as 1,000 mi. to the south, serving areas as far away as San Diego.

The Klamath diversion would include only water that probably could never be put to beneficial consumptive use in the Klamath River Basin.

The study reveals, however, that California's potential growth will, in the future, outstrip more accessible water supplies.

World's record structures

This diversion, one of several alternatives that may be worthy of further study, would use the Sacramento River as a means of transporting the waters over much of the distance. It would require a world's record, 813-ft. dam, near the Klamath's mouth, and a series of tunnels to connect with the river below Shasta Dam. Giant pumps would be necessary to lift waters from the river near the juncture with the San Joaquin, and canals would transport it southward. More tunnels would be required to take it through the mountains ringing the southern end of the Central Valley. Agricultural areas, industries and municipalities all along the way could be served.

Evidence was disclosed that water

heretofore thought unobtainable could be supplied for at least 2,000,000 acres of new California irrigation, in easy stages, perhaps over the next half century. This includes at least 1,250,000 acres of land that could be irrigated in the San Joaquin Valley, over and above the acreage that could be served by the fullest development of Central Valley water, including a potential Trinity River diversion.

The report, based on a general survey to ascertain if sound interbasin developments could be possible, definitely indicates the engineering and economic possibility of such a development. The whole question is still subject to further engineering and economic study.

Bureau of Reclamation investigators verified that there were enormous surpluses of water in the Klamath and other northern rivers that could never be consumed even with population, irrigation and industrial growth on a "saturation" basis. They point out that many areas, particularly the Pacific Southwest, are approaching a stage of development at which further economic growth will be drastically curtailed unless new sources of water are found.



LIFT-SLAB TILT-UP TEAM-UP

"Riding the slab," workmen check and control progress on one of three lifts that raised nearly 13,000 sq. ft. of roof in 3 days — Tilt-up panels completed erection in 38 working hours

SPEED and efficiency were demonstrated by the Austin Company two months ago in its erection of a building that combines for the first time two of the newer techniques of reinforced concrete construction. The techniques are "lift-slab" and "tilt-up," and the building is the Whittier Research Laboratory, built for American Potash & Chemical Co. in Southern California.

Three lift-slab sections make up the roof of the building. They went up in 3 days. Each daily cycle included setting jacking equipment, raising the slab, and welding its inset collars to the supporting columns. The 33 wall panels, both interior and exterior sections and averaging about 6 tons each, were set into place in 2 additional days. Erection time: 5 days. From the laying of the first floor slab forms to completion of erection, the total time was 22 working days.

The building is L-shaped, with an actual area of about 10,200 sq. ft., while the roof (with variable over-

hang) has an area about 2,500 sq. ft. greater. The frontage is 114 ft. and total depth is 176 ft. The wing portions have widths of 40 and 37 ft. Roof overhangs on major portions of the building range from 4 to 10 ft. The one-story structure has 35 rooms, providing for administrative offices, project laboratories, and supplemental services.

Design

Designed for vertical load and also for lateral and rotational forces, the building has 33 columns of 6-in. 20-lb. steel H-sections supporting the flat-slab reinforced concrete roof. This roof is 8 in. thick and was designed in accordance with a PRESAN analysis. Precast wall sections are 6 in. thick, fixed in place by the use of dowels and dry-pack. Spacing and anchorage of dowels was calculated to meet shear requirements, and location of the wall panels was chosen to insure proper bracing of the structure. The front wall is Norman brick.

Many other wall areas are predominantly glass.

Casting

Foundations and floor slab were constructed and the floor finished smooth to provide a satisfactory casting bed. In order to extend this bed to provide for roof overhang, thin concrete slabs were laid to necessary dimensions outside the building lines. Since the floor slab was fully used as a casting bed for the roof, it was necessary to provide another casting area for the wall panels. Thin slabs were cast for this purpose convenient for crane use, and little space was required, because precast wall panels were "stacked" to a height of 5 or 6 units. These temporary casting slabs were in general $1\frac{1}{2}$ or 2 in. thick, for either wall panels or roof extensions.

The finished floor slab was cured by application of Hunt Process curing compound. In preparation for the casting of the roof slab, the floor was treated by applying a "parting agent." The material used for the purpose was a non-silica "sand" in a fine powdery form, which was effective in breaking bond.

The roof was divided into 3 sections, separated by a space of about 2 ft. Reinforcing bars from adjacent sections were lapped. After the slabs were lifted, the procedure used was to

weld alternate lapped bars, shore the slab edges, place a soffit form and cast the junctions to complete the roof.

Developers of the lift-slab method have recommended that a concrete strength of 2,700 psi. is essential at the time of lifting. On this project, a 3,000-psi. requirement was set, a high-early Pozzolith mixture was used, and at the age of nine days, when lifting

was started, tests showed that the requirement had been met.

Lifting

On the Whittier job, the 3 roof sections were lifted on 12, 12, and 9 columns, respectively. As required for use of the lift-slab method, lifting collars were placed around the columns, bushings inserted, and bushing holes and column clearance space

stuffed to prevent concrete from entering. The roof slabs were then cast to encase the collars. When it was time for lifting, the lifting crew attached threaded rods to the bushings and mounted hydraulic jacks on top of each column, tubes for hydraulic fluid serving each jack being connected to a central control panel. Quoting from the manual on the method published by the Institute of

The jack: how it worked on "the house that jacks built"

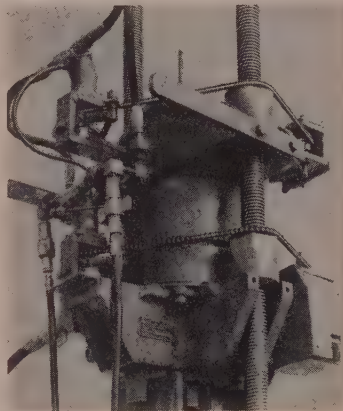
LIFT-SLAB is just that. According to the Institute of Inventive Research in San Antonio, "the method consists basically of pouring the upper floors and roof of a structure at the ground level in their relative positions in the building, and then mechanically lifting them to the proper elevations and . . . permanently fastening them to the columns."

The general idea was thought up by two people at about the same time. The co-inventors, architect Philip Youtz of New York and business man Tom Slick of Texas, combined their ideas and put development in the hands of the Institute of Inventive Research. That organization, together with the Southwest Research Institute, also of San Antonio, has conducted exhaustive tests of the method and its related equipment. The Institute of Inventive Research owns all lifting equipment and leases it to licensees for lift-slab work. Customarily, the lift-slab contractor is a sub for that phase of a job only. Naturally, design by the engineer, and other operations by the general contractor, do have to be conceived with lift-slab especially in mind.

Jacking mechanism

Though engineering design for lift-slab is somewhat different from usual, it is straightforward. For the man in the field, the important aspect is the function of the lifting equipment—what it is, how it is hooked up and controlled, and how it maintains a positive mechanical hold during the lifting. A picture of a jack and a little description tell a lot about it.

The jacking action is supplied by a hydraulic cylinder located between two crossheads. These elements are apparent in the picture, the lower, stationary, crosshead being the casting that bears a nameplate. It rests atop a column of the structure—ordinarily a steel H-section, as in the Austin Company job described on these pages, though concrete columns or circular steel ones are occasionally encountered.



KEY TO THE OPERATION is hydraulic jacks like this (practical maximum of 12), controlled from "console" carried up on rising slab.

Shoulders are provided on both crossheads for bearing by four nuts, through which pass two threaded tension, or lifting, rods. These nuts may be turned at various times in the lifting process, by means of sprocket chains actuated by hydraulic motors. But they do not—they cannot—turn under load. Here is how a lifting cycle goes:

Jack operation

It begins with the hydraulic jack retracted, the upper crosshead at its lowest point. As pressure is introduced and this crosshead starts to rise, the slab load is taken by the tension rods and transmitted by the upper nuts to the shoulders of the upper crosshead. These upper nuts do not turn, nor do the tension rods. However, the lower nuts do turn, downward with respect to the tension rods, thereby always remaining just in contact with the shoulders of the lower crosshead. If the hydraulic system should fail, the slab load is instantly, and without dropping, transferred to the lower nuts, and through them to the lower crosshead shoulders.

When the jacking cylinder has reached its full extension of 3 in.,

it must be retracted for a "new bite." At this time, the slab load is intentionally transferred to the lower crosshead nuts, as described above. Then, the jack is retracted and, at the same time, the upper nuts are turned down by their sprocket chain. Complete retraction of the jack finds these upper crosshead nuts turned down onto their shoulders, ready for a new lift.

Control of slab

The 12 jacks ordinarily employed simultaneously during a lift are controlled from one "console." A counter system at each jack records lifting increments of 0.083 in. at the console, and this is the maximum undetected lifting differential that can occur. Jacking pressures may be varied among the 12 assemblies by the console operator. This assures a uniform rise of the slab despite possible slight binding at one or more columns, requiring more pressure.

Proponents of lift-slab attribute many direct and indirect advantages to the method. All of them ultimately mean economy of construction, but perhaps these three are most notable:

(1) All forming (edges only), fabrication, and concrete pouring for floors and roof take place at ground level. No skip hoists, concrete pumps, etc., are needed. Access to all points on a slab is simplified.

(2) Forms, centering, and scaffolding are eliminated. As the originators of lift-slab said: "Why build a timber structure in order to build a concrete one inside it?"

(3) Work of all trades may proceed simultaneously on all levels as soon as the lifting is done.

In combination with tilt-up, as described in this article, lift-slab comes to spectacular status. The structural elements of a building have been completely formed, fabricated, and erected in 22 working days. An estimate of time required for the same building using conventional methods has been given as 55 working days. The economies are apparent.



Inventive Research of San Antonio, Texas, the operation proceeds as follows:

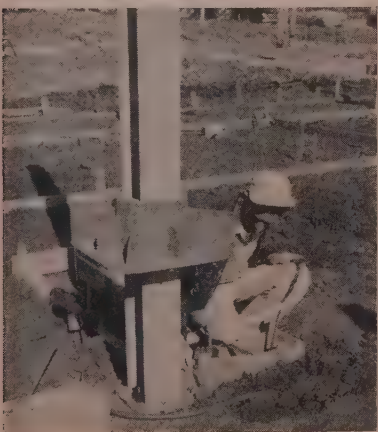
"The lifting equipment is set up and properly fastened to the bushings which were inserted in the collars. The slab is lifted 3 in. and leveled at all column points. This leveling is done by the lifting engineer from pre-established grade marks set on each column by the general contractor. The slab is then lifted, with periodic level checkings, to the desired height. At that point the slab is leveled at each column separately and there welded to the column in the manner specified on the plans."

Lift technique

Lifting four or five thousand sq. ft. of roof slab in this manner requires knowledge and proper equipment, but it does not call for a lot of man-power. The crew consisted of 4 men—an operator or lifting engineer, a millwright and 2 iron workers. It could be said of one of these slabs that "it floats through the air with the greatest of ease." Of course, there are points and details to be considered and followed in making the system work as it is intended.

For example, the technique for accomplishing the original parting from the casting bed is to peel off the slab by actuating the jacks successively,

LIFTING COLLARS and columns are in place before floor slab is formed and poured. Holes in collar are bushed to receive tension rods.



EVERYTHING IS UP IN THE AIR at completion of lift. Jacks and console are plainly evident. Note gaps between slabs, where tapped steel will be welded before encasement in concrete.

rather than to attempt to overcome suction over the large area by simultaneous lifting at all points. A point affecting cost to be remembered is that a large slab on 12 columns requires the same lifting time as a small slab on 6 columns. Layout to permit maximum use of maximum lifting capacity in each operation will enhance the economy of the construction.

It has been mentioned that the 33 precast wall panels were placed in the structure in a little less than 2 days. This would not be unusual except for the fact that these sections had to be placed in exterior walls under an overhanging roof and in locations distributed inside the building. Obviously, a method of handling had to be developed to meet the situation. The method used seems to be a simple answer to the problem. The crane placed a wall panel at a convenient point along the building. A fork-lift truck then approached the panel, its forks entered slots provided in the casting of the panel, and the lift truck moved the slab to position for alignment and anchorage. The crew necessary for the wall-setting operations consisted of 9 men—job superintendent, crane operator, truck operator, fork truck operator, 2 riggers, and 3 laborers.

Double feature

The striking point about this job is the double feature, the use of tilt-up and lift-slab together, each offering the advantage in cost and time saving that stems from doing work on the ground as far as possible. The rapid growth in use of tilt-up, and of the many forms in which precast concrete can be utilized, shows that it is no idle dream that these methods are sound and economical. As for lift-slab, there seems no reason to doubt that the same kind of story will be told as builders become more and more familiar with it. The single-story layout of the building here reported is not ideal for maximum construction economy, yet this structure with lift-slab roof

could be constructed at a very small premium over a building with combustible roof and ceiling protection. The combination of lift-slab and tilt-up, first demonstrated here, will doubtless receive a good deal of consideration now for many structures.

It is not surprising that this building should be the first example of the combination. The Austin Company was early in the tilt-up field, it has done development work on prestressing, and it has previously used the lift-slab method in construction of the multi-story Technicolor Laboratory building in Hollywood several months ago.

Personnel

The Austin Company engineered and constructed the building as a project of its Los Angeles office. R. E. Ward is vice president and district manager. A. E. Schmidt was in charge of engineering and W. Hosack was project superintendent.

Vagtborg Lift Slab Corporation was sub-contractor for the lifting operations. As a licensee of the Institute of Inventive Research, the lifting contractor takes full responsibility for lifting the slabs and making the necessary connections to hold them permanently in position.

PATTERN OF STEEL encloses collar as roof is ready for pour. Note rods welded to collar. Bushed holes and column clearance are stuffed to keep concrete out.



When should joints be grouted?

PRESENTED HERE is a discussion of the structural behavior of arch and straight gravity concrete dams, and the influence of this behavior on the design of contraction joints. The necessity of providing contraction joints in concrete dams and today's practice have been included partly in an accompanying box.

Three problems are discussed in detail: (1) whether contraction joints should have keys or flat faces, (2) whether joints should be grouted, and (3) what is the most suitable time from the structural standpoint to grout the joints. Other considerations, such as seepage through the joints and cooling of concrete before grouting the joints, are not included in the discussion.—*Editor.*

THE PROBLEM of deciding whether the transverse or radial contraction joints should be grouted is discussed here with reference to the type of the dam, its structural behavior, shape of the canyon, and the basis for possible economies.

Structural behavior of an arch dam

The structural behavior of an arch dam can be more readily understood if the monolithic structure is assumed to be composed of horizontal arch and vertical cantilever elements.

The Trial Load Method¹ of analyzing arch dams, which has been used as the basis of design of some of the highest arch dams in this country, was developed on this basic concept of dividing the dam into hypothetical horizontal and vertical elements. This method of analysis assumes that the external load acting on the dam is divided between the arch and cantilever elements, and only that division of load would be considered true which causes equal arch and cantilever deflections at all common points in all arches and cantilevers in tangential, angular, and radial directions. The validity of this method of analysis has been proved by tests on laboratory models^{2,3} and large-scale test dams.⁴

It can thus be conceived that a certain amount of load will be transferred to the abutments by horizontal arch action, and the vertical elements will transfer the balance of the load to the foundation by gravity action. To emphasize the significance of this three-dimensional transfer of load, the distribution of load obtained by Trial Load Analysis of a 564-ft. high arch dam is shown in Figure 1. The water load at this elevation is 13,125 lb. per sq. ft. In addition to the water pressure, the analysis also included effects of temperature, ice pressure, horizontal earthquake acceleration, and elastic abutments and foundation. It will be seen that the vertical canti-

lever elements resist a good portion of the load at this elevation, and also that the distribution of the arch load is not uniform from the crown to the abutments.

On the basis of this premise it can be concluded that monolithic action of both the horizontal arches and vertical cantilevers is very desirable, if the structure as a whole is expected to behave as presumed in its design and analysis. In other words, all radial contraction joints in the dam should be thoroughly grouted so that the horizontal and vertical systems of elements will transfer their share of the load to the abutments and foundation by bending and shear.

Structural behavior of a straight gravity dam

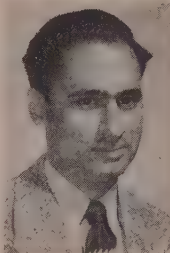
Most of the straight gravity dams built in recent years have been designed on the basis of two methods of analysis⁵—(1) the Gravity Method, and (2) Trial Load Twist Method.

The Gravity Method of analysis assumes that the dam is composed of a series of vertical blocks, each of which carries its load to the foundation without any transfer of load from or to the adjacent vertical block. Although the Gravity Method of analysis is used for designing some important dams, such dams necessarily require greater volume of concrete for stability purposes than would be required if they were designed as three-dimensional structures. That even straight gravity dams with keyed and grouted or ungrouted transverse contraction joints act as three-dimen-



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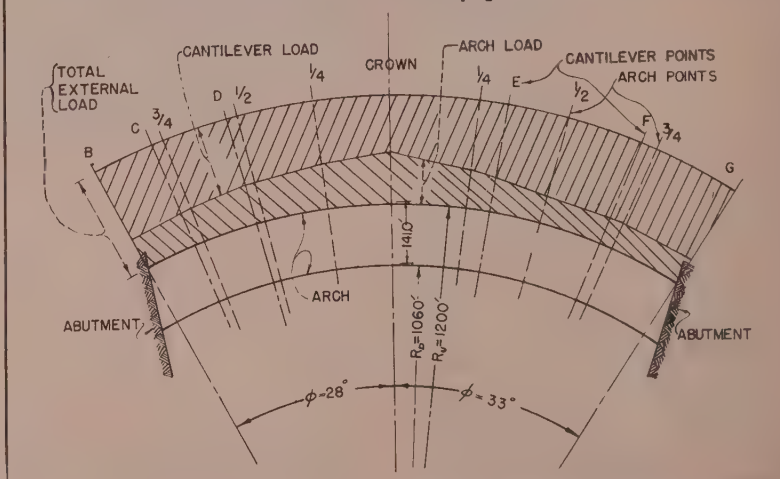
AND



G. S. SARKARIA
Assistant
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FIG. 1—LOAD DISTRIBUTION 215 FT. BELOW TOP OF DAM

Obtained utilizing the Trial Load Method, in terms of three-dimensional transfer of load. See text on this page for discussion.



The "what" and "where" of contraction joints

PROVISION of contraction joints in concrete dams as a controlling measure against cracking due to shrinkage of concrete is a generally accepted design practice. Shrinkage cracks are not only objectionable to sight, but they also endanger safety of the dam by accelerating deterioration of concrete as well as by preventing monolithic action of the structure. Hence, it is considered desirable to substitute for the haphazard crack, a "designed crack," which will be architecturally acceptable and will not develop undesirable characteristics at a later date.

In dams of moderate height, only transverse or radial joints are provided. These joints are normal to the axis of the dam and run from the upstream to the downstream face and are continuous through the entire height of the dam. In higher and massive dams, longitudinal contraction joints may also be provided to forestall the formation of shrinkage cracks parallel to the axis and in the interior of the dam. Such a system of transverse and longitudinal contraction joints divides the dam into columnar monoliths of reasonable dimensions, suitable for ease of construction and which are also satisfactory from the designer's viewpoint.

Keyed and flat joints

Transverse contraction joints may have flat surfaces or they may be formed with interlocking keys. On the other hand, longitudinal contraction joints should always have keys and these joints should always be grouted to restore monolithic action in the section. Keys, where provided, should be easy to form, have dull corners and mild batter. Vertical keys should be provided along transverse joints, while longitudinal joints should have horizontal keys.

The decision to provide or eliminate the keys along transverse contraction joints should be arrived at in the light of the method and basis for the design and analysis of the structure.

Concrete dams may be designed as monolithic structures which are capable of transmitting the forces exerted against them to the foundation and abutments in an efficient and economical manner. Gravity dams may also be designed as a series of individual monolithic blocks which transmit the external loads to the foundation by gravity action alone.



SYSTEM OF BLOCKS formed by longitudinal and transverse construction joints and the vertical keys along one of the transverse joints are shown in construction view at Shasta Dam during 1941.

RADIAL contraction joints and vertical keys along the joints can be seen in this recent view at Hungry Horse Dam in Montana.



sional structures will readily be understood from the following discussion.

A gravity dam may be considered to be composed of a series of vertical blocks hinged together at the contraction joints by the interaction of the keys or tied together if the joints are grouted. If the canyon profile is narrow with steep sloping walls, each block from the center of the dam toward the canyon walls will be shorter than the preceding one. Each block will therefore be deflected less by the water load than the preceding block and more than the succeeding one. Due to the restraint of adjacent blocks, the taller block will tend to pull the adjacent block forward and the shorter block will tend to hold it back. This interaction between adjacent blocks causes torsional moments, or twists, in the blocks. This twist action materially affects the way

in which the water load is transferred to the foundation and abutments by the dam.

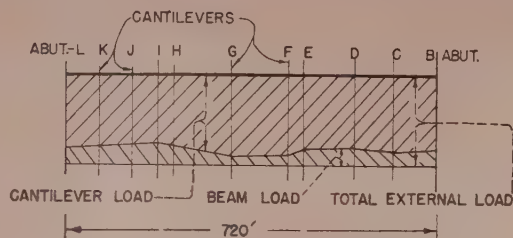
If the canyon profile is wide and flat at the stream bed, the cantilever blocks in the central portion of the dam are approximately the same height and each block will deflect very nearly the same amount under the action of the water load. Effects of twist action in this portion of the dam will therefore usually be negligible. At the sloping canyon walls, however, where the height of the blocks changes rapidly, effects of twist action will be very important.

Trial Load Twist Method

To evaluate the effects of twist action, the Trial Load Twist Method of analysis assumes the dam to be composed of vertical cantilever and horizontal beam elements, and assumes that the external load is dis-

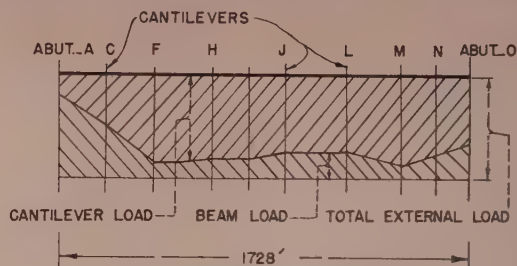
tributed between these two elemental systems. If the transverse contraction joints are keyed and grouted, part of the load will be transferred horizontally to the abutments by bending, shear and twist in the horizontal beam elements. If the transverse contraction joints are keyed but ungrouted, part of the load will be transferred horizontally to the abutments by shear and twist across the keys. If the joints are flat and ungrouted, the entire load on the dam will be transferred vertically to the foundation by gravity action.

To illustrate the effects of twist action in straight gravity dams, load distributions between the horizontal and vertical elements at certain elevations as obtained by Trial Load Twist Analyses of Canyon Ferry Dam, now under construction in Montana, and the proposed 783-ft. high Kosi Dam in India, are repro-



**FIG. 2—LOAD DISTRIBUTION
AT CANYON FERRY DAM**

at elevation 3725 (reservoir surface at El. 3800)



**FIG. 3—LOAD DISTRIBUTION
AT KOSI DAM**

at elevation 815 (reservoir surface at El. 960)

duced in Figures 2 and 3, respectively (see this page). Canyon Ferry Dam is being built in a wide and flat canyon, the crest length to maximum height ratio being 4.64. The Kosi Dam site is V-shaped with steep canyon walls and its crest length to maximum height ratio is 2.47. In both cases the contraction joints have been designed with keys.

Twist action at Kosi Dam

The portion of the external load transferred horizontally to the abutments, indicative of the influence of shape of the canyon, is much greater in case of Kosi Dam than in case of Canyon Ferry Dam. This means that the twist action is much less impor-

tant in Canyon Ferry Dam than in Kosi Dam. To take advantage of this horizontal transfer of load, thus taking off some load from the vertical elements and improving stress and stability conditions at their foundation, it has been proposed that the transverse contraction joints in Kosi Dam be grouted. In Canyon Ferry Dam, on the other hand, the transverse contraction joints will be left ungrouted.

Transfer of a portion of the load to the abutments by horizontal beam and twist action may or may not be beneficial from a stress and stability standpoint. In certain cases analysis may show that more favorable stress or stability conditions can be obtained,

as well as a reduction can be achieved in concrete quantities, if the transverse contraction joints are keyed and grouted. In other cases, it may be indicated that the transverse joints should be flat and left ungrouted, or that they should be keyed but left ungrouted.

Grouting longitudinal joints in gravity dams

By whichever method a gravity dam may have been designed and analyzed, it is always assumed that all or part of the external load is transferred vertically to the foundation by monolithic action of cantilever elements. It means that longitudinal contraction joints, if any are provided, should be grouted from one transverse joint to the next. The program of grouting longitudinal joints should be carefully planned keeping in view the schedule for placing concrete and raising water level in the reservoir. This longitudinal joint grouting program has a very marked influence⁸ on the distribution of stresses in a dam, and it should be accorded due consideration during the stress analysis.

Time of grouting transverse joints

From the standpoint of structural behavior of the dam, it is very important to determine as to what should be the reservoir water level when the transverse joints are grouted. In arch dams, in order to bring full arch action into play as early as possible, the radial joints are grouted ahead of the rise in reservoir level, provided temperature conditions permit the grouting to be carried out. For example, in the Hungry Horse Dam in Montana, now nearing completion, the radial contraction joints were grouted when the reservoir water level was approximately 250 ft. below the lift then being grouted.

In the case of straight gravity dams, where high-tensile stresses at the beam abutments make it desirable that the abutments be relieved of

Contraction joint data for prominent concrete dams

ARCH DAMS

Dam	Location	Maximum height feet	Transverse joints provided?	Longitudinal joints provided?	Do joints have keys?	Joints grouted?
Bromme.....	France	143	Yes	No	—	Yes*
Hoover.....	Ariz.-Nev.	726	Yes	Yes	Yes	Yes
Hungry Horse.....	Montana	564	Yes	Yes	Yes	Yes
Parker.....	Ariz.-Calif.	320	Yes	No	Yes	Yes
Sarrans.....	France	325	Yes	No	—	Yes*
Seminole.....	Wyoming	295	Yes	No	Yes	Yes

STRAIGHT GRAVITY DAMS

Dam	Location	Maximum height feet	Transverse joints provided?	Longitudinal joints provided?	Do joints have keys?	Joints grouted?
Bakra.....	India	680	Yes	Yes	Yes	Yes
Bull Shoals.....	Arkansas	283	Yes	No	No	No
Canyon Ferry.....	Montana	217	Yes	No	Yes	No
Detroit.....	Oregon	450	Yes	No	No	No
Friant.....	California	319	Yes	No	Yes	Yes
Grand Coulee.....	Washington	550	Yes	Yes	Yes	Yes
Hiwassee.....	No. Carolina	307	Yes	No	Yes	No
Kosi.....	India	783	Yes	Yes	Yes	Yes
Pine Flat.....	California	440	Yes	No	No	No
Shasta.....	California	602	Yes	Yes	Yes	Yes

*These dams have slots instead of radial joints. After completion of the dam, the slots were filled with concrete and grouted.

Shape of canyons (for listed dams)

Hoover—Hungry Horse—Parker—Seminole—Bakra—Bull Shoals—Canyon Ferry



Detroit—Friant—Grand Coulee—Hiwassee—Kosi—Pine Flat—Shasta

Good records gain good bank credit

Contractors: your bank credit standing depends on past performance — A bank's evaluation of your financing needs and capabilities begins with the past — Accurate, intelligible records pave the way to a good line of credit

BANK-LOAN FINANCING of a relatively small contractor often poses a delicate problem, for the bank as well as for the contractor. The reason for this is that there are no "rules of thumb" by which to determine requirements of financial data and, later, to extend credit.

Actually, it is a good thing that there are no such rules, for they would be both inexpedient and difficult in themselves. Yet the problems still exist, for the nature of a contractor's business is such that the banker is constantly wondering how much information to require, how much protection his bank should try to obtain when about to extend credit to finance one or more jobs.

Bankers certainly regard contractors, both large and small, as businessmen who are entitled to credit accommodation, provided enough information is furnished to show that the applicant is qualified to receive it. This feeling governs the approach to credit applications of those in almost any business. However, the greater venturesome nature of a contractor's business is such that the bank must require the contractor to maintain adequate records and submit more information from them than do those engaged in many other lines.

Bank is not "nosey"

In the bank's conscientious effort to analyze properly an applicant's request, it sometimes happens that the contractor thinks that the bank requires too much information. This may be the case both at the time the loan application is received and at various times after the credit is granted. This attitude is unfortunate, because a contractor may therefore refrain from requesting bank credit even though, upon proper presentation of an application, his financing needs would be met.

A review of the kind of information generally requested is given here, with the hope that it will assist small contractors seeking credit. In passing, it should be noted that to a large extent the major contractors voluntarily keep their bankers continuously informed of their bidding, finances and job progress, so that it is seldom necessary to request supplemental data. If the smaller contractor would take his banker into his confidence to the same degree, his financing problems would be considerably lessened and he might be more prosperous.

By **DONALD FALCONER**

Assistant Vice President

Bank of America

San Francisco, Calif.

Assuming that the prime requisite for obtaining credit—good character—has been established through introductions and checkings with bonding company, associates, competitors, trade bureaus, etc., the next important thing considered in opening credit negotiations is the experience of the contractor in the type of work he wishes financed. A list of the jobs completed, parties for whom the work was done, basis on which the jobs were awarded, and a statement of profit are helpful in gauging the qualifications of the applicant. The

CONTRACTORS are business men. To be successful they must apply the rules of business to their operations. One of the cardinal rules is to maintain records covering bids, costs, job progress and profits in a manner that will insure the confidence and backing of financial organizations. Only by having this type of information available in proper form will a contractor be in a favorable position as a borrower of funds needed to finance and equip his next job. Aside from the large construction organizations, there is agreement among lending agencies and equipment distributors that most contractors are lax in their financial record keeping.

To be of assistance to contractors who are interested in improving the business side of their operations *Western Construction* presents this article on the fundamentals of how to build and maintain an adequate credit rating. There is much more to the subject than could be covered in this short discussion, but the observance of the basic points that are outlined will help build the foundation for successful contracting.—Editor.

banker is particularly interested in detailed information, including explanations as to why a previous job was not profitable.

It is of considerable interest and assistance to the banker if the contractor will supply information concerning his bidding. He may do this even though he is not in debt to the bank or considering an application for a loan. Periodic information on the number of bids made during that period and the number of times he was successful bidder helps in getting a reasonable idea of the contractor's operations.

Stay one jump ahead

It is highly desirable that the contractor discuss the possibilities of getting credit before submitting a bid. Far too often a contractor is embarrassed by making a bid, having it accepted, and then applying for credit, only to find the banker unfavorable toward making the loan.

The contractor will find his progress quicker and the bank more responsive if he can furnish complete data concerning the job to be financed, a cash budget for the new job, data concerning jobs in progress and a current financial statement.

To assist in such a presentation the data set forth in the illustrated form, "Contractors Loan Application," ought to be supplied, along with a copy of the contract. Such information forms a basis for discussion which results in the banker obtaining a fairly complete idea of the job to be financed.

Another form, "Projected Cash Budget," helps the banker to decide whether the credit requested is reasonable, and whether the borrowings and repayments are realistic considering the terms of the contract. When a contractor claims he is unable or seems unwilling to prepare such a budget it raises doubt in the banker's mind as to whether the contractor has figured both his bid and cash requirements properly. If a contractor is able to estimate a job properly, with all the diverse elements and conditions involved, he should be able to figure how much financing he will need, when he will need it, and when he will be able to repay his borrowings. If, over a period of time, he obtains bank financing and his borrowings are handled reasonably close to the budget, his future applications surely will be regarded with greater favor by his banker.

The average contractor generally has a number of jobs under way at one time. In order to size up his position at the time of a new application a progress report on such jobs is essential. A third form, "Contractors Progress Report," or a report con-

taining similar data should be furnished upon applying for new credit, and periodically if borrowing from the bank. Such a report helps the banker to gauge the status of the applicant's jobs and the probable outcome, provided the contractor keeps proper job records. A consolidated "Job Progress Report" is desirable if a large number of jobs are under way.

The contractor should submit his financial statement and profit and loss figures annually, supported by schedules explaining the principal assets and liabilities on the statement.

Preparation of the annual statement by qualified outside accountants, particularly accountants who understand the construction business, is preferred by all bankers. Interim statements prepared during the course of the fiscal year are always helpful. Furnishing such statements to the banker and a discussion of changes in financial condition assist in determining a contractor's credit limits.

The amount of credit to be extended and the basis on which it will be granted necessarily vary with the financial responsibility record of the contractor, the status of other jobs in progress, and the status of the job to be financed. It is preferable to have each job financed separately on a revolving credit basis rather than to establish an overall line of credit to finance all jobs.

Assignment

When approved, loans are generally on an unsecured basis with advances made in accordance with budget received. The banker may decide that for additional support the payments due under the contract should properly be assigned to the bank. Such an assignment does not give the bank security, due to prior rights of the bonding company and the fact that money due will not be paid to the bank as assignee unless the contractor satisfactorily performs and pays his bills for the job being financed. But the assignment does give the bank protection against creditors whose claims originate from other work or claims.

If the applicant is a wholly-owned or closely-owned corporation it is considered reasonable, in view of the risks involved, that the personal guaranty of the principal or principals be given.

In discussing his operations, especially in those cases where he has a number of jobs, the contractor should inform his banker freely about his superintendents and other key men. Too frequently it is found that although a job is bid right, and other conditions are favorable toward a profitable outcome, the job results in a financial loss due to lack of proper supervision.

At times the contractor may bid and be awarded a contract at a location

removed from the area where he is well known and has been operating for a number of years. Under such circumstances it occasionally happens that because of local conditions in the labor market, antagonism of unsuccessful local bidders, etc., the contractor will be operating under unfavorable conditions. It is well for the contractor to inform his banker of his survey of such conditions.

This review purposely does not try to indicate what should be the ratios of current assets to current liabilities,

debt to worth, fixed to worth, etc. The elements that enter into a contractor's operations are too varied to justify suggestions here as to the financial position a contractor should maintain or how much work he should take on at any one time. The contractor will find that if his credits are set up on a case basis, after first furnishing sufficient data and discussing his problems and prospects frankly with his banker, he will fare better than if he endeavored to program his affairs according to an arbitrary formula.

PAPERWORK IN BANK FINANCING . . .

CONTRACTORS LOAN APPLICATION

Name _____	Amount \$ _____	Maturity _____	19 _____
Contract For _____		General Contractor _____	
Type of Job _____	Location _____		
Bid ☐ or Negotiated ☐	Cost-Plus Fee of \$ _____	Bonding Company _____	
Contract \$ _____	2nd Low Bid \$ _____	3rd Low Bid \$ _____	
Our Bid Includes an Estimated Profit of \$ _____			
Portion of Our Contract to be sublet \$ _____			
Sub-Contractor _____	Amount \$ _____		
Terms of Contract _____			
Start: _____	19 _____	Penalty for failure to complete on time: \$ _____	per day _____
Completion _____	19 _____	Progress payments on the _____ day of each month less _____ % withhold.	
Is labor supply adequate? _____		Is equipment adequate _____	
Do union contracts protect labor costs during life of contract? _____		Is material contracted for to insure adequacy of supply & protection on price? _____	
Applicant is engaged in Other contracts as follows:			
Job _____	Bid or Cost Plus _____	Amount _____	Completion Date _____ % Completed _____ Estimated Profit _____

PROJECTED CASH BUDGET

Borrower _____	19 _____	1 _____
Contract _____	No. _____	M _____
In Thousands of Dollars		
CASH AND RECEIPTS:		
Cash on Hand (Beginning of Month)		
Receipts - Progress Payments		
Bank Loan Borrowings		
Other Borrowings (attach explanation)		
Other Funds (attach explanation)		
Total Cash and Total Expected Receipts		
DISBURSEMENTS:		
Material		
Labor		
Supervision		
Machinery & Equipment - Purchases		
Machinery & Equipment - Rentals		
Officers Salaries - Withdrawals		
Other Administration Expense		
Payroll Taxes		
Payments to Sub-Contractors		
Interest		
Bonds - Freight - Insurance, Etc.		
Other - Explain on Reverse		
Payments on Bank Loans		
Payments on Other Loans		
Total Expected Disbursements		
Cash Balance on Hand (End of Month)		
Total Outstanding Bank Loan Borrowings		
THIS PROJECTION IS BASED ON REASONABLE EXPECTATIONS AND		
Firm or Corporation _____		
By _____ Title _____		
Date _____		

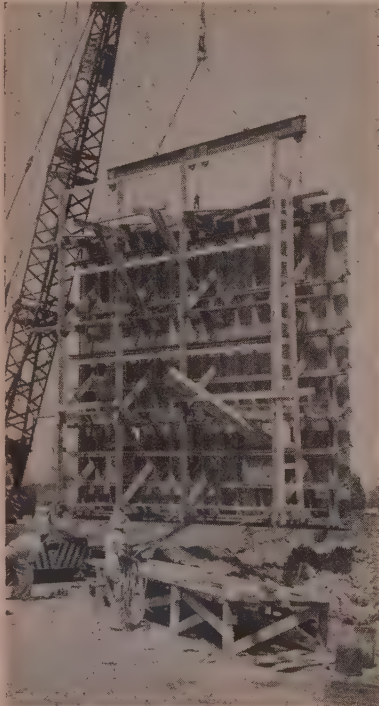
JOB PROGRESS REPORT

Borrower _____	
Job _____	
Date Started _____	
Completion Date _____	
Amount of Original Contract	\$ _____
Net Amount Change Orders	\$ _____
Present Contract Amount	\$ _____
Cost to Date	\$ _____
Estimated additional cost to complete	\$ _____
Estimated financing to complete	\$ _____
Current estimate of profit or loss	\$ _____
Earned to date	\$ _____
Progress payments received to date	\$ _____
Unpaid billings due	\$ _____
Earned estimates - unbilled	\$ _____
Retains or holdback	\$ _____
Amount Due Bank	\$ _____
Due Sub-Contractors	\$ _____
Other Bills Due	\$ _____
Explain fully any changes in job due to extras, change weather conditions, etc. and if such change orders	
Explain any changes from original projected cash budget	
Balance Sheet as of _____	attached _____
List separately amounts:	
(a) Due subcontractors	
(b) Due now for material	
(c) Not yet due for Materials received	
(d) Due for taxes	

San Diego increases storage capacity with —

12-mg. roofed concrete reservoir

Half below ground, \$500,000 L-shaped structure has cantilevered walls, precast columns and beams, and roof designed to support parked cars — Watertightness achieved by carefully placed rubber water stops in wall and floor slab joints — Steel pan forms used for placing roof slab



PREFABRICATED FORMS for 19-ft. high wall sections were provided complete with windows and chutes.

By W. C. BROWN

Principal Engineer
City of San Diego
Water Department

THE RAPID GROWTH of population in San Diego has placed an increasing strain on the city's water storage and distribution facilities. A focal point of these municipal "growing pains" has been at the city's main distribution center, on two square blocks in the University Heights district. A variety of installations here have served the city's needs since the turn of the century. The latest is a 12,000,000-gal. roofed concrete reservoir, financed from bond issues voted in 1951 and completed in January 1953 at a cost of about \$500,000.

In preparing the site for the reservoir, it was necessary to remove an old filtration plant, alter or remove many pipes and connections, reconstruct a booster pumping plant, and move an operator's residence to a new location.

Site problems

The ground at the site consists of a layer of adobe about 7 to 9 ft. deep, underlain with very firm hardpan. The adobe is not suitable foundation material; its volume changes under varying moisture content. Therefore,

the new reservoir was constructed entirely on the hardpan. A portion of the site was occupied by an old concrete-lined reservoir originally used for water storage but more recently for reclamation of wash water from the filters. Demolition of this reservoir was included in the contract for the new reservoir.

Design

The University Heights North Reservoir is "L"-shaped in plan, and has cantilever walls 19 ft. in height above the floor. Walls have a thickness of 1 ft. at the top and 2 ft. at floor level. The wall footing is 18 ft. in width, of which 12 ft. extends into the reservoir as a part of the floor. About one-half of the depth of the reservoir is below the level of the surrounding ground. Maximum depth of water will be about 18 ft.

Vertical joints in the walls occur at intervals of 18 or 21 ft., corresponding to joints in the floor, and are provided with keys, dowels and rubber water stops. A continuous water stop is embedded in the construction joint between wall and footing. At every fourth or fifth vertical wall joint a 1-in. cork joint filler is provided to take care of expansion of the wall.

Provisions for water tightness

The reservoir floor is 6 in. thick and is constructed in 18 x 21-ft. panels,

FLOOR PANELS, 18 x 21 ft., were placed in checkerboard pattern. Porous concrete drains were provided under floor joints. Note strips of rubber water stops in foreground. Center area of each floor slab is provided with extra reinforcing to take column loads from footings.





20-TON MOBILE CRANE handled erection of precast columns and beams, delivered to erection site by a lumber carrier.



NOTCHED ENDS and dowels were provided at beam ends for connections over columns.

ROOF SLAB, placed on steel pan forms, was machine trowelled and then sprayed with membrane curing compound.



the joints corresponding to those in the walls. Edges of slab at joints are thickened to 9 in., and joints are provided with $\frac{1}{2}$ x 6-in. rubber water stops with bulb-shaped edges. Great care was taken to prevent the occurrence of voids or rock pockets under the water stops upon which the water tightness of the reservoir depends to a large extent. All junctions and crossings of rubber water stops are vulcanized. Formed grooves of $\frac{3}{4}$ x $1\frac{1}{2}$ -in. section extending along the top of each floor joint are filled with a joint filler.

An area 8 ft., 6 in. square in the center of each floor slab panel is provided with extra reinforcement to distribute column loads which are transferred to the floor by means of footings 3 ft., 6 in. square constructed on top of the completed floor.

Precasting

Columns and beams for supporting the roof were precast at the job site. Columns, which are 12 in. square and 17 ft. to 17 ft., 10 in. in length, are provided with dowels for end connections, and are flared at the top to a width of 2 ft. in the direction of the beam line. Beams are 12 x 24 in. in section and 20 ft., 6 in. in length, and are spaced 18 ft. o.c. Ends of beams are provided with dowels and deep serrations. The dowel laps were welded after placing the beams on columns. The 6-in. spaces between ends of beams over the columns were filled with concrete at the time the roof slab was poured.

Placing roof concrete

The roof slab, which is $3\frac{1}{2}$ in. thick, and integrally cast joists 2 ft., $7\frac{1}{2}$ in. o.c., extending 8 in. below bottom of slab, were placed using steel pan forms supported on the roof beams by temporary steel angles bolted on sides of the beams.

Future use of the roof for parking cars has been proposed and tentatively approved, and a slight change

of reinforcement was made to accommodate the loads which would be imposed by this type of use.

Construction of the reservoir began in February 1952. Excavation was performed with a $2\frac{1}{2}$ -yd. shovel, 1-yd. backhoe, 2 mobile cranes with clamshells, 2 skip loaders, 3 bulldozers, 1 power grader, and several compressors and dump trucks.

Job schedules

Concrete placing was started in March and was completed in late December. The work included 7,418 cu. yd. of concrete and 310 tons of reinforcement steel. Maximum daily placement of concrete in the various features of the work was as follows: 11 floor slab panels, 5 cantilever wall panels, and 150 cu. yd. of cast-in-place roof slab. A maximum of 11 precast columns and 11 beams was erected in one day. Precasting of columns and beams took place on an adjacent street until a sufficient area of floor slab was available for this work. These precast items were moved with a lumber carrier and erected by means of mobile cranes. A large steel scaffold on wheels was used for placing and stripping the steel pan forms for the roof slab.

After completion and cleaning of the reservoir, it was filled with water for testing. No leakage either through the walls or in the underdrain system has been observed up to the date of writing this article, one week after filling the reservoir.

Personnel

The University Heights North Reservoir was constructed by M. H. Golden Construction Co. of San Diego. Paul Everton was superintendent for the contractor.

T. V. Huff was Resident Inspector at the Reservoir. P. Beermann is Director of the Water Department, Carl Rankin is Consulting Engineer, and W. C. Brown, Principal Civil Engineer.

INTERIOR VIEW of completed reservoir shows detail of columns, beams and roof joists. Installed at lower right is a 42-in. butterfly valve at the inlet connection.





STATESIDE POWERHOUSE is virtual twin of Mexican facility. Intake structures vary, U. S. penstocks leading from concrete dam section seen in background adjacent to spillway structure. This view shows progress in December 1952, with entire project three-quarters completed.

One dam, 2 countries, one builder

**5-mi. long Falcon Dam project straddles Rio Grande, and national boundary —
Two power plants, two concrete mix designs, two languages, but only one prime
contractor — Dual role of U. S. venture simplifies administration in field**

THE FALCON DAM project, being built on the Rio Grande by the International Boundary and Water Commission of the United States and Mexico, was 80% complete at the end of 1952. Authorized by the Water Treaty of 1944, this structure and its auxiliary works comprise the first of several projects planned to conserve Rio Grande waters. The affected area is a 1,160-mi. reach of river between Fort Quitman, at the lower end of the El Paso-Juarez valleys, and the Gulf of Mexico.

It's international

Because of the large irrigated area in both countries in the lower Rio Grande Valley, Falcon Dam, located about 75 mi. below Laredo, was stipulated in the treaty as the first international dam to be built.

Studies of water supply, irrigable areas, and possible dam sites had been carried on in joint investigations by the two sections of the commission for many years prior to an agreement reached in 1944. Plans for construction of the dam and its two power plants were prepared by the Bureau of Reclamation under agreement with

By LAWRENCE M. LAWSON

United States Commissioner
International Boundary and
Water Commission

the commission and were approved by the United States and Mexican governments in the fall of 1949.

A history of events leading to inauguration of this project was presented in *Western Construction* for April 1950. The dam and power plants were described at that time. The description is repeated in a box on these pages because several modifications, of hydraulic equipment especially, have since been incorporated in the design.

Schedules

Construction work was divided into two schedules, with an agreed allocation made of items to be performed by the respective sections of the International Boundary and Water Commission. Schedule No. 1 consists of United States items to be done at that country's expense, and Schedule No. 2 is a comparable one for Mexico.

Actual quantities for the various items differ widely, as shown in the accompanying table.

Specifications, in English for Schedule 1 and in Spanish for Schedule 2, were issued in September 1950. The low bidder on both schedules was a group of United States contractors, organized as Falcon Dam Constructors for the United States work and as Constructora Intercontinental, S. A., for the work in Mexico. The ventures each consist of: C. F. Lytle Co., Sioux City, Iowa; Foley Brothers, Inc., St. Paul, Minn.; Massman Construction Co., Inc., Kansas City, Mo.; Tellepsen Construction Co., Houston, Texas; Edward Peterson Co., Omaha, Neb.; San Ore Construction Co., McPherson, Kan.; and Amis Construction Co., Oklahoma City. Contracts were awarded in November 1950, the completion dates for both falling in October 1953. The estimated cost of the dam, spillway, and power systems is \$47,312,000.

Within 30 days after signing contracts, the contractors began moving in their equipment. By the end of December 1950 virtually all earth-moving equipment was on hand. [The

VITAL FALCON STATISTICS

FALCON DAM is of rolled earth-fill construction, with a total axial length of 26,294 ft., of which 10,133 ft. is in the United States and 16,161 ft. in Mexico. The crest of the dam, at El. 323, is 15 ft. wide and stands at a maximum height of about 150 ft. above the river bottom. The upstream slope is 3:1 above a 20-ft. berm (in the river section) at El. 225, and 4:1 below that point. The downstream slope is 2:1 from the crest to El. 250, and thence 4:1 to El. 190, where it breaks to 2:1. In the maximum section the distance between upstream and downstream toes is about 1,000 ft.

Spillway and outlet works

The spillway is located through the United States abutment. It is a reinforced concrete structure of conventional design controlled by six 50 x 50-ft. fixed wheel gates. The maximum design capacity of the spillway is 456,000 cfs., with a reservoir water surface elevation of 314.2 ft.

Separate outlet works are provided for each country. The United States outlet works consists of a concrete gravity dam section adjacent to the spillway in which are embedded the upstream ends of the four 13-ft. penstocks that admit water to the turbines. The intake of each penstock is protected by a trashrack structure and control of water is obtained by 10.75- and 20.56-ft. fixed-wheel gates. An outlet pipe branches from the first

penstock and bypasses water to the river through two 72-in. hollow-jet valves. The designed capacity of the works is 4,500 cfs. with the reservoir at El. 248. This involves passing water through two turbines and through the outlet pipes that bypass a third. (The fourth penstock will receive its turbine at some future date.)

The Mexican outlet works consists of a conventional tower structure in which is located the upstream end of a 22-ft. diameter penstock controlled by a fixed-wheel gate. At the lower end of the header line is a manifold section having four 13-ft. diameter branches equipped with 168-in. butterfly guard valves leading to the turbines. The header line terminates in a Y-junction with two outlet pipes that bypass water to the river. A 102-in. butterfly guard valve and a 90-in. hollow-jet valve will be installed in each of these. The capacity of the Mexican outlet works is 3,350 cfs. with the reservoir at El. 255.9, and 6,360 cfs. with the reservoir at El. 265.7. As with the United States works, this discharge is obtained through two turbines and the outlet pipes.

Power plants

The power plants, one on each side of the river, are near the downstream toe of the dam and are identical in size, space, generating and service equipment. Each plant will initially contain three vertical-shaft, single-runner, Francis tur-

bines, each developing 14,750 hp. at a rated head of 100 ft. The three 60-cycle vertical waterwheel generators are rated at 10,500 kw. Provision has been made for installation of the fourth unit to each plant in the future.

Reservoir

The total capacity of Falcon Reservoir is 4,085,000 acre feet. Of this, 1,685,000 acre feet will be reserved for flood storage and 2,100,000 acre feet for conservation. Dead storage and capacity for silt come to 300,000 acre feet.

The area of the reservoir will be 78,000 acres with the water at a normal elevation of 296.4 ft. Maximum area, with the water at El. 314.2, will be 113,000 acres. The normal pool elevation, 296.4 ft., will result in a lake 40 mi. long and 7 mi. across, maximum. With the reservoir spilling at El. 314.2, this length and width will increase to 60 mi. and 11 mi., respectively.

The Water Treaty of 1944 specifically provided that construction of Falcon Dam and formation of this reservoir will produce no change in the international boundary line, which will remain at the center of the present river channel. However, the treaty did provide for establishment of a jurisdictional line to be used in the exercise of customs, immigration, and police regulations of both countries. The line will be marked by monuments and buoys within the reservoir.

PRINCIPAL CONTRACT ITEMS

ITEM	SCHEDULE 1	SCHEDULE 2
Excavation—common	2,254,000 cu. yd.	12,037,000 cu. yd.
Excavation—rock	1,186,400 cu. yd.	1,361,220 cu. yd.
Embankment and backfill	1,819,000 cu. yd.	10,496,000 cu. yd.
Riprap	130,000 cu. yd.	290,000 cu. yd.
Drilling grout and drainage holes	9,800 lin. ft.	—
Pressure grouting	5,040 cu. ft.	—
Sewer pipe drains	44,350 lin. ft.	9,200 lin. ft.
Drilling holes for anchor bars and grouting bars in place	51,400 lin. ft.	600 lin. ft.
Reinforcing steel and fabric	15,653,000 lb.	7,010,000 lb.
Concrete	197,395 cu. yd.	63,165 cu. yd.
Cooling concrete	33,800 cu. yd.	—
Gates, gate guides and hoists	4,653,000 lb.	531,200 lb.
Trash racks and guides	389,000 lb.	257,000 lb.
Cranes and service hoist	384,000 lb.	595,000 lb.
Butterfly valves	—	520,000 lb.
Hollow-jet valves	129,000 lb.	198,000 lb.
Structural steel	250,000 lb.	430,000 lb.
Motor driven pumps	17,000 lb.	19,700 lb.
Metal pipe, fittings and valves:		
Less than 6-in. diameter	129,000 lb.	135,000 lb.
Over 6-in. diameter	294,000 lb.	167,200 lb.
Penstocks and outlet pipes	1,685,000 lb.	1,340,000 lb.
Steel doors and sash	3,000 sq. ft.	3,215 sq. ft.
Other metal work	151,000 lb.	89,350 lb.
Electrical conduit and cable	35,610 lin. ft.	50,500 lin. ft.
Road guard rail	15,600 lin. ft.	38,800 lin. ft.
Road surfacing	7,450 cu. yd.	21,900 cu. yd.

major items are tabulated with this article.]

Concrete aggregates are processed in a screening and washing plant having a capacity of 150 tons per hr. It is located in the Mexican Terrace borrow area, in the reservoir site. Concrete is batched in a 2-yd. automatic plant located near the downstream end of the spillway on the United States side. Mixing is done in three 2-yd. mixers. Aggregates are moved from four stockpiles to the batch plant by conveyor belt and are re-screened prior to storage in the plant bins. The plant has 11 concentrically arranged weigh batchers which automatically weigh and discharge material into the mixers. The mixed concrete is hauled from the plant in 2-yd. buckets. Two 2,500-bbl. cement silos, one 2,000-bbl. cement silo, a 750-bbl. pozzolan silo, and a 119,000-gal. water storage tank service the plant.

Cooling concrete

During the hottest weather, up to 150 lb. of tube-ice are required to cool a 2-yd. batch of concrete to 80 deg.



ACRES OF BORROW in reservoir site were tapped by a fleet of more than 70 "Eucs" traveling over long, high-speed haul roads to build nearly 5 mi. of dam.



LOOKING DOWNSTREAM on left (U. S.) bank of river: spillway at left, U. S. penstocks in foreground. Single batch plant equipped with four mixers supplies all concrete for the work.

F., and as much as 100 tons of ice has been used in a 10-hr. night shift. Ice for this purpose is made in a plant located at the batcher; it has a capacity of 120 tons in 20 hr.

Maintenance shops

Shops for the maintenance of the contractors' equipment and plants are located on both the United States and Mexican sides of the project. These shops employ about 100 men on two

shifts.

The Boundary Commission organization operates under policy determination by the Foreign Relations Office of Mexico and the State Department of this country. David Herrera Jordan is the commissioner for Mexico and Joaquin C. Bustamante is the principal engineer. The author is the United States commissioner, J. F. Friedkin is principal supervising engineer, and L. H. Henderson is

principal planning engineer.

At the dam site representing the Mexican Section is Oscar Gonzales Lugo, construction engineer, and his assistant Carlos Molina Rodriguez, resident engineer. On the United States side R. B. Ward is project engineer and R. B. Collons is construction engineer. Phil Royer is general superintendent for both Falcon Dam Constructors and Constructora Intercontinental, S. A.

EQUIPMENT

- 1 P&H DE 1400 shovel
- 3 P&H 1055 LC cranes
- 3 P&H 1055 combinations
- 2 MC414 Lorain motor cranes
- 1 MC504W Lorain motor crane
- 4 80-D Northwest shovels
- 1 605 Koehring shovel
- 1 54-B Bucyrus-Erie crane
- 1 Model 98V Euclid loader
- 23 D-8 Caterpillar tractors
- 4 D-7 Caterpillar tractors
- 3 4-D 19 Allis-Chalmers tractors
- 4 TD-2Y International tractors
- 1 TD-14A International tractor with Hough loader
- 1 HD-20G Allis-Chalmers tractor with rack fork and scoop
- 7 Caterpillar Model 12 graders
- 4 Caterpillar Model 80 scrapers
- 4 Wooldridge scrapers Model TCY-converted
- 48 Euclid bottom dumps, 13-15 yd.
- 6 Euclid bottom dumps, 24-yd.
- 18 Euclid end dumps, 10-yd.
- 20 International LF192 dump trucks
- 4 Ford F-7 dump trucks with cement bodies
- 14 Ford F-8 trucks
- 2 Worthington 500-cfm. compressors
- 2 Gardner-Denver 500-cfm. compressors
- 1 Chicago Pneumatic 500-cfm. compressor
- 1 Ingersoll-Rand 1100-cfm. compressor
- 1 Sullivan 1000-cfm. compressor
- 1 Johnson concrete plant with four 2-yd. mixers in combination with two 70-ton Vogt ice plants
- 1 Pioneer Model 405W gravel plant
- Miscellaneous Chevrolet and Ford pickups, sedans and service trucks, including one Model 170-A Cessna airplane.

SUPPLEMENTAL FALCON FIELD FACTS

SOME SIDELIGHTS to Mr. Lawson's article on the design and administration of the Falcon Dam project bear more particularly on the field operations of Falcon Dam Constructors, and Constructora Intercontinental, S. A.

Especially to be noted is the Cessna airplane, included in the tabulation of contractors' equipment. On this international project, it has been invaluable for a variety of executive uses, including expediting materials and making necessary quick trips to the interior of either Mexico or the United States.

Contractor's schedules

Hampered by materials delays, the job is not as far along as the contractors' own original schedule called for. However, all progress requirements of the Boundary Commission will be met well in advance. Over 70% of the total fill, 12,500,000 cu. yd. of rolled earth, dumped stone, and riprap, is in place. Also, as of the end of last year, 202,730 cu. yd. of concrete had been poured on Schedule 1 and 55,390 cu. yd. on Schedule 2.

Concrete placement rates have varied widely. High points have been between 1,200 and 1,900 yd. per day with two 10-hr. shifts pouring on both sides of the river. Daily production on embankment, again with two 10-hr. shifts and using Mexican labor, normally runs above 30,000 yd.

The fact that one group of contractors was awarded both contracts somewhat simplified many procedures. For example, all concrete is

mixed at one plant on the United States side, and all aggregates are produced nearby on the Mexican side. Cement, however, is furnished by the two sections of the Boundary Commission from sources within each country. The 2,500-bbl. silo is used for American cement, and the 2,000-bbl. silos for Mexican cement.

There is also an 875-bbl. silo for the storage of pozzolan. Pozzolan is not used in the Mexican concrete, since the Mexican cement is manufactured from blast furnace slag. The American variety is a Type II portland cement of low alkali content, and Boundary Commission specifications provide for the addition of pozzolan to that material.

The aggregate borrow area contains an abundance of gravel, but sand of good gradation is fairly short. The screening and washing plant, producing 150 tons per hr., salvages about 60% of the material processed for the job.

Contractor's personnel

There are about 1,200 men employed by the two contracting ventures. The contractors' supervisory personnel include A. M. Croxon as project manager and P. C. Royer as general superintendent. Alva Lee Ellis is assistant general superintendent.

On the United States side Dave Milhan is project engineer and Fred Kenny is office manager. Ing. Gomez Reyes is chief engineer on the Mexican side, and Luis R. Zarate is superintendent of dirt work.

HOW IT WAS DONE...

Re-usable plywood form sections speeded schedule on Alaskan Way Viaduct

STANDARDIZED re-usable plywood form sections, some used as many as ten times, helped contractors on the central section of Seattle's Alaskan Way Viaduct complete the job well ahead of schedule. This is particularly noteworthy in view of the fact that variable beam and girder depths and roadway widths for the double-deck structure created a complex form problem.



NEARLY COMPLETED section gives an idea of complex form problem that faced the contractor. Typically, viaduct is made up of 3-span rigid frame units, each about 220 ft. long. But beam and girder depths vary. So do roadway widths.

The center section (Schedule C) was awarded to a joint venture of Morrison-Knudsen Co., Inc., and Rumsey & Co., in February 1951 on a bid of \$3,691,400. A total of 600 calendar days was allowed for completion.

Typically, the center section consists of 3-span rigid frame units with split columns at the end of each unit. Maximum length of each unit is 220 ft., and roadway widths vary from 40 to 52 ft. The reinforced concrete deck is supported by two exterior girders up to 9 ft. high and

BEAM AND GIRDER bottom forms were built up inside standard vertical form panels in what contractor called "floating beam bottoms." System simplified handling of variations.



two interior girders of varying depths with a shallow center beam. Cross-beams were placed at the columns and at intermediate points on centers averaging about 14 ft.

The form problem was worked out by John Rumsey, Jr., job superintendent, T. W. Barber, former project engineer on the job, and Robert Nesser, carpenter superintendent. The solution was a system of standard-size re-usable form panels for girders and pans devised to accommodate "floating beam bottoms" to handle variations in beam and girder depth and shape.

The vertical panels were 8 ft. long and 9 ft. high for the exterior surfaces of the outside 9 ft. high girders. The panels were built 8 ft. long and 6 ft., $3\frac{3}{4}$ in. high for the inside surfaces of the girders and interior girders and beams. The contractor used $\frac{5}{8}$ -in. plywood panels nailed across 2 x 6-in. studs on 12-in. centers. Double 2 x 6-in. walers 2 ft. or more o.c. braced the panels, which were held in position with $\frac{1}{2}$ -in. patented form ties.

These standard panels were supported on 4 x 4-in. joists 2 ft. o.c., laid across three or four 6 x 18-in. stringers placed side-by-side. The vertical panels were clamped solidly into place on the joists with nailing blocks. To bring the floor of the form to the varying depth of the beams and girders, the contractor built a false bottom inside the vertical forms at heights and angles conforming with the design of the structure.



PATTERN of plywood forms for girders and cross beams is shown here. Standard panels for shallow cross beams and shallow center beams were not as high as those for girders. Contractor built forms for 660 ft. of viaduct at one time.

Pan forms for the roadway slab were also in standard sections 9 ft., $2\frac{1}{2}$ in. x 2 ft. or 4 ft. They consisted of $\frac{5}{8}$ -in. exterior fir plywood laid across 2 x 8-in. joists spaced 12 in. o.c. to conform with stud spacing on the vertical form panels. The contractor began by laying starter panels for chamfer strips first to form the bevel in the design of the beams and girders. The remainder of the pan form was placed with standard sections and completed with a ship-lap filler section.

Falsework, placing of forms and pouring of concrete were carefully synchronized to keep the job moving. Usually the contractor built enough formwork for three spans or 660 ft. at a time.

Because of the smooth surfaces obtained with the ply-

Concluded on page 86



POWER

for 24-hour-a-day digging

Like hundreds of other earthmoving units owned by Peter Kiewit Sons Co., this Manitowoc dragline is Caterpillar powered.

Working on a 1,200,000-yard contract near Quincy, Washington, the big dragline is digging a drain ditch, 10 feet wide at the bottom, 75 feet wide at the top, and 9 3/10 miles long. It's part of the Columbia Basin Irrigation Project.

Equipped with a 120-foot boom and 5- to 6-yard bucket, the machine requires plenty of power. And it has to be *dependable* power, for the dragline works 24 hours a day. Its D386 develops 360 HP to provide full power for top production.

"We like the Cat Engine fine," says I. J. Garver, Superintendent. "It's got good power for the dragline. It's easier to service, and parts are readily available."

Another reason why owners like Caterpillar Diesels is their economy. They use low-cost No. 2 furnace oil without fouling, and they're built to stand up on the job month after month with a minimum of down-time. When service is needed, your Caterpillar Dealer is right there, as close as your phone, ready with genuine Caterpillar parts.

Leading manufacturers of excavating equipment can supply Cat Engines in the machines they build. Specify Caterpillar power when you order.

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

CATERPILLAR

REG. U. S. PAT. OFF.

**Diesel Engines
and Electric Sets**

HOW IT WAS DONE...

Continued from page 84

wood forms, the only finishing work required was filling of tie-holes and beads which were ground and sacked.

About 400,000 sq. ft. of plywood was required for the job. The contractor reported an average of four re-uses with the plywood, about 25% of which was re-used seven or eight times. In some cases the forms were good for



PAN FORMS were also built in standard sections. Starter panels or chamfer strips were laid first. Remainder of the form was laid with standard form sections and completed with a shiplap filler section.

ten uses and in other cases it was possible to re-face old forms with 1/4-in. plywood.

General superintendent on the job was John Rumsey, Jr.; Jack Wells was construction engineer.

Airplane tires pass the test for varied construction use

USING AIRPLANE TIRES on all types of heavy equipment and farm machinery was the ingenious idea of Ben W. Colburn of Tulare, Calif., whose Airplane Tire Company claims to have the world's largest stock, stored in more than 100,000 square feet of warehouse space.



HEAVY AIRPLANE TIRES on this tractor-scraper leave their tread-marks in the soft soil. One illustration of the many uses found for the versatile equipment stocked by the Airplane Tire Co. of Tulare, Calif.

The company, which maintains a shop to make up hubs and spindles and adapt wheels when necessary, has been in business since 1935. The tires, made of real rubber and built exceptionally strong for stress and impact conditions, are more serviceable because of flotation effectiveness, more rugged construction, and lower initial cost.

The wheels and spindles are built to withstand side stress under heavy loads, to give free-rolling minimum friction during strenuous operating conditions, and are flexible for minimum overhead cost in changing over.

Varying uses for these tires are revealed in these letters from satisfied users:

A Los Banos, Calif., man said, "By using large size airplane tires and wheels, I have eliminated the use of springs on heavy equipment trailers and implement carriers."

The manufacturers of Miller Scrapers wrote: "Airplane tires require less horsepower from tractors when pulling the scraper."

"I have been able to maintain schedules with the highway patrol, move along at speeds of 20 mph. with these units on the highway, and cut down the time and delay for the normal traffic on highways.

"Thanks to the tremendous carrying capacity of these tires, I have been able to move these houses without any tire trouble while on the highways and county roads on my route," reported a housemover.

Deep-sea divers come to the rescue on high-altitude repair work

ALTHOUGH WORKING 28 ft. beneath the water's surface, two deep-sea divers were 1,457 ft. above sea level while repairing a steel grillwork over the intake tunnel behind Van Arsdale Dam, el. 1,485 ft., on the Eel River in northeastern Mendocino County last month.



DIVER Berger Rorvik receives a wrench and bolt from P. G. & E. crew member Joe Salerno at Van Arsdale Dam. Rorvik switched from salt to fresh water to help repair a collapsed grizzly and get the Potter Valley Powerhouse back in operation.

A storm, which raised the Eel River to flood stage, had swept tons of debris from the mountains down the river to lodge against the intake grill, known as a "grizzly," and stopped the storm-littered water's flow. A 10½-lb. vacuum was recorded in the tunnel. Then, the experts surmise, a big log crashed into the four-sided framework and caused one side of the 35-ft. high grizzly to collapse.

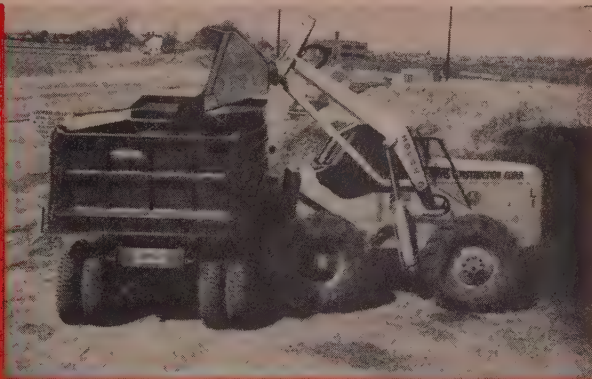
Enough debris got into the 5 x 7-ft. tunnel to jam wicket gates in the Pacific Gas and Electric Company's turbines at the Potter Valley Powerhouse on the other side of the mountain. Shutdown of the powerhouse, which feeds a 60,000-volt transmission line and an 11,000-volt local distribution circuit, did not cause any service interruptions.

This diversion, incidentally, adds to the flow of the Russian River during the summer months. About 300 cfs. are needed to operate the Potter Valley installation, put into service in 1908 by the Snow Mountain Water and Power Company, a predecessor of P. G. & E.

DIGGING — Contractor Del Balso of Bronx, N.Y., keeps his Model HM profitably busy. Here it's lowering grade for a new pavement . . . easily cutting the many tree roots encountered.



LOADING — Model HM doing a fast loading job on a dirt pile for Davis Construction Corp., Long Island. Fast reverse speeds and power boosted steering give this "PAYLOADER" high production on loading work.



BACKFILLING — A very popular "PAYLOADER" use is trench work — loading excess dirt and backfilling the trench. Tires do not injure pavements and the bucket can backfill over the top of sheeting or other obstructions.



SPREADING — On the Penn-Lincoln Parkway near Pittsburgh, Frank Mashuda's Model HM spreads shoulder material while concrete pouring goes on beside it. Good tire flotation and maneuverability is an important HM asset here.

MASTER OF MANY JOBS

Big 4 wheel drive "PAYLOADER" tractor-shovels are capable *and* versatile — able to do *many* jobs and drive quickly from one job to another at speeds of 17 m.p.h. Big tires, plus 4-wheel-drive, gives them catlike traction and flotation to surmount poor ground conditions. Power boosted rear wheel steer makes them maneuverable and easy to handle . . . 4 gear ratios in each direction provide the right speeds to fit each task.

The powerful 1½ cu. yd. "PAYLOADER" is the flagship of the "PAYLOADER" fleet, which includes 7 sizes down to 12 cu. ft. bucket capacity. Also a choice of 4 wheel drive, rear wheel drive and

front wheel drive to best fit your needs. Your Hough Distributor, one of 200 in the U.S. and Canada, is ready to serve you *right* — with extensive application experience and complete parts and service facilities. The Frank G. Hough Co., 707 Sunnyside Ave., Libertyville, Ill.

WRITE for full information on any of the "PAYLOADER" models: FourWheel Drive HM — 1½ yd. and HR — 1 yd.; Rear Wheel Drive Models HY — 1¼ yd., HF — ¾ yd., HE — ½ yd.; Front wheel drive Models HAH — 15 cu. ft., HA — 12 cu. ft.



PAYLOADER®

THE FRANK G. HOUGH CO.

SINCE 1920



HOW IT WAS DONE...



Look what's stopping motorists . . .



. . . And how they make the best of a rough (and hot) situation

Arizona highway contractor uses good public relations

IT'S DOUBTFUL whether detour signs and construction flagmen will ever be thoroughly welcome sights through the average motorist's windshield. But if Del W. Fisher, youthful and modern-minded president of Fisher Contracting Co., Phoenix, Arizona, has his way, travelers held up by construction work will be prone to discuss, rather than cuss, the inconveniences of the road.

The Western motoring public has accepted new road construction as a necessary evil and has learned to accept, as a matter of fact, long waits under a broiling sun while being showered with dust stirred up by busy machinery.

It was a pleasant surprise, then, when users of U. S. Highway 60, a few miles south of Show Low, Arizona, where the road hugs Carrizo Canyon, discovered that something can be done where construction activity makes it necessary for tourists to stop, sometimes at length.

Wherever possible on this road-widening project, Fisher tried to make the waiting places as comfortable as possible, stationing the flagmen at a point where shade trees were available, and the scenery was interesting. What's more, the flagmen had to be a cheerful sort of fellow who would ask the motorists to stretch their legs and enjoy the scenery while being detained.

Too, a water cooler was conveniently placed for mom, pop, and the always-thirsty kids. Fisher found that folks took to the idea, relaxed, and made the best of their pause. Some even took advantage of the wait to have a picnic.

Fisher's job, a \$715,000 project, covers 6.8 mi. of widening and relocation at an elevation of approximately 6,000 ft. Seventy-five per cent of the yardage involved in pioneering with Caterpillar D8 tractors is composed of malapai rock, which requires considerable blasting. The D8's clear out as much as they can before the blasting, after which they move in again to clear the road to permit traffic to proceed for another period.

Despite the difficulties of the job, and the necessary traffic delays, it appears that Fisher has done a good public relations job by taking the traveling public's mind off a temporary discomfort.

Compressed air de-ices lake for winter operations

THE PROBLEM of a lake freezing over in winter has shut down more than one Western construction job where the weather otherwise presented no insurmountable problem. A lumber company at McCall, Idaho, has met the problem and beaten it, with the result that enough of Payette Lake, adjacent to the mill, can be kept open to permit year-around mill operation. Maybe there is something in the method that construction men can profit from.



AIR VIEW of Payette Lake shows in foreground the mill pond "unfrozen" through use of compressed air at the Brown Tie & Lumber Co., McCall, Idaho.

Warren Brown, owner-manager of the Brown Tie & Lumber Co. at McCall, took temperature records at various depths in Payette Lake during the entire winter a few seasons back. Although the lake was frozen over at all times, he found that the water was never colder than 38 deg. F. at a depth of 10 ft. below the surface.

Brown also knew that an air bubble any place in the lake would make a hole in the ice. Such a hole is usually small, not more than 1 ft. in diameter. Putting two and two together, Brown decided in 1951 to improve on nature by the use of compressed air and a pipeline.

He prepared two 1,000-ft. lengths of 1-in. pipe, drilling a 1/32-in. hole every 60 ft. along each pipe. Next, he and a crew cut trenches in the ice with power saws and laid the pipelines in place, roughly parallel and about 60 ft. apart. The water depths ranged from 20 ft. near the shore to a maximum of about 100 ft. at the offshore end of the lines.

The temperature was near zero when air was turned into the lines at about 5:00 p. m. on the trial day. By the next morning all ice had disappeared from the lake surface over an area about 100 x 1,000 ft. At times thereafter the temperature dropped as low as 30 below, but no ice would form in the water warmed and agitated by the continuing rise of air bubbles from the pipelines.

Knowing now that the plan is workable, Brown has extended his system to include over 1 mi. of pipe. He can thaw out any portion of the pond simply by opening one valve and turning air into that portion of the system. Air is furnished from a 200-cfm. compressor operated by electric power in the mill.



Macwhyte' 6x25F PRE-formed Monarch Whyte Strand Wire Rope with I.W.R.C.

How many moving parts?

- In this particular rope construction there are 199 individual wires. Each is a carefully designed "moving part."
- Outside wires are one size. Inside wires are another size. Core and filler wires are still other sizes.
- Altogether, 8 different sizes of wire are used, and each has a specified strength, toughness and flexibility.
- Macwhyte has specialized in the manufacture of wire rope like this for over half a century.
- To assure highest quality, all stages of wire manufacture and rope fabrication are closely controlled.
- An exact "breathing space" between each wire is provided in order to increase flexibility.
- Each wire is protected with a film of lubricant that is force-fed *cold* during the fabricating.
- Since any piece of wire rope is a complicated piece of machinery, precision is as important in its manufacture as in the making of a fine watch.
- In designing and manufacturing its thousand and one wire ropes, Macwhyte exercises all the special care that assures long service and low cost to you. May our engineers recommend the right rope for *your* equipment?

MACWHYTE WIRE ROPE

THE RIGHT ROPE
FOR YOUR EQUIPMENT

Ask for G-15 Handbook

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SEATTLE 4..... 87 Holgate Street, Ph: MAin 1715

HOW IT WAS DONE...

World's largest primary gyratory crusher now working in Colorado

THE WORLD'S LARGEST primary gyratory crusher, a massive steel structure standing approximately 27 ft. high with a diameter close to 19 ft. and weighing well over 1,000,000 lb., has been shipped from Nordberg Manufacturing Co. to Climax Molybdenum Co., Climax, Colorado.

It took 12 railroad cars to ship the crusher. Because of the large size and extremely heavy weights of the parts,



OFFICIALS of Climax Molybdenum are dwarfed by the crusher, shown here erected at Nordberg's Milwaukee plant.

special heavy duty railroad cars with capacities up to 100 tons each were used.

This "Symons" Primary Gyratory Crusher has a 60-in. feed opening and was built by Nordberg in its Milwaukee plant. It will be used by Climax Molybdenum for the primary crushing of molybdenum ore at that company's new Storke Level plant high in Colorado's Rocky Mountains.

Method of measuring silt in river during spring run-off wins award

DEVELOPMENT of a method for accurate measurement of the amount of silt carried down the Rio Grande during spring run-off each year has brought an award to Ernest Pemberton, hydraulics engineer with the Bureau of Reclamation at Albuquerque.

Most previous estimates of quantities of silt carried by a stream have been obtained by mathematical calculations. But it has been questionable whether these are accurate because of the constantly changing quantities and velocities of river flow.

Pemberton devised a system for sampling and obtaining

actual measurements. He selected an 11,000-ft. length of the river as being representative, and with the cooperation of the Geological Survey, had cables strung across the river at 1,000-ft. intervals. Boats were then able to cross the river, held by the cables, to obtain numerous samples as required from the river. Measurements and samplings, and subsequent determinations of silt in each sample, were repeated each time Rio Grande flow rose or dropped 3,000 cfs. during the spring run-off. While the cables and boats were being utilized, it was also possible to obtain a new cross-section of the river for the 11,000-ft. stretch and to determine how much scouring or sedimentation had occurred since earlier measurements.

136-ft. steel bridge section moves through L. A. with little difficulty

MANEUVERING a 136-ft. long fabricated bridge section through the busy streets of Los Angeles was accomplished recently with a minimum amount of difficulty by Belyea Truck Co. and Consolidated Western Steel Div. of U. S. Steel. The 22-ton span, one of the longest single pieces of fabricated steel ever to be transported on L. A. streets, was fabricated by Consolidated at its Maywood plant for a pedestrian overpass on the Ramona Freeway. A pictorial record of how the move was accomplished is shown in the series of pictures below.



THE START. Leaving manufacturing plant 10 mi. from job.

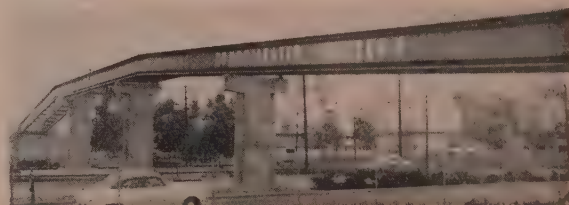


TOUGH PROBLEM. Difficult turn under overpass onto freeway.



AT SITE. Three cranes slowly maneuver long span into place.

COMPLETED JOB. 309-ft. pedestrian bridge crosses freeway.



TO THE CONTRACTOR and HIGHWAY ENGINEER!

FOR YEARS highway engineers have been working toward the elimination of road forms, and at the same time building a road that was known to be definitely level on both sides of the longitudinal joints.

Accuracy could be obtained at the shoulders with a line. The thickness of the course could be ascertained with a gauge but a line at the center of the road for establishing an absolute level was obviously impractical. Up to now, even with the most modern equipment, to arrive at any approach to accuracy in maintaining the level of a black top course over its full width was no more than a reasonably good guess. Matching devices can assure that one course will match the other course at the joint. In other words, both parallel courses will be the same depth where the courses abut, but the course at any given point may have a roll in it.

The shoulder remains true because of the line—The longitudinal joint can be tight—But, the center of the road is veiled in mystery insofar as its level qualities are concerned. There has been no means to correct the roll and dips that won't show under a straight edge.

Now, for the first time in the history of paving this situation can be corrected and it is possible for the Contractor and Highway Department Engineers to know exactly what the condition of the road surface is insofar

as its level characteristics and slopes are concerned.

The direct-lift, one-piece-unit Cutter Bar Screed of the Adnun Black Top Paver has made possible the application of a Fluid Level to black top paving. The Fluid Level can be used either with a line for a primary setting along the edge of the road or without it. A simple, accurate device, it serves the purpose of leveling up a road course just as a carpenter uses a level to level up a structure. It permits correcting for any desired slope at any station. It permits holding an absolutely level grade without modifying the desired crown. It permits leveling up old shoulder and blending it into the crown but most important of all it takes out the dips that won't show under the straight edge and it gives you absolute control of the laying of the *center of the road*. With the Adnun Fluid Level you both *match the joint and take out all the undulations on each side of the joint!* Your road is as level and true at the center as it is at the shoulder.

The Adnun Fluid Level should be standard equipment on every black top spreader. It means better, smoother, longer life roads for the State and County. It means less waste of material, smoother running jobs, and better work acceptance for the contractor.

The season is opening! Now is the time to get the full story on this Adnun device.

Write for details.

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TRADE MARK REGISTERED
BLACK TOP PAVER

BLAW-KNOX

FOOTE CONSTRUCTION
EQUIPMENT DIVISION
OF BLAW-KNOX CO.
1940 State Street,
Nunda, New York



REPORTS

FROM THE COURTS

By

HOWARD S. BURNSIDE

Attorney at Law
Registered
Professional Engineer



Contract collateral to illegal purpose enforced

IF A CONTRACTOR furnishes labor and material for the construction of bleachers and facilities for chicken fights will he be allowed to enforce payment under his contract and apply the mechanics lien laws in the courts if it is illegal to conduct such fights? It is basic that a contract made to further something prohibited by statute or to assist any party therein is void and will not be enforced by the courts.

This is an actual case and represents a general type of situation in which any contractor may knowingly or unwittingly find himself. The manner in which the court resolved this particular problem may be viewed as a typical solution.

"Plaintiff may recover for clearly his contract was collateral to any illegality. Plaintiff here was merely building a structure for defendant. As an eminent author has stated: 'An action for clothes sold to a prostitute . . . cannot be defeated merely by showing that plaintiff was aware of the defendant's situation, although from the nature of the articles the plaintiff might have known . . . the purpose for which they were intended.' The trial court found that the plaintiff . . . did not involve himself in any way in the venture, after it was completed, so as to become identified as an actual party to any illegal venture."

²Thomas v. Owens 241 P 2d 1114.

Contract created when mutual assent manifested

IN A CASE recently before the Supreme Court of Arizona the question was whether a contract for purchase of lumber was created during oral discussions and confirmed by later telegrams or whether a binding contract was made only after the exchange of telegrams, the discussions being preliminaries.

The facts in evidence showed that plaintiff's representative called at defendant's office and examined lumber in the yard which ranged in moisture content from bone dry to very green. Plaintiff was advised of this and shortly afterward forwarded a written order specifying air dried

lumber. After an exchange of telegrams concerning payment the defendant formally accepted the written order. A carload of lumber shipped pursuant to this order was rejected by plaintiff's customer because it was green and stained which was confirmed by a reinspection made under the rules of the Western Pine Association. Plaintiff then sold the lumber elsewhere at a loss and sued for breach of contract.

In reversing the trial court and ordering judgment for the plaintiff, the court said: "It is elementary that before there can be a binding contract there must be mutual consent of the parties but once it is mutually agreed between them the contract is formed and is binding according to its terms . . . The purchase orders and the telegrams which placed the order specified that the lumber was to be air dried, and that term was accepted by the defendants . . . the evidence conclusively shows that the contract of sale was entered into by the parties after an exchange of telegrams and correspondence on both sides. Plaintiffs offered to buy air dried and not green lumber, which offer the defendants accepted and they so referred to it in their invoices and confirmation. The inspection by McNutt was merely preliminary dealing looking forward to a contract by the parties and not the contract itself."

¹Spellman Lumber Co. v. Hall Lumber Co. 73 Ariz. 322.

Restrictive covenant in sale of business

A RESTRICTIVE COVENANT is an agreement by one to refrain from doing certain specified things. In business activities a restrictive covenant often encountered is the agreement of a seller of a business not to compete with the buyer after the sale is made. The buyer's object is to prevent the seller from setting up shop "next door" in competition with him after he has paid a purchase price which includes the value of good will and reputation of a going business. If the seller does not keep his agreement a legal remedy for the buyer is an injunction. The injunction here is the order of a court to refrain as agreed but before issuing it the court will examine the restrictive covenant because unduly severe restraints on

trade are not sanctioned. The foregoing summary of a large field of the law is illustrated by a case in Arizona involving the sale of a plumbing business.¹

In a written agreement for the sale of the business it was agreed that the defendant "shall not work in said business for a period of five years within the Wickenburg area." Later the defendant did work in the prohibited area as a plumber for day wages. The plaintiff obtained an injunction against defendant working as a plumber for hire or in the plumbing business in the area for five years. Defendant appeals and makes various assignments of error.

First defendant contends that plaintiff did not prove he was damaged or would be damaged by defendant's working in the area. Therefore the court should not enforce the restrictive covenant. To this the court replies that while some states may require a showing of irreparable injury and special damages before issuing an injunction Arizona in adopting the so-called majority rule does not in that damage is presumed to be irreparable in such cases.

The defendant also contends that it was error to enjoin him because the restrictive covenant prohibiting him from earning a livelihood is against public policy and void. In response to this the court points out this was the rule at one time but the majority of jurisdictions do not today have such a blanket rule. Citing authority, "Where the restraint is limited as to both time and space, the agreement is ordinarily valid, unless such agreement is to refrain from all business whatsoever . . . The validity of an agreement in restraint of trade is according to the trend of authority to be tested by its reasonableness with respect to the protection of the covenantee and the public interest involved, and in all cases it is essential that the restrictive covenant be incidental to another contract or sale involving some interest requiring the protection of the restraint."²

In concluding its opinion the court found that the scope of the injunction enjoining defendant from working for hire or in the business was intended by the parties in their agreement.

¹Henderson v. Jacobs 239 P. 2d 1082.

²17 C.J.S. Contracts 245, 246.



liquid diet
for a
**GROWING
AMERICA**

Photo courtesy Marlow Pumps, Ridgewood, New Jersey

nearly 25% more water with Chrysler Industrial Power

Too seldom does Mother Nature supply moisture in the right proportion for maximum realization of the good things of the soil. This problem is not confined to the so-called "dry" or "arid" regions of the country. For instance, here's a field of beans in upper New York State. This farmer, like many other farmers and growers, has found that a sprinkler system fed by a Chrysler-powered pump provides the supplemental irrigation necessary for best growth.

The Marlow Pump in use here is designed for high capacity pumping. For that reason, the powerful new 180 horsepower, 331 cubic inch displacement Model 20 Chrysler V-8 Industrial Engine was selected to power it. Result: nearly twenty-five percent more water than delivered by pumps powered by engines of similar weight and

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This is another fine example of how Chrysler meets the many and varied requirements for industrial power. For instance, Chrysler can equip any of its engines with a corrosion-resistant or fungus-treated electrical system; propane or natural gas burning carburetor; 3, 4 or 5 speed transmission; standard or gýol Fluid Drive.

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WITH A PEDIGREE

WESTERN CONSTRUCTION NEWS

MARCH 1953

Wilson orders freeze on new defense construction

A FREEZE on awarding of new construction contracts by the military services was ordered last month by Defense Secretary Charles E. Wilson, according to press reports from Washington.

The services were also instructed to stop work immediately on current projects which cannot be justified as essential and to prepare reports on the essentiality of construction which is less than one-fifth complete, as well as that which has not yet been started, the reports added.

Wilson's order covered all military public works for the regular defense setup, all construction in connection with the reserve program (such as building new armories), and construction of such procurement facilities as warehouses, depots, and the like.

The stop work order will be in effect until a review of existing and future projects can be made. Since the Korean war started, Congress has voted some \$10,000,000,000 for construction purposes, of which a third remains unobligated.

New Mexico studies future road needs

CONCERN with New Mexico's highways was occupying much of the time of that state's legislators last month, according to press reports.

A State Highway Department needs study revealed that some \$397,000,000, spent over a five-year period, would be needed to bring roads up to acceptable standards and provide replacement and maintenance services.

The survey committee, headed by H. S. Wiley, made no suggestions as to how the work should be financed. Department spokesmen, however, reported that the most logical sources would be to increase gasoline taxes, increase motor vehicle fees, assess a property tax, or issue bonds.

Meanwhile, legislators have been asked to bring New Mexico's laws of the road up to date and make them uniform with those of many other states, the reports said.

The proposed new law would permit installation of traffic lights on highways, require rear view mirrors on vehicles, require bicycle riders to

obey all traffic laws, and regulate the use of high headlight beams. Truckers would have to follow the Interstate Commerce Commission code in regard to lights on their vehicles.

Ralph Tudor is new Interior Dept. official

RALPH A. TUDOR, president of Tudor Engineering Co. in San Francisco, has been appointed Under Secretary of the Interior by President Eisenhower. Tudor brings to his new post an excellent and diversified background of accomplishments in planning, finance and operation of civil works, and an international reputation resulting from his duties as senior designing engineer for the San Francisco-Oakland Bay Bridge in 1936.

Ralph Tudor,
Under Secretary
of the
Interior



After graduating from West Point in 1923, Tudor did graduate work at Cornell, where he received the degree of Civil Engineer in 1925. He was then in active Army service until 1929. He returned to the service as a lieutenant colonel when World War II fell upon the United States in 1941. During most of the war he served as a colonel with the Army Corps of Engineers.

For one year after the war he was vice president of Morrison-Knudsen International Co., and in charge of a wide variety of work done in the Orient. Entering private practice in 1947, Tudor has since headed his own firm in San Francisco. His work in connection with The Dalles and McNary dams is noteworthy. Revenue studies, finance method advice, and completed design problems have been features of the company's services.

In addition to his duties with the California Toll Bridge Authority in connection with the Bay Bridge, Tudor has served in agencies of the California Department of Public

Works, including the Division of Highways and the Division of San Francisco Bay Toll Crossings.

Tudor is a member of San Francisco Section, American Society of Civil Engineers. He also holds membership in the Society of American Military Engineers. Tudor is married, and his 16-yr. old daughter attends high school in their home town of Palo Alto, California.

Flood delays Folsom Dam construction until April

CONSTRUCTION work on the Folsom Dam, delayed when the American River went on a rampage and washed out the upstream cofferdam (*Western Construction*, February 1953, p. 92) will not be back into full operation until after April 1, according to Lt. Col. Earl G. Peacock, executive officer of the Army Corps of Engineers Sacramento District.

An estimated loss of more than \$350,000 was the figure set by Merritt, Chapman, and Scott and the Savin Corp., joint contractors on the power installation. It will be impossible to learn the exact figure, Peacock said, until the water is diverted and the channel is emptied again.

Soundings in the channel indicate that once the dam is rebuilt it will take some time to clear away gravel and debris which has piled up since the dam gave way, he said.

Concrete pouring on the east abutment of the dam is continuing, however, and the contractors will be able to work on several other parts of the job while waiting for the water to subside in the main river channel.

Oregon highway prospects boosted by bond approval

OREGON'S emergency road construction program received a big boost last month when the State House of Representatives approved, by a vote of 53 to 6, the request of the State Highway Commission for \$32,000,000 in bonds.

The bonds, if approved by the Senate and governor, will be issued over a three-year period: \$10,000,000 in 1953; \$15,000,000 in 1954; and \$7,000,000 in 1955, according to press reports.



Tough Going-

but DW20s maintain schedule at Old Hickory

The Old Hickory Lock and Dam project, in Tennessee, calls for moving 1,700,000 yards of heavy, fat clay. Roads are spongy, grades are steep. But H. N. Rodgers & Sons Co., of Memphis, have kept up to schedule.

The big reason is their use of Caterpillar DW20 Tractors and No. 20 Wagons. With 225 honest horsepower available at the flywheel, these big yellow wheel tractors can pull through heavy clay cuts without excessive engine strain, and they travel 26 mph. on the haul.

The No. 20 Wagon is a perfectly matched unit, with 20-cu.-yd. heaped capacity. That means up to 25 tons

Big loads in tough going are easy for this Cat DW20-No. 20 unit, one of 8 on the job at Old Hickory. The Lima dragline is powered by a Caterpillar D17000 Engine.

in heavy material. The wagon is an easy target to hit with the shovel, and positive controls make possible either instantaneous or windrow dumping.

The Rodgers firm has been using Caterpillar equipment for 23 years, and the fact that 90% of their present machines are Cats shows what they think of them.

Your Caterpillar Dealer will gladly demonstrate the DW20-No. 20 team for you in any kind of hauling you choose. And he backs it with genuine Caterpillar parts and service—the only kind that gives you genuine Caterpillar performance. See him today!

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TRACTORS • MOTOR GRADERS
EARTHMOVING EQUIPMENT**

Columbia River mouth in for a cleaning

AN \$8,555,000 project to deepen the shipping channel at the mouth of the Columbia River by 8 ft. has been recommended by Army engineers of the North Pacific Division.

Initial dredging on the job, which calls for removing 18,000,000 cu. yd. of material, would cost an estimated \$2,898,000. The channel would then be 48 ft. deep at mean low water over a half-mile width, according to Col. E. C. Itschner, Division engineer.

The plan also provides for construction of a spur jetty for approximately \$5,657,000. If approved by the Army Engineers Board of Rivers and Harbors at Washington, D. C., the project will be presented to Congress, which must appropriate the construction funds.

Cachuma Project nears finish

IT'S CURTAINS for the last acts of construction work on Southern California's \$36,000,000 Cachuma Project, now about three-fourths completed. Contracts for Ortega and Carpinteria regulating reservoirs, the final two major portions of the project, were let at the end of December to Wonderly Construction Co. for \$939,003. And at the beginning of the year closing time arrived at the dam's outlet tunnel on the Santa Ynez River, enabling the first storage of water to safeguard the interests of users in Goleta, Santa Barbara, Montecito, Summerland and Carpinteria. Water from this reservoir will flow through

Tecolote Tunnel, now under construction through mountains north of Goleta, to the south coast water districts. Conduits now under construction will carry the supply south to Carpinteria. Completed portions of the work include the Goleta section of the conduit and Lauro Dam, which will take the flow from the conduit, regulate pressures and feed a major portion of the distribution system. This dam can handle a capacity of about 642 ac. ft., or approximately enough water to supply Santa Barbara for a 30-day emergency. The project was designed to provide users with an annual 30,000 ac. ft. of water.

Idaho Power announces huge 1953 budget

A \$12,858,600 construction budget for 1953 for enlarging and improving facilities in southern Idaho and eastern Oregon has been announced by Idaho Power Co.

Included are items of \$4,012,500 for power plant construction, \$2,500,400 for transmission lines, \$2,475,000 for distribution lines, \$2,170,000 for substations, and \$1,700,000 for miscellaneous service facilities.

"It is our hope that approval by regulatory authorities will be given in time to permit beginning the construction of the long-delayed Oxbow project, and the budget anticipates it," says T. E. Roach, company president.

The proposed Oxbow site on the Snake River is just upstream from the government's proposed Hells Canyon Dam site. Oxbow would be flooded if Hells Canyon Dam is built.

Tahoe tunnel proposal opposed by residents

A TUNNEL from Incline Beach at Lake Tahoe to Washoe Lake in Nevada has been proposed by the U. S. Bureau of Reclamation to increase water and power supplies and aid flood control. Cost is estimated at \$90,000,000.

The plan would require construction of five reservoirs and seven power plants, and it would be at least three years before funds for the job became available, H. A. Hunt, a Bureau official, said.

Residents of the area have expressed some opposition to the idea, according to press reports, feeling that widespread flooding and irrigation rerouting were disadvantages which would more than outweigh the benefits. Alternative plans will be discussed further by local interested persons and organizations, the reports concluded.

Washington plans to unplug bottleneck

ONE of the major bottlenecks in the present Pacific Highway between Portland and Seattle will be opened up as soon as possible, according to Paul McKay, Lewis County district engineer for the Washington State Highway Department.

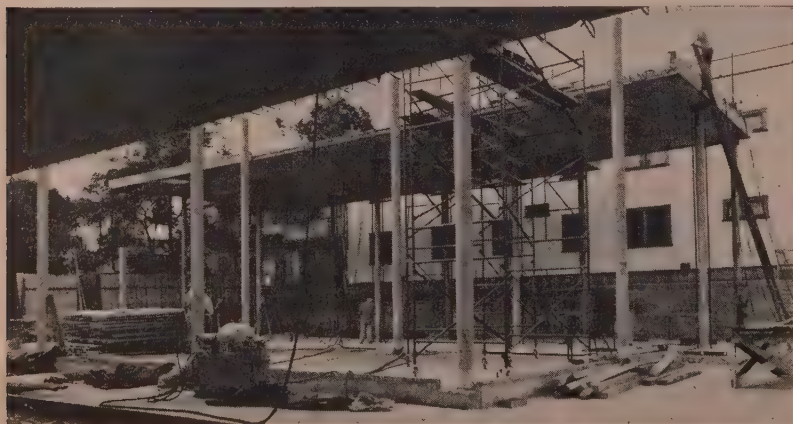
The project, a three-mile stretch of highway between Chehalis and Centralia, is part of the nearly \$10,000,000 in contracts, in effect and contemplated, let during 1952 and 1953, he said.

CIRCULAR STEEL COLUMNS USED TO ELEVATE ROOF SLAB

ANOTHER LIFT-SLAB JOB in Southern California lately (see article on page 71) was the two-story Cass & Johansing office building. The structure was designed by Albert C. Martin & Associates, and J. A. McNeil Co. was the general contractor. The 17,000 sq. ft. of lifting was done on subcontract by Vagtborg Lift-Slab Corp. An interesting point of this job was its employment of circular steel column sections,

rather than the H-sections that have been commonly used.

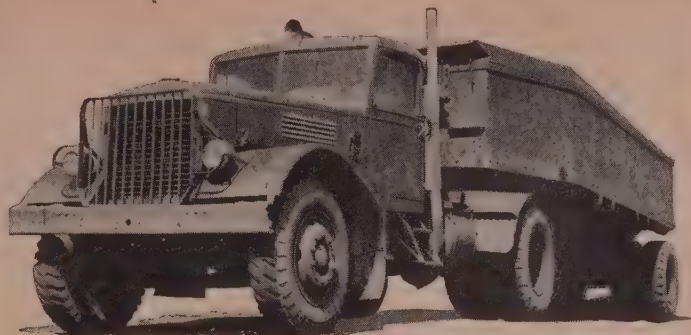
The overall picture shows a section of roof in place, after a lift that took 5 hr. Tension rods have been lowered again for securing to lifting collars in the second floor slab. The close-up shows details of the key-hole shear and lifting collar used for this job. Corrugated paper was used as a separation medium between the slab concrete and the steel column.



"Faster Work
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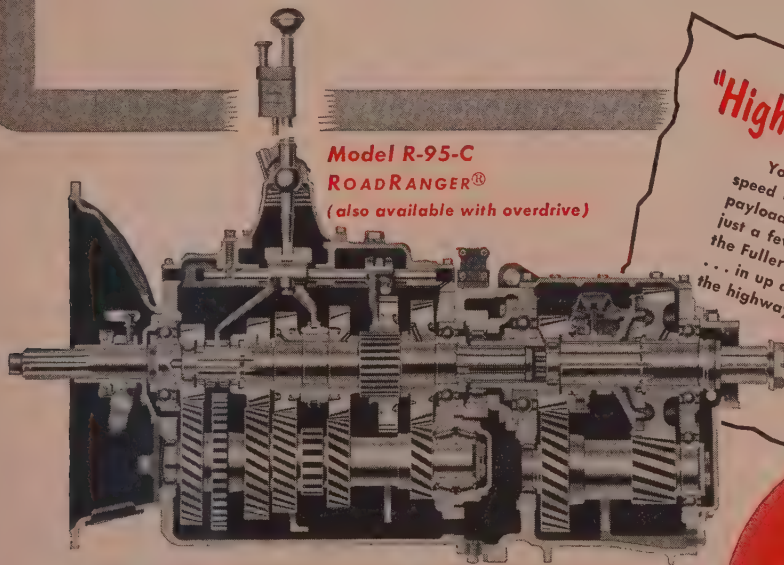
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"Standard Fuller 10-speed transmissions do an excellent job on the lesser grades of our '550-Pit' . . . but we use the ROAD-RANGER units to keep up work cycles with 45-ton-plus loads on the longer haul, with its up to 5% grades."

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You hear it everywhere . . . "higher average speed on grades . . . less driver fatigue . . . more payload . . . use lighter engines . . .". And that's just a few of the many things they're saying about the Fuller ROADRANGER. North, east, south, west . . . in up and down hauling, in dense traffic . . . on the highway and off . . . fleet operators are turning to the new efficiency of this 10-speeds-with-one-lever transmission.

They like the ROADRANGER because of these advantages:

- 1** No gear splitting—10 selective gear ratios, evenly and progressively spaced.
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- 3** Higher average road speed—engine operates in peak hp range with greater fuel economy.
- 4** Less driver fatigue—1/3 less shifting.
- 5** Range shifts pre-selected—automatic and synchronized.
- 6** More compact than other 10-speeds,
- 7** More cargo on payload axle.



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12 CARCO WINCHES

**speed up jobs for
Houston Construction
Company**



IN PREPARING THE BED on a 40-mile stretch of a 158-mile, 30-inch pipeline from Texas to Tennessee, the Houston Construction Company used one of their 12 Carco GO winches to tow a 30-ton ditcher. This ditcher has a 12-foot cutting wheel that cuts about one mile of bed, 5½ ft. wide by 6 ft. deep, every 12 hours.

Carco GO winches were specified because this winch was designed and built for pipeline and oil field work. It's a two-speed winch . . . a slow speed with high line pull for the hard, steady pulls needed in towing heavy machinery, rescuing mired and ditched equipment and pulling long pipe sections . . . and another speed for lighter winching jobs such as loading, unloading, lifting pipe, and general construction and oil field uses.

The Carco GO winch has an extra large cable capacity for the "long reach." It mounts on tractors in the 76- to 100-horsepower range. A four-roller fairlead, which maintains maximum line pull regardless of the direction of the load, can be easily attached. See your nearest Carco dealer. PACIFIC CAR AND FOUNDRY COMPANY, Renton, Washington. Branches at Portland, Oregon and Franklin Park, Illinois.

**WINCHES FOR ALL
INDUSTRIAL TRACTORS**



AEC to build engine test area at Idaho station

SOME \$12,000,000 in construction contracts at the National Reactor Testing Station will be awarded in 1953, according to Allan C. Johnson, director of the Division of Engineering and Construction at the Atomic Energy Commission's Idaho Operations Office.

Johnson, who addressed the annual meeting of the Idaho chapter of the Associated General Contractors last month described two major construction projects in connection with building ground testing facilities for a prototype aircraft propulsion reactor.

Contracts for the first part, construction of assembly, maintenance, and administration areas, are expected to exceed \$6,000,000. The second, construction of an engine test area, will total about \$5,000,000, Johnson said.

Other proposed work for this year includes construction of a hot cell and hot cell building, a railway type turntable, sewage disposal system, a transmission line and substation for an aircraft project, and a boiler addition, decontamination facility, hazardous materials storage facility, and compressed bottle gas storage building at the Chemical Processing Plant, he said.

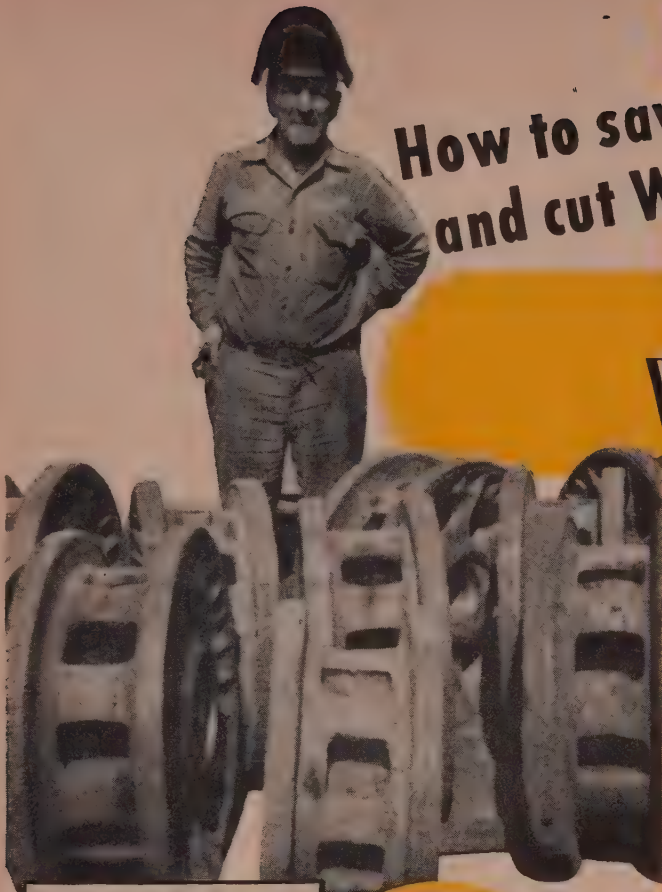
Diesel fuel use decides whether it's tax-free

AN INTERESTING quirk in Bureau of Internal Revenue regulations affecting contractors has been pointed up recently by chapters of the Associated General Contractors. A part of final regulations recently published by the Bureau pertains to the federal tax on diesel fuel and to the heavy equipment in which tax-free fuel may be used.

According to the Bureau of Internal Revenue, the distinction between highway and off-highway vehicles, both using diesel fuel, is made on the basis of the nature of the equipment and not its use. The diesel-powered highway vehicle is one capable of general use on highways—trucks, buses, highway tractors, etc. The off-highway vehicle, obviously, is a grader, a power shovel, a crawler tractor, or similar rig.

The quirk occurs in the Bureau's decree that freedom from fuel taxation depends on the above definitions of equipment. Using an example, the regulation cites the circumstances of construction of a dam at a remote site, well removed from public highways. Diesel fuel used in equipment defined above as off-highway equipment is tax-free. But tax must be paid on fuel consumed by highway-type dump trucks even though they operate entirely on the project's own construction and haul roads.

How to save Parts Cost and cut Welding Time . . .



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Take a tip from the job superintendent who repaired these worn idlers. Rather than wait until they were completely worn out, he hardfaced with VICTORALLOY as soon as one pass was required to bring them back to size. His welders estimate VICTORALLOY cut welding time 25 to 50% and saved rod because:

One pass and 100 lbs. of VICTORALLOY rebuilt these ten track idlers, thus saved costly replacement!

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Northwest water outlook good for '53

THIS YEAR'S water supply outlook for the Pacific Northwest was generally good by the end of January, according to press reports.

Both river flow and snow moisture content were reported well above normal, although below last year's records at a comparable time.

Virtually all reservoirs will be filled for the 1953 season, provided the weather is anywhere near normal, said Harold T. Nelson, Bureau of Reclamation regional director.

By the end of January, Grand Coulee Dam on the Columbia River had 4,258,000 acre-feet of usable water impounded, as compared with the 3,133,000 acre-feet it held at the same time last year, and it contains more than a third greater power potential than it did at the same time last year, Nelson added.

In its first year of major storage operation, Hungry Horse Dam on the Flathead River in northwestern Montana held 660,000 acre-feet in its reservoir by the end of January. Its ultimate goal is 2,000,000 acre-feet.

Five reservoirs serving the Minidoka project and the Upper Snake River Valley in Idaho held 2,134,214 acre-feet of usable water, less than last year's content but well above the 10-year average of 1,792,300 acre-feet.

Five reservoirs on the Boise project in southern Idaho held 691,259 acre-feet, and the Owyhee reservoir in eastern Oregon held 512,750 acre-feet, both well over average.

The highest January precipitation on record in the Yakima Basin of central Washington boosted the water supply to near average and changed the outlook from "poor" to "fair." The reservoirs then held 497,-



INFORMAL SESSION of the men most directly concerned with the USBR's construction program took place in Denver during the third Construction Engineers Conference, concluded February 6. Standing, left to right are: *K. B. Keener*, chief designing engineer; *Grant Bloodgood*, chief construction engineer; *W. E. Blomgren*, assistant chief engineer; *L. N. McClellan*, chief engineer and division engineer. Seated, left to right, are the regional engineers for each of the Bureau's seven regions: *H. E. Prater*, Region 7; *W. J. McCrystle*, Region 2; *J. P. Jones*, Region 3; *C. G. Anderson*, Region 6; *C. H. Carter*, Region 4; *D. S. Walter*, Region 1, and *A. A. Lewis*, Region 5.

100 acre-feet of usable water, as compared with the 10-year average of 588,900 acre-feet.

Deschutes project reservoirs in north central Oregon held 200,000 acre-feet, Nelson said.

The only unfavorable outlook in the region is at the Umatilla project in the same region, where Cold Springs reservoir held only 20,000 acre-feet as compared with 31,500 acre-feet last year and a 10-year average of 28,400 acre-feet.

Oregon's 1953 water supply depends on its mountain snow cover to a great extent, according to a combined report by the U. S. Department of Agriculture Division of Irrigation of the Soil Conservation Service and the Oregon Agricultural Experiment Station at Medford.

The outlook is still uncertain, the report said, and depends to a large extent on the snows after February 1,

when normally about half of the snow at moderate and high elevations falls.

A Wyoming press report revealed that the water content of snow in the lower mountains is above average. High elevation measurements will not be made until after March 1, however, the report concluded.

Stream flow and lake levels in the Pacific Northwest have increased sharply, said M. F. Hatch, a Washington Water Power Co. supervising engineer, early in February.

Inflow into the Columbia River above Grand Coulee was about 80,000 cfs. as compared to 22,000 cfs. a month previously. The Spokane River was running 28,000 cfs., compared to 2,500 cfs., and the Kootenai River flowed at 18,000 cfs., as compared to 4,500 cfs. a month before. The Pend Oreille River was reported at 23,000 cfs., up from 5,000 cfs., he said.

Hatch reported that Lake Coeur d'Alene, the power company's principal storage reservoir for the six hydroelectric plants on the Spokane River, had risen 6.2 ft. in a month.

He explained the sharp rise as due to a combination of warmer weather and increased rain or snow over the entire Northwest area.

TALLEST TILT-UP YET is the distinction claimed for the 28-ft. high by 20-ft. wide precast walls at United Air Lines' new San Francisco maintenance base warehouse. The 48 wall sections, 6 in. thick and weighing 19 tons each, were cast at the site and crane-hoisted into position. New 56,000-sq. ft. warehouse will contain impressive array of machinery designed for overhauling United's fleet of big Mainliners.



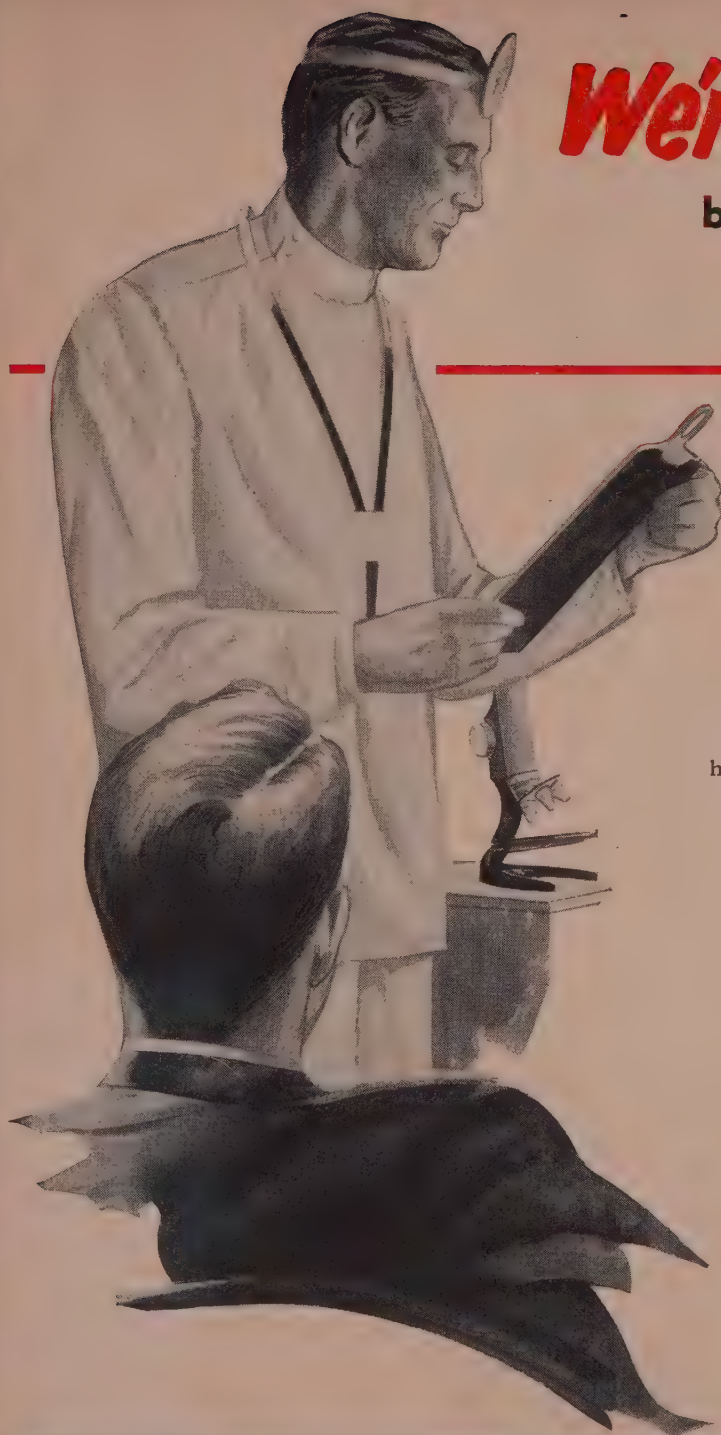
Big flood control projects on L. A.'s agenda

CONTRACTS are scheduled to be advertised/soon for work on two major flood control projects, at a cost of \$1,150,000, to help relieve flood conditions in the Orange-Los Angeles County boundary area, according to the Los Angeles County Flood Control District.

The larger job, to cost \$900,000, will undertake to widen and improve the San Gabriel River channel east of Long Beach. The other is a plan to spend \$250,000 to make a 140-ft. wide channel for Coyote Creek. Work is expected to begin at the end of the rainy season.

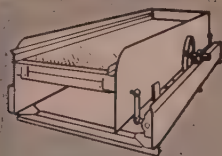
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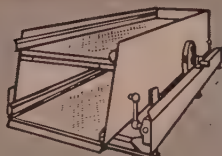


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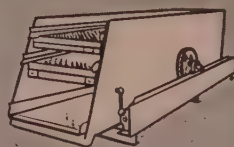
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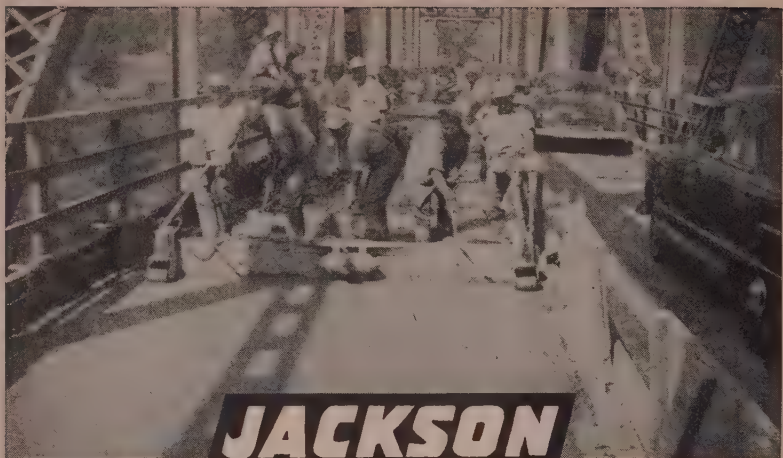
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Cascade tunnel hopes fade as costs rise

PROSPECTS for a long-proposed Naches Pass tunnel and highway through the Cascade Mountains faded last month with a report that the project would cost more than \$25,000,000 and be economically unsound for the present.

The report, prepared by the Washington State Highway Commission and the State Toll Bridge Authority, was given to the legislature by Senator E. D. Ivy and Representative L. E. Shropshire, both of Yakima.

It said that the somewhat reduced mileage from Yakima to Seattle and other coast points would not attract sufficient traffic to offset the construction costs, even on a toll road basis.

The proposed route would save about 42 mi. to Tacoma, as compared with the present Snoqualmie road, but observers feel that planned improvements for Snoqualmie, a lower altitude pass, would make that route more attractive, especially for trucks.

The Highway Department indicated that projected road improvements and financial strain on the department at present would make the tunnel difficult to finance.

Home-made pipe for Phoenix

LOCAL INDUSTRY in Phoenix received a shot in the arm with the announcement that special pipe, to be used in the municipal water works expansion, would be made in the city.

Production of about \$1,250,000 worth of pipe, to be made on the machines and under the supervision of the American Pipe and Construction Co. of Los Angeles, will start around May 1, according to Del Fisher, Fisher Contracting Co. of Phoenix, which will place the pipe.

The job, which will cover 12 mi. of mains from 16 to 66 in. in diameter, will last about 6 months, Fisher said.

Gas firm plans expansion to tune of \$175,250,000

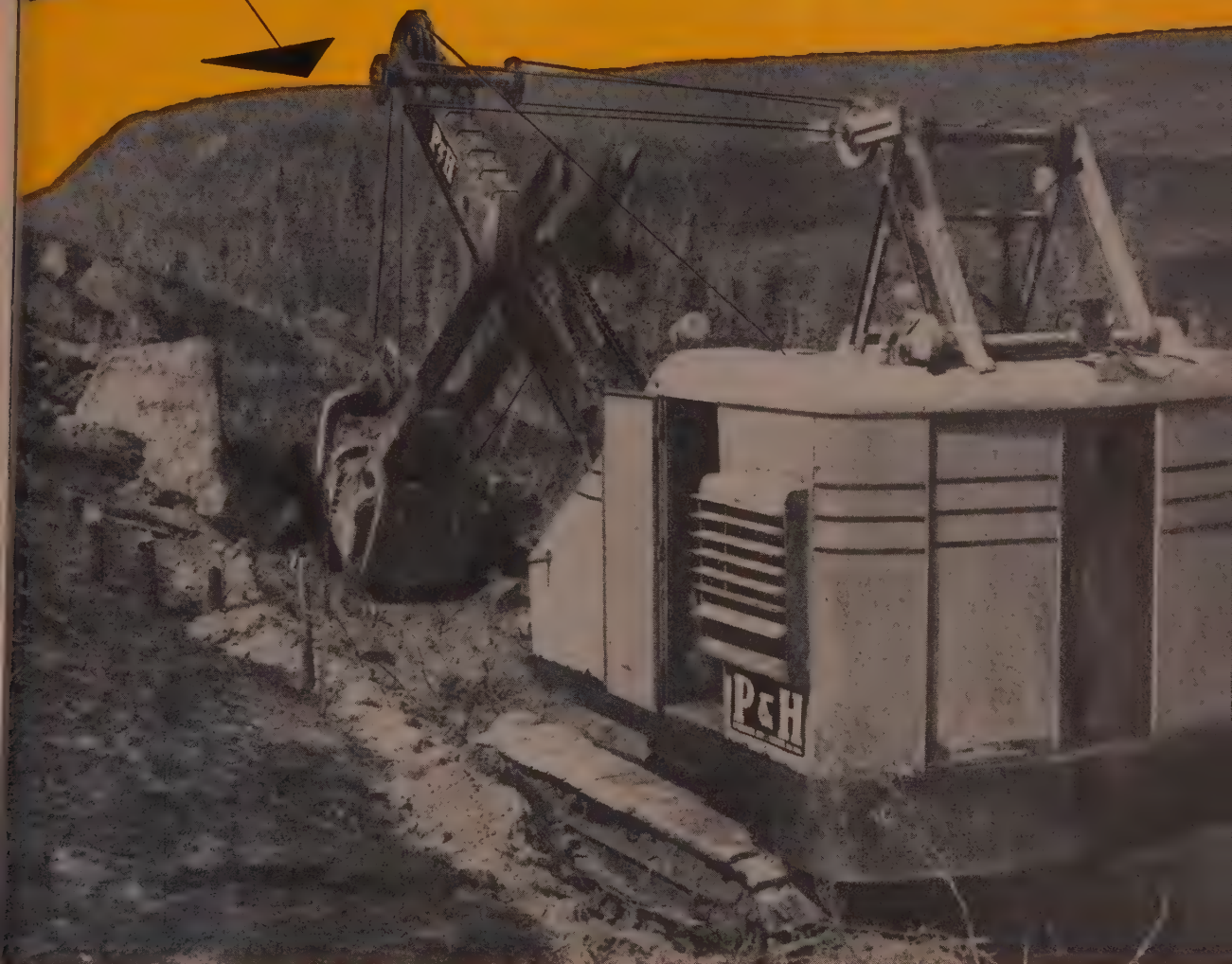
A PLAN to bring an additional 400,000,000 cu. ft. of natural gas daily from New Mexico and Texas to customers in New Mexico, Arizona, California, and Texas was revealed when the El Paso Natural Gas Co. filed an application for a \$175,250,000 expansion program with the Federal Power Commission.

The project would include 1,778 mi. of 30-in. pipeline and 161,860 compressor horsepower capacity. The new line would cross New Mexico 35 miles south of Albuquerque and would include two compressor stations. It would connect with the company's present line near the Arizona border.

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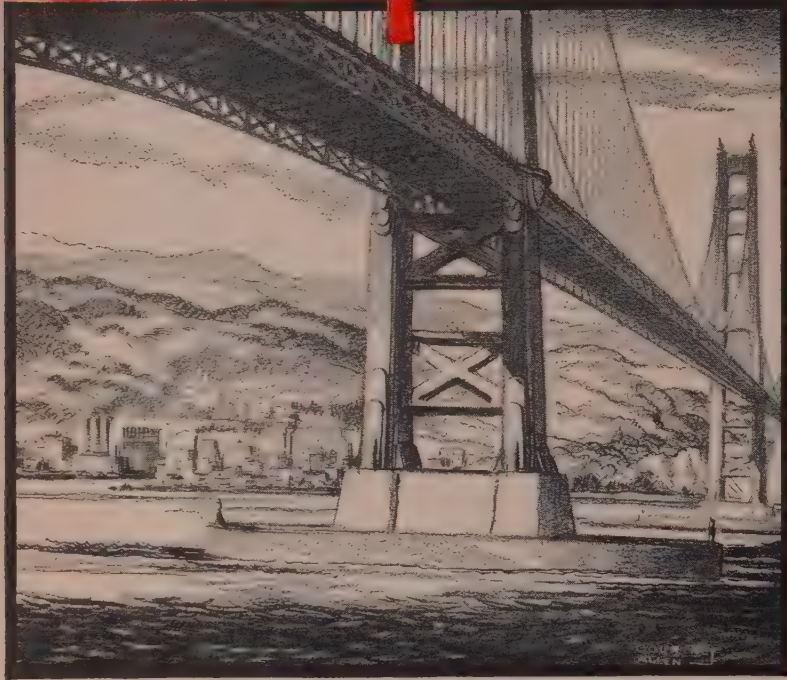
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SALT LAKE CITY, Utah.....Western Machinery Company, 748 West 8th, South
SEATTLE 8, Washington.....Bow Lake Equipment Co., Inc., 300 Michigan Street
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The Aetna Casualty & Surety Company — through its nationwide bonding organization — is proud to have worked with so many contractors on countless projects that serve the nation better. To serve you better, the Aetna has constantly expanded and improved its bonding facilities. That is why you can always count on Aetna for prompt, informed, efficient service. That is why so many contractors bond with Aetna — always.

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Scanty water supply seen as Denver growth bar

DENVER must develop new sources of water supply if it expects to maintain a population of more than 700,000 persons at its present rate of water consumption, according to a city planning office bulletin.

Its greatest hopes are to obtain a diversion of the Blue River from across the mountains, which would add a minimum of 157,000 acre feet of water annually to the metropolitan water supply, the bulletin said.

E. L. Mosley, secretary-manager of the Denver Water Board, says:

"The growth of Denver after the year 1960 is predicated upon the amount of water which will be allocated to it from this last available source of raw water supply."

The planning office report discussed the question of whether the city should encourage industries which are users of great amounts of water to locate in Denver. Denver has a good quality water for industrial purposes, it added—chemically balanced and free of certain undesirable elements.

The report made the point that local water rates are about equal to or a little less than rates for both industrial and residential use in comparable Western cities.

Denver's annual average rainfall is 14 in., but melting mountain snows add to the water supply.

Structural Conc. Assn. is born on Coast

E. S. McKITTRICK, Los Angeles contractor, was elected president of the newly-formed Structural Concrete Association for 1953. Other officers include William J. Moran and Harold Roach, vice presidents; Robert G. Swan, secretary, and Corwin Wickersham, treasurer.

The board of directors, composed of West Coast industrial leaders, includes Emil Wohl, chairman; Arthur Menke, Carl H. Wittenberg, John A. Alexander, Harry H. Hilp, Robert M. Golden, and H. A. Anderson, in addition to McKittrick and Moran. All are from Los Angeles except Hilp of San Francisco, Golden of San Diego, and Anderson, Portland.

President McKittrick revealed that the Association was formed to aid members in facing current problems, especially with regard to technical and legal stumbling blocks found in the design and construction of structural concrete projects.

Membership in the Association includes architects, engineers, and contractors on the West Coast primarily, Secretary Swan says, but widespread interest has prompted the group to accept membership and support from members of the construction industry all over the country.

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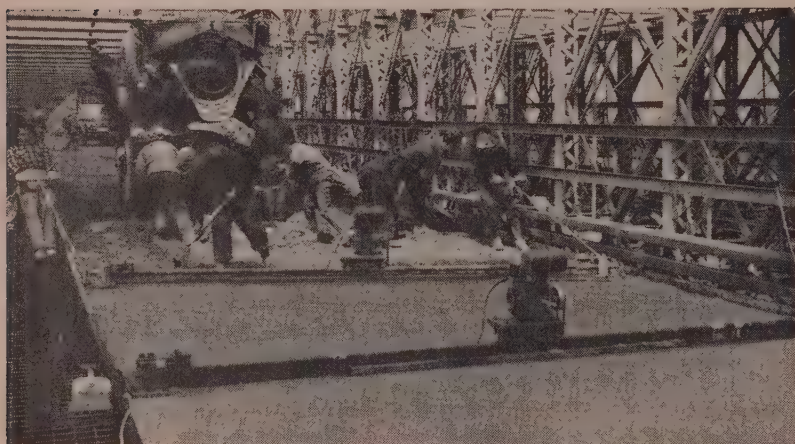
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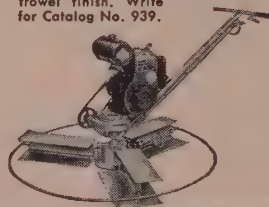
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Seattle City Light to spend 20 million in '53

COMPLETION of the Ross Power Plant, tunnels, and intake system and the installation of two more 90,000-kw. generators is the biggest single job scheduled by City Light of Seattle for 1953.

The first generator, also 90,000 kw., went into service on December 30, 1952. New housing and community facilities for Ross and Diablo power plant personnel, located at Reflector Bar near the Diablo plant, were partially built during 1952 also.

Other plans for 1953 construction include the installation of 75,000 kva. of substation transformation and the necessary line work to integrate facilities acquired from Puget Sound Power and Light with City Light's original facilities.

Planned expenditures for 1953 of approximately \$20,700,000 include \$16,700,000 for hydro development, \$2,950,000 for distribution facilities, \$550,000 for transmission systems, and \$500,000 for general plant additions.

Strengthening in store for Golden Gate Bridge

AUTHORIZATION to strengthen the Golden Gate Bridge was given in January when the Bridge board of directors approved an appropriation of \$3,500,000 for the job.

The project, under study since December 1, 1951, when the bridge was closed for three hours during a 59-mile-an-hour windstorm, will take 4,750 tons of steel in the form of bottom lateral bracings.

Details of how the job will be paid for will be taken up by the board finance committee.

Clifford E. Paine, one of the original Bridge engineers, has agreed to prepare plans and specifications for the job and to supervise the required engineering. He estimates the work will take from 9 to 12 months.

P. G. & E. steam plant completed as "biggest"

THE BIGGEST package of steam-electric power west of the Mississippi River is in full operation in Monterey County, California.

It is Pacific Gas and Electric Company's \$80,000,000 Moss Landing Steam Plant, where the fifth and last generating unit now has been completed and successfully tested four years and four months after ground was first broken in a broccoli field in 1948.

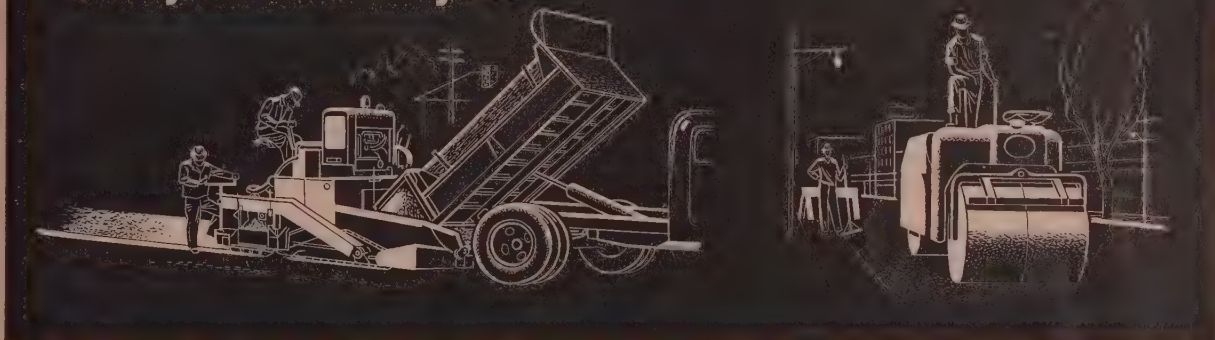
Completion of the fifth unit brings the plant's electric generating capacity to 575,000 kw.—greater than the power capacity of the Central Valley Project's Shasta and Keswick Dam installations combined.

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Here's how a contractor made money...



a city saved money...



... by bringing low-cost native aggregates up to "paving" standards with versatile BITUMULS®

IN EVERY LOCALITY there are low-cost aggregates—decomposed granite, red rock, bank-run gravel, shell, etc. Untreated, these materials are rarely suitable for base construction. When cold-mixed with small amounts of Bitumuls, however, they become stable and easily pass specification requirements for this type of work.

Municipalities get lowest paving costs when *maximum* use is made of these native aggregates and local plant mixing equipment. Typical are conditions in Oakland, California, where a local contractor conveyor-feeds waste bank-run gravel directly into hoppers that feed the material into his pug-mill. There it is mixed with a small quantity of Bitumuls and dropped directly into trucks that haul it to the job. This material, mixed cold and with damp aggregate, is ready for

immediate compaction as base material on streets throughout the city. Costs are low due to use of marginal aggregate and utilization of spare time of the mix plant. *This results in profits to the contractor and lower costs to the city for high bearing base material.*

The wearing course may be asphaltic concrete from the same plant but with approved aggregate, or macadams bound with quick-setting grades of Bitumuls.

Throughout the country, Bitumuls is readily available from strategically located plants for on-job delivery.

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Yuba water program to cost \$33,000,000

IT WILL TAKE a minimum of \$33,000,000 to pay for a proposed Yuba County (California) water development program, according to E. A. Bailey, consulting engineer, who submitted a partial report to the Yuba County Water Resources Board in January.

Some 272,700,000 kw-hr. could be developed in two power plants, to be built as part of the program, Bailey said. Power revenues would slightly exceed expenditures annually, he added.

Still to be estimated is the prospective income from sale of water for irrigation, the primary purpose of the 208,000 acre-foot Yuba project.

Present plans call for financing the work by issuing revenue bonds, to be retired over a 40-year period.

Chief Joseph's power will be second greatest

CHIEF JOSEPH Dam on the Columbia River in central Washington will ultimately turn out 1,728,000 kw. from its 27 generators, making it the second largest power producing installation in the world, according to Army engineers. Only Grand Coulee, 51 mi. upstream, will surpass it.

Contracts will be awarded in 1953 for 6 hydraulic turbines, 4 generators, transformers, station-service turbines, governors and generators, intake gate operating machinery, and

other powerhouse equipment, they said.

Expenditures for Chief Joseph Dam (*Western Construction*—January 1953, pp. 57, 59) for Fiscal Year 1953 will total \$14,903,000. Concrete placement in the main dam and the powerhouse and intake structures will continue through 1953.

Two of the highest voltage power transmission lines in the United States—extending from Chief Joseph Dam to Snohomish Substation—have been surveyed and bids will be invited in May on clearing the right-of-way, according to V. M. Murray, Bonneville Power Administration Northwest area manager.

The lines will be rated at 345 kv., instead of the 230 kv. originally planned. Overall cost is estimated at \$30,962,000.



Electrocution claims big tally in Calif.

CONTACTS with power lines by cranes, booms, well rigs and similar equipment were the leading causes of deaths by electrocution in California during the 1951-52 fiscal year, says the California Public Utilities Commission on electric utility accidents.

The summary of fatal and serious accidents reported to the Commission by the utilities for the year showed 13 deaths were caused by contacts of equipment with energized lines.

The accidents occurred in spite of compliance with strict safety regulations of the Public Utilities Commission for overhead lines.

Fatal and serious accidents during the year numbered 79, fewest in any of the past six years, the Commission report shows, but fatalities increased from 26 in 1950-51 to 36 the past fiscal year. Seven utility company employees and 29 non-employees were fatally injured.

No fatalities in '52—Columbia Basin's record

FOR THE FIRST time in the history of the Columbia Basin Project, there were no fatalities in the construction, operation, and maintenance of the Columbia River District for the past year, according to District Safety Officer Harold E. Wersen. His report covers the activities of an average of about 5,000 contractor and Bureau of Reclamation employees working on the 1,029,000-acre project.

A wide variety of jobs, including high-hazard construction, totaled more than 5,300,000 man-hours of exposure to possible accidents.

The following is the 1952 summary:

Government employees:

	Lost-Time Injuries	Days Lost	Man-Hours Exposure
1951	85	1,276	3,858,790
1952	40	467	2,957,999

Contractor's employees:

1951	107	19,916	3,171,152
1952	63	1,543	2,438,082

"This is our best safety record, and we're mighty proud of it," Wersen declares. "It was made possible by the cooperation of every worker and supervisor in the project."

"The fact that we had less total employees this year than last," he adds, "actually made it more difficult to set the excellent overall record we had in 1952, because all these figures are based on million man-hours of exposure, and a single accident can push your figures way down."

In the face of this, Wersen reported that government employees marked a reduction in accidents of 38% below 1951, and contractors' employees 23% reduction. Both the construction and government employees' records are well below the national average figures.

Safety film available for heavy truck operation

THE NATIONAL Safety Council has announced a new sound slide film, "Operating Heavy Duty Trucks Safely," produced especially for those engaged in hauling operations in quarries, construction, and open mines.

The film shows those who operate and work around heavy trucks the safe practices that will prevent the most frequent and serious accidents on company property. Among the topics covered are safe methods of driving, towing, dumping, riding and getting on and off heavy duty trucks. The film features several spectacular shots of accidents.

The 35-mm sound slide film can be used on automatic as well as the bell type of projection equipment. For additional information and prices, write the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

Job accidents take their toll

THESE were the accidents that resulted in deaths on the West's construction jobs during the last reported month:

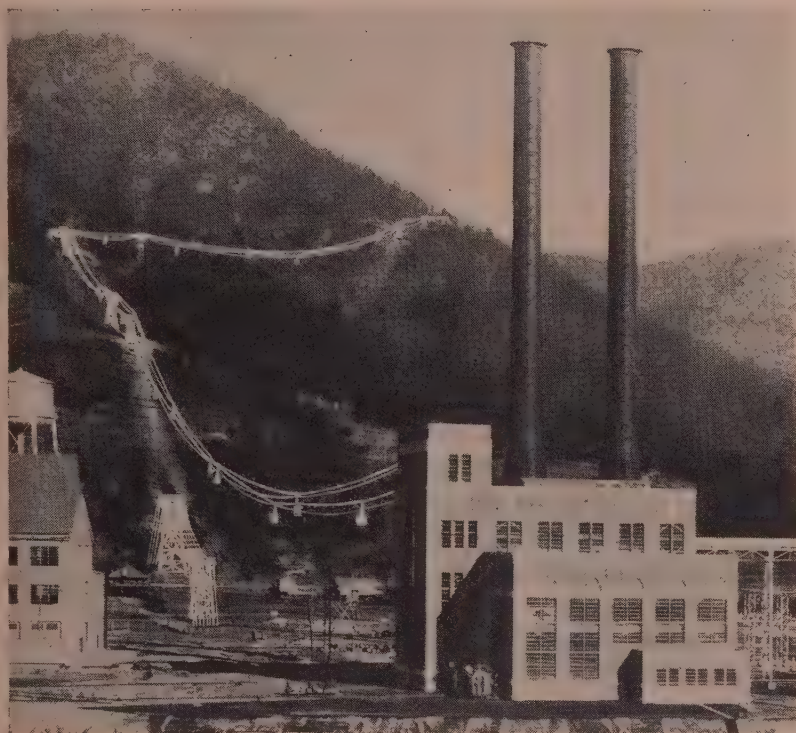
At San Diego, Jack F. Baumann, 33, was crushed to death Feb. 6 while servicing an asphalt paving machine. A heavy tamper, part of the machine, slipped and fell on him.

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

Clyde Keithley, 19, of Pasco, Wash., employed as an oiler by the contractor for raising the Northern Pacific Bridge over the Columbia River between Pasco and Kennewick, was drowned Jan. 20. He fell into the river while stepping from an LSM to a crane-bearing barge and was swept downstream before onlookers could provide help.

At San Francisco, Bruce Barton, 50, employee at the city's asphalt plant, died of suffocation when he was trapped at the bottom of a partially-filled bin of wet sand. Barton had been standing on a ladder outside the bin jabbing with a pole in an effort to speed the flow of sand into the bin from a conveyor belt. Apparently, he fell and was sucked into the bin chute. When his body was freed, it was discovered that his safety belt was in place around his waist. He evidently had neglected to hook it to the ladder.

Aerial tramways give low-cost transportation



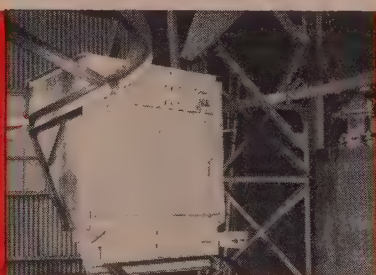
This 8,775 foot bicable tramway has been in continual operation for 23 years, transporting large quantities of coal at low ton-mile cost and giving dependable all-weather service.

The tramway has two stationary track cables and a traction rope that moves continuously in one direction. Buckets clamp to the moving rope at 205 foot intervals and move at 500 feet per minute. The 48 cu. ft. end dump buckets load and unload automatically. For loading, buckets detach from traction rope, run on graded rails, and attach again after being loaded. Detaching and attaching are also automatic.

This aerial tramway was designed and installed by the Tramway Division of U. S. Steel at the Alloy, West Virginia, plant of Electro Metallurgical Company, a Division of Union Carbide and Carbon Corporation.



Conveying materials for a few hundred feet or for several miles, Columbia-Geneva Tramways can be built to handle from 1½ to more than 300 tons hourly. They can be designed to meet almost every type of operating condition, and to handle many kinds of commodities easily and economically—from a tray of optical lenses to a carload of lumber.

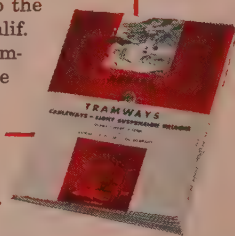


Load carriers, like this one on a bicable tramway, are available in many different types and sizes. Services of Columbia-Geneva's Tramway Division include designing the tramway...supplying the steel...excavating for foundations and erecting support structures...furnishing and installing all wire rope, cables, and electrical and mechanical parts.



Tramway support structures are of many types, depending on terrain and job. Because of this flexibility, tramways are free of ground contour, roads, railroads, etc., are unhampered by bad weather, and can climb extremely steep grades. Other advantages: loads can be moved without rehandling and rights-of-way are easier to acquire.

Send for this free manual on aerial tramways. Write on your letterhead today to the Tramway Division, Columbia-Geneva Steel, 141 Battery St., San Francisco 6, Calif. Or for an expert study of your transportation needs, ask for the services of a Tramway Engineer. He can show how an aerial tramway would pay off for you, and he can contract for its design and all phases of its construction, including materials.



Tramway Division
Columbia-Geneva Steel

Division United States Steel Corporation

UNITED STATES STEEL

NEW BOOKS

FOUNDATION ENGINEERING — Pack, Hanson and Thornburn

The jacket describes this book as "the first elementary but comprehensive treatment of foundation engineering since the advent of soil mechanics." The authors not only develop and utilize knowledge of soil mechanics but also present a vast store of practical engineering information essential to the foundation engineer. The text is divided into four parts arranged in logical sequence. Part A embraces soil mechanics as applied to any branch of civil engineering. Part B contains descriptive matter concerning foundation practice. Part C, said to be a unique contribution, shows the reader how to select the most appropriate type of foundation for whatever subsurface conditions encountered, thus bridging the gap between the results of soil studies and the selection and design of the foundation. Part D presents the elements of structural design of commonly used foundations and retaining structures, excluding elaborate and unusual structures. Published by John Wiley & Sons, Inc., New York. 398 pages, 6 x 9. Price \$6.75.

STUDIES IN ELASTIC STRUCTURES—Pippard

This work grew out of the studies in elastic structures made by the author, a civil engineering professor at the University of London, and various colleagues over many years. Structures and problems treated differ widely, and much of the work was started to answer problems rising in connection with actual designs. Many of the results are those which answered problems not amenable to rigid analysis but for which the author found solutions sufficiently accurate to provide a basis of design. Considerable use is made of the principle of superposition to obtain results in a form suitable for reasonably quick computation. This book should be an aid to advanced students and to practicing engineers. Published by Edward Arnold & Co., London, 352 pages, 6 x 9½. Priced at \$11.50.

HOUSE CARPENTRY AND JOINERY (5th ed.)—Burbank

If construction serves the reader a double purpose as both vocation and avocation, here's a clear, completely illustrated handbook for all-round carpentry, designed for the use of amateur or journeyman. Each job method is fully described with large detailed drawings and photographs.

The book tackles everything from house plans and foundations up to roofing and gingerbread, so that in off-job periods one can do anything from putting up outside frame walls on a house-to-be to installing built-in cabinets and bookcases. This collection of instructions on step-by-step procedures for house carpentry and joinery has become widely adopted as a trade school text. Published by Simmons-Boardman Publishing Corp., New York. 219 pages, 8½ x 11. Priced at \$4.75.

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.

ARCHITECTURAL DETAILING —Hornbostel and Bennett

A beautifully designed book representing an annotated, cross-indexed and organized collection of 165 of the selected architectural details which have appeared as the most popular feature of "Progressive Architecture" for many years. The book is organized for easy reference into two parts, the first a collection of details inherent to particular building types, and the second details inherent to many types of buildings, such as fireplaces, windows and doors. Each of the 14 chapters is arranged with an introduction explaining general design problems by Caleb Hornbostel. Then follows a series of clear, handsome drawings by co-author Elmer A. Bennett, as well as carefully-chosen illustrative photographs showing the design in application over various sections of the country. Introduction by Richard J. Neutra. Published by Reinhold Publishing Corp., New York. 218 pages, 9 x 12. Priced at \$12.00.

MECHANICS OF MATERIALS —Popov

A fine example of an engineering text which combines the best aspects of the practical and the fundamental scientific points of view. Though designed for use in an undergraduate course in strength or mechanics of materials by a University of California professor, it may be used also as a reference work. The author presupposes at least a previous knowledge of statics. The articles are arranged in logical sequence. Each chapter gradually introduces the more complex material with more advanced problems covered in detail

whenever justified for logical development of the subject. Hooke's law, inelastic bending with reference to limit design, and a description of the photoelastic method of stress analysis are examples of some of the advanced topics. Both illustrative examples and problems are given in each chapter. Detailed tables are added as appendix. Published by Prentice-Hall, Inc., New York. 435 pages, 6½ x 9. Priced at \$9.00.

AN APPROACH TO URBAN PLANNING—Breese and Whiteman, ed.

An analysis of the complexities confronting today's urban planner, the reader should find this paperback study an aid for clarification. The editors have selected material by several well-known authorities on the subject: an admirable procedure for a controversial task with diverse aspects and possibilities. The scope is broad: chapters cover the process itself as it is now an integrated function of local government; the goals of land-use control and zoning; housing and urban development; metropolitan control; traffic problems, and in the concluding chapter, fiscal programming. Contributors are Hugh R. Pomeroy, Norman Williams, Jr., Charles K. Agle, K. McKim Norton and Walter H. Blucher. The editors are members of the Bureau of Urban Research, Princeton University. Includes an extensive detailed bibliography nearly 40 pages long. Published by Princeton University Press, Princeton, N. J. 108 pages, 5¼ x 7¾. Price \$2.00.

PLANE TABLE MAPPING—Low

A useful field manual which is the first treatment devoted exclusively to a heretofore rather neglected subject in the literature of earth sciences. Author Julian W. Low, a geologist for The California Co., was called upon a dozen years ago to drill company trainees in plane table mapping methods in order to make up for the lack of adequate training and experience with common field procedures. Success of the manual is evidenced in its present appearance in Harper's Geoscience Series. It now serves a double purpose as elementary text and as an assembly of a large number of methods adaptable to certain types of mapping in order to prove more convenient to the man in the field. Much care has been exercised in placing methods into categories defined by scale ranges because of the close general relationship between the scale of the map and the precision which can be obtained by the plane table method. Detailed tables are included. Published by Harper & Brothers, New York. 325 pages, 5 x 7½. Priced at \$4.50.



This representative S-A installation includes storage and reclaiming conveyors and a 500-foot storage conveyor with tripper (over storage pile at right). At left is the compartment bin for railroad car loading.



CONVEYING *Systems* for **HANDLING— STORING—RECLAIMING...always at lowest cost per ton**

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Ship Loading Boom Conveyors
Stacking Conveyors
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ENGINEERS ON THE MOVE

Two of the Bureau of Reclamation's top-notch engineers left their Denver offices for Australia at the end of January in order to aid the Snowy Mountain Hydroelectric Authority carry out initial preparation for the Adaminaby Tunnel, the longest and largest irrigation tunnel in the world. **W. A. Dexheimer**, assistant chief construction engineer, and **A. R. Reeves**, chief of the canals branch, intend spending four to six weeks bringing details to the final form so that bid invitations soon may be issued for initial construction work.

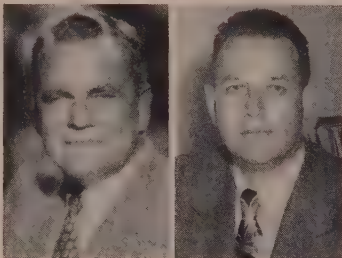
Designs and construction plans for a 300-ft. concrete dam and two huge tunnels totaling 16 mi. in length originated in Denver at the Bureau's desks and drafting tables. In November 1951 the United States and Australia entered into a formal agreement for the Bureau of Reclamation to furnish technical assistance. The current situation illustrates the three aspects of the agreement—design services, in-service training here for Australian engineers, and advisory missions. Australia is financing the work with her own funds. The entire Snowy Mountain project is one of the world's largest water developments.

Montana has appointed **Scott P. Hart** of Helena to fill the post of state highway engineer, left vacant by the recent resignation of **Troy Carmichael**. Hart is taking over a job which will be an old one to him, for it was a position which he held several years ago. In February 1948 he succeeded **Howard W. Holmes** and in April 1949 he became program engineer after the appointment of **C. E. Stahl** as highway engineer. He has been with the Alaska Road Commission since leaving the Montana highway department in 1950.

Carmichael, who was at one time Helena's city engineer, held the state post since the middle of May 1950. The State Highway Commission named **W. E. Bawden**, highway planning survey engineer, as acting state highway engineer, prior to the appointment of Hart.

W. Ray Rogers has been elected president of the Portland Chapter, Associated General Contractors, succeeding **Herb G. Palmberg**. **Harry I. Hamilton** is now first vice president; **Lloyd Babler** is second vice president and **Frank Lyons** is secretary-treasurer.

the last mentioned re-elected to a post which he held last year. Newly elected members to the board of directors are: **Harry A. Dick, Jr.**, **Glen D. Dennis** and **Mel A. Erland**. Those members whose status on the board has not been changed are: **Ivan W. Bruensbach**, **Donald W. Hall**, **K. F. Jacobsen**, **G. E. Kibbe**, **Henry A. Kuckenberg**, **Jack McDougall**, **Marshall R. Newport**, **Herb G. Palmberg**, **Carl A. Schram**, **Fred H. Slate** and **Porter W. Yett, Sr.**, as well as National Directors **Ray H. Northcutt** and **J. R. Wininger**.



Rogers

Van Loo

H. W. Van Loo is the newly-appointed construction engineer-in-charge of the Coachella division, All-American Canal System, effective January 18. Van Loo has been acting in that position since last August, following the resignation of **Charles S. Hale**, and since then has proved his ability to carry out the responsibilities of the Bureau's construction activities in the area. With the exception of war years, Van Loo has been an employee of the Bureau since re-

ceiving his civil engineering degree from the University of Arizona in 1939. At that time he joined the chief engineer's staff in the Denver office. Since 1946 he has been associated with the Coachella division, first serving as assistant to the office engineer and then as office engineer.

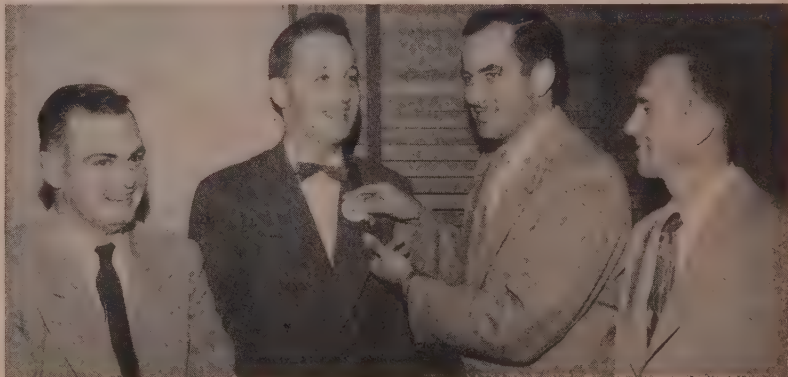
New district engineer of the Salt Lake City office of the Portland Cement Association is **Ralph E. Spears**. Spears succeeds **E. B. Wilson** who resigned to enter business for himself in Oklahoma. Spears joined the Association in 1948 as district structural engineer of its St. Louis office.

The Portland post, Society of American Military Engineers, has elected as president **Col. E. C. Itschner**, North Pacific division engineer, to succeed **Col. Thomas H. Lipscomb**, Portland district engineer. Other new officers: **Charles G. Tupling**, vice president; **Dave Lewis**, secretary; **A. J. Brugger**, treasurer, and **Col. H. A. Skerry**, **John A. Cornbaum** and **Col. Lipscomb** are directors for the current year.

Robert L. King, since March 1948 a staff member of the Portland chapter, AGC, is now executive secretary of Portland Home Builders. His position with AGC has been taken over by **Bass Dyer**, formerly with General Motors Acceptance Corp.

The Mountain Pacific Chapter of the Associated General Contractors named its new officers and board members for 1953 at the annual membership meeting in Seattle on January 16. Officers are: **Don L. Cooney**, president; **V. R. (Rod) Scheumann**, vice president; **Frank Brennan**, treasurer, and **W. H. Landaas**, secretary-manager. The board of trustees count 13 members: **James Arcorace**, **J. A. Gauntlett**, **I. L. Gebhard**, **James**

AT THE MEETING of the Los Angeles Junior Forum, American Society of Civil Engineers, the organization's retiring prexy, **Jack Howe**, is shown pinning the traditional presidential badge on the new president, **Dick Gerke**. The smiling officers attending are **Hal Halldin** (right), vice president, and **Hugh MacDonald** (left), secretary-treasurer.



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Goodfellow, Hugh Govan, Axel Osberg, John Romano, Jack Samuelson, Howard Sievers, A. J. Turnbull, Glen Wasson, Elmer White and C. R. Wilcox. Landon Meredith and Joe H. Moss are associate trustees.

Walker Paul, assistant to chief engineer of the Southern Pacific Co. since 1945, recently retired. He plans to enter business as an engineering consultant. Paul is a member of the national board of directors of the American Right-of-Way Assn., and a past president of the San Francisco chapter of that organization.

New superintendent of California's highway maintenance in district No. 10 (an area of about 200 mi., covering Ione, Jackson, Pine Grove and extending to the Nevada line), is Donald W. Bergevin. Bergevin is replacing John O'Malley, who is being transferred to district No. 7, with headquarters in San Fernando.

Lt. Col. H. N. Turner, executive officer for the Corps of Engineers' Albuquerque District since July 1950, left his post in January for an assignment with the Joint Construction Agency in Orleans, France, the organization which does the building for the North Atlantic Treaty Organization.

A switch from Wyoming to Utah recently took place when Alton Peterson, construction engineer in Rock Springs, Wyo., with the Bureau of Reclamation began work in the same capacity at the Weber Basin Project, Ogden.

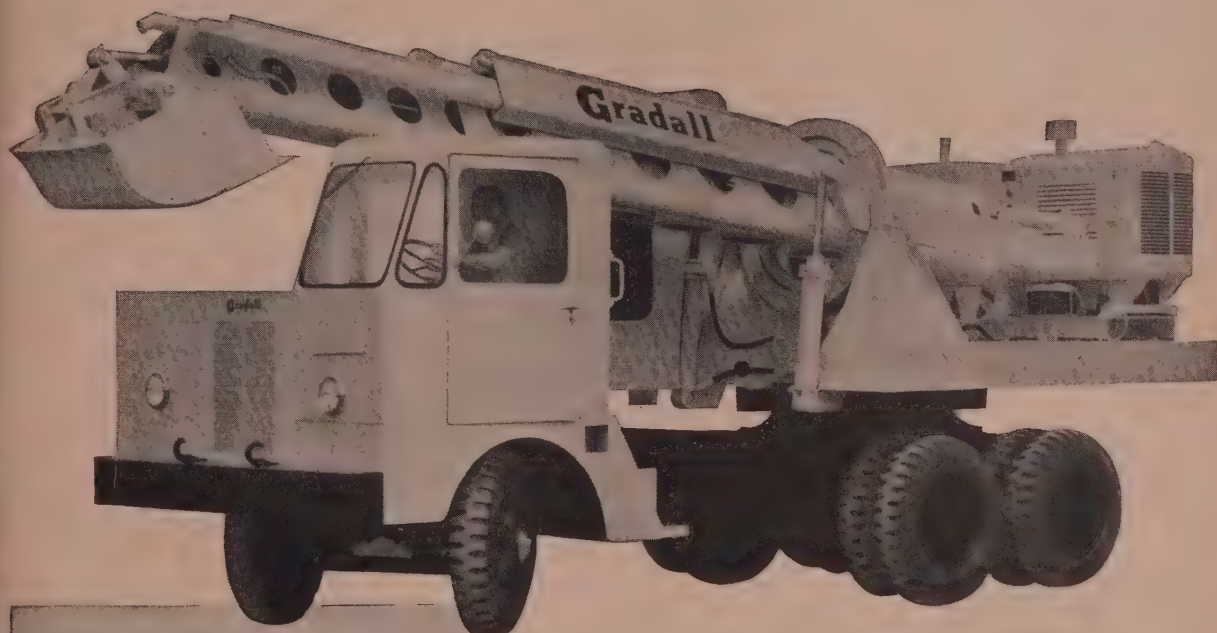
Maurice Pearce, city engineer of Chico, Calif., recently resigned to accept the corresponding position in Monterey, Calif.

Donald O. Puls, formerly chief of survey parties for the USBR, with official headquarters in Duluth, Minn., is now project engineer with the U. S. Forest Service at work on forest road construction in the northeast sector of Superior National Forest.

The Cochise (Ariz.) County board of supervisors has appointed Ralph Motz to the position of county engineer.

Col. Lynn C. Barnes is the new Albuquerque District Engineer, succeeding Col. Charles H. McNutt who has been reassigned as Chief of Staff, 6th Armored Division, Fort Leonard Wood, Mo. Col. Barnes began his Army service in 1940 after having been a construction executive in private industry. His first appointments were with the Quartermaster Corps,

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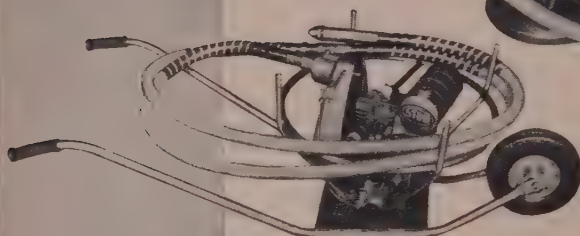
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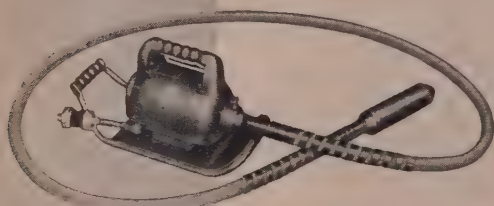
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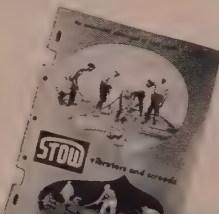


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and when responsibility for Army construction was transferred from that unit to the Corps of Engineers in 1941, Col. Barnes was also transferred to the Engineers. Between March 1948 and February 1950 he was stationed at the Presidio in San Francisco. From there he went to the Far East Command as Chief, Engineering and Operations Division, Engineer Section, General Headquarters. For the last two years he has been on the Japanese Islands in charge of the local agency which handles all major construction not executed by troops. Col. Barnes has been awarded both the Legion of Merit and an Oak-leaf Cluster, the latter for meritorious service during 1950.

The road engineer of Yakima County, Wash., **O. E. Brashears**, retired in January after more than 42 yr. at his post. He was replaced by **Harold R. Sweet**, assistant county engineer. In 1917, Brashears was responsible for organizing the county's highway department which became the first of its kind in the state.

Chris Fauerso, for 30 years an engineer for the Oregon State Highway Commission and Wasco County was recently appointed county engineer for Josephine County, Ore.

Claude Nowlan, formerly a fieldman for the county engineer's office, has been appointed county engineer for Grays Harbor County, Wash., following the retirement of **John Kirkwood**.

Charles G. Kincaid is now field engineer for Morrison-Knudsen Co., Inc., at the Wellton, Ariz., site of canal construction.

The Spokane Chapter, Associated General Contractors, elected **Gus J. Bouten** president for 1953. **E. R. Haynes** is new vice president, and **J. L. Hazen**, retiring president, was named to the executive committee, as were **Philip McKinnis** and **John C. George**.

New chairman of the Northern Chapter, Idaho Society of Professional Engineers, is **Elmer Soniville**, Coeur d'Alene's city engineer. Other new officers are **Robert Baird**, vice president, and **Tom Miller**, secretary-treasurer.

Milton T. Wilson, district engineer for the U. S. Geological Survey in Salt Lake City and a director of the American Society of Civil Engineers since 1950, has been elected chairman of the Utah Engineering Council. **Wayne Shaw** is vice chairman, **Leslie Seagar** is secretary and **Paul Worthen** is treasurer.

DEATHS

H. Stanley Bent, head of the firm of Bent Construction Co., died at his home in San Marino, California, February 8, at the age of 80. Mr. Bent and his older brother Arthur S. Bent built this construction organization (formerly, Bent Bros. Inc.) which was well-known throughout the West for carrying out important construction jobs such as Exchequer Dam, Friant Dam, Conchas Dam, Devil's Gate Dam and Morris Dam.

Mr. Bent was born in Los Angeles in 1873 and in 1901 joined his brother Arthur in the company he had founded fifteen years earlier. He became the active head of the construction company in 1920 and expanded its operations to include work in the petroleum field. However, the organization specialized in dam building and is credited with the construction of a total of 32 dams.

In addition to his work in the construction field, Mr. Bent was an active citizen of San Marino, serving as a councilman for 22 years and a three year term as mayor from 1941 to 1944. He was active in the Associated General Contractors and was recognized for his adherence to the high contracting principles of that organization.

Howard S. Cooper, 69, structural engineer, died January 12 in San Gabriel, Calif. He had been a consulting engineer for Alhambra, San Gabriel and El Monte.

George K. Hutson, 77, former construction superintendent, died January 11 in Los Angeles.

Nicholas M. Fiorito, 66, prominent contractor, died January 16 in Seattle. Fiorito entered the contracting business in Seattle in 1912 when he joined his brothers in founding the Fiorito Bros. Co. In 1930 he founded his own firm, the Nick Fiorito Co. His two sons later joined the firm as partners.

John D. Slye, 67, former district engineer for the Bureau of Public Roads in Cheyenne, Wyo., died January 15 in Mesa, Ariz.

Spencer W. Lowden, 64, an employee of the California Division of Highways since 1912, died January 13 in San Bernardino, Calif. Lowden had been district engineer at San Bernardino since 1950.

Arthur B. Cleaveland, 78, retired engineer with the California Division of Highways, died February 10 in Los Angeles.

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Superintendent **J. K. Riggle** and **Frank Kunze**, Riggle's assistant, are heading the job for **Lewis A. Hopkins Co.'s** \$852,621 award for tactical area facilities at **Camp Hanford, Wash.**

N. B. Griffiths is supervising for **Le Grande Johnson's** \$111,430 award for a bridge and approaches in **Idaho**.

Edwards Air Force Base, Calif., is the site of a \$1,169,750 job for installing sewer, gas and water systems, a contract held by **Engineers, Ltd. Pipeline Co.** **R. P. Price** superintends the job; **C. W. Webb** is project office manager, and **H. J. Montague** is field office manager.

William Yarnell, Jr., is heading a joint venture of **Stolte, Inc.**, and **Fred J. Early, Jr. Co., Inc.**, to construct a \$3,597,500 sewage treatment plant for **Sacramento, Calif.**

N. Lee Van Valkenburgh is heading the job for **N. P. Van Valkenburgh Co.'s** \$585,640 award for installing main supply line pipe in **Hemet, Calif.** **R. B. Flournoy** is purchasing agent and **Carl R. Staiger** is finance officer.

L. E. Steelman is project manager for construction of the hydroelectric powerhouse for **Lookout Point Dam**,

Ore. **H. I. Maxwell** is general superintendent; **D. W. Lutes** is project engineer, and **D. M. Drugan** is office manager. This \$2,987,375 award is a joint venture of **Morrison-Knudsen Co., Inc.**, **Peter Kiewit Sons' Co.**, and **Macco Corp.**

Bill Cole, assisted by **John Valentine**, is supervising 7.4 mi. of road construction in **Fremont National Forest, Ore.**, for **Peter Kiewit Sons' Co.** **Harry Eckstein** is job office manager.

C. E. Jones, assisted by **C. A. Peterson**, is superintending the construction of a health and receiving hospital in **Los Angeles.** **Henry Ramsey**, project engineer, and **Jack Barnett**, field engineer, are also on the job for **Robert E. McKee, General Contractor, Inc.**, who has the \$4,665,100 award.

James B. Goodfellow, Jr., is superintending a \$176,235 grading job on **Stevens Pass Highway, Wash.**, for **Goodfellow Bros., Inc.** **Kelly Hotchkiss** is master mechanic and **A. Huffman** is foreman.

A portion of the **San Diego Aqueduct**, contracted by **Johnson Western Contractors**, finds **Roy H. Richards** as job superintendent; **Fred McKinley**, excavation, superintendent; **Gar-**

land L. Gray, project engineer; **Bob Simmons**, office manager; **Roy A. Nimmo**, pipeline foreman, and **Oscar Goddard**, powder foreman. **Clifford Drake** is superintendent for **Hagen Materials Co.**, the reinforced steel contractor, and **Lee Purdin** is in charge of the Bureau of Reclamation work on the project.

A \$2,500,000 job to build four warehouses for **North American Aviation** at **El Segundo, Calif.**, ended on January 1, 1953. **Adolph Schmid**, superintendent, and **T. E. "Ted" Spornhauer**, assistant superintendent, supervised the work for **Vinnell Co.**

Joe D. Miller is supervising his company's job for putting in sanitary sewers in **Planz Road, Bakersfield, Calif.** **Joseph Solarz** and **James Bowen** are foremen.

Grove, Shepherd, Wilson & Kruge, Inc., has a \$4,800,000 job to construct an electric-electronics shop at **Mare Island Naval Shipyard, Calif.** **Raymond D. Lewis** is superintendent, **Kenneth P. Morris** is concrete superintendent, and **William P. McGrath** is chief engineer.

Newell A. Pennington, superintendent, and **M. O. Mittry**, engineer, head 3,160 ft. of conduit construction in **Denver, Colo.**, for **K. S. Mittry** and **N. M. Saliba**, contractors.

Utah's Gateway Tunnel for the **Weber Basin Project** is now under construction on a \$2,486,615 contract held by **Utah Construction Co.** **H. C. Miller** superintends, assisted by **D. H. Walker** and **L. A. Stallard.** **Charles Hageman** is project engineer, **John Gately**, chief electrician, and **C. J. Getz**, office manager.

Lyle Everett, superintendent, **R. P. Michaels**, carpentry foreman, and **Bob Murphy**, job engineer, are at work on **F. E. Young Construction Co.'s** \$936,000 contract for building the county juvenile correction home at **Linda Vista in San Diego.** **Don H. Mahaffey Drill Co.** has the contract for caisson work on the foundations. The building is expected to be completed in **September 1953.**

Construction of an earthfill dam and levees at **Whittier Narrows**, near **Los Angeles**, is being handled under a joint \$3,747,319 contract by **A. Teichert and Son, Inc.**, and **Bressi and Bevanda Constructors.** On the job are: **James P. Cagle**, general superintendent; **Berle Grounds**, assistant superintendent; **Maurice Brotherton**, master mechanic; **Roy Hamm**, mechanical foreman; **Lowell Wright**, job engineer; **M. F. Lund**, office man-

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ager; A. R. Richardson and C. C. Bonds, excavation foremen; Grady Williams, grade foreman; W. A. Porter and O. A. Cram, labor foremen; Howard Wickle, carpenter foreman, and Ralph Pugh, tractor foreman. J. G. Morgan is Army project engineer.

R. M. Johnson is superintendent for McDonald & Schado on construction of an 18-unit motel in Las Vegas, Nev. Dick Hightower is foreman.

The San Diego Gas & Electric Co. is building itself a multi-million dollar power plant at Encino, Calif. M. Hjalmarson is general superintendent, assisted by D. Keely. F. Hickey is field engineer, Frank A. Velez is carpentry foreman and C. Teeple is master mechanic.



**J. C. Nicholson,
superintendent
at work in
Southern Calif.
(see item below)**

J. C. Nicholson is supervising construction work on a 6-story reinforced concrete hospital addition in Los Angeles. Havstad & Jensen has the \$2,300,000 contract.

Running the Second Barrel, San Diego Aqueduct job, for Engineering Construction, Inc., are: W. A. Denton, project manager; T. Wilcox, superintendent; R. K. Griffith, assistant superintendent; Otis Johnson, engineer; Ray Mather, office manager; and Roy Powell, Glen Tate and Al Ferguson, labor foremen.

An L. C. Anderson Co. contract to build new training facilities at the San Diego, Calif., Naval Training Center finds the following men busy on the \$2,000,000 job: C. S. Williams, project manager; Sam Brock, field superintendent; Roy Keyes, job superintendent; Frank Miller, carpenter foreman; James F. Ford, foundation foreman; Eddie Garcia, cement finisher foreman; M. S. Walker, pre-slab foreman; Les Hoyt, labor foreman; Olaf Lindboe, steam foreman, and Paul Winward, office manager. Acting for the Navy are Jim Hartnett, inspector in charge, and Ralph Turner, his assistant.

Another L. C. Anderson contract finds Keyes, Miller, Ford, Walker and Hoyt on the job. Additional men are George Lincieu, office manager, and Roy H. Hinkley, carpenter foreman.

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NEW LINCOLN PLANT CREATED BY INCENTIVE INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

© LE Co. 1953

WELDED DESIGN CUTS WEIGHT AND COST OF 12 TON ORE BRIDGE

By **B. A. ROSE**, Director of Engineering
Heyl & Patterson, Inc., Pittsburgh, Pa.

THE many advantages in lower cost, less steel, ease of maintenance and simpler details have prompted maximum use of welded design on this 12-ton ore and coal handling bridge. The result is a span approximately 50% welded. 28 cross frame sections are prefabricated by shop welding, marking a sharp break with tradition in the design and erection of a structure of this type.

The bridge trusses comprise 16 panels, framed by 17 cross frames, fourteen of which are shop welded manually and at low cost in fixtures to hold alignment. Use of wide flange beams for top and bottom chords, top cross members and some diagonal bracing saves the need for complicated built-up structural sections and improves overall reliability.



Fig. 2. 12-ton Ore and Coal Handling Bridge at Hamilton, Ontario. One of two bridges built here. Designers, fabricators and erectors: Heyl & Patterson, Inc., Pittsburgh, Pennsylvania.

**SIMPLIFIES
DESIGN...CUTS
MAINTENANCE**

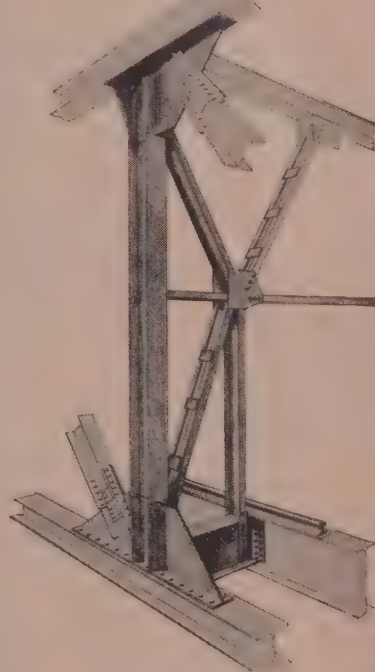


Fig. 1. Comparison of riveted and welded cross frame connection on coal handling bridge for Dominion Foundries and Steel Ltd., Hamilton, Ontario. Clean design prevents usual accumulation of dust and corrosion . . . helps reduce cost of painting.

**NEWEST ORE BRIDGE
IS 50% WELDED**

Studies in Structural Arc Welding free on request. Designers and engineers write on your letterhead to Dept. 4301.

THE LINCOLN ELECTRIC COMPANY
CLEVELAND 17, OHIO

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

and **Eric B. Adney, Sr.**, labor foreman. The million-dollar job is building nine tilt-up construction, two-story, prefabricated, 100 x 150-ft. barracks for the Navy at San Diego.

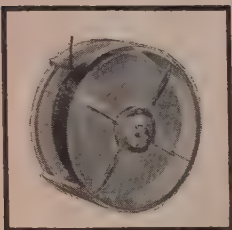
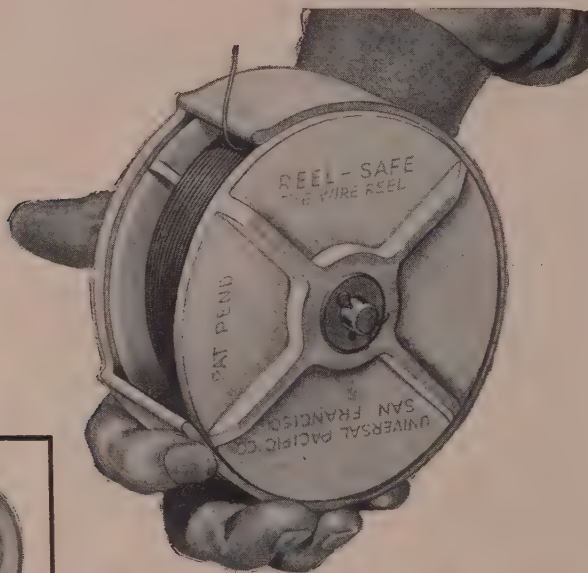
A. H. Steiner is project manager on two steel bridge jobs at The Dalles, Ore., for the Atkinson Ostrander Co. Working on the superstructure are: **Brad Jormin**, assistant project manager; **Joe McNabb**, engineer; **Joe Canto** and **Jim Daley**, excavation superintendents; **Carl Schmitt**, drill and shoot superintendent, and **Burt Louis**, master mechanic. Putting in 41 bridge piers are: **Vernon Bradley**,

general superintendent; **John Skeels**, engineer; **Floyd Jaspers**, piledriver superintendent; **Joe Davis**, carpentry superintendent; **Bill Roark**, concrete superintendent, and **Charlie Chamberlain**, in charge of excavation and unwatering.

Construction of three new buildings at the University of California's Riverside campus finds the Physical Science Building, contracted for by H. M. Hodges, and the Plant and Biological Building, being built by Hodges and the Pozzo Construction Co. on a joint venture, both under the supervision of **P. N. Schmoker**.

William Rothenberg is office manager on both jobs. **P. D. Schmoker** is general foreman and **Clarence A. Scott** is labor foreman on the Physical Science Building, and **M. J. Chandler** is general foreman and **R. C. Barge** labor foreman on the Plant and Biological Building.

The third structure, the Physical Education Building, is being built by Brunzell Construction Co., with the following personnel on the job: **John Bartlett**, chief inspector; **John Braucher**, job inspector; **Frank Jackson**, superintendent; **Dean Kishpaug** and **Milton Norland**, carpentry foremen; and **Leo Murray**, labor foreman.



CAL-TIE WIRE in the Safe Dispenser

In concrete reinforcement tying jobs, CAL-TIE in the safe dispenser steps-up work and brings down costs. It's a sound *safety* measure too, for CAL-TIE wire in a Universal Pacific Reel-Safe leaves no loose pieces underfoot. And the savings in wire will surprise you.

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THE COLORADO FUEL AND IRON CORPORATION



PICTURED at the site of a road relocation job adjacent to Idaho's Palisades Dam, is **Frank Marshall**, superintendent for Kiely Construction Co.

Delbert Norton is project manager for D. O. Norton & Son on remodeling and construction of new buildings for Yuma Union High School, Yuma, Ariz. Foremen on the \$1,180,000 contract are **Dave Trimble**, **E. J. Johnson** and **Frank Connor**. **Wayne Dickey** heads work in the office.

R. W. Bailey, **O. E. Lesh** and **I. Weddell** are heading the job for Robert E. McKee, General Contractor, Inc.'s \$2,786,440 award for the communicable diseases unit of Los Angeles County Hospital. **Bailey** is job superintendent, **Lesh** is project engineer and **Weddell** is field engineer.

Another McKee big building contract is a \$7,057,000 award for Imperial-Compton low rent housing in Southern California. Key men are **J. L. Morris**, superintendent; **T. H. O'Melveny**, project engineer; **W. M. Carson**, office manager, and **F. W. Anding**, field engineer.

A joint venture of **Maurice L. Beir Inc.**, **Nathan Fish, Inc.**, and **The Beir Construction Co.**, is constructing Compton Junior College in Compton, Calif. Work on the \$3,000,000 project is supervised by **K. C. Damon**, who assisted by **F. M. Brown** and **George Sliger**. There are seven carpentry foremen: **W. Fronfelter**, **W. Mettler**, **W. D. Robertson, Jr.**, **C. R. Muller**, **H. A. Borden**, **J. W. Wunderlich** and

J. M. Smith, W. F. Kinman and C. B. Kossack are surveyors, **Al Sidell** is job engineer, and **R. A. Rudich** is expeditor and timekeeper. **J. O. Gould** represents the architects, **Austin Field & Fry**.

Louis E. Hilliard, superintendent, of Astoria, Ore., and **Ted Anderson** of Otter Rock, Ore., are heading a \$183,-298 job for grading and paving on the Oregon Coast Highway in Douglas County. **C. H. Grimstad & Vandervelt** holds the contract.



WITH A CLEAR SKY behind him, **Joe Canto** pauses a bit from his work as excavation superintendent for **Guy F. Atkinson Co.**'s tailrace channel excavation below **Folsom Dam**. For what happened when rains came, see our news section for this month and last.

Building a Fleet Air Defense Training Center for the Navy at San Diego are: **Chris Larsen**, superintendent; **Arthur Vitus**, assistant superintendent; **J. T. Finster**, office manager; **William Bennett**, job engineer; **Jack Golden** and **Robert Saunders**, carpenter foremen; **Mike Pettretta**, labor foreman, and **George Elliott**, cement finisher foreman, for the **M. H. Golden Construction Co.**

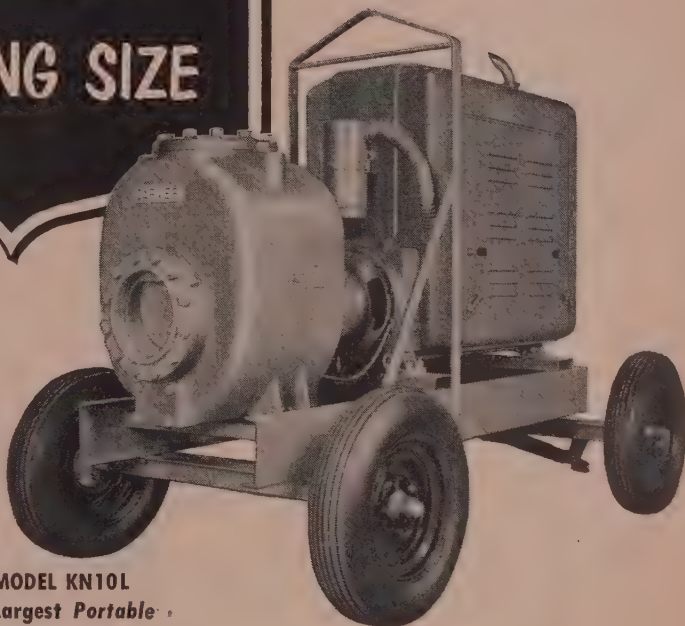
Oscar Erickson is heading construction of **Carnation Milk Co.**'s research laboratory in **Van Nuys, Calif.**, for contractor **William Simpson Construction Co.** Office manager is **Robert E. Merrin**. **Eric A. Erickson** and **Richard H. Murphy** are carpenter foremen and **Earl E. Demaine** is labor foreman.

William Simpson Construction Co. is putting up a clinic for the **Children's Hospital Society** in **Hollywood, Calif.** General superintendent is **Vern D. Guilfoyle**. Carpenter foreman is **Carl Erickson**, labor foreman is **George Mahan**, and **Harvey Webster** is timekeeper.

J. J. Draine is project manager for **Guy F. Atkinson Co.**'s \$788,500 contract for completing the structure for the **Valley Steam Plant**, **Pacoima, Calif.**, a project being built for the



**250,000
Gallons
per Hour!**



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Self-Priming Pump

The big fellow in the **CARVER** line. Enough capacity to move a river! Rugged oversize-construction plus high efficiency and fastest priming put this giant in a class by itself. A big pump for big jobs—construction, well-point, irrigation, dam construction, water supply, etc.

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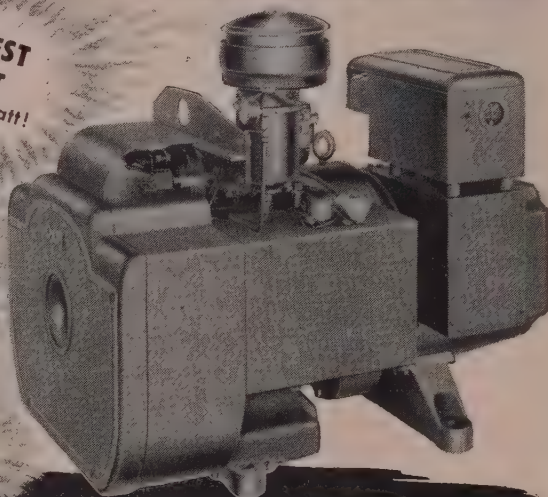
CARVER PUMPS

Take a good look at this New Powerhouse!

**LOWEST
COST**
per kilowatt!

**HIGHEST
OUTPUT**
per pound!

**MOST
COMPACT!**



The ONAN "CW" Electric Plant 5,000 or 10,000 WATTS

Designed to fit every application better... standby, portable, mobile and stationary. Whatever your need for electric power, the new Onan CW-5 and 10 give you top performance and value!

Here for the first time are 5 and 10KW electric plants powered by revolutionary, new air-cooled gasoline engines, designed and built by Onan exclusively for electric plant use!

Both engines are 1800 R.P.M. The 13HP Onan engine which powers the CW-5, and the 20HP Onan engine used for the CW-10 weigh much less than general-purpose engines, and are amazingly compact. Built to deliver dependable, trouble-free service in heavy-duty use. Two-cylinder, alternate-firing design assures smooth, vibration-free power. New, quiet, highly-efficient vacuum air cooling drives out all heated air through one side duct. The same duct carries exhaust gases, simplifying installation.

Impulse-coupled, high-tension magneto ignition for quick starting under all conditions. Both models in all standard voltages 60-cycle A.C., single or three phase.

Far-Out-Front in design and engineering

- Twin-cylinder, horizontally-opposed, air-cooled, alternate-firing engines •
- Aluminum-alloy cylinder heads • Extra-large, replaceable bearings • Full-pressure lubrication, 6-quart oil capacity, oil filter • Impulse-coupled, high-tension magneto ignition, radio suppressed • Quiet, vacuum air-cooling of generator and engine • Excellent accessibility; snap-off air housings • High-performance generators • Completely equipped with controls and instruments.



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2580 N.W. Upshur, Portland, Oregon

City of Los Angeles. Al A. Nemitz is general superintendent. Other men on the job are: R. S. Corr, project engineer; Elliot J. Lane, engineer; W. E. Elwing, job office manager; David T. Dool, general labor foreman; Frank R. Patton and Russel J. Barry, carpenter foremen. C. C. Moore is responsible for boiler installation, and has Ralph Farrell as erection engineer, Don Henley, pipe superintendent, and Dick Atkinson, pipe general foreman.

Lyman Smallwood is heading 8 mi. of road construction through Suislaw National Forest, Ore., for E. L. Gates & Co., Inc. Les Quigley is foreman.

Glenn Barnes, formerly job superintendent with Raymond Concrete Pile Co., has replaced Harley Walker as business representative for Pile Drivers' Local 2375, Wilmington, Calif.

Henry C. Vander Kuhlen, superintendent, is heading construction of St. Joseph's Hospital in Burbank, Calif., for Pozzo Construction Co. Vander Kuhlen is assisted by Jack McPhee, Labor foreman is Alex Marone. Foreman for Mechanical State Plumbing Co., a subcontractor, is Charles Allen. Paul Soza is superintendent for Los Angeles Lathing Co., another subcontractor.

Project Manager Henry Hewitt is heading construction of a \$4,000,000 F. H. A. housing project in Richland, Washington. Gerry Haskell is superintendent, assisted by Roy Gummere. This work is under contract to Bauer Construction Co., an organization which is headed by President Bruce Bauer. Henry Hewitt is co-owner and project manager. Other important men in the organization are: Charles W. Haskell, office manager; Tim Boardman and Nolan Ledbetter, job superintendents; Bill Nelson, purchasing agent; Glenn Roland, mill foreman, and "Doc" Parrish and L. Reighley, carpenter foremen.

Pile driving under way at Redondo Beach, Calif., for Southern California Edison Co., is being supervised by J. S. Clary. Pile driving foremen are Fred Miles, Charles Guth and Holt Powell. Earl Shepherd and George Jones are concrete foremen. This work is under general contract to Stone & Webster Engineering Corp., and Raymond Concrete Pile Co. holds the subcontract.

Norman Olafson is superintendent for a \$100,000 contract recently awarded Allison-Honer Co. for construction of the Santa Ana Savings and Loan Building in Santa Ana, Calif.

It's the NEW Blue Brute 600' portable air compressor



A BIGGER Compressor for your air tools

Here it is . . . biggest and most powerful of all Blue Brute Portable Compressors! This 600' unit *really* costs less to operate, with its *low* fuel consumption and the *minimum* maintenance it calls for.

Just check these Worthington features it incorporates:

Air-operated fuel-saver control that keeps fuel consumption way down (never a pound of unnecessary air pumping, automatic unloading at idling speeds, engine speed in ratio to air requirements) . . . hydraulically controlled clutch for really easy operation . . . identical stack-type, oil-bath air cleaners on engine and compressor for easy servicing . . . two full-length tool boxes with ample capacity . . . two-piece side panels for better temperature control and easy handling by one man . . . unit core radiator and intercooler, offering maximum cooling surface . . . frame protected fuel tank for easy, low level filling . . . three-point engine and compressor mounting . . . formed steel channel frame, semi-elliptical spring mounting and automotive-type steering.

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ENOUGH AIR IS LEFT OVER in this hookup with the new Blue Brute 600' and with two 4-inch wagon drills to operate the heavy-duty rock drill in foreground!

H.2.4



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WORTHINGTON



Construction Equipment

CONTRACTS

Summary of bids and awards for major Western projects

Alaska

\$5,886,500—**L. E. Baldwin, Inc.**, 1103 N. 36th, Seattle—Low bid for 47 eight-family quarters bldgs., Elmendorf Air Force Base, Seattle; by C. of E.

\$1,058,690—**Boen-Koon Construction Co. and Egge Cummins Construction Co.**, Seattle—Low bid for 7 two-story family quarters bldgs. with utilities, Eielson Air Force Base; by C. of E.

\$8,364,970—**J. C. Boespflug Construction Co.**, 1912 4th Ave. So., Seattle—Low bid for a 400-bed hospital at Elmendorf Air Force Base; by C. of E.

\$149,026—**Carson Construction Co., Inc.**, 1236 E. 6th Ave., Helena, Mont.—Award for Cordova water system improvements; by Alaska Public Works.

\$2,786,000—**Ben C. Gerwick, Inc.**, 112 Market St., San Francisco—Low bid for control tower, crashboat house and utilities, Kodiak Naval Base; by U. S. Navy.

\$1,603,968—**Grove, Shepherd, Wilson & Krue, Inc.**, 247 Park Ave., New York—Low bid for 3 organizational maintenance shops and 4 gasoline dispensing stations for Ladd and Eielson Air Force Bases; by C. of E.

\$1,236,096—**Peter Kiewit Sons' Co.**, 1024 Omaha Natl. Bank Bldg., Omaha, Neb.—Award for two 200-man barracks, Ladd Air Force Base; by C. of E.

\$976,240—**Lloyd W. Martin**, Fairbanks—Award for construction of a remote transmitter facility for Eielson Air Force Base; by C. of E.

\$5,620,703—**Patti-MacDonald Construction Co.**, Kansas City, Mo.—Award for 46 eight-family quarters bldgs., Ft. Richardson; by C. of E.

\$1,273,499—**Raber & Kief and Raber & Co.**, 420 Queen Anne, Seattle—Award for marine barracks, a garage and runways, Adak; by U. S. Navy.

Arizona

\$2,457,020—**Fisher Contracting Co.**, P. O. Box 4035, Phoenix—Award for installing 69,000 ft. of 16- to 66-in. water mains and appurtenant structures in metropolitan Phoenix; by City.

\$226,257—**H. J. Hagen, Globe**—Low bid for a 5-span steel girder bridge crossing Burro Creek on State 93, Mohave County; by St. Hwy. Dept.

\$195,721—**W. J. Henson**, P. O. Box 471, Prescott—Low bid for 5¾ mi. of grading and draining over a new alignment, Wickenburg-Kingman hwy.; by St. Hwy. Dept.

\$122,701—**Kolob Construction Co.**, P. O. Box 1832, Phoenix—Award for a 4-span steel girder bridge over Dripping Springs Wash 11 mi. north of Winkelman, plus 1 mi. approach hwy.; by St. Hwy. Dept.

\$178,655—**Larsen Contracting Co.**, P. O. Box 1790, Phoenix—Award for 4 mi. of grading, draining, select material, aggregate base and bit. plant-mix, West Indian School Rd., Maricopa County; by St. Hwy. Dept.

\$137,525—**Tanner Bros. Construction Co.**, 731 N. 19th Ave., Phoenix—Low bid for paving on portions of nine streets, Phoenix; by City.

\$351,530—**Wallace & Wallace, Contractors**, P. O. Box 470, Phoenix—Low bid for 4 mi. of reconstruction along a stretch of new alignment, Tucson-Benson hwy.; by St. Hwy. Dept.

\$281,725—**Western Constructors, Inc.**, P. O. Box 1604, Phoenix—Award for 4 mi. of grading, draining, select material,

aggregate base and bit. plant-mix, 25 mi. north of Nogales on Tucson-Nogales hwy.; by St. Hwy. Dept.

\$124,300—**Western Constructors, Inc.**, P. O. Box 1604, Phoenix—Award for a 5-span steel girder bridge and approaches crossing Aravapai Creek 11 mi. south of Winkelman; by St. Hwy. Dept.

California

\$1,055,875—**Guy F. Atkinson Co.**, P. O. Box 593, South San Francisco—Low bid for surf. 7.9 mi. betw. Tulare Airport and Tagus; by Div. of Hwys.

\$364,926—**Guy F. Atkinson Co.**, P. O. Box 593, South San Francisco—Award for two reinf. conc. bridges and approaches, and city streets to be graded, Placerville, El Dorado County; by Div. of Hwys.

\$131,190—**Stanley Ball**, 1101 Westminster Ave., Alhambra—Low bid for resurfacing shoulder areas of runways and taxiways, grading, surf. end of catapult, working and parking areas, Inyokern; by U. S. Navy.

\$402,003—**Drury Electric Co.**, 1019 W. 3rd St., San Bernardino—Low bid for telephone cable systems at Four Camps Camp Pendleton; by U. S. Navy.

\$356,950—**Engineering Constructors, Inc.**, Box 150, South Gate—Low bid for 10,000 ft. of 48-in. prestressed pipe, Valle Steam Plant supply line, Sun Valley; by Los Angeles Dept. of Water and Power.

\$294,999—**Fredrickson & Watson Construction Co.**, 873 81st Ave., Oakland—Low bid on first major unit of freeway through Placerville, El Dorado County; by Div. of Hwys.

\$156,117—**Ben C. Gerwick, Inc.**, 112 Market St., San Francisco—Award for repairing Jeheemy Ramp at Naval Amphibious Base, Coronado; by U. S. Navy.

\$407,805—**Gould & Cross**, 636 Quay Ave., Wilmington—Award for a 15,000,000-gal. capacity reservoir at Morningside Park, Inglewood; by Dept. of Public Works.

\$253,020—**Theodore R. Gregory**, 1112 Wellington Ave., Pasadena—Low bid for utilities, West March Air Force Base; by C. of E.

\$636,405—**Haddock Engineers Ltd.**, 1616 S. Greenwood St., Montebello—Low bid for streets, curbs, gutters, walks, water supply system in Ocean Gate Ave., Hawthorne; by Los Angeles County.

\$1,148,000—**Kemp Bros.**, 8750 Mettler St., Los Angeles—Award for high school, Whittier; by Whittier Union High School District.

\$145,418—**Vido Kovacevich Co.**, Rosemead—Award for 1.1 mi. of grading and PMS surf. on untreated rock base and existing pavement, Rosecrans Ave. betw. San Gabriel River and Lakewood Blvd., Los Angeles County; by Div. of Hwys.

\$432,850—**Offco Construction Co., Inc.**, 2650 Cherry Ave., Long Beach—Low bid for supporting utilities, Norton Air Force Base, San Bernardino; by C. of E.

\$163,420—**Schallock & Glanville**, 2618 Nile St., Bakersfield—Award for sewerage system and disposal plant, Ivanhoe; by Ivanhoe Public Utility District.

\$234,368—**Ralph B. Slaughter**, P. O. Box 228, Julian—Low bid for ¼ mi. of grading and surf. on a new alignment, and about 6.1 mi. of widening, CTB to be constructed and PM to be placed over existing surf. and CTB, and seal coats to be applied over both areas, betw. Vista and Escondido, San Diego County; by Div. of Hwys.

\$444,140—**Stolte, Inc.**, and **Pacific Construction Corp.**, 845 San Leandro St., Oakland—Low bid for earthwork and structures, lateral and sublaterals, North Section Unit No. 1, Part 1, Madera Distribution System, Central Valley Project by USBR.

\$233,250—**J. B. Stringfellow Co.**, P. O. Box 6, Riverside—Award for reconstructing portions of embankment slopes and placing riprap thereupon, betw. Point Mugu and Little Sycamore Creek, Ventura County; by Div. of Hwys.

\$1,218,245—**Ford J. Twaits Co., Morrison-Knudsen Co., Inc. and Macco Corp.**, 449 S. Beaudry Ave., Los Angeles—Low bid for additional bldgs. at Marine training center, Twenty-nine Palms; by U. S. Navy.

\$1,411,770—**R. A. Wattson Co.**, 12550 Saticoy St., No. Hollywood—Award for Eagle Rock-Hollywood Conduit Unit, Los Angeles; by Los Angeles Dept. of Water & Power.

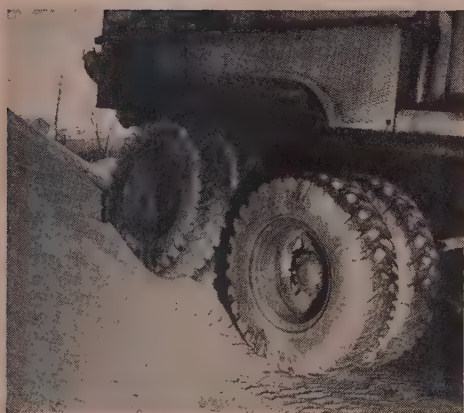


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EVEN TOUGH GOING LIKE THIS is no match for a GMC Diesel. A third differential in the power divider sends each of the drive wheels just the power it needs—despite irregularities in tire wear or terrain. No more power waste or tire fight! But an optional* differential lockout operating from the dash lets you pour full and equal power to all four wheels when demanded by ice, snow or muddy going.

*Optional, at extra cost.



DIESEL TRUCKS 19,500 GVW to 100,000 GCW

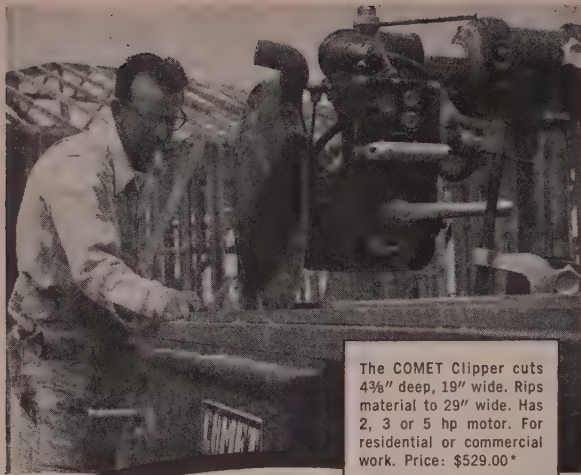
ONLY GMC's hard-slugging Diesel six-wheelers deliver the *two-way* performance you need for tough on-and-off-the-highway Diesel hauling—all the way up to the 63,000 GVW-100,000 GCW range.

The unmatched smoothness of their 2-cycle Diesel power hustles capacity loads over the highways in schedule-bettering time. And at the job site, they can pour on mighty reserve to wrestle through the slickest mudholes, the rockiest pits—or up the most murderous grades.

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The COMET Clipper cuts 4 3/8" deep, 19" wide. Rips material to 29" wide. Has 2, 3 or 5 hp motor. For residential or commercial work. Price: \$529.00*

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MORE PROFIT—LESS TIME LOST!

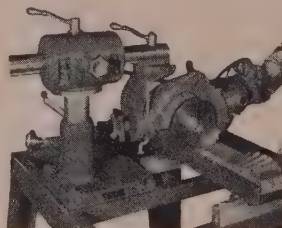
Hundreds of Western made COMET saws have been in continuous service for eight to ten years *without ever having been in the shop for any major repair work!* That's because COMET saws are designed to take hard wear and remain accurate and fast. Permanently lubricated, fully enclosed, ball-bearing rollers carry the arm. All parts are extra heavy. Exposed surfaces are chrome or cadmium plated or enameled to protect against corrosion.

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MACHINERY & SUPPLY CO., LTD.**
2031 Santa Fe Avenue, Los Angeles 21, Calif.

*Prices quoted are for basic unit, FOB, Los Angeles.

Colorado

\$115,470—**Carl V. Hill**, 1844 13th Ave., Greeley—Low bid for 3.4 mi. on States No. 257 and 392 betw. Windsor and Lucerne, Weld County; by St. Hwy. Dept.

\$232,730—**Schmidt Construction Co.**, 10145 W. Colfax Ave., Denver—Award for sewer collection system, incl. 13 mi. of sewer laterals, Englewood; by South Englewood Sanitation District #1.

Idaho

\$135,380—**Arrington Construction Co.**, P. O. Box 881, Idaho Falls—Award for hot cell, hot cell bldg. at Natl. Reactor Testing Station, Idaho Operations Office, Idaho Falls; by AEC.

\$270,690—**Brennan Construction Co.**, Box 507, Pocatello—Award for 8.18 mi. of Lost River Hwy., Reverse to Peoples Canal, Bingham County; by St. Dept. of Hwys.

\$163,160—**Holmes Construction Co.**, Rt. 1, Heyburn—Award for 6.47 mi. of bit. surf. rd., Bob Barton Rd., and 4.06 mi. of Orchard Valley Rd., Gooding County; by Dept. of Hwys.

\$108,316—**Quinn-Robbins Co., Inc.**, 703 S. 16th St., Boise—Low bid for alterations to Arrowrock Dam, Boise Project; by USBR.

\$183,951—**Joseph Vasconcellos, Inc.**, Long Island City, N. Y.—Award to design, furnish and install a railway-type turntable at Natl. Reactor Testing Station, Idaho Operations Office, Idaho Falls; by AEC.

Nevada

\$179,203—**Wells Cargo, Inc.**, 1800 E. 4th St., Reno—Award for 14.95 mi., from 9 mi. no. of Pahump to the Nye-Clark County line, Nye County; by Dept. of Hwys.

New Mexico

\$195,613—**Jack Adams**, Santa Fe—Award for 10.64 mi. of grading and draining, Ft. Wingate-McGaffey rd., McKinley County; by St. Hwy. Dept.

\$1,594,539—**Allison & Haney**, 1412 N. Broadway, Albuquerque—Low bid for Item 1, water transmission lines, Albuquerque; by City.

\$228,216—**Brown Contracting Co.**, P. O. Box 1479, Albuquerque—Award for 6.2 mi. of grading and draining, Gallup-Grants rd., McKinley County; by St. Hwy. Dept.

\$273,228—**O. D. Cowart**, Albuquerque—Low bid for 4.16 mi. of forest rd., Apache Natl. Forest, Catron County; by BPR.

\$2,010,001—**Lembke-Clough & King**, Albuquerque—Low bid for 12-story Simms Bldg., Albuquerque.

\$100,536—**Lowdermilk Bros.**, P. O. Box 501, Los Alamos—Award for 3.13 mi. of grading and draining, Cundiyo-South rd., Santa Fe County; by St. Hwy. Dept.

\$271,760—**G. I. Martin**, 520 S. Tulane, Albuquerque—Low bid for 5.89 mi. of grading and base surf., James Canyon rt., Lincoln Natl. Forest, Otero County; by BPR.

\$347,500—**Miller & Smith**, P. O. Box 6007, Station B, Albuquerque—Award for feeder lines for water system, North Albuquerque; by City.

Oregon

\$816,140—**Bay Construction, Inc.**, and **Don L. Cooney Co.**, 1762 Airport Way at Holgate, Seattle, Wash.—Award for Schedules I and II, McNary Powerhouse 230-kv. transmission lines, and Schedule II, McNary-Big Eddy 300-kv. transmission lines; by Bonneville Power Administration.

\$236,875—**Columbia Builders**, Hermiston—Low bid for McNary substation 1 mi. east of Umatilla; by Bonneville Power Administration.

\$159,221—**J. C. Compton Co.**, Box 86, McMinnville—Low bid for 7.01 mi. of paving and rocking shoulders, plus 13,000 cu. yd. of crushed rock in stock piles, Fremont Junction-Rosa Creek section, Warner hwy., Lake County; by St. Hwy. Comm.

\$262,890—**Diamond Tractor & Equipment Co.**, Portland—Award for 10.18 mi. of grading, topping and leveling, 11.69 mi. of rock shoulders and oil mat surf., and furnishing 3,700 cu. yd. crushed rock or gravel in stockpiles, Rome-Princeton hwy., 17 mi. south of Crane, Harney County; by St. Hwy. Comm.

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PHOENIX: Cummins & Moran

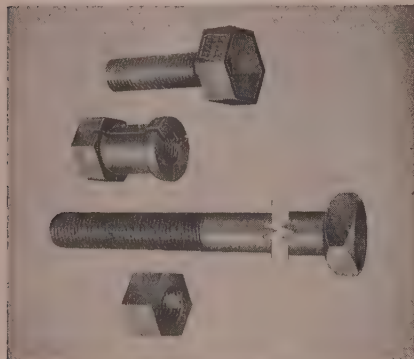
Branches: ALBUQUERQUE; EL PASO, Authorized Sales & Service; YUMA—Cooper Tractor Service; FARMINGTON—H. G. Cozzens Company; LAS VEGAS—Stirling Diesel Service.

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\$188,225—Donald M. Drake Co., 904 Lewis Bldg., Portland—Low bid for removing 415 ft. of conc. viaduct and constructing 511 ft. of conc. viaduct for the N.E. 102nd Ave. overcrossing of Banfield Expressway, Multnomah County; by State Hwy. Comm.

\$480,105—Funderburk Construction Co., Sutherlin—Award for 1.59 mi. of grading and oil mat surf., South Umpqua River-Fairgrounds unit, Deady-Shady section of Pacific Hwy. in and south of Roseburg, Douglas County; by St. Hwy. Comm.

\$1,052,192—Goodfellow Bros., Inc., Box 1337, Wenatchee, Wash.—4.6 mi. of grading, 11.34 mi. of rock base and paving, and 1 timber bridge, Arlington-Heppner Junction section of Columbia River Hwy. east of Arlington, Gilliam County; by St. Hwy. Comm.

\$207,370—Carl M. Halvorson, Inc., 218 Builders Exchange Bldg., Portland—Award for twin reinf. conc. viaducts, Cereghino overcrossing of U. P. tracks on the T. H. Banfield Expressway west of Fairview, Multnomah County; by St. Hwy. Comm.

\$497,028—R. A. Heintz Construction Co., 211 N.E. Columbia Blvd., Portland—Award for 6.86 mi. of grading, Elkhead Rd.-Rice Hill unit, Divide-Rice Hill section of Pacific Hwy. east of Yoncalla, Douglas County; by St. Hwy. Comm.

\$494,971—Roy L. Houck & Son, Salem—Award for 4.89 mi. of grading and selected roadbed topping, Turner Rd.-Battle Creek Junction Unit, Salem By-pass section of Pacific Hwy. East, south and east of Salem; by St. Hwy. Comm.

\$1,229,045—Vernie Jarl, Box 254, Gresham—Award for 5.7 mi. of grading and paving, Rowena-Chenoweth Creek Unit, Mosier-The Dalles section of Columbia River Hwy., Wasco County; by St. Hwy. Comm.

\$130,580—Tom Lillebo, Reedsport—Low bid for 4 conc. viaducts, State St.-Battle Creek unit, Salem by-pass, Marion County; by St. Hwy. Comm.

\$364,607—Parker-Johnson Co., 2002 S.E. Clinton, Portland—Award for 0.67 mi. of grading and paving and construction of 11 reinf. conc. structures, at various intersections of the T. H. Banfield Expressway in Portland, Multnomah County; by St. Hwy. Comm.

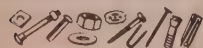
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Construction Equipment Division

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\$490,453—**Rogers Construction Co., Inc.**, 11760 N.E. Glisan, Portland—Award for 9.07 mi. of grading and paving, Lapine-Forest Boundry Unit, Lapine-Diamond Lake Junction section of The Dalles-Calif. hwy. south of Lapine, Klamath and Deschutes counties; by St. Hwy. Comm.

\$435,410—**Rogers Construction Co., Inc.**, 11760 N.E. Glisan, Portland—Award, 6.89 mi. of rock base and paving, Boones Ferry Rd.-Willamette River Unit, Barbur Blvd.-White School section of West Portland-Hubbard hwy. nr. Tualatin, Washington and Clackamas counties; by St. Hwy. Comm.

\$756,470—**Rogers Construction Co., Inc.**, 11760 N.E. Glisan, Portland—Low bid for 12.09 mi. of grading, paving and oiling shoulders, north unit, Bend-Lapine section, The Dalles-California hwy., Deschutes County; by St. Hwy. Comm.

\$648,682—**Fred H. Slate Co., Oregon Ltd., and E. C. Hall Co.**, 7805 S.W. 40th Ave., Portland—Award for 2.91 mi. of grading, Brush Creek-Rinehart Creek Unit, Rocky Point-Gold Beach section of Oregon Coast Hwy, about 10 mi. south of Port Orford, Curry County; by St. Hwy. Comm.

\$302,140—**J. G. Watts Construction Co.**, 4538 S.W. Macadam, Portland—Low bid for 2 mi. of the relocated State No. 58 in the Dexter Dam reservoir area; by C. of E.

\$524,152—**White Bros. Construction Co., Inc.**, 3rd & Sumach, Walla Walla, Wash.—Award for 4.96 mi. of grading, Deady-Winchester Unit, Shady section of Pacific Hwy. about 8 mi. no. of Roseburg, Douglas County; by St. Hwy. Comm.

\$245,915—**Young & Smith Construction Co.**, 306 Beason Bldg., Salt Lake City, Utah—Low bid for repairs and reconstruction at Savage Rapids Dam nr. Grants Pass; by USBR.

Utah

\$404,541—**Barker Construction Co.**, Ness Bldg., Salt Lake City—Award for sewage treatment plant, Murray; by City.

\$570,954—**W. W. Clyde & Co.**, Springville—Award for 4.4 mi. of plant-mix bit. surf. rd., Mills Fork to Red Narrows, Utah County; by St. Rd. Comm.

\$814,000—**Statewide Plumbing & Heating Co., Inc.**, 1706 N. Main St., Pocatello, Idaho—Award for sanitary sewer ex-

tension, betterments and outfall sewer to treatment plant, Murray; by City.

Washington

\$589,990—**Guy F. Atkinson Co.**, 5315 N.E. 101st. Ave., Portland—Award for draining and grading 1.4 mi. of State No. 1, Snohomish River bridge to Great Northern railway overcrossing, Snohomish County; by St. Hwy. Comm.

\$435,225—**S. Birch & Sons, McLaughlin, Inc., and E. V. Lane Corp.**, 314 Ford Bldg., Great Falls, Mont.—Low bid for hydrant refueling and bulk storage facilities, Larson Air Force Base; by C. of E.

\$40,000,000—**Blaw-Knox Co., Chemical Plants Div.**, 321 Pennsylvania Ave., Pittsburgh, Pa.—Award for chemical processing plant, Richland; by AEC.

\$136,411—**Troy T. Burnham**, Seattle—Low bid for a channel change and twin 217-ft. reinf. conc. girder bridges over Lacamas Creek on State No. 1, Lewis County; by St. Hwy. Comm.

\$930,425—**M. P. Butler**, Seattle—Award for Steamboat Slough swing-span bridge with steel truss and reinf. conc. approach spans, Snohomish County; by St. Hwy. Comm.

\$2,471,686—**Cherf Bros. Construction Co., Sandkay Contractors, Inc., and J. A. Jones Construction Co.**, P. O. Box 938, Ephrata—Low bid for apron paving, and warm-up pad, Larson Air Force Base, Moses Lake; by C. of E.

\$1,248,057—**Dahlgren Construction Co.**, 1700 21st Ave. South, Seattle—Award for Rainier Ave.-Lake Way grade separation project, Seattle; by St. Hwy. Comm.

\$246,285—**Lige Dickson Co.**, 3315 S. Pine St., Tacoma—Low bid for primary and access roads at Training Center, Yakima; by C. of E.

\$1,282,175—**N. Fiorito Co.**, 844 W. 48 St., Seattle—Award for 3 maintenance docks and apron paving, McChord Air Force Base; by C. of E.

\$122,040—**General Construction Co.**, 4850 N.W. Front Ave., Seattle—Award for draining, grading, asph. conc. approaches, and construction of a reinf. conc. girder bridge on State No. 1,



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CALIFORNIA—Coast Equipment Company, San Francisco, Calif.

OREGON—P. L. Crooks & Co., Inc., Portland 10, Oregon

WASHINGTON—Construction Equipment Corp., Spokane, Wash.

Clyde Equipment Company, Seattle, Washington

Vancouver freeway, 24th St. undercrossing vicinity, Clark County; by St. Hwy. Comm.

\$271,615—**Lewis A. Hopkins Co.**, 2205 Lincoln Ave., Yakima—Award for roads, levees and pumping plants, Pasco, Franklin County; by C. of E.

\$4,444,532—**Kansas City Bridge Co.**, 928 Broadway, Kansas City, Mo., and **Massman Construction Co.**—Award for lift railway bridge over Columbia River betw. Pasco and Kennewick; by Northern Pacific Railway.

\$202,500—**Max J. Kuney Co.**, N. 120 Ralph St., Spokane—Award for jet fuel facilities at Geiger Air Force Base; by C. of E.

\$1,895,025—**Max J. Kuney Co.**, N. 120 Ralph St., Spokane—Award for heating installations, Fort Lewis; by C. of E.

\$2,000,000—**Nelse Mortensen & Co., Inc.**, 1021 West Lake No., Seattle—Award for housing at Larson Air Force Base nr. Moses Lake; by C. of E.

\$295,590—**Northwest Construction Co.**, 3950 6th Ave. N.W., Seattle—Award for 4.9 mi. of draining and grading on State No. 1, Lewis County line north, Thurston County; by St. Hwy. Comm.

\$496,365—**Northwest Construction Co.**, 3950 6th Ave. N.W., Seattle—Award for 4.7 mi. of State No. 1, Maytown south, Thurston County; by St. Hwy. Comm.

\$146,220—**Charles A. Power, E.** 27 - 8th Ave., Spokane—Award for reinf. conc. cribbing on 0.13 mi. of Riverside State Park Rd., Spokane County; by St. Hwy. Comm.

\$365,265—**Thomas Scalzo**, 3211 Airport Way, Seattle—Award for clearing, draining, grading and a steel girder railway undercrossing on 1.9 mi. of State No. 1, Marshall Rd. north, Snohomish County; by St. Hwy. Comm.

\$117,271—**John N. Williams**, Kennewick—Low bid for a 1,276,000-gal. water reservoir and extension of water system, Prosser; by City.

\$316,850—**Young & Smith Construction Co.**, 306 Beason Bldg., Salt Lake City, Utah—Low bid for Puget Sound outfall channel, Fort Lewis; by C. of E.

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DAM JOINTS

... Continued from page 76

some load and that a larger portion of the load be transferred to the comparatively more stable foundation, it may be specified that the reservoir water level should be raised practically to the top of the dam before the transverse joints are grouted. Such a schedule will result in pre-stressing the vertical cantilevers, forcing them to withstand more load than they would have to if the dam functioned as a three-dimensional monolith when the reservoir water level was raised. The necessity of a series of thorough three-dimensional stress and stability analyses, before a transverse joint grouting program could be adopted, is therefore quite evident.

Conclusions

The following conclusions can be drawn from the preceding discussion:

a. Arch dams

- (1) All contraction joints should have keyed faces.
- (2) All contraction joints should be grouted.

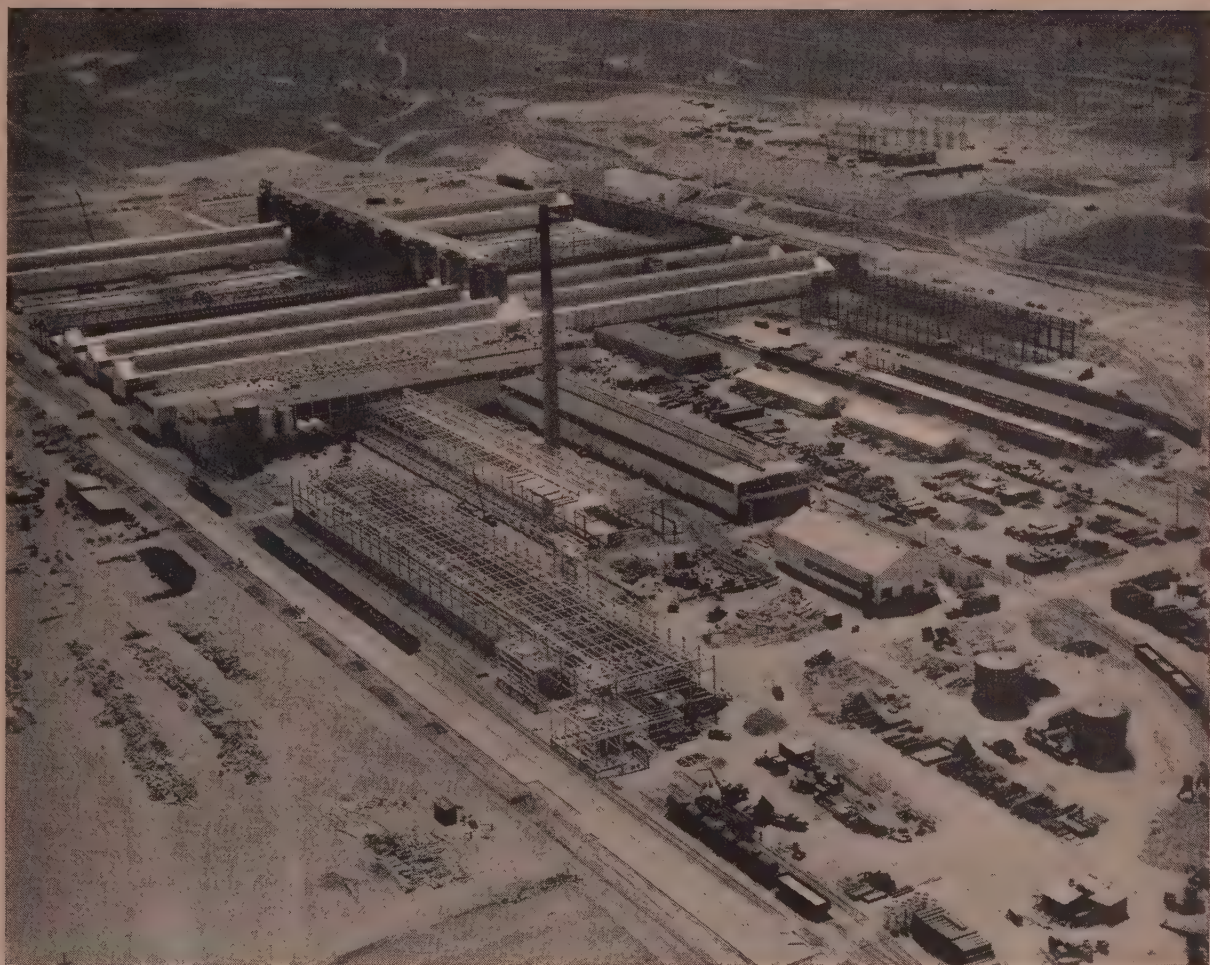
b. Straight gravity dams

- (1) Longitudinal contraction joints, where provided, should be keyed and grouted.
- (2) Provision of keys and grouting of transverse contraction joints should be decided after thorough Trial Load Twist or any other equivalent three-dimensional method of stress analysis. The possibility of having either unkeyed and ungrouted, or keyed but ungrouted transverse contraction joints is much greater in the case of dams located in wide and flat U-shaped canyons.

c. Time of grouting joints. The most appropriate schedule to grout either longitudinal or transverse contraction joints should also be determined from the results of a series of stress analyses, or by the judgment of an experienced designer.

REFERENCES

1. "Trial Load Method of Analyzing Arch Dams," Bulletin 1, Part V, Boulder Canyon Project Final Reports, United States Bureau of Reclamation, Denver, Colorado, 1938.
2. "Model Tests of Boulder Dam," Bulletin 3, Part V, Boulder Canyon Project Final Reports, 1939.
3. "Die Berechnung der Gewölbemauer am Hiersmann nach dem Versuchslastverfahren" (Analysis of Hiersmann Arch Dam by the Trial Load Method) by Von K. Goriupp, Österreichische Bauzeitschrift, Vienna, 1950.
4. "Arch Dam Investigations," Vol. I and II, Engineering Foundation, New York, 1927.
5. "Gravity Dams," Chapter 9, Design Supplement 2, "Reclamation Manual."
6. "Influence of Construction Program on Stresses in a Large Concrete Dam," by G. S. Sarkaria, "The Central Board of Irrigation Journal," India, May 1950.



11,000 TONS OF STRUCTURAL STEEL for Alcoa Aluminum Plant at Wenatchee

The new aluminum-reduction plant being erected for the Aluminum Company of America, near Wenatchee, Washington, will be one of the country's largest. It is designed to produce 170 million lbs of pig aluminum annually. Some 20 acres of buildings, ranging from small store rooms to pot rooms 1000 ft long, will house the integrated operations.

Bethlehem Pacific fabricated and erected more than 11,000 tons of structural steel for this plant. It is the latest addition to a long list of industrial structures, commercial buildings, bridges and towers in the Northwest, containing steelwork by Bethlehem Pacific.

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Link-Belt crawler crane equipped with a 100-ft. boom and ½-yd. concrete bucket.

The pipeline is 27 in. I.D., spun reinforced concrete with rubber gasket joints, and was supplied by American Pipe and Construction Co. of Los Angeles.

Excavation of the pipe trench, on each end of the line involving cuts up to 25 ft., was accomplished by drilling and blasting the sandstone and removing the broken rock with a backhoe and Bay City truck crane equipped with a ¾-yd. clamshell bucket. Where the trench bottom was in rock, excavation was carried 6 in. below the bottom of the pipe and backfilled with compacted sandy material. The truck crane used in the excavation also lifted the pipe and placed it in the trench for installation by the laying crew. After the pipe joints were grouted, the pipe was backfilled above the midpoint with hand-tamped select material. Following testing of the line the remainder of the backfill will be compacted by flooding.

Progress on the diversion works has been severely hampered by the storms and bad weather; however, the job is progressing steadily. The concrete in the diversion tower and control building is completed and the terminal structure is nearing completion. About 3,400 ft. of concrete pipe is in place. Completion in ample time to pump water from the spring runoff is anticipated.

The entire project, the cost of which will approach \$1,000,000, will be another outstanding example of what private industry is doing to conserve water and produce more strategically important copper.

Personnel

The development of the project is under the direction of C. R. Kuzell, General Manager, Phelps Dodge Corporation.

The works were designed and construction is being supervised by Leeds, Hill & Jewett, consulting engineers of Los Angeles, represented by the writer and four assistants.

Furman Byars is project manager for Isbell Construction Co., assisted by A. C. Newton as superintendent. Guy Davis is superintendent for J. H. Welsh & Son Contracting Co. on the diversion works.

U. of Wash. tops West's engineering enrollment

LARGEST college engineering enrollment in the West is at the University of Washington, with 1,600 students registered for the fall term. It is the first time the university led the list.

UNIT BID PRICES

Selected abstracts for Western projects

Streets and Highways

Grading and asphaltic concrete paving on untreated rock base

California—Los Angeles County—State. M. S. Mecham & Sons of South Gate submitted the low bid of \$211,444 before the California Division of Highways for about 0.8 mi. of grading and asphaltic concrete paving on untreated rock base to provide a 4-lane highway in the cities of Compton and Long Beach on Artesia St. between Alameda St. and Long Beach Blvd. Unit bids submitted were as follows:

(1) M. S. Mecham & Sons	\$211,444	(5) J. A. Thompson & Son, Contractors	\$216,565
(2) Vido Kovacevich Co.	212,669	— Ukropina-Polich-Kral	217,773
(3) J. E. Haddock, Ltd.	214,311	— Warren Southwest, Inc.	222,994
(4) Griffith Co.	215,209	— Hess Construction Co., Inc.	228,470

	(1)	(2)	(3)	(4)	(5)
Lump sum, removing existing bridge	\$3,250	900.00	\$3,000	\$2,500	\$2,580
40 cu. yd. removing concrete	4.50	7.50	10.00	12.00	6.50
42 sta. clearing and grubbing	65.00	100.00	80.00	75.00	130.00
17,000 cu. yd. roadway excavation	.35	.60	.65	.54	.88
3,200 cu. yd. structure excavation	1.80	1.80	1.70	2.30	1.65
120 cu. yd. ditch and channel excavation	1.80	2.00	2.00	1.50	3.50
35,000 sq. yd. compacting original ground	.05	.07	.04	.05	.05
229,000 sta. yd. overhaul	.005	.0075	.005	.005	.01
29,000 ton imported subbase material	1.20	1.20	1.20	1.15	1.22
Lump sum, dev. wat. sup. and furn. wat. equip.	\$2,000	\$1,000	\$2,000	\$1,250	500.00
2,000 M. gal. applying water	1.75	3.00	1.50	1.80	1.50
42 sta. finishing roadway	10.00	12.00	10.00	18.00	15.00
16,000 ton untreated rock base	2.25	2.40	2.30	2.35	2.20
45 ton liquid asphalt, SC-2 (pr. ct.)	30.00	30.00	30.00	22.00	27.50
9,500 ton asphalt concrete	4.46	4.50	4.75	4.95	4.75
11 ton asphaltic emulsion (pt. bdr. and sl. cts.)	40.00	40.00	40.00	36.00	45.00
35 ton screenings (sl. ct.)	5.00	5.00	5.00	5.50	3.50
1,900 lin. ft. placing asphalt concrete curbs	.60	.30	.25	.25	.55
650 lin. ft. raised traffic bars	1.50	1.00	1.30	1.00	1.50
240 cu. yd. Class "A" P.C.C. (structures)	67.00	55.00	60.00	51.00	61.00
46,000 lb. bar reinforcing steel	.15	.10	.11	.11	.105
2,300 lb. misc. iron and steel	.35	.35	.37	.40	.40
76 lin. ft. pipe handrail	7.50	7.00	7.00	7.50	6.30
760 cu. yd. Class "B" P.C.C. (curbs, gutters & sdwks.)	26.75	23.00	26.00	32.00	26.00
8 ea. installing metal culvert markers	4.00	1.25	4.00	6.00	10.00
950 lin. ft. salvag. and reconstr. exist. chain link fence	1.00	1.00	1.00	.90	.85
94 lin. ft. 18-in. R.C.P.	5.70	5.20	5.00	4.50	4.45
1,850 lin. ft. 24-in. R.C.P.	7.45	8.50	6.70	6.00	5.50
220 lin. ft. 48-in. R.C.P.	16.00	16.00	18.50	17.00	16.50
10 ea. adjusting manholes to grade	25.00	25.00	20.00	30.00	35.00
6 ea. reconstructing brick manholes	65.00	100.00	200.00	170.00	225.00
164 lin. ft. 6-in. clay sewer pipe	7.00	5.50	9.00	6.00	6.50
Lump sum, traffic signal equipment	\$2,000	\$1,200	\$1,350	\$1,600	\$1,350

Widening 2½ mi. of highway in Nevada

Nevada—Washoe County—State. Isbell Construction Co. of Reno submitted a low bid of \$771,197 before the Nevada Department of Highways for widening 2.459 mi. of U. S. 40, 1 mi. southwest of Verdi across the California state line. Unit bids submitted were as follows:

(1) Isbell Construction Co.	\$771,197	(4) H. Earl Parker	\$848,674
(2) Silver State Construction Co.	795,576	(5) Harms Brothers	868,182
(3) Dodge Construction, Inc.	816,469		

	(1)	(2)	(3)	(4)	(5)
Lump sum, signs	\$5,000	\$5,000	\$2,500	\$2,000	\$3,000
Force account, flagmen	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500
Force account, maintain base	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
7 ea. remove trees	78.00	50.00	100.00	35.00	100.00
685 lin. ft. remove culvert pipe	2.00	2.00	1.50	1.75	2.35
13 ea. remove headwalls	25.00	25.00	20.00	22.50	35.00
7 cu. yd. remove concrete	25.00	25.00	25.00	22.50	25.00
3,220 lin. ft. remove beam type metal guard rail	1.00	.25	.75	1.10	.60
3,040 lin. ft. remove fence	.10	.10	.10	.14	.25
79 ea. remove monuments	2.00	.50	3.00	3.00	2.50
Lump sum, move building	\$1,500	500.00	\$2,500	\$1,000	\$1,000
276,750 cu. yd. roadway excav.	1.25	1.35	1.60	1.34	1.55
1,330 cu. yd. drainage excav.	1.30	1.25	1.00	1.40	2.50
10 sta. V-type ditches	10.00	10.00	10.00	30.00	30.00
Force account, scale existing slopes	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000
42 sta. slope rounding	15.00	10.00	25.00	15.00	30.00
825,370 yd. sta. overhaul, yd. sta.	.02	.02	.02	.01	.01
85,010 yd. mi. overhaul, yd. mi.	.25	.20	.20	.36	.25
1,750 cu. yd. structure excav	2.50	2.00	3.00	1.90	3.50
1,980 cu. yd. backfill	2.50	1.50	2.00	2.15	3.00
12,291 M. gal. water	1.50	1.00	1.50	1.50	1.50
Lump sum, furnish water equipment	\$10,000	\$5,000	\$10,000	\$15,291	\$2,500
360 hr. power roller	7.50	7.00	7.50	6.00	9.00
7,160 ft. hr. tamping roller	1.00	.50	.75	.70	1.00
500 ft. hr. pneumatic-tired roller	1.50	.75	1.00	1.50	1.50
50,683 ton Type 1 gravel base	1.30	1.50	.80	1.36	1.35
25,460 ton Type 2 gravel base, one inch	1.83	1.75	1.00	2.20	1.55
192 ton liquid asphalt, Type MC-1 (prime)	34.00	35.00	35.00	40.00	37.50
650 ton sand blotter	3.50	2.00	5.00	6.00	5.00
124 ton emulsified asphalt (seal)	38.00	40.00	40.00	40.00	38.50
740 ton screenings	5.00	4.00	5.00	6.00	7.00

(Continued on page 140)



QUOTE:

"The Schramm 315 c.f.m. Diesel Engine Driven Compressor illustrated is being used by the Racquette River Construction Corporation, Potsdam, N. Y., on the Niagara Mohawk Power Corporation job at Carry Falls.

For the past year, this compressor has carried the brunt of our drilling for rock excavation, pressure grout holes, and rock rip rap quarrying. We ordinarily use four individual hammers drilling two feet to six feet holes and occasionally have out

as much as eight hundred feet of $\frac{3}{4}$ " hose, in the aggregate. For the grout holes and rip rap, we use the machine to operate two 50 pound wagon-mounted hammers drilling twenty feet holes.

When not employed as mentioned above, we use the compressor for such other jobs as cleaning concrete surfaces with air, pumping water (with an air mop) and pressure grouting."

Cordially yours,
RACQUETTE RIVER CONSTRUCTION CORP.

Frederick Rexford,
Superintendent

... and

HERE'S THE COMPRESSOR
THAT CARRIED THE BRUNT
OF THE DRILLING JOB!

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A SIZE AND MODEL FOR EVERY AIR NEED

20-35	60	105	210	315	600

RAINMAKING

... Continued from page 62

conomic value. Likewise, it is most effective when it is least needed and might be of definitely negative economic value. Even without resulting in floods, the extra rain from seeding ventures must be controlled to be of any use. If the water finds its way to natural channels in orderly fashion but then wastes to the sea, it yields little economic benefit. Assuming considerable increase in rainfall—over 10% on the average—to result from seeding, engineering works on the ground must exist that will control and store this increment for use. Finally, cloud seeding offers no solution to the sustained drought with cloudless skies and hot sun.

What position should contractors take with respect to cloud seeding? Certainly many of them have too much at stake to permit ignorance of the subject at this time. For, although there is little absolute proof that seeding does have any effect on rainfall, there is no absolute proof that it doesn't.

It would seem that the contractor should make it a point to be aware of seeding operations in the area of his work. State laws requiring the advertisement of intention to seed are a big help—where such laws exist. The contractor should then take all reasonable legal precautions to protect his right to redress if it seems warranted.

He should also try to keep informed on the trend of thinking among meteorologists on the subject of cloud seeding. Some important experiments are now in progress which may lead to more definite conclusions in the relatively near future.

Finally, the contractor could profitably begin to establish, quantitatively, the extent of damage he suffers on various kinds of jobs in various kinds of weather. Doing this with some care and accuracy would be analogous to filing an inventory with his insurance company when taking out a policy on his equipment. By this means he becomes prepared to determine the damage, beyond that of a natural storm, brought to his work by "rain-making."

Sacramento is building unusual power line

THE SACRAMENTO Municipal Utility District recently awarded the Okonite-Callender Co. a \$258,290 contract for supplying 3½ mi. of a special pressurized oil pipeline which will carry high voltage electric power into California's capital. Officials feel certain that this unusual transmission line will insure adequate power for the downtown area. It is said to be the first of its type in the West.

UNIT BID PRICES... CONTINUED

	(1)	(2)	(3)	(4)	(5)
821 ton liquid asph., Type SC-6 (plantmix)	27.00	30.00	30.00	30.00	29.00
16,420 ton Class F-2 plantmix	3.20	4.00	3.25	4.35	3.90
240 cu. yd. special Class A concrete	85.00	85.00	90.00	100.00	100.00
23,660 lb. reinforcing steel	.16	.15	.15	.14	.14
212 lin. ft. 8-in. corr. metal pipe (dipped)	2.00	2.00	2.75	2.60	2.50
368 lin. ft. 18-in. corr. metal pipe	3.25	3.50	3.75	4.25	3.50
2,188 lin. ft. 24-in. corr. metal pipe	5.50	4.50	5.00	6.40	5.50
75 lin. ft. 30-in. corr. metal pipe (12 gauge)	8.25	7.00	7.50	10.50	9.50
120 lin. ft. 36-in. corr. metal pipe	9.50	10.00	9.00	12.30	11.50
10 lin. ft. relay culvert pipe	2.00	1.00	1.50	3.10	1.75
3 cu. yd. hand-laid riprap	20.00	20.00	15.00	21.50	28.00
179 cu. yd. grouted hand-laid riprap	30.00	25.00	30.00	37.50	45.00
6,310 lb. structural steel	.40	.30	.40	.36	.30
11,810 lin. ft. beam type metal guard rail	3.50	4.00	3.50	4.25	4.25
3,060 lin. ft. reset beam type metal guard rail	2.50	2.50	2.00	2.50	3.15
8,360 lin. ft. timber curb	.50	1.00	.50	.62	.35
236 ea. culvert markers and guide posts	6.00	6.00	7.50	7.50	8.50
61 ea. remove and reset guide posts	6.00	4.00	7.50	3.60	7.00
3,500 lin. ft. construct Type B-5B fence	.60	.50	.35	.54	.55
1 ea. 14-ft. metal gate	100.00	50.00	100.00	110.00	80.00
68 ea. right-of-way markers	10.00	6.00	12.50	10.00	5.75
3,150 sq. yd. plantmix shoulder dike	.35	.50	1.00	.25	.20
110 sq. yd. plantmix ditches	1.50	1.00	1.00	1.00	1.50
1 ea. embankment protector (dipped)	40.00	50.00	30.00	50.00	45.00
650 ton bituminous premixed patching material	5.00	3.00	3.00	4.00	5.00
39 ton liquid asphalt, Type SC-3	27.00	30.00	30.00	30.00	27.00

Grading and stockpiling crushed aggregate in Washington

Washington—Lewis County—State. Strong & Macdonald, Inc., Tacoma, with a low bid of \$529,507, was awarded a contract by the State Highway Commission of Washington, for clearing, grading, draining, and stockpiling crushed stone and aggregate for 4.626 mi. of Primary State Highway No. 5, Kiona Creek to Randle. Unit bids submitted were as follows:

(1) Strong & Macdonald, Inc.	\$529,507	—	Peter Kiewit Sons' Co.	\$615,811
(2) N. Fiorito Co.	554,445	—	Vernie Jarl	618,423
(3) J. N. Conley	568,756	—	Guy J. Norris	623,227
(4) Goetz & Brennan	571,416	—	Thomas Scalzo	633,458
(5) Osberg Construction Co.	577,824	—	Erickson Paving Co.	654,768

	(1)	(2)	(3)	(4)	(5)
61.63 acres clearing	500.00	500.00	500.00	500.00	400.00
44.95 acres grubbing	250.00	500.00	450.00	500.00	400.00
Lump sum, clearing and grubbing	750.00	\$3,000	\$1,750	\$5,000	\$5,000
256,940 cu. yd. common excav. incl. haul of 600 ft.	.35	.36	.34	.32	.32
75,190 cu. yd. solid rock excav. incl. haul of 600 ft.	1.35	1.50	1.50	1.50	1.40
7,970 cu. yd. com. trench excav. incl. haul of 600 ft.	.75	2.00	1.50	1.75	2.00
150 cu. yd. solid rock tr. excav. incl. haul of 600 ft.	5.00	5.00	7.00	4.00	7.00
130,210 cu. yd. sta. overhaul	.02	.015	.015	.02	.02
3,735.7 M. cu. yd. sta. overhaul	5.00	4.50	5.00	5.50	5.00
7,000 cu. yd. stripping borrow and surf. pit. incl. haul	.30	.15	.30	.25	.20
2,420 cu. yd. structure excav.	3.00	2.50	3.75	3.00	3.00
199 day smooth-wheeled power roller	50.00	60.00	50.00	45.00	55.00
89 day tamping roller	50.00	60.00	70.00	60.00	65.00
288 day pneumatic-tired roller	50.00	60.00	50.00	55.00	55.00
82 day mechanical tamper	45.00	45.00	40.00	45.00	40.00
24,610 lin. ft. slope treatment Class B	.12	.15	.15	.11	.15
281.6 sta. (100 ft.) finishing roadway	12.00	15.00	10.00	20.00	20.00
3,310 M. gal. water	3.00	2.50	2.00	2.50	3.50
60 cu. yd. gravel backfill for foundations	3.50	8.00	4.50	5.00	4.00
250 cu. yd. gravel backfill for drains	6.00	10.00	4.50	9.00	4.00
16,350 ton crushed stone surfacing top course	1.50	1.45	1.80	1.70	1.80
16,820 ton crushed stone surfacing base course	1.50	1.40	1.70	1.65	1.75
42,920 ton ballast	1.30	1.30	1.45	1.50	1.65
700 cu. yd. cr. stone surf. top crse. in pl. from stkl.	1.00	1.00	1.20	1.40	2.50
700 cu. yd. ballast in place from stockpile	1.00	1.00	1.20	1.40	2.50
11,600 tons cr. stone surf. top crse. in stockpile	1.30	1.10	1.60	1.25	1.20
9,000 ton ballast in stockpile	1.30	1.00	1.25	1.10	1.05

MINERAL AGGREGATE FOR BITUMINOUS SURFACE TREATMENT "PLANT-MIX" TYPE F IN STOCKPILE

3,700 ton mineral aggregate ¾-in. - ¼-in. in stkl.	1.30	1.10	1.60	1.55	1.50
4,500 ton mineral aggregate ¾-in. - 0-in. in stkl.	1.30	1.10	1.60	1.65	1.60

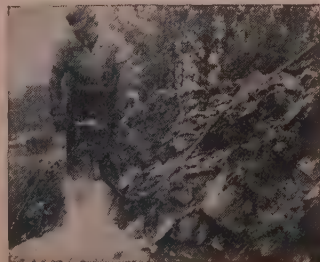
OTHER ITEMS

309 cu. yd. concrete, Class A	85.00	70.00	70.00	75.00	90.00
43,400 lb. steel reinforcing bars	.14	.14	.125	.13	.15
210 lin. ft. conc. or V.C. drain pipe 8-in. diam.	1.50	1.25	1.50	.80	1.00
1,077 lin. ft. plain conc. culvert pipe 12-in. diam.	2.00	2.00	2.00	1.75	2.00
36 lin. ft. plain conc. culvert pipe 18-in. diam.	4.00	3.50	3.50	3.25	3.75
141 lin. ft. std. reinf. conc. culvert pipe 12-in. diam.	3.00	2.50	2.50	2.50	3.00
2,424 lin. ft. std. reinf. conc. culvert pipe 18-in. diam.	4.50	4.00	4.00	4.25	4.50
375 lin. ft. std. reinf. conc. culvert pipe 24-in. diam.	7.50	6.50	7.00	6.50	7.00
129 lin. ft. std. reinf. conc. culvert pipe 30-in. diam.	9.00	8.50	9.00	9.50	9.00
150 lin. ft. std. reinf. conc. culvert pipe 42-in. diam.	15.00	14.00	16.00	15.00	16.00
225 lin. ft. ex. str. reinf. conc. culv. pipe 42-in. diam.	18.00	16.25	18.00	17.50	19.00
33 lin. ft. relaying conc. culvert pipe 18-in. diam.	4.50	3.50	3.00	1.00	3.00
70 lin. ft. galv. iron water pipe 1-in. diam.	1.00	1.00	1.50	.60	1.00
20 lin. ft. galv. iron water pipe 1½-in. diam.	1.25	1.50	1.50	.80	1.50
210 lin. ft. galv. iron water pipe 2-in. diam.	1.50	1.75	1.50	1.00	2.00
420 lin. ft. steel water pipe No. 10 ga. 8-in. diam.	4.00	5.00	4.00	3.50	5.00
200 lin. ft. remov. and relay. galv. iron pipe 1-in. diam.	1.00	1.00	1.00	.60	1.00
60 lin. ft. remov. and relay. galv. iron pipe 1½-in. diam.	1.25	1.25	1.50	.80	1.50
425 lin. ft. remov. and relay. galv. iron pipe 2-in. diam.	1.50	1.75	1.50	1.00	2.00
100 lin. ft. removing galv. iron pipe 1½-in. diam.	.50	.25	.75	.50	.50
100 lin. ft. removing wood pipe 2-in. diam.	.75	.25	.75	.50	.50
380 lin. ft. removing steel pipe 8-in. diam.	1.00	.50	1.50	1.50	1.00
1 only special concrete inlet	125.00	150.00	125.00	200.00	200.00

(Continued on page 142)



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



UNIT BID PRICES... CONTINUED

	(1)	(2)	(3)	(4)	(5)
250 lin. ft. standard beam guard rail.....	3.50	4.00	3.50	4.00	3.50
171 only reinf. conc. right-of-way markers.....	6.50	7.00	6.00	6.00	6.00
20 cu. yd. rubble masonry riprap.....	20.00	30.00	40.00	30.00	20.00
Lump sum, removing concrete foundation.....	125.00	150.00	100.00	250.00	1,000
Lump sum, removing conc. foundation wall and steps.....	125.00	150.00	500.00	250.00	500.00
Lump sum, removing timber foot bridge.....	100.00	100.00	100.00	100.00	500.00
Lump sum, removing portions of arch culvert.....	350.00	750.00	400.00	1,000	1,000
40 sq. yd. removing cement concrete sidewalk.....	.75	1.00	.50	.60	.50

Grading, gravel surfacing and oiling in Montana

Montana—Gallatin County—State. Bob Gibson & Black Top Construction Co. was awarded a contract by the State Highway Commission of Montana on the basis of a low bid of \$205,257 for 8.023 mi. of grading, gravel surfacing, road mix oiling and small drainage structures. Work is located on the Belgrade West and Belgrade South highway. Unit bids submitted were as follows:

(1) Bob Gibson & Black Top Construction Co.....	\$205,257	— Peter Kiewit Sons' Co.....	\$237,622
(2) McLaughlin, Inc.....	209,019	— O'Brien Construction Co.....	239,891
(3) Sundling Construction Co.....	211,564	— Naranche & Konda.....	240,680
(4) S. Birch & Sons Construction Co.....	216,539	— Thomas Staunton.....	243,510
(5) F & S Construction Co.....	218,122	— Inland Construction Co.....	249,600
(6) Charles Shannon Co.....	230,032	— O'Neil Construction Co.....	257,443
— Stanley H. Arkwright, Inc.....	235,040	— Albert LaLonde Co.....	257,887
— Nilson Smith Construction Co.....	236,943	— Ed Tangmo.....	266,999
		— Taggart Construction Co.....	276,040

	(1)	(2)	(3)	(4)	(5)	(6)
249,031 cu. yd. uncl. excav. and borrow.....	.20	.17	.175	.21	.20	.23
41,725 mi. yd. overhaul.....	.18	.10	.09	.19	.15	.20
1,214 cu. yd. culvert excavation.....	2.00	2.00	1.50	2.00	2.50	2.00
65,618 ton sel. borrow base course.....	.48	.60	.61	.47	.60	.60
35,385 ton Type "A" top coat surf. ¾-in. grav.....	.70	1.00	.97	.85	1.00	1.00
2,142 ton cr. gravel cover matl.....	3.50	3.00	4.50	3.50	3.50	3.50
8,023 mi. processing.....	900.00	900.00	900.00	\$1,000	\$1,000	\$1,000
817 sq. yd. processing.....	.50	.50	.50	.50	.45	.50
24,423 gal. applying MC-1 ARO—prime.....	.155	.15	.15	.14	.145	.17
141,751 gal. applying MC-3 ARO—mix.....	.142	.14	.13	.14	.125	.125
42,749 gal. applying MC-4 ARO—seal.....	.155	.15	.15	.15	.145	.17
—5,510 M. gal. watering.....	1.10	1.00	1.25	1.00	1.00	.75
units rolling embankment.....	6.00	7.50	7.00	7.50	7.00	7.00
560 units rolling surface courses.....	7.00	6.00	7.00	7.00	7.00	7.00
74 lin. ft. reinf. conc. P. culv. 15-in. diam.....	4.00	4.00	3.20	4.00	3.50	5.00
1,058 lin. ft. reinf. conc. P. culv. 18-in. diam.....	5.50	5.00	4.00	5.00	4.75	5.25
366 lin. ft. reinf. conc. P. culv. 24-in. diam.....	7.00	7.00	6.50	8.50	6.25	7.00
26 lin. ft. corr. metal P. culv. 15-in. diam.....	3.50	4.00	3.20	4.00	4.00	5.00
34 lin. ft. corr. metal P. culv. 24-in. diam.....	6.00	6.00	6.00	6.50	5.50	8.00
108 lin. ft. corr. metal P. arch culv. 25-in. S. x 16-in. R.....	5.00	5.00	5.00	6.00	4.75	7.00
116 lin. ft. corr. metal P. arch culv. 58-in. S. x 36-in. R.....	22.00	26.00	22.00	26.00	22.00	25.00
172 lin. ft. metal ditch lining Trade No. 18.....	2.00	2.75	3.00	3.00	3.50	3.00
139 lin. ft. relay pipe culverts.....	2.00	2.00	3.00	2.00	2.00	3.00
20,769.4 lb. reinforcing steel.....	.21	.15	.19	.24	.18	.19
149.22 cu. yd. Class "AD" concrete.....	84.00	80.00	80.00	95.00	80.00	80.00
10 ea. traffic control devices.....	25.00	40.00	25.00	40.00	25.00	30.00
10 ea. reflectorized R.R. adv. warning signs.....	75.00	75.00	100.00	25.00	25.00	90.00
8 ea. wood guide posts.....	75.00	50.00	15.00	100.00	100.00	90.00
2 ea. constr. project markers.....	20.00	25.00	25.00	30.00	25.00	25.00
57 ea. constr. r/w monuments.....	5.00	5.00	7.00	6.00	3.00	5.00
600 ton Type "A" stkl. gravel ¾-in. gr.....	.75	1.00	.80	.76	1.00	1.00

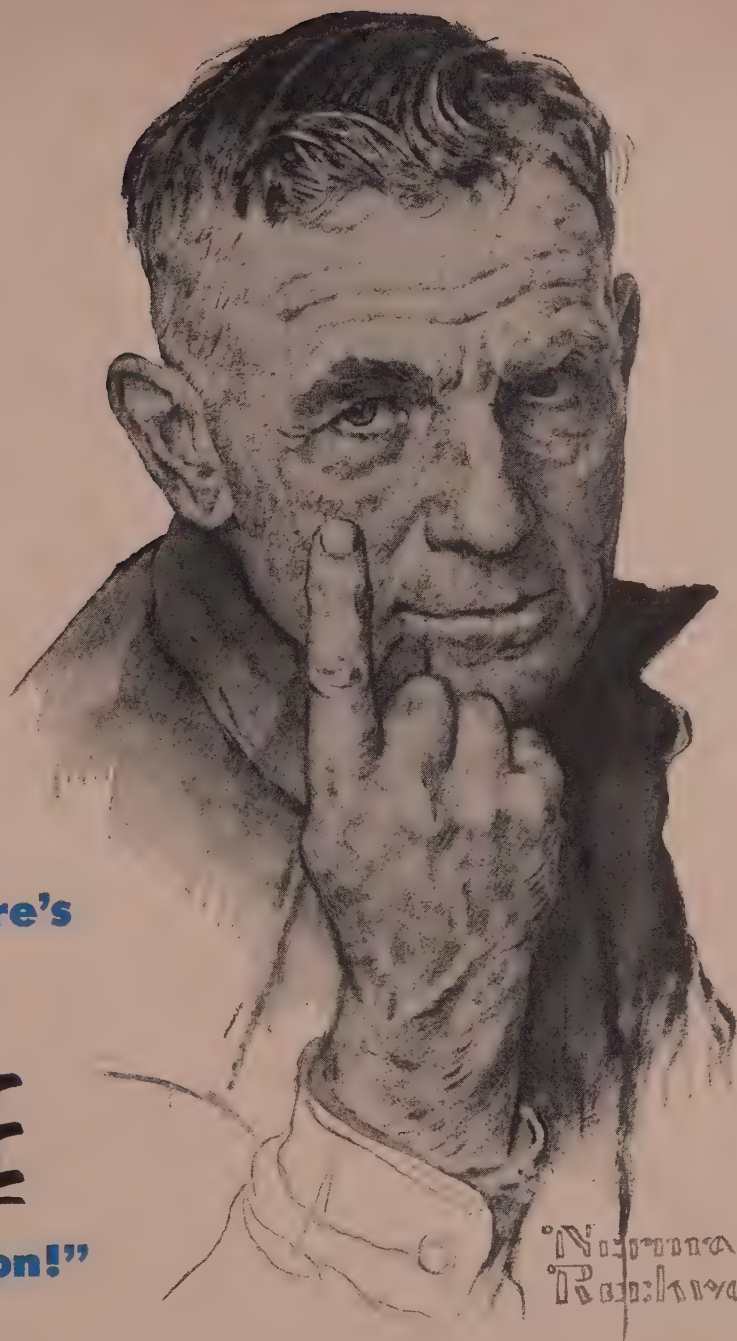
Plant-mix surfacing and concrete slab overcrossing

Washington—Yakima and Benson counties—State. Curtis Gravel Co., Spokane, was awarded a contract by the Washington State Highway Commission on the basis of a low bid of \$529,090 for 7.701 mi. of Secondary State Highway No. 3-A, Byron to Prosser. Work consists of grading, drainage, crushed stone surfacing, bituminous plant-mix, seal coat and a reinforced concrete slab bridge overcrossing. Unit bids submitted were as follows:

(1) Curtis Gravel Co.....	\$529,090	— Nat McDougall Co.....	\$612,668
(2) F. R. Hewett Co.....	551,441	— C. E. Oneal.....	614,650
(3) P. L. Saddler.....	555,361	— Lige Dixon Co.....	626,718
(4) Sather & Sons.....	578,842	— J. N. Conley.....	629,450
(5) Goetz & Brennan.....	583,259	— J. W. Hardison.....	632,005
— Goodfellow Bros., Inc.....	583,582	— Murphy Bros. & Stone & Thaut.....	649,571
— R. A. Heintz Construction Co.....	595,797	— J. A. Teretling & Sons, Inc.....	654,779
— C. & E. Construction Co., Inc.....	598,857	— Newport Construction Co.....	685,459
— Halvorson Construction Co., Inc.....	604,250	— Roy L. Bair & Co.....	1,336,872

	(1)	(2)	(3)	(4)	(5)
Lump sum, clearing and grubbing.....	\$5,000	\$7,500	\$30,000	\$5,000	\$11,500
344,160 cu. yd. common excav. incl. haul of 600 ft.....	.21	.21	.23	.28	.23
171,660 cu. yd. Class A excav. incl. haul of 600 ft.....	.30	.30	.50	.50	.60
3,430 cu. yd. solid rock excav. incl. haul of 600 ft.....	2.00	2.00	1.50	1.25	1.10
4,685 cu. yd. com. trench excav. incl. haul of 600 ft.....	1.00	1.00	1.00	.80	1.00
270 cu. yd. solid rock trench excav., incl. haul of 600 ft.....	5.00	4.00	4.00	2.00	3.00
464,620 cu. yd. stas. overhaul.....	.01	.01	.01	.02	.01
4,568.6 M. cu. yd. stas. overhaul.....	4.00	4.00	3.00	4.00	4.00
3,000 cu. yd. stripping borrow and surf. pit incl. haul.....	.25	.10	.01	.01	.25
2,248 cu. yd. structure excav.....	2.00	2.00	2.00	2.00	2.00
321 days tamping roller.....	40.00	40.00	1.00	1.00	40.00
97 days mechanical tired roller.....	40.00	40.00	1.00	40.00	40.00
29,700 lin. ft. slope treatment Class B.....	.10	.12	.20	.12	.08
453.3 stas. (100 ft.) finishing roadway.....	10.00	12.00	15.00	15.00	6.00
9,900 M. gal. water.....	2.00	1.75	1.50	1.50	2.00
35,625 ton crushed stone surfacing top course.....	1.20	1.45	1.25	1.42	1.25
35,540 ton crushed stone surfacing base course.....	1.20	1.30	1.15	1.37	1.15

(Continued on page 144)



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Norman Rankine

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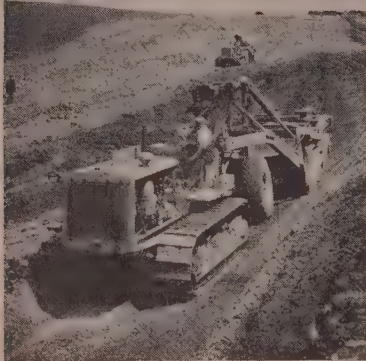
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UNIT BID PRICES . . . CONTINUED

	(1)	(2)	(3)	(4)	(5)
60,015 ton ballast in place	1.20	1.30	1.00	1.15	1.10
13,720 ton cr. stone surfacing top course in stklp.	1.10	1.15	1.00	1.20	1.00

LIGHT BITUMINOUS SURFACE TREATMENT—METHOD A

8.7 mi. preparation, construction, finishing	255.00	300.00	200.00	255.00	255.00
308 ton asphalt cement MC-3	43.75	45.00	43.00	43.75	43.75
4,150 ton crushed cover stone in stockpile	1.00	1.20	1.00	1.20	1.00
2,900 cu. yd. placing cr. cover stone from stklp.	1.60	1.50	1.25	1.60	1.60

MINERAL AGGREGATE FOR NON-SKID SINGLE SEAL TREATMENT SCHEDULE A IN STOCKPILE

3,600 ton crse. cr. screenings 3/4-in. - 1/4-in. in stklp.	1.20	1.30	1.25	1.25	1.25
1,000 ton fine cr. screenings 1/4-in. - 0 in stklp.	1.20	1.30	1.25	1.25	1.25

MINERAL AGGREGATE FOR BITUMINOUS SURFACE TREATMENT PLANT MIX TYPE F IN STOCKPILE

8,550 ton mineral aggregate 3/4-in. - 1/4-in. in stklp.	1.20	1.30	1.25	1.25	1.25
8,550 ton mineral aggregate 1/4-in. - 0 in stklp.	1.20	1.30	1.25	1.25	1.25

OTHER ITEMS

70 only precast white reflecting traffic buttons.....	5.00	4.00	25.00	5.00	4.00
36.0 cu. yd. concrete Class A	90.00	59.50	75.00	80.00	60.00
28.5 cu. yd. concrete Class B	85.00	118.00	85.00	80.00	90.00
91.5 cu. yd. concrete Class C	45.00	36.00	75.00	80.00	75.00
5,785 lb. steel reinforcing bars	1.15	.16	.12	.20	.13
84 lin. ft. special conc. irrigation pipe 4-in. diam.	1.00	.50	1.00	1.00	.60
946 lin. ft. special conc. irrigation pipe 6-in. diam.	1.00	1.00	1.00	1.10	.70
865 lin. ft. special conc. irrigation pipe 8-in. diam.	1.25	1.15	1.00	1.20	.80
80 lin. ft. special conc. irrigation pipe 10-in. diam.	1.50	1.30	1.00	1.30	1.00
115 lin. ft. special conc. irrigation pipe 12-in. diam.	2.00	1.60	1.50	1.40	1.20
1,028 lin. ft. spec. conc. irri. pipe 6-in. diam. Type 1	1.00	1.10	2.00	1.00	.80
300 lin. ft. spec. conc. irri. pipe 6-in. diam. Type 2	1.50	2.60	5.00	1.00	1.25
93 lin. ft. plain conc. culvert pipe 12-in. diam.	2.00	1.90	2.50	2.00	1.50
99 lin. ft. plain conc. culvert pipe 18-in. diam.	3.40	2.50	4.00	2.80	3.00
315 lin. ft. std. reinf. conc. culv. pipe 18-in. diam.	4.00	3.80	4.00	3.50	3.50
612 lin. ft. std. reinf. conc. culvert pipe 24-in. diam.	6.50	5.00	6.00	5.00	5.50
1,968 lin. ft. std. reinf. conc. culvert pipe 36-in. diam.	10.00	10.00	10.00	9.00	10.00
76 lin. ft. plain corr. metal pipe 8-in. diam.	2.00	2.00	3.00	1.80	2.50
154 lin. ft. plain corr. metal culv. pipe 48-in diam. No. 12 gauge	15.00	14.00	16.00	15.00	18.00
24 lin. ft. asbestos bonded corr. metal culv. pipe 48-in. diam. No. 10 gauge (jacking meth.)	40.00	40.00	50.00	50.00	35.00
363 lin. ft. half round plain corr. metal spillway 36-in. diam. No. 12 gauge	6.50	6.00	7.00	7.00	7.00
416 lin. ft. half round plain corr. metal spillway 48-in. diam. No. 12 gauge	8.50	8.00	10.00	12.00	10.00
3 only distribution gate—lock and handle 6-in.	15.00	15.00	75.00	30.00	20.00
1 only distribution gate—lock and handle 10-in.	20.00	25.00	80.00	30.00	25.00
86 lin. ft. relaying galv. iron pipe 1 1/4-in. diam.	1.00	1.00	1.00	.50	.50
2 only removing cone. weir box	30.00	35.00	50.00	50.00	5.00
0.7 mi. scarifying existing oiled roadway	400.00	100.00	220.00	300.00	500.00
68 only reinf. conc. right-of-way markers	5.00	10.00	6.00	5.00	6.00
28 only monument case and cover	30.00	60.00	50.00	35.00	30.00
5 cu. yd. hand placed riprap	20.00	25.00	30.00	10.00	25.00
2 only reflector units	25.00	35.00	25.00	25.00	10.00

REINF. CONC. SLAB BRIDGE OVERCROSSING

310 cu. yd. structure excav.	4.00	1.50	2.00	5.00	4.00
265 cu. yd. concrete Class A	59.00	62.00	68.00	60.00	62.50
38 cu. yd. concrete Class B	59.00	45.00	52.00	60.00	45.00
205 lin. ft. reinf. conc. bridge railing	8.50	8.50	9.50	10.00	9.50
62,000 lb. steel reinf. bars	1.15	.12	.12	.14	.11
4 only bridge drains	45.00	70.00	75.00	60.00	70.00
40 lin. ft. downspouts	3.00	6.00	8.00	5.00	6.00

Canal

Concrete-lined Chandler power canal

Washington—Yakima Project—USBR. J. A. Terteling & Sons, Inc., of Boise, Idaho, submitted the low bid of \$1,613,278 before the Bureau of Reclamation for construction of 7.6 mi. of the Chandler power canal. Work includes earthwork, concrete canal lining, structures, pipe and box culvert, and 13 timber bridges. Location is about 9 mi. from Prosser. The canal is to be constructed from Prosser power plant to Chandler power plant, and its capacity will be 1,500 cfs. Unit bids submitted were as follows:

(1) J. A. Terteling & Sons, Inc.	\$1,613,278	(5) C. J. Montag & Sons	\$1,936,609
(2) Peter Kiewit Sons' Co.	1,746,386	— Long Construction Co.	2,062,780
(3) Osberg Construction Co.	1,832,349	(6) Engineer's estimate	2,038,791
(4) Morrison-Knudsen Co., Inc.	1,856,826		

	(1)	(2)	(3)	(4)	(5)	(6)
432,000 cu. yd. excav., common, for canal	.67	.32	.25	.36	.73	.32
8,500 cu. yd. excav., common, for flume	1.22	.75	.50	.65	1.07	.60
182,100 cu. yd. excav., rock, for canal	.67	1.00	1.30	1.30	.73	1.50
33,900 cu. yd. excav., rock, for flume	1.22	1.80	1.50	2.00	1.07	2.00
2,300 cu. yd. excav., common, for drain. chans. and ditches	.41	.35	1.50	.70	.40	.30
100 cu. yd. excav., rock, for drainage chans. and ditches	2.75	5.00	25.00	3.75	5.00	2.00
40,000 cu. yd. excavation from borrow	.25	.35	.40	.26	.35	.40
30,000 cu. yd. fill at top of canal lining	.35	.40	.30	.30	.40	.50
166,000 cu. yd. compacting embankment	.19	.30	.30	.50	.23	.35
4,250 cu. yd. fill at top of canal lining	1.35	.90	.30	3.80	1.00	1.00
2,300 cu. yd. excavation, common, for structs.	1.15	2.00	2.50	1.40	2.00	1.25
1,400 cu. yd. excavation, rock, for structs.	4.10	6.50	20.00	4.00	5.00	3.50
105,000 sq. yd. preparing rock foundations for conc. canal lining	.82	1.20	1.25	1.57	1.25	1.50
157,000 sq. yd. trimming earth foundations for conc. canal lining	.45	.53	.65	.82	.60	.65

UNIT BID PRICES... CONTINUED

	(1)	(2)	(3)	(4)	(5)	(6)
8,600 cu. yd. backfill about structures	.34	1.10	1.00	.80	1.00	.60
2,500 cu. yd. compacting backfill about struct.	5.00	4.25	3.00	4.30	2.25	3.00
270 cu. yd. riprap	4.75	10.00	7.00	5.50	4.00	7.00
70 cu. yd. gravel bedding for riprap	3.45	6.00	5.00	5.25	5.00	6.00
640 cu. yd. concrete in structs.	69.00	85.00	65.00	66.00	60.00	75.00
1,930 cu. yd. concrete in flume and transitions	41.50	50.00	45.00	44.00	44.00	50.00
28,700 cu. yd. concrete in canal lining	12.40	15.30	16.00	13.80	20.00	21.00
46,900 bbl. furnishing and handling cement	5.50	5.85	6.50	5.00	5.50	5.50
338,000 lb. furn. and placing reinf. bars	.14	.12	.14	.145	.145	.16
40 sq. ft. furn. and placing 1/4-in. elastic filler in joints	3.75	2.50	2.50	3.50	1.00	2.00
1,840 lin. ft. placing 6-in. rubber water stops in jts.	.60	1.50	.75	1.60	1.50	1.50
125 M.b.m. furn. and erecting untr. timber in bridges	225.00	290.00	210.00	310.00	285.00	275.00
71 M.b.m. furn. and erect. tr. timber in bridges	715.00	630.00	700.00	645.00	572.00	390.00
4,000 sq. ft. furn. and plac. asph. plank on bridge floors	1.05	1.00	1.50	1.10	1.40	1.15
55,000 lb. furn. and install. metal pipe for irriga. and domestic water crossings	.35	.30	.40	.50	.30	.45
112 lin. ft. furn. and laying 36-in. diam. conc. pipe	13.80	12.50	16.00	15.00	10.00	13.00
260 lin. ft. furn. and laying 12-in. diam. corr. metal pipe	3.65	4.00	3.50	4.30	2.50	3.50
26 lin. ft. furn. and laying 18-in. diam. corr. metal pipe	4.15	5.50	5.00	6.30	4.00	5.00
26 lin. ft. furn. and laying 24-in. diam. corr. metal pipe	6.35	8.00	7.00	9.30	7.00	7.50
3,150 lin. ft. furn. matls. and constr. 6-in. diam. underdrains with uncem. joints	1.90	2.00	2.00	2.00	1.00	3.00
770 lin. ft. furn. and laying 6-in. diam. drain pipe with cem. joints for outlet drains	1.55	2.00	2.00	1.30	1.00	2.00
18,000 lb. furn. and installing miscl. metalwork	.56	.65	.50	.67	.50	.60

Dam

Small earth fill dam in New Mexico

New Mexico—Rio Grande Project—USBR. Pecos Valley Construction Co. of Carlsbad submitted a low bid of \$66,278 for the earth fill North Branch Dam, located on Picacho Arroyo, about 5 mi. north-west of Las Cruces. Unit bids submitted were as follows:

(1) Pecos Valley Construction Co.	\$ 66,278	—	Armstrong & Armstrong	\$104,944
(2) E. M. Silver	84,052	—	Allison & Haney	107,688
(3) Floyd Haake	86,779	—	Owl Truck & Construction Co.	108,566
(4) O. D. Cowart	92,656	—	Boone Contracting Co.	123,443
(5) T. J. Martin	95,476	—	Boone Contracting Co.	135,485
— Laren D. Morrill	103,973	(6) Engineer's estimate		113,200

	(1)	(2)	(3)	(4)	(5)	(6)
10,100 cu. yd. excavation for spillway	.25	.27	.33	.22	.30	.25
8,700 cu. yd. excavation for foundation of dam	.25	.26	.18	.50	.26	.40
25 cu. yd. gravel blanket	3.00	5.00	6.00	10.00	10.00	4.00
65 cu. yd. riprap	6.00	10.00	10.00	18.00	14.50	6.00
76,400 cu. yd. earth fill in dam embankment, Zone 1	.31	.37	.40	.42	.50	.60
170 cu. yd. special compaction of earth fill	3.00	10.00	4.00	8.00	11.00	3.00
78,800 cu. yd. sand and grav. fill in dam emb., Zone 2	.28	.40	.40	.42	.40	.55
135 cu. yd. concrete in outlet works	71.00	80.00	100.00	90.00	90.83	85.00
200 bbl. furn. and handling cement	4.50	7.00	8.00	8.00	5.00	7.00
23,000 lb. furn. and placing reinf. bars	.19	.20	.14	.19	.18	.18

Bridge and Grade Separation

Twin truss span bridges over the Cowlitz River

Washington—Lewis County—State. Peter Kiewit Sons' Co. of Longview was awarded a contract by the Washington State Highway Commission on the basis of a low bid of \$1,049,094 for construction of twin Cowlitz River bridges below Toledo on Primary State Highway No. 1. The structures will be steel truss spans with reinforced concrete girder approaches. Unit bids submitted were as follows:

(1) Peter Kiewit Sons' Co.	\$1,049,094	—	Morrison-Knudsen Co., Inc.	\$1,128,152
(2) C. J. Montag & Sons	1,083,018	—	M. P. Butler	1,129,843
(3) General Construction Co.	1,087,136	—	MacRae Bros.	1,148,948
(4) Guy F. Atkinson Co.	1,113,748	—	Carl M. Halvorson, Inc.	1,158,960
(5) Anderson Farley Co.	1,120,832			

	(1)	(2)	(3)	(4)	(5)
1.18 acres clearing	300.00	300.00	200.00	400.00	300.00
1.00 acre grubbing	200.00	200.00	200.00	300.00	300.00
2,180 cu. yd. common excav. including haul	.75	.50	.55	.35	1.00
10 cu. yd. common trench excav. including haul	5.00	2.00	3.50	4.00	5.00
15 cu. yd. structure excavation	5.00	2.50	6.00	4.00	5.00
1,160 cu. yd. selected roadway borrow	1.75	2.50	2.30	.70	2.00
22.5 day mechanical tamper	50.00	40.00	60.00	80.00	50.00
63 lin. ft. standard reinf. conc. culv. pipe 30-in. diam.	8.00	8.00	13.00	4.00	10.00

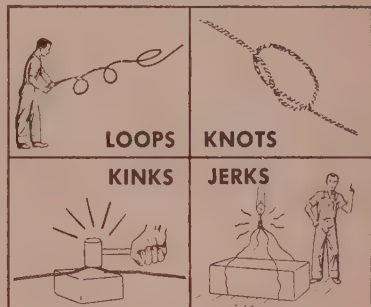
TWIN STEEL TRUSS SPAN BRIDGES WITH REINFORCED CONCRETE GIRDER APPROACHES

	(1)	(2)	(3)	(4)	(5)
6,300 cu. yd. structure excavation	1.00	5.00	3.00	3.50	6.00
Lump sum, shoring and cribs	70,000	120,755	103,000	96,000	95,000
2,200 cu. yd. concrete Class A	65.00	70.00	72.00	80.00	70.00
3,100 cu. yd. concrete Class F	44.00	38.50	30.00	42.00	35.00

(Continued on page 146)



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UNIT BID PRICES... CONTINUED

	(1)	(2)	(3)	(4)	(5)
1,260 cu. yd. concrete Class H	24.00	20.00	25.00	35.00	24.00
1,107 lin. ft. reinforced concrete bridge railing	9.50	8.00	8.00	7.00	10.00
720,000 lb. steel reinforcing bars	.11	.10	.105	.12	.12
3,325,000 lb. structural carbon steel	.207	.20	.21	.19	.12
18 only bridge drains complete	95.00	80.00	80.00	80.00	75.00
16,470 lin. ft. furnishing timber piling (untreated)	.40	.35	.70	.40	.60
549 only driving timber piles untr. first 10 ft. of pene.	43.00	20.00	30.00	50.00	30.00
8,240 lin. ft. driving timber piles untr. beyond first 10 ft. of penetration	.20	.20	.15	.10	.30
10,530 lin. ft. furnishing precast concrete piling	3.30	3.50	3.50	3.30	3.50
351 only driving precast conc. piles first 10 ft. of pene.	40.00	30.00	50.00	48.00	50.00
6,410 lin. ft. driving precast conc. piles beyond first 10 ft. of penetration	.11	.20	.10	.10	.12
3 only furn. and driving untr. timber test piles	750.00	250.00	430.00	600.00	300.00
3 only furn. and driving precast conc. test piles	800.00	500.00	\$1,750	\$1,600	\$1,800
236 lin. ft. waterstop	2.50	2.50	2.00	2.50	2.50

5-span steel girder bridge in Arizona

Arizona—Pinal County—State. Western Constructors, Inc., Phoenix, was low of four bidders with \$124,301 for construction of a 5-span steel girder bridge and approaches crossing Aravaipa Creek. The work is located on State 77 between Winkelman and Mammoth. Unit bids submitted were as follows:

(1) Western Constructors, Inc.	\$124,301	(3) San Xavier Rock & Sand Co.	\$133,854
(2) Vinson Construction Co.	129,977	(4) H. J. Hagen	143,465

	(1)	(2)	(3)	(4)
2,200 cu. yd. roadway excavation	.75	.30	.60	1.00
175 cu. yd. structural excavation	1.75	4.00	3.00	4.00
35,700 cu. yd. borrow (CIP)	.45	.39	.50	.60
Lump sum, provide water supply	\$1,500	\$1,450	\$1,500	500.00
1,450 M. gal. apply water	1.00	1.00	2.50	3.00
325 hr. rolling	7.00	8.00	9.00	8.00
2,200 ton select material (CIP)	.65	1.00	.65	.65
1,500 ton aggregate base (CIP)	1.50	1.00	2.00	2.00
94 ton blotter matl. for bituminous surface treatment (CIP)	6.00	7.00	6.00	4.00
23 ton liquid asph. for bitum. surface treatment (Grade MC-2 or MC-3) (CIP)	50.00	45.00	45.00	50.00
10 ton liquid asph. for bitum. surface treatment (Grade SC-6) (CIP)	48.00	43.00	43.00	50.00
27,000 lb. structural steel (new) (CIP)	.32	.30	.31	.32
149,000 lb. structural steel (used—furnished by State) (CIP)	.12	.12	.12	.125
584 lin. ft. structural steel handrail (CIP)	6.60	8.00	6.80	7.00
223 cu. yd. Class "A" concrete (including cement)	48.00	60.00	60.00	55.00
185 cu. yd. Class "D" concrete (including cement)	59.00	75.00	65.00	60.00
61,000 lb. reinforcing steel (bars) (CIP)	.125	.13	.13	.125
64 lin. ft. 24-in. corr. metal pipe (CIP except excav.)	6.00	7.00	5.50	7.00
80 lin. ft. conc. test piles (steel shell or precast conc. piles) (furnish and deliver)	8.00	6.00	6.50	10.00
960 lin. ft. conc. piles (steel shell or precast conc. piles) (furnish and deliver)	5.70	6.00	6.15	8.00
2,300 lin. ft. steel sheet piles (used) (furnish and deliver)	4.65	5.00	4.50	5.50
2 ea. driving test piles (steel shell or precast conc. piles)	265.00	250.00	170.00	200.00
32 ea. driving piles (steel shells or precast concrete piles)	100.00	145.00	100.00	150.00
92 ea. driving steel sheet piles (used)	50.00	27.00	40.00	55.00
1,040 lin. ft. filling pile shells (concrete and reinf. steel) (this item for cast-in-place piles only)	2.10	4.00	3.10	.10
1,700 lin. ft. road guard (std. C-7) (CIP)	3.50	3.00	3.50	5.00
12 ea. guide posts (std. C-8) (Type B) (CIP)	7.00	6.00	7.00	7.00
4 ea. r/w markers (std. C-1) (Type B or C) (CIP)	8.50	10.00	10.00	30.00
7,000 lin. ft. line fence (std. C-15 or C-16) (CIP)	.22	.25	.25	.25
Lump sum, break up concrete ford (rt. sta. 1712±)	250.00	600.00	700.00	500.00

Water Supply

Ortega and Carpenteria reservoirs and control stations

California—Cachuma Project—USBR. Wonderly Construction Co. of Long Beach submitted a low bid before the Bureau of Reclamation of \$939,003 for Schedule 1, Ortega Reservoir and control station, and Schedule 2, Carpenteria Reservoir and control station. Unit bids submitted were as follows:

	Schedule 1	Schedule 2
(1) Wonderly Construction Co.	\$644,213	\$294,789
(2) Norman I. Fadel	no bid	322,494
(3) Fred J. Early, Jr., Co., Inc., and John Delphia	686,985	393,030
(4) Engineer's estimate	605,211	316,977

	(1)	(3)	(4)
12,800 cu. yd. excavation for control station and pipe trenches	.82	1.40	2.25
900 cu. yd. excavation for roadway	.89	1.25	1.10
155,000 cu. yd. excav. for reservoir and transport'n to embank., Zone 1	.57	.40	.55
133,100 cu. yd. earthfill in reservoir embankment, Zone 1	.879	.24	.30
20 cu. yd. special compaction of earthfill in reservoir embankment	2.50	9.50	4.00
5,500 cu. yd. backfill	.447	1.00	.75
4,000 cu. yd. compacting backfill	3.54	3.50	3.50
350 cu. yd. selected roadway surfacing	6.37	7.00	3.00
5,400 sq. yd. gravel base course	1.00	2.00	1.00
11 ton liquid asphalt, SC-2, for penetration treatment	29.82	42.00	40.00
9.3 ton asphaltic emulsion for seal coat	30.21	52.00	45.00
37 cu. yd. stone chips for seal coat	7.46	14.00	8.00
20 ton furn. plant-mixed bituminous material for dikes	5.65	12.00	10.00
520 lin. ft. constructing dikes	.292	1.75	1.00
70 sq. yd. dry-rock paving	4.66	8.50	7.00
6,000 cu. yd. topsoil for planting	2.00	1.45	1.00
15 ton mulching topsoil areas	166.67	165.00	60.00
80,000 cutting ice plant (mesembryanthemum edule) cuttings	.05	.07	.05
213 M. gal water for planted areas	11.00	11.00	8.00

	(1)	(3)	(4)
8,000 lin. ft. furn. matls. and constr. graded sand and gravel drains without sewer pipe	.563	1.10	.50
1,120 lin. ft. furn. matls. and constr. graded sand and gravel drains with 4-in. sewer pipe	1.62 ^a	2.20	1.50
1,170 lin. ft. furn. matls. and constr. graded sand and gravel drains with 8-in. sewer pipe	2.31	3.30	2.00
500 lin. ft. furn. matls. and constr. embankment toe drains with 8-in. sewer pipe	1.70	8.50	3.00
870 lin. ft. furn. and laying 8-in. sewer pipe with cemented joints.....	2.12	3.80	2.00
50 lin. ft. furn. and laying 18-in. sewer pipe with cemented joints.....	7.06	16.00	6.00
470 cu. yd. concrete in structures	65.10	80.00	65.00
2,460 cu. yd. concrete in Ortega Reservoir lining and paved gutter.....	30.24	41.00	35.00
95 cu. yd. concrete in parapet wall	65.10	100.00	65.00
80 cu. yd. concrete encasement of inlet-outlet pipe	26.48	40.00	15.00
4,770 bbl. furnishing and handling cement	5.24	5.30	5.50
277,000 lb. furnishing and placing reinf. bars	.1317	.16	.15
6,150 sq. ft. furnishing and placing elastic joint-filler material	1.38	2.10	1.80
14,700 lin. ft. placing rubber water stop	.254	2.75	1.25
Lump sum, constructing Ortega chlorination house superstructure	\$14,221	\$20,500	\$17,500
0.8 M.b.m. furnishing and erecting timber	260.00	650.00	350.00
480 lin. ft. furn. and laying concrete pipe, symbol B18NC	7.35	12.00	8.50
230 lin. ft. furn. and laying concrete pipe, symbol B24NC	10.70	15.00	11.50
150 lin. ft. furn. and laying concrete pipe, symbol D30NC25	14.73	20.00	16.20
265 lin. ft. furn. and laying concrete pipe, symbol E30NC25	15.46	21.00	17.00
290 lin. ft. furn. and laying concrete pipe, symbol B30NC40	14.63	21.00	16.00
60 lin. ft. furn. and laying concrete pipe, symbol C30NC40	15.53	21.00	17.25
225 lin. ft. chain-link fence at control station	4.15	6.00	5.00
2,400 lin. ft. chain-link fence at reservoir	1.89	2.20	4.00
150 lin. ft. furn. and laying 16-ga. 6-in. diam. corru.-metal pipe.....	1.62	3.20	2.50
2 assemb. furn. and placing roadway drain assemblies	38.00	44.00	50.00
180 lin. ft. furn. and laying 18-in. diam. corru.-metal pipe.....	3.58	6.50	5.00
1,650 lin. ft. furn. and installing rodent guards	4.60	2.70	1.75
3,800 lb. furn. and laying 4-in. cast-iron soil pipe	.445	.45	.35
1,500 lb. furn. and erecting 8-in. and 12-in. flanged cast-iron pipe.....	.205	.25	.30
3,000 lb. furn. and installing miscel. steel pipe	.676	.75	.60
2,700 lb. furn. and installing miscel. metalwork	.58	.60	.60
1 valve furn. and installing 8-in. gate valve	183.00	225.00	200.00
Lump sum, furn. and installing slide gates and gate lift	\$1,474	\$2,300	\$2,500
2 installation furn. and installing cast-iron frame and gratings for catch basins	75.00	150.00	100.00
Lump sum, furn. and installing regulating valves for control station.....	\$56,731	\$59,000	\$50,000
Lump sum, furn. and installing regulating pipe for control station.....	\$27,076	\$43,000	\$20,000
Lump sum, furn. and installing venturi meters and rate of flow controllers for control station	\$33,195	\$36,000	\$30,000
Lump sum, furn. and installing inlet-outlet screen and control station metalwork	\$8,763	\$8,000	\$9,000
Lump sum, installing chlorination equipment	283.00	\$2,700	\$3,500
Lump sum, furn. and installing metal pipe, fittings, supports, and valves for chlorination piping	\$1,436	\$3,800	\$2,000
Lump sum, furn. and installing trolley hoist and lifting beam	\$1,090	900.00	700.00

SCHEDULE 2

	(1)	(2)	(3)	(4)
3,800 cu. yd. excav. for control station and pipe trenches	.82	1.00	1.90	1.75
12,300 cu. yd. excav. for reservoir and transport'n to emb., Zone 2	.65	1.00	.40	.60
29,000 cu. yd. excav. for reservoir separation, and transport'n to embankment, Zone 1 and Zone 3	.735	1.00	1.60	.90
23,000 cu. yd. earthfill in reservoir embankment, Zone 1	1.05	.30	.24	.30
11,700 cu. yd. dumped fill in reservoir embankment, Zone 2	.197	.30	.12	.20
4,000 cu. yd. rock fill in reservoir embankment, Zone 3	.262	.50	.18	.25
400 cu. yd. special compaction of earthfill in reservoir embank.	2.50	4.00	10.00	4.00
1,100 lin. ft. removal of existing 4-in. steel pipe with steel risers.....	.48	1.00	2.60	1.00
585 lin. ft. removal of existing 6-in. steel irrigation main	.25	1.00	2.60	1.50
215 lin. ft. removal of exist. 14-in. conc. drain with catch basins	.70	2.00	2.60	3.00
2,700 cu. yd. backfill	.447	.50	1.00	.75
1,700 cu. yd. compacting backfill	3.54	3.00	3.50	3.50
550 sq. yd. gravel or crushed-rock surfacing	.56	1.00	1.50	3.00
3,140 sq. yd. gravel base course	1.00	1.00	2.00	1.00
6 ton liquid asphalt SC-2 for penetration treatment	29.82	50.00	42.00	40.00
5 ton asphaltic emulsion for seal coat	30.21	50.00	52.00	45.00
21 cu. yd. stone chips for seal coat	7.46	10.00	14.00	8.00
50 ton furn. plant-mixed bituminous matl. for dikes	5.85	8.00	12.00	10.00
1,350 lin. ft. constructing dikes	.292	1.00	1.70	1.00
2,420 lin. ft. furn. matls. and constr. graded sand and gravel drains without sewer pipe	.563	.70	1.10	.50
1,500 lin. ft. furn. matls. and constr. graded sand and gravel drains with 4-in. sewer pipe	1.62	1.70	2.30	1.50
1,000 lin. ft. furn. matls. and constr. graded sand and gravel drains with 6-in. sewer pipe	1.96	2.50	3.30	1.75
300 cu. yd. concrete in structures	65.73	75.00	80.00	65.00
1,620 cu. yd. concrete in Carpinteria Reservoir lining	30.85	29.00	40.00	35.00
80 cu. yd. concrete in parapet wall	65.73	75.00	100.00	65.00
8 cu. yd. concrete encasement of inlet-outlet pipe	27.00	30.00	40.00	45.00
3,050 bbl. furnishing and handling cement	5.24	5.00	5.30	5.50
193,000 lb. furnishing and placing reinforcement bars	.1317	.14	.16	.15
3,360 sq. ft. furnishing and placing elastic joint-filler material	1.35	1.00	1.80	1.80
6,190 lin. ft. placing rubber water stop	.254	2.00	2.30	1.25
Lump sum, constructing Carpinteria chlorination house superstruct.	\$14,100	\$18,000	\$19,100	\$17,500
0.2 M.b.m. furnishing and erecting timber	260.00	350.00	600.00	350.00
235 lin. ft. furnishing and laying concrete pipe, symbol D18NC	7.35	18.00	12.00	9.00
52 lin. ft. furnishing and laying concrete pipe, symbol D24NC25	11.80	25.00	18.00	14.00
46 lin. ft. furnishing and laying concrete pipe, symbol E24NC25	11.00	35.00	17.00	12.50
14,25 lin. ft. furnishing and erecting 54-in. diam. concrete pipe.....	28.70	30.00	40.00	36.00
38 lin. ft. chain-link fence at control station	2.88	6.00	4.00	5.00
2,070 lin. ft. chain-link fence at reservoir	2.00	2.20	2.30	4.00
216 lin. ft. furn. and laying 16-ga., 6-in. diam. corru.-metal pipe	1.62	3.00	3.20	2.50
3 assembly furn. and placing roadway drain assemblies	37.00	100.00	44.00	50.00
1,300 lin. ft. furnishing and installing rodent guards	4.85	2.20	2.70	1.75
1,600 lb. furnishing and laying 4-in. cast-iron soil pipe	.445	.50	.45	.35
11,000 lb. furnishing and laying 8-in. cast-iron soil pipe	.485	.35	.25	.35
200 lb. furnishing and installing miscel. steel pipe	.70	.50	.50	.60
700 lb. furnishing and installing miscel. metalwork	.58	.50	.60	.60
1 valve furnishing and installing 8-in. gate valve	183.00	600.00	225.00	200.00
890 lin. ft. furnishing and laying 6-in. steel irrigation pipe	2.50	3.00	4.50	2.00
Lump sum, furn. and installing regulating valves for control station.....	\$16,600	\$8,000	\$19,000	\$15,000
Lump sum, furn. and installing slide gate and gate lift	\$1,473	\$3,500	\$2,300	\$2,500
Lump sum, furnishing and installing regulating piping for control sta.	\$11,529	\$15,000	\$20,000	\$7,500
Lump sum, furnishing and installing venturi meter and rate of flow controllers for control station	\$13,976	\$16,600	\$16,000	\$15,000
Lump sum, furnishing and installing inlet-outlet screen and control station metalwork	\$9,163	\$13,000	\$13,000	\$15,000
Lump sum, installing chlorination equipment	230.00	\$5,000	\$2,700	\$3,000
Lump sum, furnishing and installing metal pipe, fittings, supports, and valves for chlorination piping	\$1,659	\$3,200	\$3,800	\$2,000
Lump sum, furnishing and installing trolley hoist and lifting beam.....	\$1,018	\$1,250	900.00	700.00

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NEW LITERATURE

301

Steam generators

An unusual application of steam generators is outlined in a folder offered by **Malsbary Manufacturing Co.** Describing the experience of Acme Concrete Products, who installed a Malsbary steam generator to air cure aggregate blocks, the folder shows by charts the kiln type with approximate cost of steam generator, and cost of steam curing per thousand. Complete specifications are given for both gas-fired and oil-fired generators.

302

Quick-lock hose couplings

Hose Accessories Co. has an 8-page bulletin on its Quick-Lock hose couplings and fittings which can be coupled and uncoupled in a half second or less and work well on air, water, gas, oil, hydraulic or steam lines. In addition to data on this type, the bulletin also gives a handy selection chart for other couplings.

303

Catalog available on Berger instrument line

C. L. Berger & Sons offer a catalog on their precision built engineering, surveying and mining instruments. Among the various instruments illustrated are engineers' and mining transits, levels, theodolites, collimators, and alidades.

304

Fifty years of power transmission cited

A half century of steady development in the field of power transmission is described in the golden anniversary publication of its house magazine by **Fuller Manufacturing Co.** Yesterday and today in motor trucks, mobile machines and highways are depicted in clever drawings and photographs in this attractive book. Fuller's part in providing power transmission to many on-highway and off-highway applications is told in interesting picture-stories from dozens of actual work reports drawn from logging, construction, mining, materials handling and leading heavy equipment manufacturing plants.

305

ABC guide to hydraulic power transmission

To help both the user and manufacturer of powered equipment to better understand the application of hydraulic couplings and torque converters, **Twin Disc Clutch Co.** is offering a 32-page special issue of their com-

pany's magazine. This illustrated, easy-to-read publication explains where couplings or torque converters should be used and furnishes a source of clearly explained facts on the subject of hydraulic transmission of power.

306

Parson trenchliner described

Parson Co.'s improved model 250 trenchliner is fully described in a 16-page catalog KP 352 issued by the manufacturer. Attractively illustrated, the booklet shows in detail some of the exclusive features that make this trenchliner a heavy duty producer in municipal and utility construction projects.

307

Coal tar tape described

The advantages of coal tar protection, in handy tape form, is described in a booklet released by **Tapecoat Co.** Based on the manufacturer's experience in serving the gas and oil fields, water and sewage, and industrial applications, the booklet presents practical suggestions on combating corrosion.

308

Link-Belt gear booklet

Full page, cross-sectional views show in detail the design and construction features of both double and triple reduction helical gear drives in a booklet (No. 2451) released by **Link-Belt Co.** All factors governing correct selection, such as horsepower ratings, various drives, etc., are shown in tabular form. Load classes for 170 types of machines, arranged alphabetically, are also tabulated.

309

Clay tile adhesive data

Use of adhesives in installing clay floor and wall tile is given industry-wide recognition by clay tile manufacturers in a specification book K-400 now released by the **Tile Council of America.** Resumé of existing practices in tilework installation by thin setting bed methods, obtained by a country-wide survey, and detailed specifications for this type of work are given.

310

Pipeline wrap

Johns-Manville has issued a folder on its recently developed cold applied pipeline wrap for underground gas and oil pipeline protection. This folder is designed to be a source of ready reference data for engineers and contractors engaged in this type of work.

311

Job pictures on pipelining

Latest addition to the series of **Caterpillar Tractor** booklets on specialized phases of construction work is this one titled "Pipelining on Schedule." Illustrations tell the story of Caterpillar electric sets and powered cranes, shovels, ditchers and compressors proving their worth on pipeline jobs. No. 30579.

312

Unusual manual on power shovel and cranes

A series of eight articles discussing the use and application of power cranes and shovels has been compiled under one cover and made available by the **Koehring Co.** In addition to a detailed discussion of the basic principles of such equipment, complete information is given on how to choose the proper size excavator; bucket, dipper sizes and hourly capacity; profitable crane and shovel ownership; safety considerations with excavators; operation of shovels and hoes, cranes, draglines and clamshells; and excavator operating costs. This is a handy reference manual for excavator owners or operators.

313

Concrete bar chart

A feature of this folder offered by **Columbia-Geneva Steel Division of United States Steel** on Di-Lok concrete reinforcing bars is the convenient file-size detail chart. The chart gives nominal dimensions, areas of bars per foot for various spacing, and areas of different quantities of bars.

314

Panel construction details

Available from **Symons Clamp & Mfg. Co.** are new data sheets covering its high strength panel form, light construction panel forms and all wood panel forms. Each sheet gives exact measurements of the three panels and includes step-by-step construction procedure.

315

Steel sheeting booklet

Two types of steel sheeting, flange and interlocking, are described in a folder issued by **Armco Drainage & Metal Products.** Telling how sheeting may be used to control soil or water, the folder includes installation pictures and a table of properties and weights.

316

Installation data on fiberglass roof insulation

Of interest to building contractors and architects will be the more than 40 photographs of outstanding installations of Fiberglass roof insulation contained in a folder offered by **Owens-Corning Fiberglas Corp.** More than 350 outstanding jobs along

with the names of architects, general and roofing contractors are also listed. General information on this type of roof insulation includes thermal conductance data and application directions.

363

Hardsurfacing comparison chart

A bulletin listing the leading manufacturers of hardsurfacing welding rods, and the specific rod recommended for various requirements has been published by **Rankin Manufacturing Co.**, producers of Ranite welding materials. Pertinent information such as approximate melting points of various materials, SAE steels numbering system, and a job estimating table, make this a handy reference guide.

364

Portable batching plants

General information on the new 30-45 ton portable batching plants manufactured by **Heltzel Steel Form and Iron Co.** is given in a bulletin offered by the company. Particularly designed for over-the-highway portability without requiring special permit, the batchers are made with either two or three compartments.

365

Sealing sewer joints

Philip Carey Mfg. Co. is offering a folder describing the various uses of the improved Sewertite Joint Compound. A 4-step pictorial explanation of how to apply the compound and a table of quantities required for bell

and spigot joints and tongue and groove pipes are included.

366

New portable pump info

Carver Pump Co.'s latest addition to its line of self-priming centrifugal pumps is described in a bulletin on the 1½-in. model. Complete specifications are given for the gasoline engine driven pump which handles 6,000 gph., weighs only 55 lb., and can easily be carried to the construction site.

367

Web steel joist manual offered

Latest edition of the design manual for open web steel joist construction, prepared by the **Steel Joist Institute**, is now available. In addition to the standard specification for such construction, the manual includes safe load tables per linear foot of joist as well as per square of floor or roof area. Full page tables show dimensions, sections and properties of all Institute approved joists, recommended building code regulations, code of standard practice and recommendations for handling and erection.

368

Link-Belt offers catalog on ½-yd. shovel-cranes

This fully illustrated catalog (2428) covers **Link-Belt Speeder's** complete line of ½-yd. shovel-cranes, including the firm's crawler, truck and wheel-mounted models. Comprehensive data are given for both the upper and lower mechanisms of each model and

the full convertibility of the series is described. A detailed section shows the operation, features and advantages of "Speed-o-Matic" controls, the power driven hydraulic control system.

369

How to splice wire rope

Working on the theory that a picture is as good as 100 words, **Bethlehem Pacific Coast Steel Corp.** offers a booklet showing how to splice its 6x19 class can conveyor rope. Photographs show the step-by-step methods used by a splicing specialist as he does the work.

370

Hauls anything that "flows"

Originally used for hauling centrally-mixed concrete, the **Dumpcrete** will haul and place anything that "flows" according to this folder offered by **Maxon Construction Co.** The unit is illustrated working with a variety of materials and additional pictures show the special mountings which enable it to perform difficult dumping jobs.

371

Portable gasoline hammer featured in bulletin

"A profitable tool with many uses" is the key line of a bulletin (613) issued by **Barco Manufacturing Co.** describing applications for its portable gasoline powered hammers in the utility, mining, and general construction fields. The illustrated booklet shows use of hammer on various projects and the accessories available.

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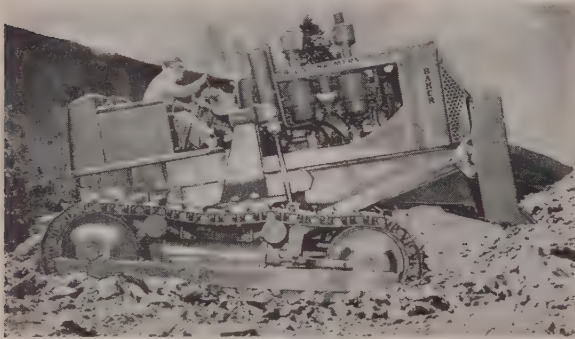
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More information on any of the items in this section may be obtained by using coupon on page 149.

317

A bigger and stronger no-pushbeam dozer on the market

Following the successful development of the 9X, the first big "no pushbeam" bulldozer, **Baker Manufacturing Co.** in cooperation with Allis-Chalmers tractor engineers has made the new Baker 15X. The powerful Hydraulic



No-Pushbeam Bulldozer is mounted on the big HD-15 crawler tractor and is adaptable to all types of excavating and construction work. Its blade is only 96 in. wide but 15 in. high for big yardage capacity. The 96-in. width permits the machine to travel over highways without special permits.

Development of this unique lifting mechanism enables the 15X to exert much more of the tractor's weight and engine hp. into positive down pressure for a faster, surer blade bite 15½ in. below ground, and a quicker blade response to a height of 39½ in. above ground.

318

30-ton Lorain Moto-Crane travels over soft ground and rough terrain

Additional crane capacity selection has been added to the Lorain line of cranes on rubber with the introduction of Lorain Moto-Crane Model MC-524 and Lorain Self-Propelled Model SP-524, both with 30-ton lifting capacity.



Both have a 30-ton capacity turntable mounted on a three-axle carrier and are powered either by gasoline or diesel.

Moto-Crane can travel up to 30 mph. over the highway and can also move over soft ground and rough terrain. Air brakes and air assist steering are standard equipment. It is convertible to shovel, crane, clamshell, dragline or hoe and is rated in the 1 cu. yd. class as a shovel. The self-propelled model, built for more limited travel, is available as a crane and dragline only. Both machines are equipped with bigger crane booms of sturdier construction that can be extended to 100 ft. in length and to which can be added a 25-ft. tip extension. The new boom is approximately ⅓ wider and ⅓ deeper in cross section than previous booms in the same models, and it is of all-welded construction with pin-connected sections. Manufactured by **Thew Shovel Co.**

319

Pneumatractor with Sky Lift makes aerial work easy

A recent adaptation of the Pneumatractor, manufactured by **Schramm, Inc.**, is the Sky Lift, a man-carrying mechanism consisting of one or two crow's nests mounted



on a rotatable articulated boom and controlled either at the crow's nest or at ground level for elevation, extension and rotation. It is said to form a safe and compact mechanism for all types of aerial work, including public utility work, spray painting and sand blasting. An air hose installation inside the boom provides air for compressed air tools. The crow's nest has a load capacity of 500 lb., and working reach is 28 ft. from the center of the turret and working height from the ground is 37 ft.

320

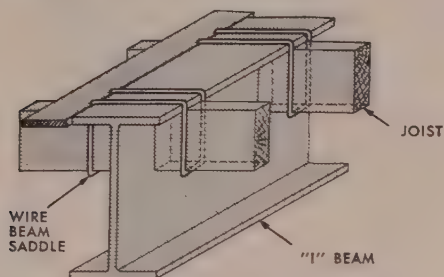
Low-cost compressor designed for fuel economy

The most recent addition to **Schramm, Inc.**'s line of compressors is designed for users where initial cost and fuel economy is an essential factor. Designated the Schramm Dezoil 210-cfm. Portable Engine Driven Compressor, it differs from the gasoline units only in that the diesel fuel is injected into the cylinder by the American Bosch injection system. Bosch magneto is used for ignition. Moreover, fuel savings up to 50% are made possible by use of the Pneumastat, a control which operates the compressor continuously from part capacity to full capacity without loading or unloading. Another big economy factor is the fact that up to 90% of the compressor parts are interchangeable with the engine, requiring very little

4 easy ways to hang forms

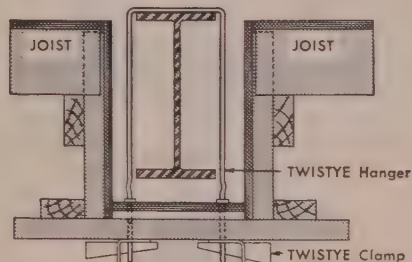
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Eliminate Costly Shoring and Falsework



1

Wire Beam Saddles—For non-fireproofed construction . . . bridges, overpasses, etc. Saddles are accurately made to insure correct relationship between deck form and beam flange.

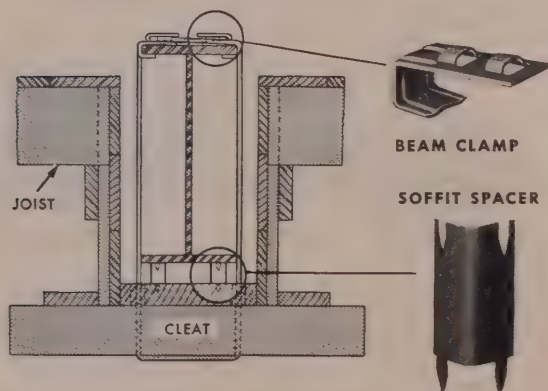


2

TWISTYE Hangers—For fireproofed construction . . . accurately fabricated to provide a positive spreader . . . guaranteed breakback . . . easy installation, quick removal.

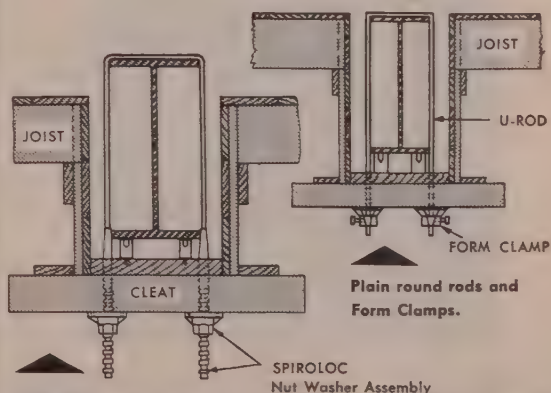
3

Beam Clamps with Band Iron and Soffit Spacers—For fireproofed construction . . . Beam Clamp has a double grip on Band Iron which develops the band's full strength. Soffit Spacers act as spreaders. Installed from above . . . no scaffolding necessary.



4

"U" Bolts—For fireproofed construction. Recommended where hangers must carry heavy loads.



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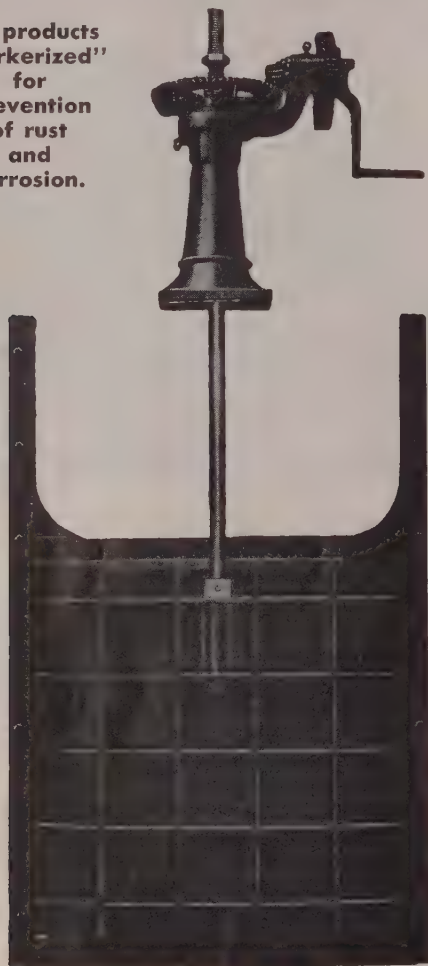
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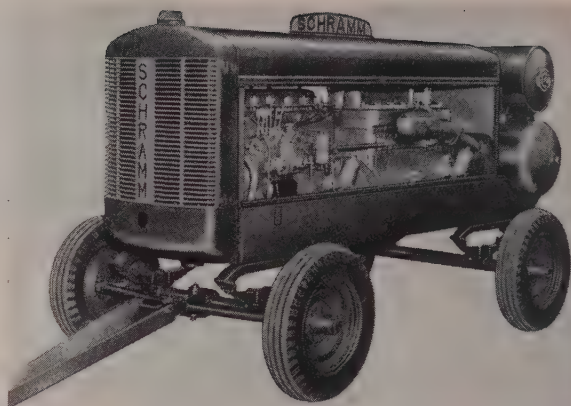
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service or large investment in parts. The engine is also built in size for operating the Model 105 Pneumatractor and the Model 105 Pneumapower Compressors.

321

Galion's new grader— big jobs at half initial cost

Galion Model 503 Motor Grader is a sturdy machine designed and built like big graders for big jobs but its price is tagged at half the cost. Powered by a 40-hp. gasoline engine, the grader tips the scales at 8,720 lb., and exerts a blade pressure of 4,975 lb.—both without extras. Among



Hydraulic Shiftable Moldboard



Removable
Cab —
Standup
height

Built like Big
Motor Graders



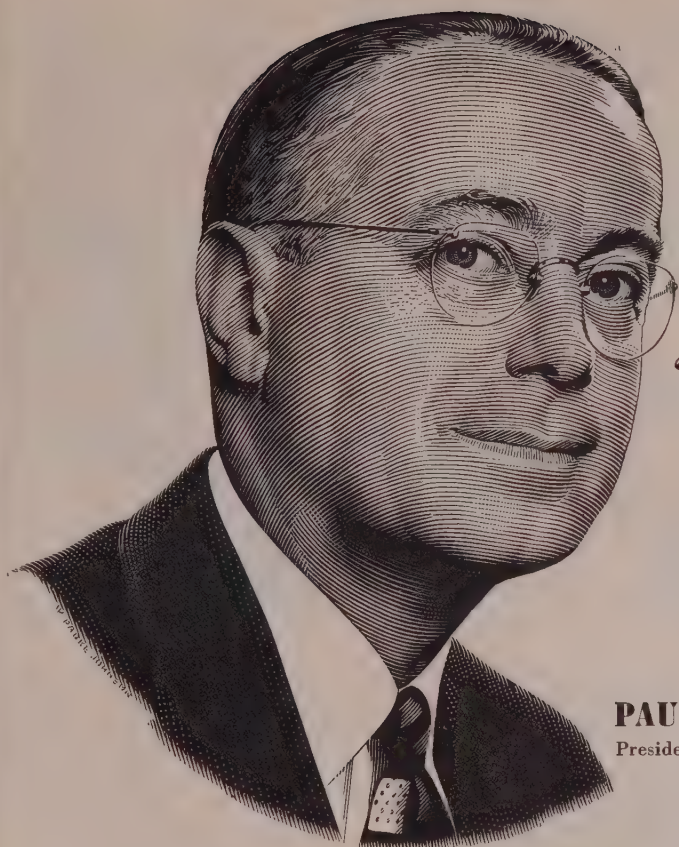
GALION MODEL 503 TANDEM DRIVE MOTOR GRADER

its important features are positive 4-wheel tandem drive and an extra-strong, box-type, high-arched frame. The manufacturer also has attractive big grader type attachments available, most of which are claimed to be exclusive for a grader the weight and size of the Galion 503. These include a Hydraulic Shiftable Moldboard, said to increase the versatility, scope and ease of blading operations; another is an all-steel enclosed cab with rubber-mounted safety glass throughout. Manufacturer is The Galion Iron Works & Mfg. Co.

322

New bantam crane ups lifting capacity by 20%

The new Bantam Model T-35 provides an increase of 20% more lifting capacity than the manufacturer's previous models of heavy-duty truck-mounted shovel-crane. Conservatively rated at 6-ton capacity, this $\frac{3}{8}$ -yd. model is available with a complete line of matching attachments, including shovel, clamshell, dragline, back hoe, magnet, wood grapple and pile driver.



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PAUL W. JOHNSTON

President, Erie Railroad

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For the same four reasons, more than 7,500,000 employed men and women in thousands of other companies are active members of the Payroll Savings Plan—their take-home savings in the form of U.S. Defense Bonds total more than \$150,000,000 per month.

Is your company in the "more than 50% participation" group? If it isn't, please bring this page to the attention of your top executive. Point out to him—

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1. Phone, wire or write to Savings Bond Division, U.S. Treasury Department, Suite 700, Washington Building, Washington, D. C.
2. Your State Director, Savings Bond Division, will show your company how to conduct a simple person-to-person canvass that will put a Payroll Savings Application Blank in the hands of *every* employee.

That is all management has to do. Your employees will do the rest. They, like the employees of the Erie Railroad, want to provide for their personal security and at the same time do their part in helping to keep America strong.

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For Construction Equipment GRE-SEN HYDRAULIC CONTROL VALVES

Ideal for operating bulldozers, scrapers, front-end loaders, landlevelers and other hydraulic-controlled rigs. Low in cost, yet you get these top-value features:

- Smooth, positive, easy control.
- Fully-balanced and self-centering.
- Built-in relief valve.
- 4 mounting holes on bottom.
- 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
\$20²⁵

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Special dealer and
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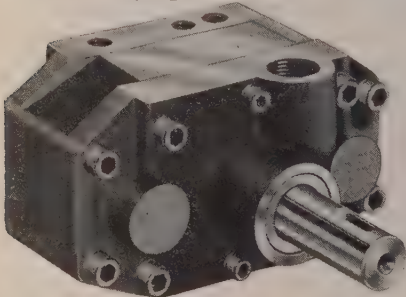
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GRE-SEN HYDRAULIC PUMPS

Made for use with dozers, scrapers, loaders, landlevelers, and other hydraulic-controlled earthmoving rigs. Low in cost, but include these important features:

- Semi-hardened gears.
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- 90%-dense bronze sleeve bearings.
- All bearings pressure relieved.
- Close-grain iron housing.
- Built-in relief valve
- Permanent or torque bar mounting.

Gear and bearing wear is practically eliminated because pump operates on 3-gear principle that keeps hydraulic forces in balance. Pump mounts either (1) by use of simple splined coupling and anchor bar with fulcrum at least 12" from center of pump shaft, or (2) by use of rigid bracket and flexible coupling.



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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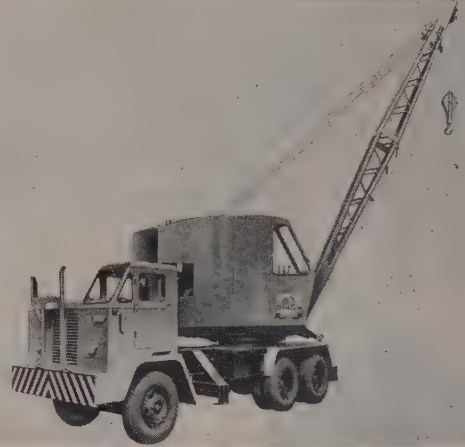
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Major improvements over the previous Model M-49 include stronger and larger body parts, a newly designed trunnion base, a vertical swing shaft bearing which allows for almost twice as much radial load on the shaft, and substantial increases in both clutch and braking surfaces. Model T-35 mounts on a special Bantam crane carrier or any tandem axle truck having a wheelbase of 164 in. or



more. Suitable single-axle trucks can also be used when ground conditions are favorable. According to the manufacturer, it will continue to be the most inexpensive machine of its size, priced at less than \$6,300, because of the company's continued specialization in mass-producing just one size machine. Manufacturer is Schield Bantam Co.



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more holes
in concrete



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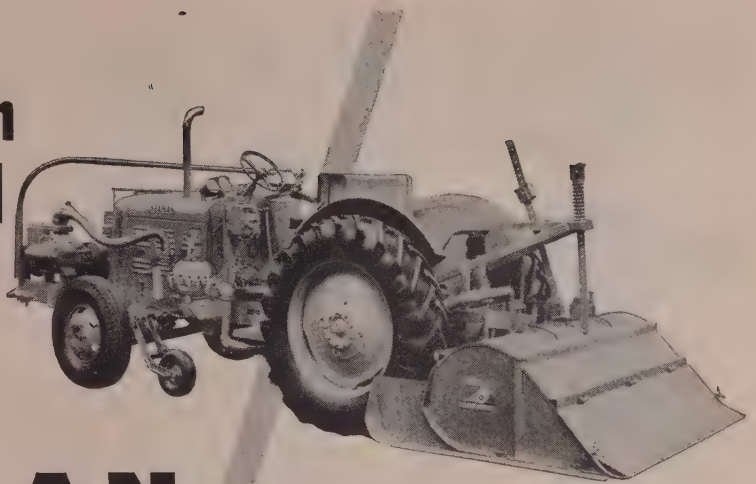
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SEAMAN MIXER



The Seaman Self-Propelled TRAV-L-PLANT 7 ft. mixing width, gasoline or diesel-powered. Equipped with pump, full tachometer assemblies, volumetric meter (optional) and spray bar for bituminous, tars, oil, emulsions.

Ingham County, Mich. engineer says: "We are mixing scarified oil mat on 90 miles of road with the Seaman Mixer and are finishing a mile a day. Incidentally, we use the Seaman to mix in calcium chloride on a number of our roads which effectively prevents frost-boils."

In an article in Public Works Magazine, Robert Bailey, City Manager, Chico (pop. 12,500) writes: "For roadmixing lime stabilized seal coated streets, we have used a Seaman Mixer very effectively."

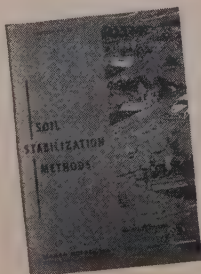
Again, in Public Works Magazine, R. E. Gahan, City Engineer, Merced, Cal. (pop. 16,000) writes, "Most effective use of equipment was the construction of some 80 blocks of road-mixed re-surfacing work with the Seaman Pulvi-Mixer."

These reports are conclusive proof that—in the construction of your city streets and your state and county highways—The Seaman Mixer provides greater daily output of high quality mix at savings up to 40%. So, put a Seaman on your equipment list this season.

Calgary, Alberta, reports that in the construction of city streets, parkways and parking lots, plus 115 miles of asphalt roads, 110 miles of gravel stabilization and 297 miles of oil-gravel mixed roads—all with the Seaman Mixer—they mixed from 230 to 345 tons per hour and finished at least one mile and sometimes two miles a day. The road widths ranged from 18 to 20 ft.

Reno County, Kansas, highway officials report a saving of \$210 per mile in road maintenance with the Seaman Mixer.

Another Kansas County reports that in using the Seaman Mixer they released one of two motor patrols for other work, found a 40% saving in cost and built a 100% better quality road.



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323

Pistol grip operation featured on new drill

Pistol grip operation is featured on a new Thor $\frac{1}{4}$ -in. Copper Line electric drill. The low-priced drill is small, streamlined and weighs only $2\frac{3}{4}$ lb.,



yet it is well built for long, rugged use. Construction features include the handle and field case cast in one piece for added strength, separate cover for switch mounting, and ample hand grip for comfortable handling. The drill is furnished with either geared chuck or keyless chuck as specified. Manufactured by Independent Pneumatic Tool Co.

324

Masonry saw recommended for cutting fire bricks

Especially recommended for cutting fire bricks, the "dustless" Clipper Masonry Saw should be a boon for cutting the intricate shapes required for lining furnaces. The manufacturer claims that the new saw gives straight, smooth cuts eliminating hidden fractures and giving perfect fitting bricks that reduce the danger of breakouts. Only a minimum of mortar is required. The saw also can be operated next to the job or even inside the furnace. Manufactured by Clipper Manufacturing Co.

325

Three sections weigh down on this new roller

A new design principle wherein three rollers operate as a single rigid unit is featured on this new diesel road roller, the Dann-Express Triplex. The roller thus exerts its maximum pressure (the pressure of the three rollers) on the exact surface point where leveling is required.

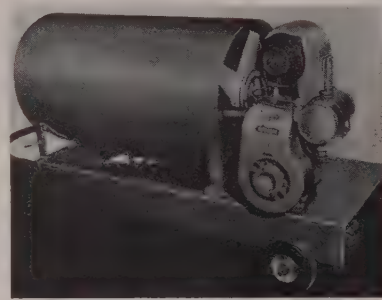


Furthermore, it is said to be a true three-section machine designed for flexibility of movement. Its turning radius is only 8 ft. Synchronized power steering turns front and rear rollers simultaneously so that all three follow the same track. Able to cope with the highway "waves" which are becoming increasing road hazards, Model DXR-10 is rated 10 to 13 tons and Model DXR-6 is rated $6\frac{1}{2}$ to 8 tons. Manufactured by Dann Diesel Corp.

326

Portable heater with gasoline engine

A small gasoline engine is the special feature of a new portable space heater. The gasoline engine increases the portability of the unit because it can heat spaces where electricity is not available, and contractors should



find it useful for plaster drying and other construction work. This new heater is available in two sizes rated at 200,000 and 400,000 Btu. A connection line to an oil drum supplies fuel. Combustion is effected to the point where a stack is not required, and instantaneous starting of the burner is assured, according to the manufacturer. The small gasoline engine is a standard make with parts and service available everywhere. Manufactured by Quiet Automatic Oil Burner Corp.

327

Attention utilities workers!

Here's a mere 11-oz. head protector which can withstand 10,000 volts with a leakage of less than 5 milliamperes. The Hard Boiled Hat is especially useful for utilities workers exposed to electrical hazards but despite its light weight, it can pass a minimum impact of 40 ft. lb. in drop tests. Manufactured by Automatic Plastics Molding Co.

328

Melting time reduced with these asphalt kettles

Kettles said to melt twice as much bituminous material in a given period as any conventional bottom-fired kettle of the same capacity are now introduced to speed delivery of larger quantities for big jobs. The kettles are the new jumbo-sized Heet-Master mounted on 4 pneumatic-tired

wheels in tandem arrangement, and can be equipped with a power or hand spray attachment for road work. Available in two models of 375- and 500-gal. capacities from Aeroil Products, Inc.

329

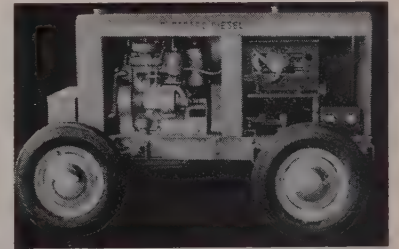
Onan CW plants are vacuum cooled

Model CW gasoline-powered electric plants manufactured by D. W. Onan & Sons, Inc., innovate a highly efficient vacuum cooling system. This device employs a powerful centrifugal blower which draws cold air through the generator and over engine, and at the same time discharges heated air out of an 8 by 12-in. side vent. The CW is said to have many advantages, among them: low initial cost per kw. of power; low operating cost; increased durability plus high output despite small size and weight, and maximum safety devices. Useful for many purposes requiring standby emergency electricity, the plants are made in 5,000- and 10,000-watt capacities and require less than 1 cu. yd. of space.

330

How about a small arc welder powered by diesel?

The first arc welders of 200, 300 or 400-amp. capacities to be powered with a diesel are being introduced in a new line of portable welders manufactured by the R. H. Sheppard Co. They are built as integral units mounted on 4-wheel trailers or on steel I-beam bases. A multi-V belt drive is featured which speeds up the



generator to 3,500 rpm., permitting the use of a smaller generator and power unit, and offering the advantages of a smaller, more mobile unit. The V-belt drive provides smooth transmission of power from engine to generator.

331

Intercommunication system for multi-story work

Now being assembled by Ets-Hokin & Galvan is a new intercommunication system for contractors' use on multi-story construction work. Consisting of a light master unit and a horn-type high-power metal enclosed speaker, the entire unit is portable and can be set up on any jobs in a few min. The entire unit, ready to use, sells for \$60 and up.

332

International Harvester offers 168 new trucks

A completely new line of light to heavy duty motor trucks has been recently introduced by **International Harvester Co.** Designated the R-line, total basic chassis models number 168 in 296 wheelbases, with gross vehicle weight ratings from 4,200 to 90,000 lb. The manufacturer states that this new line offers 307 new features. Newly styled, they are identified by the IH emblem, replacing the famed Triple Diamond.

333

New wood product for concrete form work

Masonite Presdply is an addition to **Masonite Corp.**'s line of concrete form Presdwood. The 4 x 8-ft. panels have a core of plywood and faces of specially-tempered Presdwood, made

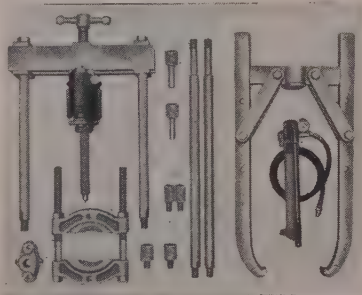


specifically for concrete form work. It combines the desirable surface characteristics of Presdwood with the structural qualities of the thicker plywoods and may be reused a number of times. Easy to handle, these panels are said to have surfaces which will not split, splinter or crack. Available in thicknesses of $\frac{3}{8}$ and $\frac{3}{4}$ in.

334

Industrial puller set reduces maintenance time 75%

The new OTC Giant 50-ton Industrial Puller Set is now on the market, and according to the manufacturer, this set will greatly simplify and reduce lost time on the job. It was de-



veloped especially for industrial pulling and installing maintenance operations involving the removal and installation of gears, bearings, pulleys, wheels, pinions, shafts, etc., on ma-

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To grab and to hold safely is the function of a grapple.

The Owen Grapple *alone* has independently acting tines each of which contacts the object to be lifted, regardless of its shape, and grips it with heretofore unknown tenacity. These photos tell the story.

The Owen Grapple opens *wide* to grasp large objects. Fast, safe operation is assured indefinitely because of the tremendous grip, scientific design and the use of the best materials available.

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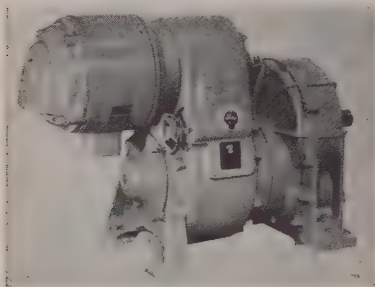
Branches: New York • Philadelphia • Chicago • Berkeley, Calif. • Fort Lauderdale, Fla.

chine tools, turbines, large dirt removing equipment, mining machines and marine engines. The new 50-ton Power-Twin Hydraulic Unit provides the power, and suitable pullers and attachments are included. Also available is a three-speed hand pump or an electrically-driven pump. Manufactured by Owatonna Tool Co.

335

Electric motor has wide range of variable speed

Rugged and self-contained, type KFEB double reduction Speed-Trols electric motors answer a demand for infinite variable speed in the low speed



ranges. The 20-hp. type 364 KFEB is available with maximum speeds ranging from 176 rpm. to 42 rpm., and the 25-hp. type 365 KFEB has maximum speeds ranging from 176 rpm. to 64

rpm. The drip-proof and splash-proof models feature the manufacturer's direct-through ventilation system; the totally enclosed fan-cooled model provides a dual cooling system for internal and external cooling. Manufacturer is Sterling Electric Motors, Inc.

336

Hydra-Matic Drive on GM's 1953 light trucks

Hydra-Matic Drive is the outstanding feature of General Motors Corp.'s 1953 series 100 to 250 light model trucks. Moreover, the company is introducing two new gasoline engines said to establish trucking industry records for high compression, power and performance. One, a 228-cu. in. (displacement) GMC 6-cylinder inline engine develops 105 hp. with a compression ratio of 8 to 1; the other, a 248-cu. in. engine develops 125 hp. with a compression ratio of 7.5 to 1. Both power plants, using only regular fuel, have a compression ratio not only higher than any other gasoline engine truck but most passenger cars as well.

337

New trench roller has two rolls operated independently

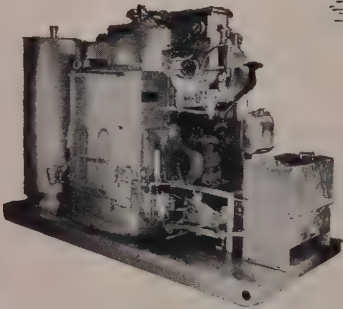
A new principle in roller design is utilized in the new APSCO Model

DTR-552 Trench Roller, a companion piece to the APSCO Widener. The machine has two compression rolls (20-in. wide and 60-in. diameter), each steering independently of the other, enabling double compression



or a parallel extension for width rolling—the equivalent of two rollers side by side. The roller exerts a pressure of 250 lb. per lineal in. (without water ballast), and up to 345 lb. with full ballast on each roll. Because the compression roll and the weight of a machine form the basis on which compaction is computed, the manufacturer claims that the larger diameter compression rolls of his machine will do a better job of rolling. Traction is increased because both rolls are driven. During operation the edge of the pavement and both compression rolls are visible. Manufactured by All Purpose Spreader Co.

**STEAM
IN TWO
MINUTES from
a cold start**



"Kwik-Steam"

Vapor-Clarkson Generator

FOR PILE DRIVING

The "Kwik-Steam" Generator is a compact, lightweight, economical unit that will get up steam pressure quickly and can easily be transported around the job, plus a unit that is automatically controlled and yet gives a full capacity of steam instantly when needed.

This Unit will produce steam in two minutes from a cold start and gives steam only when steam is needed. No experienced operator is needed on the job hours ahead to get up steam, saving hours of labor. Burning low-cost fuel-oil, the "Kwik-Steam" Generator saves up to 50% on fuel. "Kwik-Steam" Generator meets every need for Pile Driving or Pile Extraction, will operate any make of hammer. Made in sizes from 20 to 165 BHP. Can be had with electric motor or gasoline engine. Write for Pile Driving Bulletin.



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HALL-PERRY MACHINERY COMPANY.....	Butte, Montana
LUND MACHINERY COMPANY.....	Salt Lake City, Utah

YOU'RE 5 YEARS AHEAD when you buy a Jaeger compressor

Some compressors are still being built to the old 1932 ratings which are too small for modern air tools.

Other models have recently appeared with the higher ratings needed today.

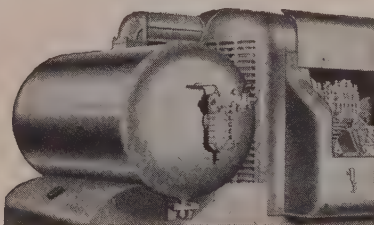
These higher ratings, which others now offer in "new models," are the ones Jaeger has been building for 5 to 7 years, and backs with proved performance of more than 30,000 "new standard" compressors in the field.

NEW:	75 cfm	125 cfm	185 cfm	250 cfm	365 cfm	600 cfm
OLD:	60	105	160	210	315	500

These 15% to 25% higher ratings insure 90 to 100 lbs. pressure at today's big tools, instead of 70 lbs., increasing their work output by 30% to 40%. No "old standard" machine can successfully compress, cool and deliver these larger air volumes. No new compressor has been built to deliver these volumes with the smooth, cool, long-life performance of the Jaeger Air-Plus.



75% to 100% larger valves for free flow without back-pressure.



Larger intercoolers, and air receivers. Relief valve for automatic drainage standard on all models.



Run these tools at 90-100 lbs. pressure

Model 75: 1 heavy breaker

medium rock drills, or one light wagon drill

Model 125: 2 heavy breakers or a 55 lb. sinker

Model 250: 3½" wagon drill or 2 heavy rock drills or a 10 hp Ka-Mo earth drill

Model 185: 3 heavy breakers, 1 heavy rock drill, 2

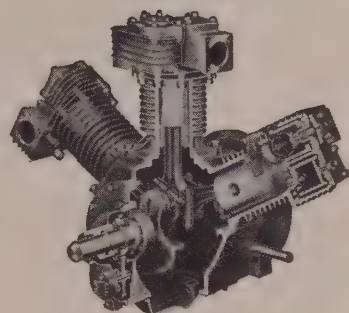
Model 365: 4" wagon drill plus a plug-hole drill, or runs 15 hp Ka-Mo earth drill

Model 600: Two 4" wagon drills and hand held drill, or runs 9B-3 pile hammer.

Sold and Serviced by:

EDWARD R. BACON CO.....San Francisco 10
NELSON EQUIPMENT CO.....Portland 14
WESTERN MACHINERY CO...Salt Lake City, Denver 2, Spokane 11
SHRIVER MACHINERY CO.....Phoenix
J. D. COGGINS & CO.....Albuquerque

SMITH BOOTH USHER CO.....Los Angeles 54
A. H. COX & CO.....Seattle 4 and Wenatchee
THE SAWTOOTH CO.....Boise and Twin Falls, Idaho
TRACTOR & EQUIPMENT CO.....Sidney, Miles City, Glasgow
CENTRAL MACHINERY CO.....Great Falls and Havre
WORTHAM MACHINERY CO.....Cheyenne, Wyo.



Balanced W-type 2-stage compressor standard in all sizes, 75-600 ft. Cooler and smoother running than any V-type.



Jaeger "Fuel Miser" standard on all models where automatic control of engine speeds means worthwhile fuel savings.

Lowest cost compressed air you can buy today

Prices of Jaeger "new standard" compressors are in every case below those being asked for old standard compressors of 15% to 25% less air capacity. On the basis of cost-per-cubic-foot-of-air-delivered, the difference is even greater, amounting to many dollars saving on every cubic foot of air capacity. On the basis of work output, the difference is greatest—amounting to 30% to 40% more production through more efficient operation of your air tools.

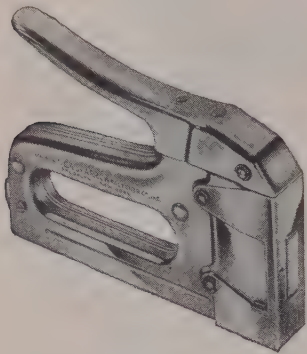
Why pay more and get far less when you can buy a proven Jaeger Air Plus Compressor.

For full facts about tools and their air requirements see your Jaeger distributor or ask for Catalog JC-1.

338

Arrow gun tacker shoots heavier, longer staple

Arrow Fastener Co., Inc., announces its new T-50 Gun Tacker, an instrument that shoots heavier, longer, patented wedge-pointed high-gauge carbon steel wire staples, up to 9/16-in. leg length. Its high-powered



spring action works on the principle of double leverage for smooth action and high power. The 1 1/4-in. movement at extreme point with total spread of 2-1/16 in., affords faster, easier tacking. The T-50 has a wide range of applications in building and general construction, such as for applying all types of insulation materials, building papers, batt wool and foil, canvas, roofing felt, shingles, sid-

ings, ceiling tile, paper linings in concrete forms and wiring. A patented non-clogging mechanism is provided, and working parts may be easily dismantled for cleaning.

339

Winch head attachment for Kwik-Mix model 6-P

An inexpensive winch head attachment for Kwik-Mix Model 6-P plaster-mortar mixer is now on the market. This attachment, which has an average lifting capacity of around 250 lb., based on the anchoring ability of the mixer itself, lifts loads to any height. Mounted outside the mixing drum and revolving with the paddle shaft, the winch head can be applied to either the tilting or non-tilting mixer models. Manufactured by Kwik-Mix Co.

340

This turtle's shell grips conveyor belts

Here's a handy device, the Turtle Conveyor Belt Fastener, which is a tight, quick and easy method of repairing and joining conveyor belts with the aid of only a mechanic's hammer. Gaping openings in the belt between the plates are eliminated. It is not necessary to pre-punch holes to guide the teeth because the Turtle's teeth are formed slightly outward instead of straight as in previous de-

signs. At present it is made in only one size. Available in steel, monel, stainless and everdur from Flexible Steel Lacing Co.

341

This glass hat is a Saf-Hed-Hat

Ever think that glass would provide the difference between a mere jolt and a cracked skull? The new Saf-Hed-Hat, manufactured from



fiber glass by the United States Safety Service Co., fills the need for a more rugged safety hat which is nevertheless lightweight and comfortable. Fiber glass, according to the manufacturer, offers the greatest strength-weight ratio of any material currently being used in the manufacture of safety hats, and because of its durability the product will wear twice as

EVERY CARTRIDGE AN EXTRA PRIMER

...when you use
PRIMACORD*

Primacord extends from top to the bottom of a hole and is normally in direct contact with every cartridge. When the round is fired, each cartridge detonates with the extra power of a primer, delivering the maximum energy available from your explosives. Primacord is doubly safe too! It requires no caps in the hole, and is insensitive to stray currents. Investigate the application of Primacord to your blasting problems today.

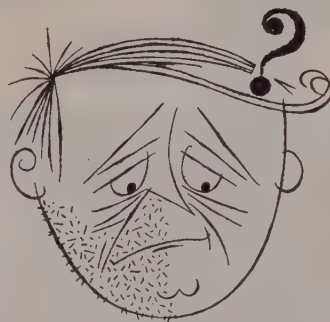
*4 types available:

**PLAIN, REINFORCED,
WIREBOUND, PLASTIC.**

Ask your powder supplier or
write for literature



COAST MANUFACTURING & SUPPLY CO.
LIVERMORE, CALIFORNIA



**WOULD
YOU
CLEAN
ONLY**

PART OF YOUR FACE?

No, of course, you wouldn't!
Then why clean only *part* of the
oil in your engine? Why
be satisfied with anything less than
the best protection you can give
your engine's moving parts?
Keep *all* your oil clean, and
all the moving parts of your engine
protected, with warranted
Winslow Full-Flow Filters!



WINSLOW FILTERS

Winslow Engineering Company • 4069 Hollis St., Oakland 8, Calif.

long. The manufacturer also claims that it meets the A.S.A. code for dielectric breakdown and exceeds the A.S.A. code for impact resistance. The cradle of the hat may be quickly and easily adjusted to fit all head sizes.

342

Shoulder sloping and ditching easy with side shifting grader blade

The American Hydraulic Side-Shift, an optional attachment available for all American Graders, allows the blade to be shifted to right or left. This extra blade reach permits the



operator to make short work of shoulder sloping and ditching jobs. The 24-in. left or right shift gives the blade an extreme reach of 56 in. outside the rear tires. Controls are conveniently located in front of the operator. Special rollers prevent the slide rails from binding and provide proper blade support when shifting while the blade is working and the machine is moving. The blade can be shifted when in any position. Manufactured by American-Coleman Co.

343

Truck-mounted compressor on the market

A new "Auto-Air" compressor assembly suitable for mounting on standard panel-type trucks is announced by Davey Compressor Co. Known as Model 105-VBA, the unit delivers 105 cfm. at 100-lb. pressure. It is driven directly from the truck engine through a Davey P-80 heavy-duty power take-off. The compressor occupies only $\frac{1}{3}$ of the truck body, leaving the remainder available for men, tools and materials.

344

Flexible manometer designed for the pocket

Series No. 1211 Flexible Slack-tube Manometer is an improved instrument which is equipped with a convex spring-steel scale for rigidity in use and flexibility for convenient carrying. It can be rolled, twisted or bent into any shape, to return to a full-length, easily-read and accurate U-tube. The scale is firmly held, yet may be easily moved back and forth for zero adjustment. Available from F. W. Dwyer in standard ranges from 8 in. to 10 ft. in water or mercury.

GRIPS ALL 6 STRANDS

to make wire rope last longer!



ESCO LONG-BOWL® SOCKETS

IMPROVE DRAG ROPE LIFE



ESCO LONG-BOWL SOCKETS take wire rope sizes $\frac{1}{2}$ " to $2\frac{1}{8}$ ", develop more than 90% of rope strength. Extra-strong, yet easy to take apart and assemble. No kinking!

When Breaks Occur Due to Uneven Strand Loading

Extensive ESCO field and laboratory tests have demonstrated that a major cause of drag line breakage is uneven loading of the rope strands. And the cause of this faulty loading generally lies in a conventional rope socket which barely grips three of the six strands! In resocketing this type of break, as much as four feet of good rope must be discarded. As a rule, a few breaks make your remaining rope too short for use, and it, too, must be discarded!

With ESCO Long-Bowl Sockets, your drag line gets a chance to wear out — instead of shortening itself into discard! Write today for full details. Ask for Catalog 192.

ESCO

Offices and Warehouses: Honolulu, T. H., Houston, Texas, New York, N. Y., Los Angeles, San Francisco, California; Seattle, Spokane, Washington, Centralia, Pennsylvania, Eugene, Oregon, Salt Lake City, Utah. In Canada: Vancouver, B. C., and Toronto, Ontario.

Representatives in all Major Cities

ELECTRIC STEEL FOUNDRY CO.

2163 N. W. 25TH AVE., PORTLAND 10, ORE.

712 PORTER ST., DANVILLE, ILL.

Here's an L-P furnace to go traveling on the job

Here's a compact furnace on wheels now available for construction use. It is the Hauck compound melting furnace which burns L-P gas (liquefied petroleum), commonly known as bottled gas. Contractors will find it an economical means for melting and heating joint compound for sewer and water lines; for gas mains and pipe line protective coating enamel, and for heating asphalt, pitch or tar for expansion joint filling and small highway patch work. The furnace is mounted on a heavy steel

frame with hinged draw handle. One man, unassisted, can move it from place to place on the job. Available in pot capacities of 4, 10, 15 and 25 gal., the furnaces have enclosed burners with a wide range of heat regulation. Manufactured by Hauck Manufacturing Co.

346

Signaling system has widespread applications

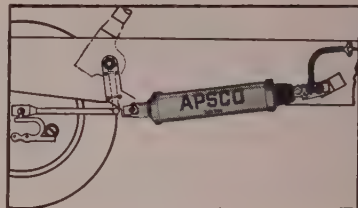
A single tone selective signaling system recently developed has widespread applications in industrial, transportation and utility communications systems. It is designed for use

in conjunction with any communication medium—two-way radio, land lines, microwave or power line carrier—anywhere where remote control or receiver selection is a necessity. The system enables an operator to initiate an operation at one or more remote points through an intervening communication medium. Manufactured by Motorola, Inc.

347

Automatic steering device cuts fatigue

A low-cost, fully automatic steering device powered by compressed air encourages safety and cuts the fatiguing vehicle steering required in manipulating heavy construction

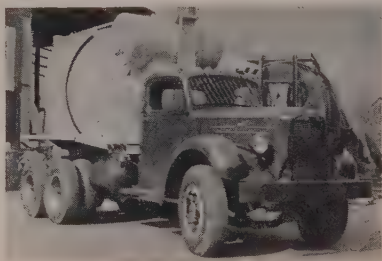


equipment. Designated the 1953 Model Power Steer Booster, it is a durable, compact and self-contained unit constructed mainly of anodized aluminum. Installation is quick and easy and maintenance cost low. The device is also said not to jam and can easily be adjusted to handle varying loads and driving conditions. Manufactured by Air-O-Matic Power Steer Corp.

348

Engineered weight featured on new truck mixer

Engineered weight to allow for greater legal payloads is chief feature of a new line of inclined-axis Hi-Up truck mixers. Light weight has been



maintained without sacrificing the heavy-duty characteristics required by ready-mix operators. They are built in three sizes, 3-yd., 4½-yd., and 5½-yd., each available in two model arrangements. Model LC is equipped with the manufacturer's simplified full-floating charging hopper with built-in seal. Model LO is equipped with a fast-charging open-end type stationary hopper. Both machines can be rated and used as agitators. The mixers also contain numerous

Continued on page 166

It keeps unstable slopes "out of the road"

Roads often need more "elbow room" near steep slopes. The easy, economical way to gain space is with Armco Bin-Type Retaining Walls.

Installation is quick and easy with unskilled labor. The strong, yet lightweight sections are easy to handle and bolt into position. Then backfilling is all that's needed to complete the job. There is less excavation, no delay for curing, and the work goes faster.

Use Armco Retaining Walls for stabilizing steep cuts or embankment slopes, for grade separations and prevention of stream erosion. Wide range of heights available. Write for complete data.

ARMCO DRAINAGE & METAL PRODUCTS, INC.

CALCO • NORTH PACIFIC • HARDESTY DIVISION

Berkeley • Los Angeles • Seattle • Spokane
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ARMCO RETAINING WALLS



Another cost-cutting secret of

HEILINER

PERFORMANCE

EXACTLY the right power correctly applied at the point of action! That's Heiliner's solution for the problem of moving more yards of dirt at less cost per yard.

When you buy an earthmover, you want a balanced rig that *utilizes* horsepower . . . instead of wasting it. Spinning the drive wheels in the pit doesn't put dirt in the bowl! The Heiliner's *properly applied* power, plus efficient, well-balanced design, *saves* horsepower and cuts

costs on every phase of the cycle . . . it heap-loads faster in a shorter digging distance, travels at speeds up to 25 mph fully loaded, spreads faster and easier . . . all with unusually low horsepower requirements.

Your Heil distributor can give you the complete story about "the right power, properly applied" and show you how Heiliners will cut costs on *your* job. Stop in or phone him today.



Fast, easy spreading with Heil positive, forced "Tilting Floor" action cuts earthmoving costs on in Minnesota.

THE HEIL CO.

3021 WEST MONTANA STREET • MILWAUKEE 1, WISCONSIN

DEPARTMENT 2133

FACTORIES: MILWAUKEE, WIS., HILLSIDE, N. J.

refinements designed to reduce operator fatigue and to decrease operating hazards. Manufactured by Worthington Corp.

349

New Fibreglas expansion joint comes in preformed strips

Kapco Fibreglas Expansion Joint now meets AASHTO and ASTM specifications as well as Federal Specification HH-F-341A. According to the manufacturer, this relatively new product is non-rotting because it is composed of inorganic glass fibers impregnated and bonded with bitumen. It is supplied in preformed strips faced with heavy, asphalt-saturated felt liners and is available in widths up to 42 in., and in thicknesses of $\frac{1}{2}$, $\frac{3}{4}$ and 1 in. Manufactured by Keystone Asphalt Products Co.

350

Vibrating screen for handling heavy loads

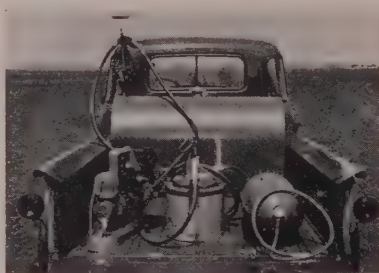
Robins Vibrex, Model MS, a new style vibrating screen, has been designed to handle heavier loads. A heavier yoke and coil springs mounting instead of leaf springs are features of this new product. The springs are encased in a neoprene rubber accordion-type boot to keep out grit and stones. The screen employs the circle-throw principle, originated by the manufacturer, which gives two

positive strokes with every revolution of the counterweights. The simultaneous action of strokes and circular action produces sharp and accurate sizing. Both single and double deck models are available, the former being easily converted to the latter by the installation of additional material. Manufactured by Hewitt-Robbins, Inc.

351

Mobile service station for spot servicing

Here's a useful truckload of equipment which will do the trick when field servicing road and construction equipment. The equipment consists



of a gasoline tank with a Tokheim Double-Action hand pump and hose, a Tokheim air compressor, a pressure lubricator and an air storage tank. The 120-gal., 14-gauge steel fuel

tank is equipped with surge plate and a combination vacuum and pressure vent in the fill cap. The air compressor supplies air to the lubricator and to the air storage tank. It is also used for spray painting and dusting of machine parts. Manufactured by Fargo Foundry Co.

352

Caulking guns loaded from refinery-filled containers

Now on the market is the 1953 model Force-Flo Caulking Gun Loader, a unit that safely and economically loads and reloads caulking gun cylinders with any viscous materials direct from bulk containers. This newest lever-action type, manually-operated gun loader has many improved features. The loading device readily fits the original refinery-filled containers which are more economical to use. The handle operates a series of levers that activate the piston and piston disc for maximum pressure to force out viscous material from the container up the loading tube into the caulking gun cylinder. There is no contamination of the material, and the formation of air pockets is prevented in the gun barrel and in the compound pail. The instrument is readily adapted to simultaneous gun loading, thereby speeding up the application of caulking material from beginning to end. The 1953 model

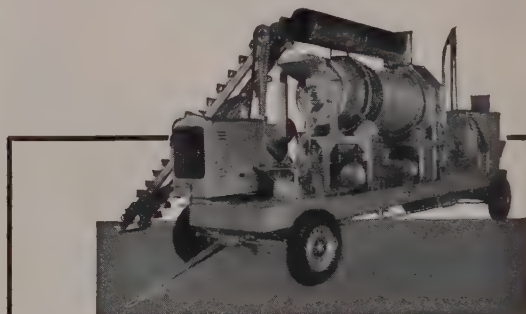


U. S. Patent No. 2,477,855

- ✓ For joining grader, trencher, ditcher and other earth moving conveyor belts.
- ✓ For belts $\frac{3}{8}$ " to $\frac{1}{2}$ " thick.
- ✓ A FLEXCO fastener that is HINGED. Has removable hinge pin.
- ✓ Troughs naturally, operates through take-up pulleys.
- ✓ Strong, durable . . . pull or tension is distributed uniformly across joint.

Order From Your Supply House. Ask for Bulletin HF 500.

FLEXIBLE STEEL LACING CO
4704 Lexington St., Chicago 44, Ill.



Portable Asphalt Plants For City, State, Repairs and Small Contract Work

These 8-10 tons per hour Asphalt Plants economically repair almost any pavement. Asphalt, brick, concrete, macadam, can be resurfaced or patched. Alleys, driveways, sidewalks, industrial plants can be paved.

Produced for immediate hot laying, or for deferred cold patching. Match any bituminous surface.

Mixes at plant, including labor, fuel, and overhead, cost about \$4 per ton, with \$2 aggregate. Average 160 to 200 sq. yds. 1" thick per hour. A money-maker for small contract work.

Also larger plants, 15 and 30 tons per hour.

Write for catalog and name of nearest dealer.

Elkhart 24 **White Mfg. Co.** Indiana

meets a need for a container-direct-
o-gun loading device. It is manufac-
tured by Force Flo, Inc.

353

his dump holds 20 cu. yd.

Recently announced by the Galion
Allsteel Body Co., this package trailer
dump is 20 ft. long and has a 20-yd.
capacity. Known as the Galion Heavy
Duty Model 12, dumping is handled
by a Galion Model 77380 hoist with a



rated capacity of 22 tons. The tandem-
axle trailer has a specially designed
heavy-duty dump trailer suspension.
It is available with either hose opera-
tion or power fifth wheel. Tire sizes
and breaks are available in several
options to meet load and service re-
quirements.

354

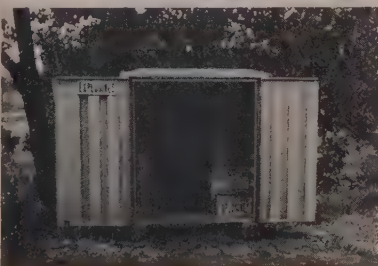
P & H's Diesel Power-Package aids shovel operations

P & H Diesel Power-Package is a
complete power unit which is engi-
neered for simple installation in any
make shovel. The replacement pack-
age is built around P & H's model
387-C, 2-cycle, 3-cylinder diesel en-
gine of 60 hp., and it includes all
equipment needed for shovel instal-
lation. According to the manufac-
turer, tests show substantial savings
in operating costs. This new engine
is easily maintained and easily ac-
cessible. Manufactured by Harnisch-
feger Corp.

355

For dynamite users . . .

A welded steel container is the
latest practical solution to the prob-
lem of supply of precarious loads of
explosives for construction jobs in



remote areas. The containers, which
have a capacity of 275 cu. ft., origi-
nally were developed as Transpor-
tainers for ocean cargo protection by
Dravo Corp. With the introduction

DAVEY Super Chief

... the lightweight champion
with the heavy-duty work punch!



● Here, for the first time, is an economically-priced, light-
weight compressor (1250 lbs.) that is designed for constant,
heavy-duty service. ● Features include clutch between
engine and compressor, full force feed lubrication, built-in
unloader system, air receiver integral with frame . . . highest
speed chassis and tow bar ever placed on a compres-
sor. ● Like the famous bigger Daveys, the Super Chief
has PERMANENT PEAK EFFICIENCY VALVES. These never
carbon or foul. They guarantee the utmost in operating
satisfaction, low cost operation and long compressor
life. ● DAVEY COMPRESSOR CO. ● KENT, OHIO

A-6784



PUT EAGLES ON YOUR PAY-ROLL

For loading from stockpiles, for a swift lifting of windrow dirt, snow or any
loose material, Eagle Truck Mounted Loaders *more* than earn their keep.
Takes only one man to run a loader and he can really get around—travelling
at truck speeds. Get the full story from the Eagle distributor near you!

Billings—Industrial Eqpt. Co.
Great Falls—Normont Eqpt. Co.
Kalispell, Mont.—Treasure State Eqpt. Co.
Portland—Nelson Equipment Co.
Salt Lake City—Western Mchy. Co.

Spokane—Western Mchy. Co.
Los Angeles—Four Wheel Pacific Co.
San Francisco—Four Wheel Drive Pacific Co.
Denver—Liberty Truck & Parts Co.
Phoenix—Neil B. McGinnis Eqpt. Co.
Albuquerque—N. C. Ribble Co.



EAGLE

JAW CRUSHERS • IMPACT BREAKERS
PULVERIZERS • CONVEYORS • LOADERS

CRUSHER CO., Inc. GALION OHIO-U-S-A

just nail 'em in...
pour your concrete

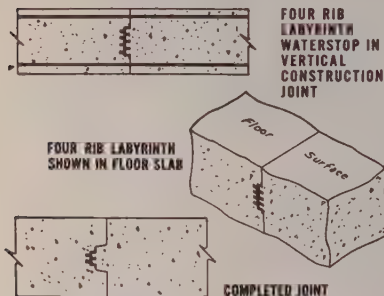


AND FORGET ABOUT SEEPAGE
WITH LABYRINTH
WATERSTOPS

● 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!



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Patent applied for

WATER SEALS, INC.,
9 South Clinton St., Chicago 6, Illinois
Send full information and sample.

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of their use for storing high explosives, the cost of erecting and dismantling temporary storage facilities was eliminated, according to a user, Illinois Powder Manufacturing Co. Transportainers can be used indefinitely. Skids permit them to be dragged short distances by a tractor, or they may be transported longer distances by motor.

356

Spar-Kover protects spark plugs from shorts

A new, activated and easily-installed Spar-Kover protects spark plugs from shorting out. Its special ceramic cartridge absorbs moisture and condensation around plugs, and its water-tight cover protects the plugs from dew, fog and splashing water. They can be used on any type of ignition-fired engine. Some suggested applications are: trucks, construction equipment and portable arc welders. They are said to be especially helpful in moist coastal areas, and are guaranteed for the life of the ignition system. Manufactured by Lucas Products Co.

357

Fiber glass helmet available for welders

A seamless fiber glass helmet claimed to cut welding helmet costs in half because of its greater strength

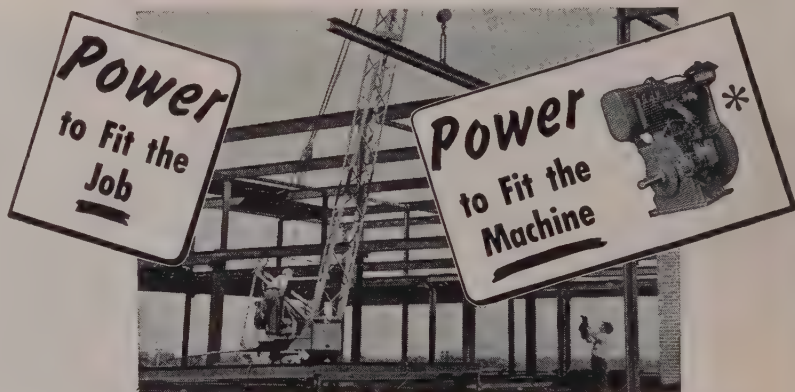


and longer life, is now being manufactured by United States Safety Service Co. This lightweight headgear has a patented position hinge which locks helmet in raised or working position and is adjustable to fit any head size. The manufacturer claims that it is resistant to warping from heat or moisture and meets the ASA code for electrical conductivity and strength.

358

Portable heater sprays heated blanket of air

Mortemp Heat Machine Co. is introducing its new heater which the company claims makes use of a new method of industrial heating—by spraying a heated blanket in a 25-ft. radius across floor and ground areas,



WISCONSIN-Powered STEEL DERRICK

Clyde Iron Works, Inc., Duluth, Minn., builds this Model W3 Whirllette, powered by a *Model AHH Wisconsin single cylinder Air-Cooled Engine. Hook work capacity: 10,000 lbs. at 10 ft. radius; 2,000 lbs. at 40 ft.; hoist line speeds, 50 to 160 f.p.m.; boom lengths, 20, 30 or 40 ft. Requires no guy wires or stiff legs; turns through 360°.

Another example of "Power that Fits the Machine and Fits the Job" . . . designed and built for heavy-duty service, delivering maximum torque at usable speeds for equipment that really has to go to work. And dependable AIR-COOLING takes care of cooling problems under all weather and climatic conditions.

You can't do better than specify Wisconsin Heavy-Duty Air-Cooled Engines for your equipment . . . single, 2- and 4-cylinder models, 3 to 36 hp.



WISCONSIN MOTOR CORPORATION
World's Largest Builders of Heavy-Duty Air-Cooled Engines
MILWAUKEE 46, WISCONSIN

A 7338-1/2-A

id no vents, ducts or oil pipes are required. The standard model L is a complete unit. The model H may be used unvented or connected to a chimney. The burner, which has an output of 175,000 Btu., is approved by Underwriters' Laboratories. It is high-pressure type and burns light kerosene, stove oil or furnace oil. An exclusive feature is the fact that it can double in five min. to distribute cool air at variable temperatures for warm weather use. Construction men will find it applicable for treating concrete, setting paint or plaster, and drying spaces.

359

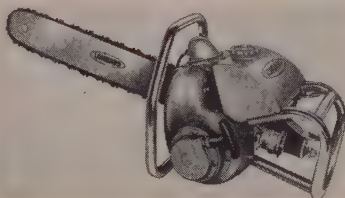
Improved sewer joint compound gives extra sealing power

New, improved Sewertite, a cold plastic sewer joint compound now in production, is said to provide extra sealing power. Sewertite's thermoplastic properties give joints tight but flexible sealing, and it provides greater resistance to cracking than ordinary sealing compounds. It is acid and alkali resistant, waterproof, flexible and permanent. Other advantages which the manufacturer describes include: immediate back-fill after application, flexible joints which remain pliable, reduction of danger of root break-through and long life without joint repair. Manufactured by Philip Carey Manufacturing Co.

360

Streamlined efficiency marks latest Woodlot Wonder saw

Streamlined efficiency, incorporating new power, speed and operating ease, sums up the new Model 3A Woodlot Wonder chain saw. Two of its efficiency devices are an automatic



oil shutoff, and a new spike bumper-grip design which allows straight limbing cuts from any angle, plus close-to-the-ground cutting for maximum log length and minimum stumpage. Manufactured by Lombard Governor Corp.

361

Folding-type crane boom for low-cost general duty

For those who require a mobile hydraulic crane that can be knocked down in less than 3 min. for traveling, Badger Machine Co. has developed its folding-type crane boom. The boom is available for use with the

manufacturer's truck-mounted Hop-to Digger. It is suitable for general light-duty crane work where mobility is important, and has a lift of 23 ft. and a lifting capacity of 1,500 lb. on a 15-ft. radius. The power unit is a Wisconsin V-F4 with 2.1 reduction and clutch. It has variable speed swing control and operates without the use of brakes, clutches or drums.

362

Tower attachment for high level concrete work

Koehring's 16-E Twinbatch can mix and discharge concrete up to a height of 48½ ft. above ground level, and all done without the aid of additional elevating equipment. That is accomplished by means of a newly designed portable tower attachment, available in 40- and 60-ft. lengths. It is raised and lowered in a few minutes by hydraulic rams, and outriggers provide stabilization for maximum rigidity. This latest improvement adds to the 16-E Twinbatch's versatility as a general purpose mixer. Moreover, the 16-E tower arrangement can be moved frequently on the same job location. The complete attachment, consisting of the tower, a 40-cu. ft. hopper and a 21½-cu. ft. concrete bucket, is optional and interchangeable with the 16-E's power controlled elevating boom. Manufactured by Koehring Co.

MAKE YOUR OLD PIPE LINE LIKE NEW...
WITHOUT APPRECIABLY DISTURBING SERVICE!

INCREASE CAPACITY...CUT COSTS

You can get new pipe line performance from old cast iron or steel pipe line economically and easily.

No need for major interruption to present service...no need to buy expensive, hard-to-get new pipe.

Patented equipment used by Pipe Linings, Inc. removes all tuberculation and incrustation from the interior of old pipe lines...applies a new continuous, smooth-surface cement mortar lining...with only momentary interruption to install by-pass lines.

So...why not get new line performance from your old pipe line at much less than the cost of new pipe? Write for full information TODAY!

Cement Mortar Lining of Old Pipe Offers These ADVANTAGES...

Protects against discoloration and contamination

Protects against corrosion

Improves flow coefficients

Prevents leakage

Reduces maintenance costs

Reduces pumping costs



Typical pipe line before Pipe Linings treatment



Old line after reconditioning by Pipe Linings, Inc.

TATE PROCESS USED on Line 4" to 16"

CENTRILINE PROCESS Used on Line 16" to 144"

Consult our hydraulic engineers...they are at your service

PIPE LININGS, Inc.

A subsidiary of American Pipe and Construction Co.
4675 Firestone Blvd.
South Gate, California

PIPE LININGS, INC.
4675 Firestone Blvd., South Gate, Calif.
Please send complete information on how we can obtain new pipe line performance from our old line.

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

Skidmore elected vice president at AED Chicago convention

Record-breaking confab attended by 2,800 members — Heaviest schedule ever attempted — Oechsle replaces Hush as president—Speakers discuss science in construction, predict future under new administration.

Top-ranking Westerner elected to office is Frank Skidmore of Albuquerque, executive vice-president.



George Jamison of Seattle will be the director of Region 12.



WITH Frank Skidmore of Albuquerque elected executive vice president, the Associated Equipment Distributors held a record-breaking annual meeting in Chicago, February 1-5. Other new officers elected for the West were: George Jamison, Seattle, director of Region 12 and Ray Corson, Denver, director of Region 14. Beal Shaw of Los Angeles continues as director for Region 11. National president for 1953 is S. John Oechsle, president of Metalweld, Inc., of Philadelphia.

The 34th Annual Meeting was attended by 2,800 construction equipment dealers and manufacturers. The business program of the convention centered around four morning sessions, a special clinic for local association officers and the traditional "Meet Your Manufacturer" session. Added to these full sessions were 19 smaller conferences including three Board of Directors meetings and 16 committee meetings. This was the heaviest schedule of activities ever attempted at an AED meeting.

To handle the record crowd and to allow time for the number of additional functions, registration opened a day earlier than usual, and the "Meet Your Manufacturer" session opened the official program on Sunday with an estimated crowd of 2,000.

Out-going President H. J. Hush, New York, opened the Monday business session with a brief report on the status of the association and then called on chairmen of various committees for separate reports. The report of the Contractor Relations Committee was presented by P. A. Dufford, Intermountain Equipment Co., Boise. A change in the by-laws of the association approved by the membership requires that a vice president from a United States region shall not carry the additional responsibilities of a director.

Largest attendance at any of the four business sessions was drawn by the distributor management report. The session, open only to principals of distributor companies, drew close to 900 dealers. The report was by the firm of Stevenson, Jordan & Har-

REPRESENTING *Western Construction* at the AED National Convention were **James I. Ballard**, Editorial Director; **Franklin Lyons**, Sales Manager; **Arthur J. Urbain**, District Manager, Pacific Northwest; **Clifford E. Beavan**, District Manager, Cleveland Office; **Richard J. Murphy**, District Manager, New York Office, and **Arthur C. Petersen**, District Manager at the Chicago Office.

rison, New York management research firm, and outlined the results of a preliminary study of distributor management undertaken for the AED. The study was based on personal surveys of 17 distributor companies located throughout the country, supported with information received through a detailed mail survey.

Election of officers was by a voice vote of the membership approving the official nominees.

Skidmore presides

Frank Skidmore, newly elected executive vice president, presided over a major session with important guest speakers. "The result of the introduction of science into construction was to develop two opposing groups; the practical and the theoretical, as represented by the constructor on the one side and the designer on the other," said Frank Nikirk, who founded the construction courses at the University of California during the past three years. "The relationship between these two groups has not always been as it should be due to the different viewpoints and the different approaches toward solving construction problems. Scientific training often ignores or discounts facts that do not fit into a pattern or formula of scientific rules, and the practical man is often intolerant of the technician who does not recognize the points or facts which he, the practical man, thinks are important."

Second speaker at this session was Joseph T. King, AED Washington representative, who told members what to look for in the new administration. Referring to President Eisenhower's "State of the Nation" address, King said, there was "the clear implication that all groups must subvert their special interests to the general welfare of the whole people. In this connection you are going to be affected." Reporting that the Director of the Bureau of the Budget had that morning ordered all agencies to screen their construction projects and eliminate all but the very essential, King said, "when it comes down to your pocketbook, it is natural for you to say, 'Let them eliminate something else, but don't let them eliminate construction projects.' It is in

A RESOLUTION

WHEREAS vast quantities of heavy construction machinery have been purchased by various agencies of the federal government for overseas use since the outbreak of the Korean conflict;

AND WHEREAS sudden and ill-advised release of such machinery in the form of surplus upon the domestic market could create unbelievable abuse and dislocation of our economy, far surpassing the problems encountered at the close of World War II;

AND WHEREAS members of this industry are in a position to render sound advice and counsel to government officials responsible for the ultimate disposition of such equipment;

THEREFORE BE IT RESOLVED that immediate steps be taken to develop a practical and feasible program, designed to provide for disposal of surplus machinery in a manner that will assist rather than disrupt economic stability;

AND BE IT FURTHER RESOLVED that the attention of the new administration in Washington be directed to the serious nature of this problem, and the urgent necessity for developing the basic principles which will govern return of surplus upon cessation of hostilities in Korea.

Westerners who attended the AED convention

Arizona

Arizona Equipment Sales, Inc., Phoenix—Joe E. Angle.
Neil B. McGinnis Equipment Co., Phoenix—Sam W. Baar.
The O. S. Stapley Co., Phoenix—H. E. Walters.
State Tractor & Equipment Co., Phoenix—J. R. Robinson.
Superior Equipment Co., Phoenix—John M. Hazelett.
Western Machinery Co., Phoenix—R. B. George and J. P. Keller.

California

Aikins & Williams Tractor Co., Eureka—E. L. Aikins.
Allied Equipment Co., Fresno—M. C. Orendorff.
Edward R. Bacon Co., San Francisco—W. G. Dunn, Albert P. Hahn, and Jack H. How.
Brown-Bevis Industrial Equipment Co., Los Angeles—V. V. Bailey, Brette Brown, and C. E. Skidmore.
Buran Equipment Co., Oakland—Irving R. Kraemer.
Casey-Metcalf Machinery Co., Los Angeles—T. D. Casey and Edward Metcalf.
Coast Equipment Co., San Francisco—Paul R. Egli and William M. Nosman.
Contractors Machinery Co., San Francisco—J. W. Beatty.
Crook Co., Los Angeles—Albert L. Chappell.
Electric Tool & Supply Co., Los Angeles—A. R. Williams.
Graco, Stockton—C. N. Minahen.
C. H. Grant Co., Oakland—C. H. Grant.
Gridley Equipment Co., Los Angeles—Horace Gridley.
Harron, Rickard & McCone Co., Los Angeles—James W. Savage and Alex B. Todd, Jr.
Hudson Corporation, San Diego—W. H. Hudson.
Jenison Machinery Co., San Francisco—E. S. Jenison.
Kern County Equipment Co., Bakersfield—J. A. Michels.
Le Roi-Rix Machinery Co., Los Angeles—W. Z. Bancroft, N. C. Deane, and R. F. Deane.
The Merrill-Brose Co., Oakland—George B. Brose.
Sacramento Valley Tractor Co., Sacramento—W. H. Pahl.
Shaw Sales & Service Co., Los Angeles—H. I. Hickman, Beal Shaw, and W. B. Shaw.
Southern California Equipment Co., Los Angeles—Lon B. Millar and Kenneth C. Norman.
Western Machinery Co., San Francisco—H. J. Mayer.
Western Traction Co., San Francisco—John Jorgensen.

Colorado

The Colorado Builders' Supply Co., Denver—E. F. Amos, C. E. Berry, C. B. Hansen, and James D. Maitland.
Constructors Equipment Co., Denver—D. G. Gibson and T. M. Sanders.
Ray Corson Machinery Co., Denver—J. J. Booth and R. E. Corson.
Gunderson-Taylor Machinery Co., Denver—G. W. Gunderson and Edward F. Taylor.
Liberty Trucks & Parts Co., Denver—F. V. Altvater and Walter W. Carlson.
McCoy Company, Denver—Jack M. Fincham.
McKelvy Machinery Co., Denver—J. R. McKelvy and Rex D. McKelvy.
H. W. Moore Equipment Co., Denver—Walter Babcock, J. C. Moore, and Jack Moore.
Western Machinery Co., Denver—L. M. Jones and R. H. McCormick.

Idaho

Engineering Sales Service, Inc., Boise—H. W. Hurd.
Intermountain Equipment Co., Boise—Philip A. Dufford and R. W. Stevens.
Olson Manufacturing Co., Boise—D. L. Watson.
The Sawtooth Company, Boise—Peter H. Cohn.
Southern Idaho Equipment Co., Idaho Falls—M. G. Gooch.
Western Equipment Co., Boise—G. M. Gehrke.

Montana

Caird Engineering Works, Helena—H. W. Bogie.
Hall-Perry Machinery Co., Butte—L. E. Jones and Ben L. Smith.
Industrial Equipment Co., Billings—W. C. Hardie.
Montana Powder & Equipment Co., Helena—R. V. McCullough and W. T. McCullough.
Mountain Tractor Co., Missoula—V. R. Howell.
NorMont Equipment Co., Great Falls—J. B. Beatty.
Seitz Machinery Co., Inc., Billings—E. L. Kleckner and Melvin Seitz.
Treasure State Equipment Co., Kalispell—H. R. Heaton.
Western Construction Equipment Co., Billings—Lloyd J. Klingler and Wayne Doolen.

New Mexico

J. D. Coggins Co., Albuquerque—Harold R. Bone and J. D. Coggins.
Contractors' Equipment & Supply Co., Albuquerque—R. A. Otterness and Frank Skidmore.
Harry Cornelius Co., Albuquerque—W. H. Cornelius and Neal Wiggans.
Lively Equipment Co., Albuquerque—W. E. Lively, Jr.
N. C. Ribble Co., Albuquerque—Ray Collins and N. C. Ribble.

Nevada

Sierra Machinery Co., Reno—J. D. Burgess.

Oregon

Balzer Machinery Co., Portland—Robert F. Rundle.
Cal-Ore Machinery Co., Inc., Medford—Walter G. Garner.
Clyde Equipment Co., Portland—Oscar B. Bjorge and W. T. Euster.
Columbia Equipment Co., Portland—F. B. McBath.
Contractors Equipment Corp., Portland—Oliver C. Jessup.
Cramer Machinery Co., Portland—C. P. Cramer.
P. L. Crooks & Co., Inc., Portland—P. L. Crooks, Jr.
Feenaughty Machinery Co., Portland—D. J. Feenaughty and M. B. Mack.
Howard-Cooper Corp., Portland—F. R. Cooper and F. S. Parker.
Edward L. Kropp Co., Portland—Edward L. Kropp, Sr.
Loggers & Contractors Machinery Co., Portland—A. F. Sersanous.
Western Equipment Co., Eugene—M. W. McCann.
Wood Tractor Co., Portland—Roy E. Wood.

Utah

Arnold Machinery Co., Salt Lake City—R. G. Arnold and R. L. Arnold.
Cate Equipment Co., Salt Lake City—D. E. Hughes.
Foulger Equipment Co., Salt Lake City—J. T. Holland.
Heiner Equipment & Supply Co., Salt Lake City—J. E. Heightsman, K. F. Heiner, W. Macey, and George E. Smith, Jr.
The C. H. Jones Equipment Co., Salt Lake City—Russell S. Stewart.
Kimball Equipment Co., Salt Lake City—John F. Kimball.
The Lang Co., Inc., Salt Lake City—John Lang, R. H. Rampton, and F. E. Scheffner.
Lund Machinery Co., Salt Lake City—Joseph N. McRae.
Rasmussen Equipment & Supply Co., Salt Lake City—Frank Rasmussen.
Rocky Mountain Machinery Co., Salt Lake City—L. W. Gurr and Leland Knudson.
Western Machinery Co., Salt Lake City—L. T. McGuire.
Wheeler-Kershaw Co., Salt Lake City—Walter W. Kershaw and J. K. Wheeler.

CONTINUED ON NEXT PAGE

Washington

Air-Mack Equipment Co., Seattle—Lewis E. Langdon.
American Machine Co., Spokane—H. A. Briggs.
Blackwell-Coleman Equipment Co., Spokane—R. E. Blackwell and R. S. Coleman.
Bow Lake Equipment Co., Seattle—Conrad Creim and Scott Simenstad.
Glenn Carrington & Co., Seattle—Arthur F. Erickson.
Construction Equipment Co., Spokane—H. H. Ferris, F. G. Peterson, Jr., and S. L. Sanders.
A. H. Cox & Co., Seattle—G. H. Jamison and J. A. Widrig.
General Machinery Co., Spokane—E. J. Simons, Jr.
Modern Machinery Co., Inc., Seattle—E. C. Stephenson.
Modern Machinery Co., Inc., Spokane—C. H. Davis and G. A. Wynkoop.

Pacific Hoist & Derrick Co., Seattle—George F. Schoen.
Philpott Equipment Co., Seattle—J. G. Woodford.
Jack Sahlberg Equipment Co., Seattle—A. J. Sahlberg.
Star Machinery Co., Seattle—J. T. Hatten, Bert J. McNae, and I. B. Rabel.
Universal Equipment Co., Seattle—F. R. Steckel.
Washington Machinery & Storage Co., Seattle—D. A. Lyons and J. P. Studebaker.
Western Machinery Co., Spokane—H. A. Myers.
Yukon Equipment Inc., Seattle—N. A. Ruthruff.

Wyoming

Studer Tractor & Equipment Co., Casper—R. A. Studer.
Wilson Equipment & Supply Co., Cheyenne—Glen Moss and H. R. Wilson.

your hands and in the hands of other businessmen to bring about a successful administration and economy in Washington. If you are not going to accept your cut right along with the other cuts that are going to be imposed on other interests, then the administration will fail in its efforts."

S. D. Maddock, president of C.I.T. Corporation, opened the final talk of the morning with a preview of market conditions as his firm expected to find them during the next 18 months. Maddock said that after careful study of market conditions, his company had concluded that, barring all-out war, the following conditions were most likely to exist:

Conditions listed

1. Business in general will continue approximately at its present level.
2. Construction equipment will be in about equal demand as at present.
3. The supply of construction equipment will increase as materials become readily available and manufacturers shift more and more to normal domestic production and distribution.
4. With an approximately level demand and a greater supply, competition in your business is certain to intensify.
5. Manpower, particularly good salesmen, will be in increasing demand.
6. Dealers will require more dollars or a faster turnover of your present supply of dollars if they are to hold their own.

In expanding on these points, Maddock said that all businesses wanted to grow. Growth in the present market cannot be measured by dollar volume alone, but also by the number of units sold. "It is not enough to think you are growing just because your dollar sales have gone up, because the price has been inflated," he said. "You grow when you sell more units."

"The dollar price of most of your units has doubled in the past ten years. It is likely to continue to in-

crease even without any further shrinking in the value of the dollar. This future price increase is likely because the market will be getting better and larger machines and equipment. You will be expected to sell these larger, more efficient units that your manufacturers will design and build."

To meet the market, the distributor's dollar must be ready to accept the old while selling the new. Maddock warned that every available dollar must be ready "to work harder, support more sales, figure in more deals."

He warned dealers to: (1) Keep fixed assets at a minimum, (2) Study inventory carefully to prevent immobilization of dollars, (3) Avoid dollars invested in rental fleets, (4) Prevent open accounts from becoming a convenient means for the contractor to trade on the distributor's good will for long terms of payment, and (5) Don't attempt to be a banker.

Maddock also warned distributors against failure to recognize the financial limitations of contractors. He said that any financial arrangements, whether handled by the distributor, or by a third party, should be based on realistic rates of payment.

"Remember," he said, "contractors are having a hard time in their financing these days. They have to provide money to pay for heavy duty, high priced equipment and have to provide money to run a high cost job. At the same time, their financial statement must be sufficiently liquid to qualify for bidding and to enable them to make bond. Too much short term debt is a definite handicap and is one of the principal reasons for failure among contractors."

Turning to the question of rentals, Maddock said that a contractor may have several reasons for wanting to dress up as a lease what is in fact a conditional sale. Some of the more important reasons are:

The contractor wishes to avoid making the usual down payment required under a conditional sales contract.

The contractor wishes to treat the rental payment in its entirety

as an expense, in hope of winning tax advantages.

The contractor wishes to improve his financial statement for bidding and bonding purposes.

Newly elected officers and directors took office at an installation luncheon on Wednesday. In a brief message to the membership following his installation as President, S. John Oechsle named some general goals toward which the association would work during the coming year:

Expanded work in the fields of customer-distributor and manufacturer-distributor relations.

Continuation of the statistical research program.

Continued expansion of services to the industry provided through the association's executive offices.

Sessions included a meeting of the Advisory Board, led by R. L. Arnold, 1951 AED president, Arnold Machinery Co., Salt Lake City; rental committee meeting, conducted by J. T. Hatten, chairman, Star Machinery Co., Seattle, Washington; and a finance committee meeting, also headed by R. L. Arnold, chairman of the 1953 committee.

Discuss training programs

The Thursday business session, sponsored by AED manufacturer members, consisted of a panel discussion on training and education programs conducted by manufacturers for distributors. The discussion covered training of sales, parts, and service personnel either at the factory or in the distributor's locality.

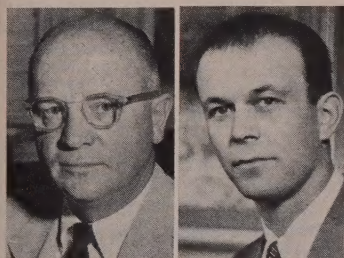
President Hush, Mrs. Hush, 1952 officers and their wives, were hosts to the entire membership at the President's Reception. The Annual Birthday Party, Tuesday evening, was also given in honor of President Hush.

Harry Fletcher, eighth president of the association, who was later in the week to serve as installing officer, was given a special honor at the welcoming luncheon on Monday. Fletcher, who has been a member of AED since 1922, was awarded a plaque for outstanding service to the association.

NEWS of DISTRIBUTORS AND FACTORY BRANCHES

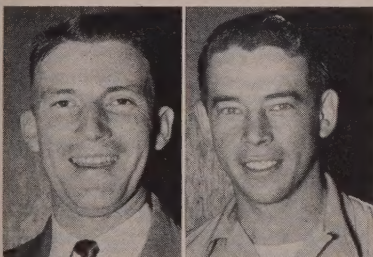
Interstate Tractor promotes four

Four members of the Interstate Tractor and Equipment Co. sales staff have been promoted in a move to strengthen the staff for 1953, according to Collis Johnson, president. The four, Robert B. Ebersole, Waldo Mor-



Ebersole

Mordini



Thayer

Hoff

dini, J. B. Thayer, and K. H. Hoff, are key members of the firm, which sells and services Caterpillar, Hyster, Skagit, and allied industrial equipment throughout the state of Oregon. Ebersole, a construction territory manager for the last seven years, was named manager of the Salem store. Mordini, a general sales representative with an extensive background in sales engineering, became assistant to George J. Alstadt, vice president and general sales manager of the company. Thayer, industrial territory manager at The Dalles, went to Portland as construction territory manager. He had recently returned from Peoria with information about new Caterpillar developments. Hoff, formerly farm territory manager at The Dalles, fills Thayer's old spot.

Leaseway Corporation formed

C. T. Mathers of Salinas, Calif., announces the formation of a new firm, called Leaseway Corp., which specializes in the leasing of new industrial equipment, including a complete line of tractors, shovels, cranes, scrapers, and compressors. The officers are Mathers, president; Jim Bardin, vice president, and George T. Jameson, secretary-treasurer. Mathers reports that Don Hardy, Granite Construction Co. maintenance supervisor for

many years, is now industrial sales representative of the Farmers Mercantile Co. of Salinas.

Goodall installs Brown in eastern Washington

With headquarters in Spokane, W. A. (Tex) Brown has been placed in charge of the Inland Empire area by Joe H. Moss, Goodall's Northwest manager. Brown, who studied engineering at the University of Montana and Cal-Tech, was formerly with the Texas Co. as lubrication engineer for the State of Washington.

Heil Co. opens in Denver

John N. Zimmerman was named head of the recently opened Denver district sales office of the Heil Co. Zimmerman, a veteran of more than 15 years' service with the company, will direct sales of truck bodies and hoists, transport and storage tanks, oil- and gas-fired home heating units, earthmoving machines, dehydrating equipment, and bottle washing machines.

Utah's AED election returns

Bert Foulger, president and general manager of the Foulger Equipment Co., Salt Lake City, has been elected president of the Associated Equipment Distributors of Utah for 1953. Foulger, who succeeds William F.

Allen, was AED secretary in 1951 and vice president last year. Other new officers are Dick Rampton, Lang Co., vice president; and L. W. Gurr, Rocky Mountain Machinery, secretary.

Sales mgr. for Chain Belt Co.

Construction Machinery Division of Chain Belt Co. announces that Parker (Red) Eddy is new district sales manager of the Los Angeles office. Parker has been an employee of the Construction Machinery Division since February 1952.

WEMCO acquires Smith Booth Usher Co.

Western Machinery Co., San Francisco, announces the acquisition of Smith Booth Usher Co., Los Angeles, one of the West's largest distributors of construction machinery and equipment. Spokesman Jack H. How said that the Los Angeles firm would be operated as a division of Western Machinery Co., occupying the same premises, 2001 South Santa Fe Ave., with substantially the same personnel. Acting manager of Smith Booth Usher Co. is Herbert J. Mayer, general manager of WEMCO's industrial sales division.

Western Machinery Co. also announces four more members to its board of directors as well as changes among its officers. These new direc-

SCHROCK MOTORIZED HEAD PULLEY For Belt Conveyors and Bucket Elevators



"PULLEY WITH THE DRIVE INSIDE"
Safe, compact, simple . . . no chains, no belts, no sprockets, no exposed motors.

Built by YUBA for sale in Arizona, California, Idaho, Montana, Nevada, New Mexico, Oregon, Texas, Utah, Washington.

Built and sold in other states by Iowa Manufacturing Company, Cedar Rapids, Iowa.

Pulley shell of this revolutionary head pulley rotates around electric motor and reduction gears, which are held stationary by torque arm attached to conveyor frame. Quickly in-

stalled — requires no more room than idler pulley. All moving parts protected against weather, grit, dirt. Diameters 16" to 48". 5 to 75 hp. for voltages to 2300. Job proved.

Write TODAY for folder and name of nearest distributor.



YUBA MANUFACTURING CO.

Pulley and Sprocket Dept.

Phone 628

Benicia, Calif.

52

tors are Mayer; Ralph B. Utt, general manager of the company's WEMCO division; Edward J. Barshell, controller, and Arthur P. Shapiro, attorney. Harry N. How, founder and president since 1915, is now chairman of the board, and Jack How, his son, succeeds him as president and general manager. Mayer and Utt are vice presidents, Barshell is secretary, and Mrs. Harry N. How is now treasurer.

Lines handled by Smith Booth Usher Co. are Austin-Western Co., Jaeger Machine Co., Independent Pneumatic Tool Co., Littleford Bros., Cleveland Trencher Co., Baldwin-Lima-Hamilton Co., and Good Roads Machinery Co. Some of WEMCO's industrial division lines are Austin-Western Co., Jaeger Machine Co., Chicago Pneumatic Tool Co., Harnischfeger Corp., and Pettibone-Miliken Corp.

New job for Standard Wire & Cable Co.

Standard Wire & Cable Co., 3440 Overland Ave., Los Angeles, has been appointed distributor for electrical wire and cable produced by American Steel and Wire Division of United States Steel Corp. The new distributorship includes such products as Amer-Clad, Amer-Bestos and Amer-Sheath.

New Calif. rep. for Union Wire Rope Corp.

Joseph T. Broadus, a Union Wire Rope Corp. employee since 1937, has been appointed California represent-

Joseph T. Broadus, Calif. representative for Union Wire Rope Corp.



ative of the corporation, working out of the Sacramento office. Broadus, who started his new duties the first of the year, returned from active service with the Air Force Reserve in August, 1952.

Worthington now sales mgr. of Madsen Iron Works, Inc.

Glenn F. Worthington is now sales manager of Madsen Iron Works, Inc., Huntington Park, Calif. He has been a member of the firm's sales department since 1945, and his promotion is part of an expanded program due to an increasing demand for Madsen's asphalt paving plants.

NEWS of MANUFACTURERS

Emsco changes name

Emsco Derrick & Equipment Co. announces a change in its corporate name to Emsco Manufacturing Co. in keeping with its wide variety of products now manufactured. Products include a complete line of drilling and production equipment for the oil industry, radio and television towers, structural fabrication, heavy duty machining and hot dip galvanizing.

Colorado Fuel & Iron acquires Roebbling

The Colorado Fuel & Iron Corp. recently completed acquisition of John A. Roebbling's Sons Co., which henceforth will be operated by John A. Roebbling's Sons Corp. as a newly-formed and wholly-owned subsidiary of Colorado Fuel & Iron. Officers of the new Roebbling Corp. are: Charles Allen, Jr., chairman of the board; A. F. Franz, president, and Charles Roebbling Tyson, executive vice president. Franz is president of Colorado Fuel & Iron and Tyson was president of the Roebbling concern since 1944. Allen also serves as chairman of board of Colorado Fuel & Iron.

Gen. mgr. for Calif. Redwood Assn.

Philp T. Farnsworth is new general manager of the California Redwood Assn., following the resignation of Sherman A. Bishop. Farnsworth was a director of the association's promotion division for a number of years. The association is interested in both the tree and its processed products.

Consolidated Western Steel officer

Ralph W. Seely, a firm employee since 1940, is now vice president and general manager of the Consolidated Western Steel Division of United States Steel Corp. Seely will assume full responsibility and authority for all Division operations under the general direction of Alden G. Roach, president.

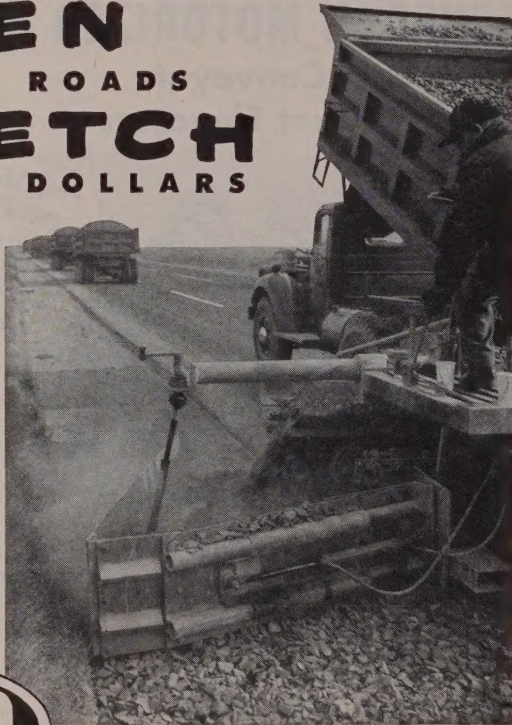
Marion Metal Products prexy

Promotion of Gilbert E. Herr to president and general manager of Marion Metal Products Co. is among recent changes in company organization. Herr, vice president and general manager since 1942, was moved up because of the recent death of former president J. Malcolm Strelitz. Mrs. Strelitz was elected to the board of directors. Joseph L. Halberstein, former secretary, is now chairman of the board of directors, and L. E. Oberlander was elected secretary to succeed Halberstein. Other board members are R. J. Graham, treasurer; E. C. Dee and R. C. Craven, chief engineer.

WIDEN ROADS STRETCH DOLLARS

At the rate of 150 to 200 tons per hour this efficient APSCO Widener fills a trench on the New Jersey Turnpike. Keeps a fleet of trucks on the jump!

It can place any loose material in trenches up to 10' wide — concrete up to 6' wide . . . and no forms required!



CAN HELP YOU!

Send for details

ALL PURPOSE SPREADER CO. • ELYRIA, OHIO

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BACKFILL, uncompacted

We were only half right

We try never to leave our readers half-informed. But here's what happened last month:

We put together a short item telling of the appointment of Ralph Tudor as the new Undersecretary of the Interior. He hadn't accepted the post, but we set our item up in type and prepared a place for it in the magazine, right at the top of page 106, "Engineers on the move." Our idea was to let it get printed if we got confirmation of the appointment in time.

Well, we didn't get the confirma-

tion in time, but neither did we remember to "kill" the item. At least, not until half of the magazines had been printed. Then we got cold feet for sure, had the Tudor item killed, and put in another telling of Seattle's new city engineer.

Tudor himself saved the day for us. He accepted his federal appointment before any of the magazines were mailed out. Even so, half of you didn't read about it. We were half-right, and you were half-informed. Tudor's experience and qualifications for his new post are detailed in an item on page 96 this month, but for the

record, so that everyone has the whole story, here are the two items of last month:

The appointment of **Cmdr. William E. Parker** as city engineer was approved by Seattle's City Council on the first of the year. The post was filled temporarily by **Robert Hubbard**, who replaced **Ralph W. Finke**, who resigned last November.

Ralph Tudor of Tudor Engineering Co., long a prominent engineer in the West, particularly known for his work in connection with San Francisco Bay crossings, has been appointed Undersecretary of the Interior in the new administration.

Five-cent cigars, too

While digging through the files in the back room for Western construction news of twenty-five years ago, we ran across some other material that was too good to pass up. Bull Run storage dam for the city of Portland was then under construction, Bent Brothers of Los Angeles having the prime contract for \$1,440,375. The dam was described as a cement-concrete, curved gravity structure having a maximum height of 200 ft.

Major equipment used by the contractor included the following: "3 mi. of standard railroad for aggregates, using 14-yd. Western cars; one 100-ton Monihan dragline, 50-ft. boom, with 2½-yd. Paige bucket; Bodison revolving screen and sand washer; a 375-ft. double compartment Insley steel tower, two 2-yd. Smith tilting concrete mixers; two P&H Model 700 gas-electric shovels; and five 5-ton Mack trucks." How about running a job with that spread today?

Some of the unit prices on the job ran like this: common excavation, \$1.30 and \$1.50 per yd. (above and below the critical elevation of 870 ft., respectively); rock excavation, \$2.50 and \$4.00 (same difference); and plain concrete, \$4.30 (the city furnished cement). How about making money with those prices today?

No clockwatcher, he

The door slammed on a San Diego contractor recently. He was just 4 minutes late to a bid opening of the board of education. Involved was a quarter-million dollar contract for construction at the new Mission Bay High School. According to the late arrival, his bid was \$500 lower than the one which was accepted. Here is one time that it would have paid off to watch the clock.

The paper reporting the incident was unable to record the name of the contractor. But, having heard of these incidents many times, we know who it was. His name is Legion!

Twenty-five years ago in Western Construction

"The board of supervisors of Contra Costa County on February 9 passed a resolution of intention to grant a franchise to the Richmond-San Rafael Bridge Co., Inc., for a bridge across the San Francisco Bay from Richmond, Contra Costa County, to Point San Quentin, near San Rafael, Marin County . . .

"The bridge will be 15,533 ft. long, with a clearance of 160 ft. above the deepest part of the bay, which is 85 ft. The estimated cost is \$15,000,000.

"Charles Derleth, Jr., chief engineer of the American Toll Bridge Co. and dean of the college of civil engineering, University of California, will design this new bridge."

* * *

"The Caterpillar Tractor Co. of San Leandro, Calif., and Peoria, Ill., announces a new model tractor designated as the "Caterpillar" Twenty. The new model takes its name from the fact that its rating is 20 hp. at the drawbar.

"The Twenty is a new tractor in size, rating and price, built to fit into a line of bigger brothers, the Thirty and the Sixty, as well as the smaller two-ton . . ."

* * *

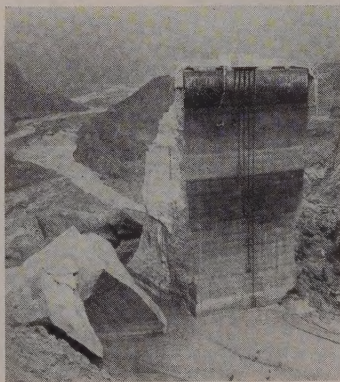
A 7½-page article by Lochiel M. King, construction engineer, described the work of sinking and joining the precast concrete units that form the Alameda Estuary Tube. Now known as the Posey Tube in honor of its chief engineer, the tube is one of a very few engineering structures that bear the names of the engineers who built them. [San Francisco engineers in 1953 have acclaimed the Posey Tube as one of the seven engineer-

ing wonders of the Bay area. This may be the reason!]

* * *

"About midnight, Monday, March 12, the St. Francis Dam on San Francisquito Creek, northwest of Saugus and 45 miles north of Los Angeles, gave way almost entirely, releasing 36,000 acre feet of water, which destroyed everything in its path down San Francisquito canyon and then through the Santa Clara Valley to the Pacific Ocean. About 300 people were killed, and the property damaged is estimated at \$20,000,000 . . .

"This dam, of the gravity type arched, was 205 ft. high above bed-rock foundation; 175 ft. high above



streambed; 668 ft. long on crest, with an extension wingwall on the right or west abutment 613 ft. long; 16 ft. thick at the crest and 175 ft. thick at the base; arched upstream on a radius of 492 ft.; contained 175,000 cu. yd. of concrete, 156,000 cu. yd. being in the dam proper; and had a maximum storage capacity of 38,000 acre feet . . ."