

WESTERN

CONSTRUCTION

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MAY 10 1951

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FEATURED THIS ISSUE

How Contractor Cut 2 Years
From 4-Year Dam Schedule



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How to Get the Most Out of
Your Compressor Equipment



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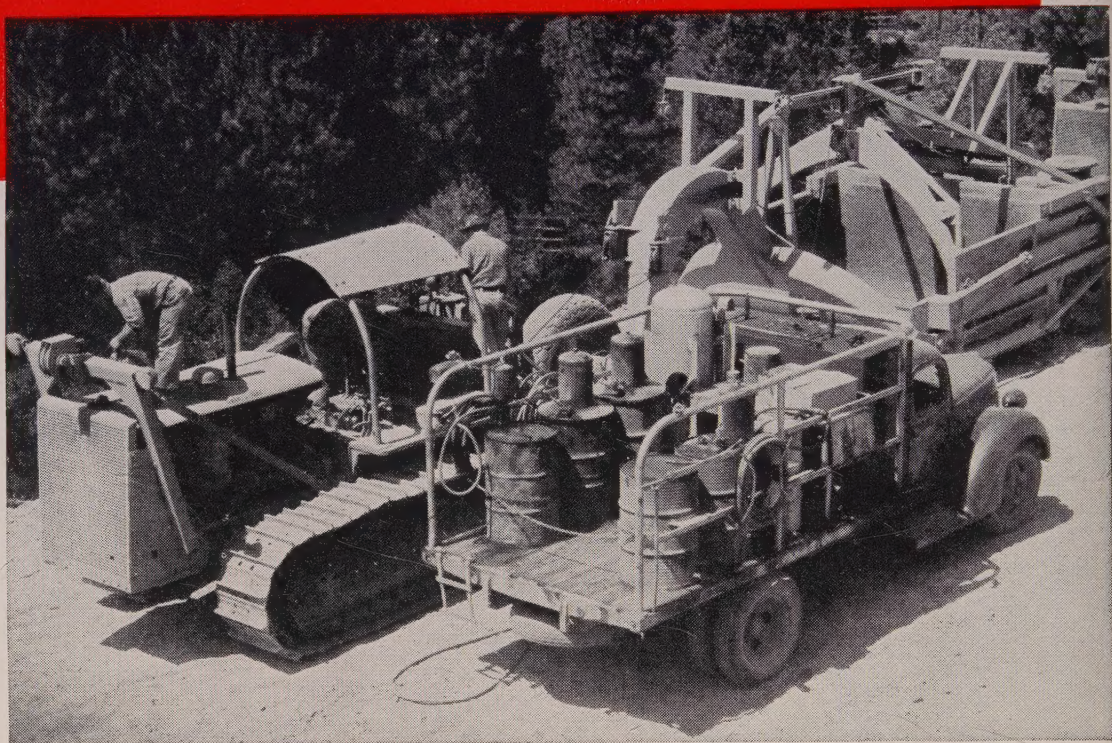


Cover Picture . . . See Page 4

MAY 1951

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TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. See newspaper for time and station.

JAMES I. BALLARD Editorial Director
JOHN J. TIMMER Managing Editor

An Artistic Backfire

WHEN ARTISTS undertake the appraisal of a proposed engineering project and come up with an objective and sound answer it is worthy of comment. Interests opposing the proposed Echo Park Dam, which is a major feature of the Upper Colorado River development, asked the Utah Federated Artists to voice their disapproval of the project on the ground that it would desecrate and destroy natural beauty. Of all organized groups an association of artists would seem to be most easily influenced by specious arguments based on factors of the aesthetic. Likewise they would seem to be least concerned with factual advantages of river control. Contrary to what was expected to be an immediate and emotional reaction, the artists decided to appoint a committee and make their own study of the project. Naturally, they were particularly interested in the elements of beauty and scenic attraction which might be adversely affected by any dam and reservoir.

The committee report, and the following endorsement of the project, indicate that artists are qualified to evaluate factors which may appear to be in another field of interest. They found that no archeological material would be flooded which had not already been adequately studied, and that any negative effect on natural beauty would not stand up against arguments for the benefits to result from the project. Although it represents a small voice, this opinion may have an important bearing on the vociferous opposition to a project which is typical of engineering developments that are stepping-stones of Western growth.

Programs Problems at Highway Conferences

HELPFUL programs are difficult to maintain for the several well-established highway conferences held annually in the Western States. Unless these programs provide fresh, worthwhile material they are not fulfilling their intended purpose, and may even indicate approaching decadence.

This comment relates primarily to those conferences, or "schools," which have been established for the express purpose of providing an opportunity for county engineers, city engineers and members of the field forces of highway departments to meet and learn about current developments in highway design, construction and maintenance. These annual meetings have served a worthwhile purpose, as sponsored by state highway departments, or engineering colleges or trade associations. The basic idea remains sound in passing along to county and city level the practical applications of those developments.

A long-range approach to the continuing of these "schools" on an annual frequency indicates that they must have either: (1) enough new and helpful material to main-

tain the interest of the regular attendant, or (2) enough new men entering the group every year to require a repeat program on fundamentals. The usual compromise program provides papers reviewing new developments which may be too advanced for men just entering the highway field, and some talks on basic information which will be rather deadly to the experienced men.

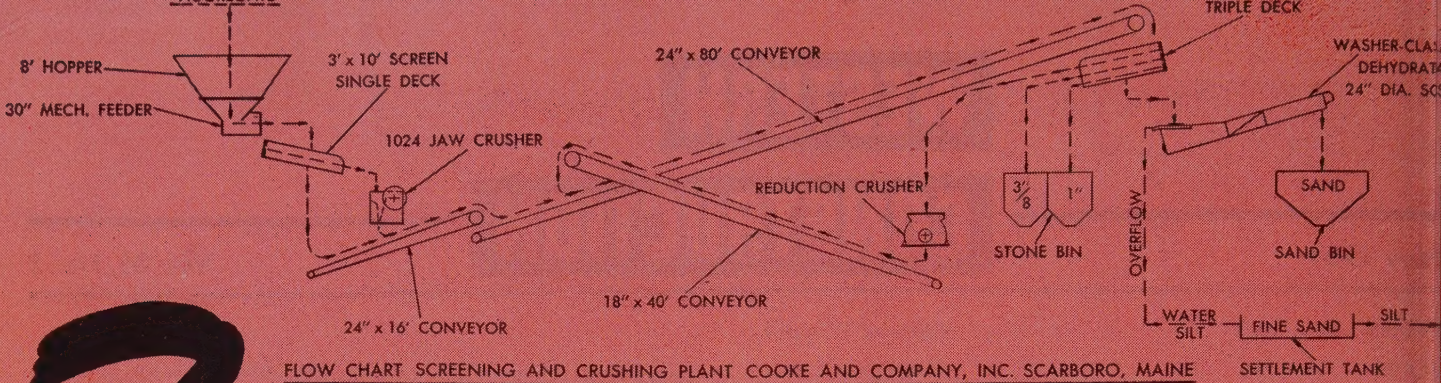
One solution to this problem is to split the conference into two simultaneous sessions, but the volume of attendance and the problem of securing the additional speakers hardly justify this refinement. Another modification in the standard program to meet this difficulty is to introduce talks on some of the borderline phases of highway work, but this is an obvious dilution of the menu, which must remain of substantial, practical help if the conference meets its expressed obligation.

Viewed objectively it is difficult to expect that developments of practical importance in the highway field will produce material for fruitful conferences at annual intervals for an indefinite period. At the same time the value of the meetings justifies their continuance. One solution would be a longer interval to allow accumulation of adequate and well-rounded selection of subject matter. Another would be alternate annual meetings on more specialized and concentrated coverage of a narrower field of interest. There may be several other means of getting equally beneficial results. Because of their value to the highway progress of the West, some means must be found to maintain the present service rendered by these highway conferences as the quality of program material begins to wear rather thin for an annual frequency.

A Prediction Affecting All Construction

PREDICTIONS for the flow of Western streams during spring and summer months are of interest to all engineers and contractors. Hydrologists have been working on this complex problem for years with results which are gradually increasing in both accuracy and reliability. The studies take two directions: first, the estimating of the total seasonal run-off which is of prime importance for conservation and water supply; second, the prediction of the possible peak flow which is of immediate importance for flood control and all construction operations in progress on the stream that season.

This issue of *Western Construction* presents the annual official governmental report on water conditions and predicted flow for the streams of this region during the coming season. The information forms the basis for setting up the programs of storage, diversion and use by all engineering agencies during 1951. Much of the construction activity in the West will ultimately be affected by these results, even though contractors are not directly aware of the relation between a snow survey and their potential volume of activity during the next few years.



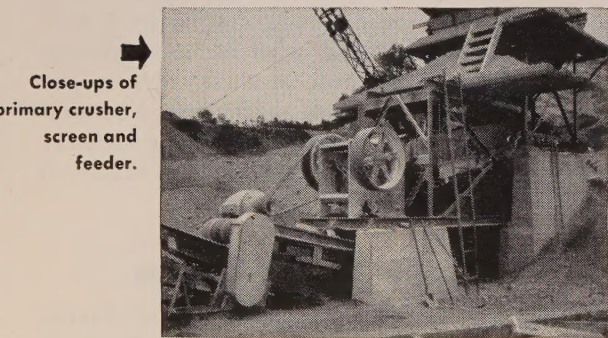
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Times the Production

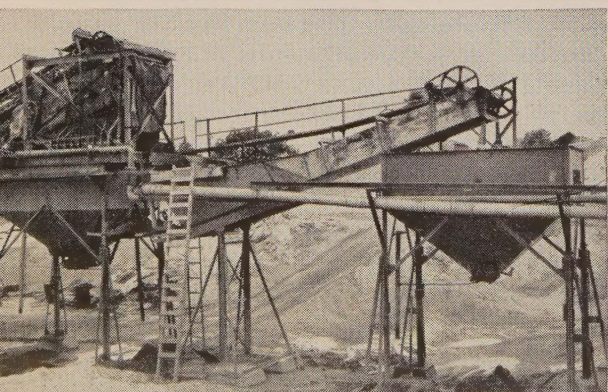
at less than HALF the cost



Over-all view of plant from discharge end. Truck in foreground is receiving load of washed sand from sand bin.



Close-ups of primary crusher, screen and feeder.



At the left, three-deck screen over two-compartment stone bin.
At the right, sand-classifier-washer-dehydrator over sand bin.

That's the experience of Cooke & Company with their new Austin-Western crushing and screening plant. Cooke & Company operate large gravel and sand pits in Scarborough, Maine; sell concrete mix, asphalt mix, washed gravel and washed sand. The separation of aggregate into stone of two sizes—"peastone" and "buckwheat"—and washed silt-free sand is the principal operation.

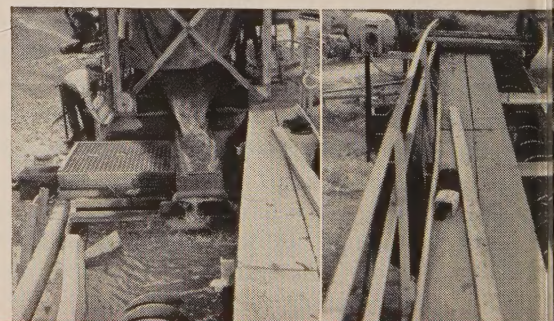
In the words of A. C. Stanley, president of the company—

"Compared with our previous operation, we save two trucks and four men — a total of \$92.00 daily . . . are producing three times as much as before, at less than half the cost . . . quality of the gravel and sand produced has been very satisfactory . . . clean, carefully washed material is important when you want to obtain concrete that does not deteriorate."

Each Austin-Western plant is "tailor-made" for a particular production problem. Our engineering department will be glad to discuss yours.

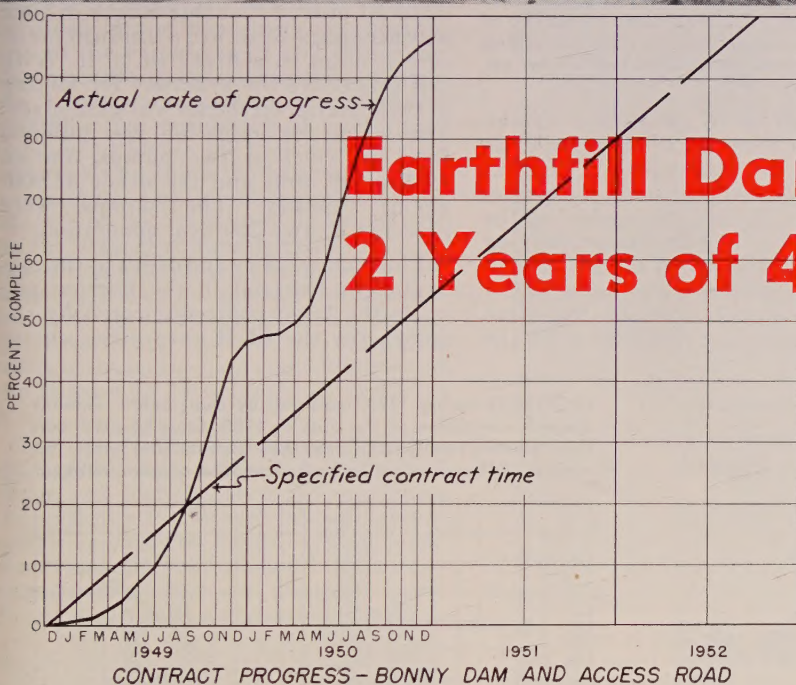
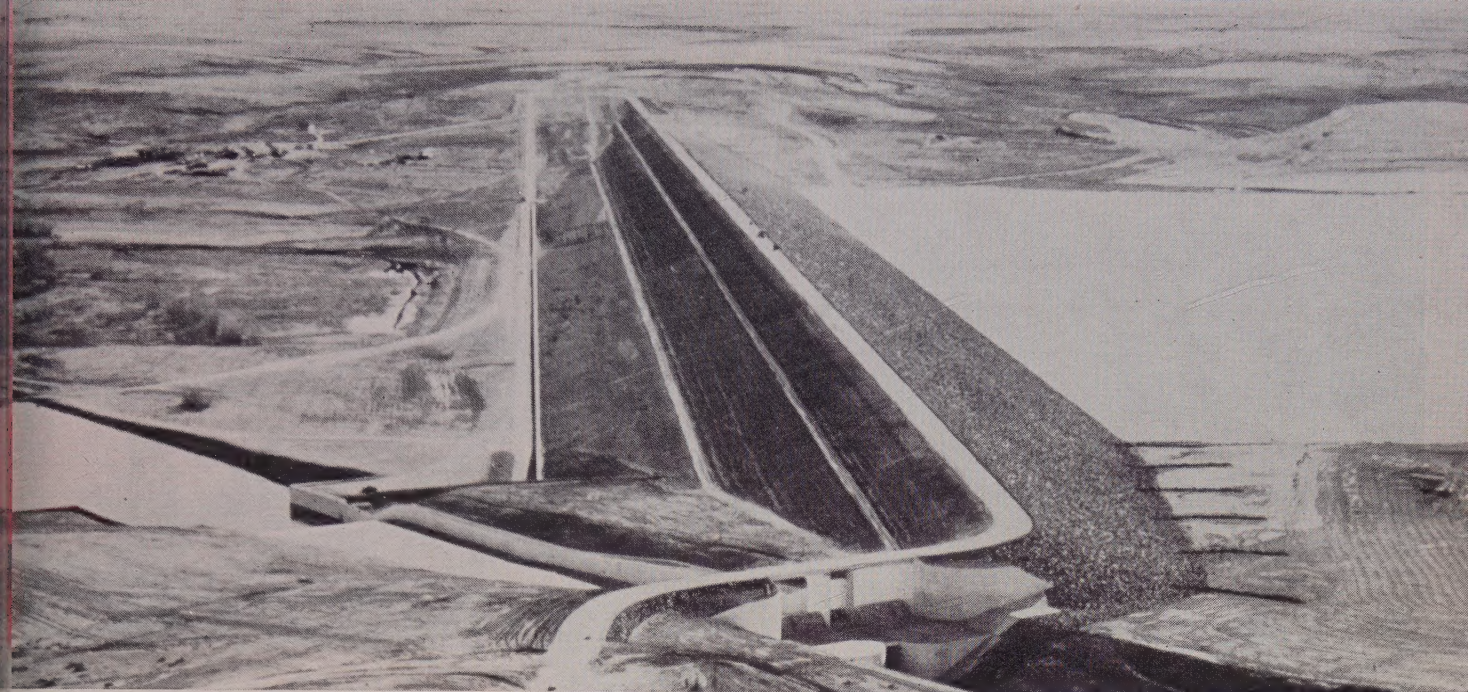
AUSTIN-WESTERN COMPANY, AURORA, ILLINOIS, U. S. A.

Feeding and discharge ends of double-screw, 24" washer-classifier-dehydrator, which has a capacity of 120 tons per hour.



ARIZONA—SHRIVER MACHINERY COMPANY.....Phoenix
CALIFORNIA—EDWARD R. BACON COMPANY.....San Francisco 10
CALIFORNIA—SMITH BOOTH USHER COMPANY.....Los Angeles 54
COLORADO—LIBERTY TRUCKS & PARTS COMPANY.....Denver 1
IDAHO—COLUMBIA EQUIPMENT COMPANY.....Boise
MONTANA—WESTERN CONSTRUCTION EQUIPMENT CO.....Billings
WYOMING—WILSON EQUIPMENT & SUPPLY COMPANY.....Cheyenne

MONTANA—WESTERN CONSTRUCTION EQUIPMENT CO.....Missoula
NEVADA—C. D. ROEDER EQUIPMENT COMPANY.....Reno
NEW MEXICO—N. C. RIBBLE COMPANY.....Albuquerque
OREGON—COLUMBIA EQUIPMENT COMPANY.....Portland 14
UTAH—WESTERN MACHINERY COMPANY.....Salt Lake City 13
WASHINGTON—COLUMBIA EQUIPMENT COMPANY.....Seattle



Earthfill Dam Completed in 2 Years of 4-Year Schedule

Moving 1,000,000 cu. yd. per month looked easy the way Utah Construction Co. did it at Bonny Dam in Colorado—Remodeled loaders work at truck-a-minute speed

By MORRIS DROSKIN
Engineer, Bureau of Reclamation
St. Francis, Kansas

BONNY DAM, a rolled earthfill structure 9,300 ft. long, has been completed about two years ahead of schedule by Utah Construction Co. The contractor established new records for Bureau of Reclamation projects when more than 1,000,000 cu. yd. of material were excavated each month for four consecutive months.

The dam, on the South Fork of the Republican River near Hale, Colorado, about 6 mi. west of the Colorado-Kansas state line, is a feature of the Missouri River Basin Project. It is the sixth earthfill dam completed by the Bureau of Reclamation since authorization of the Flood Control Act of 1944 which calls for the progressive development of land and water resources of the Basin area.

Construction of the dam, awarded to Utah Construction Co. of San Francisco on the firm's bid of \$10,301,653 began on December 7, 1948, and was successfully

completed in the following two construction seasons, about 2 years ahead of schedule.

1,334,000 cu. yd. in one month

Although construction was delayed 44 days between April and September of 1949 because of rains and floods, the contractor accomplished 43% of the contract work that year. In November of 1949, the month of record progress, a total of 1,334,000 cu. yd. was excavated and 1,043,000 cu. yd. of embankment were placed.

The dam is located in a semi-arid region of the Great Plains normally deficient in precipitation and subject to recurring drought and hot, dry summer winds. This area is also subject to occasional storms of very high intensity which transform its normally quiescent streams into raging torrents of destruction. The dam was designed as a multiple purpose structure providing for flood

control, irrigation, and silt storage as well as other benefits. Of the 175,000 acre-feet of storage capacity in Bonny Reservoir, 132,000 acre-feet are allocated to flood control with the remaining 43,000 reserved for irrigation and silt retention. In addition to the flood control and irrigation features of the dam, recreational facilities to be constructed in the reservoir area will provide fishing, boating, picnicking, camping and possibly swimming activities for an area now lacking in such recreational advantages.

Rolled-earthfill design

Bonny Dam is a rolled earthfill structure rising 128 ft. above the river bed. Approximately 9,300 ft. in length and 980 ft. in width at the base, the dam contains over 8,500,000 cu. yd. of embankment material. A 30-ft. wide graveled roadway is being constructed across the top of the embankment. A concrete



bridge 125 ft. in length spans the spillway opening at the north abutment. Construction of the spillway and outlet works structures required over 31,800 cu. yd. of concrete. A 3-mi. long graveled road was constructed as an appurtenant feature to provide access to the dam from the north.

The embankment material used in construction of the dam was obtained from borrow pits on the north and south abutments of the dam, involving average haul distances of 6,000 to 7,000 ft. This material was essentially a very fine,

THREE LOADERS fed a fleet of sixteen 13-cu. yd. and twelve 25-cu. yd. bottom-dump trucks. Two of the loaders were equipped with 10-ft. side-cutting blades for vertical cut in stratified borrow pit.

silty sand. Prior to excavation of the embankment material, the borrow areas were rooted to a depth of 4 ft. at 8- to 10-ft. intervals and irrigated for a period of 6 to 8 days. Water was applied to the areas with a sprinkler system having sprinkler heads at 90-ft. centers. Excavation of the material was deferred for about three weeks after the irrigation was completed, as experience with the

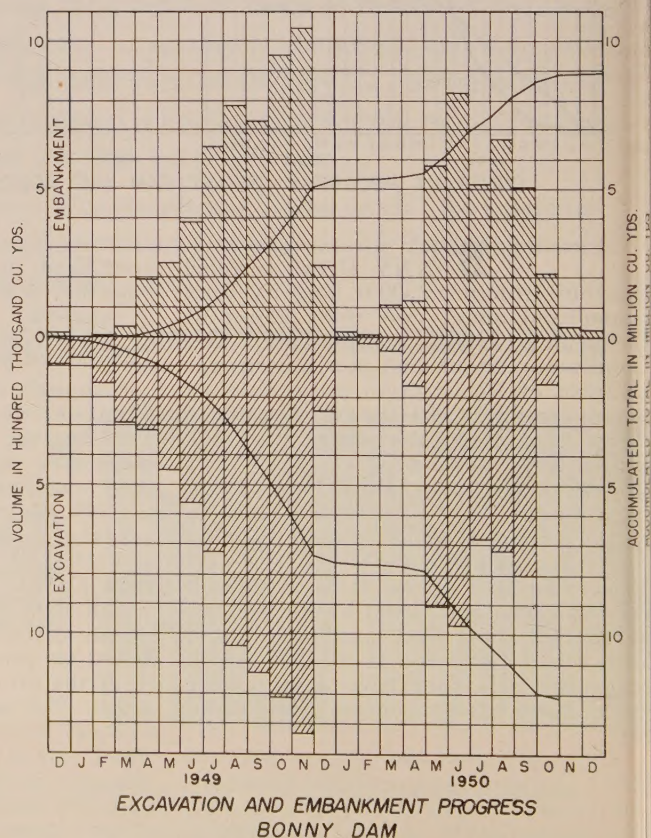
material proved that this length of time was necessary to secure a uniform moisture content to a depth of 10 ft. With this procedure the necessity for mixing of the material on the fill was minimized. The water for irrigation was pumped from the river by two pumps, one an 1,100-g.p.m. unit and the other of 900-g.p.m. capacity. The pumps were powered by two 250-kva. generators.

The homogeneity and depth of the embankment material in the borrow pits made the large loaders selected by the contractor the ideal excavating equip-

TOP—Bottom-dumps unloading fill during early stage of embankment construction.
CENTER—String of six sheepfoot rollers working in tandem compacting fill.
BOTTOM—Sandy borrow area was rooted to 4-ft. depth and irrigated for a week.



PROGRESS during 1949, indicated by chart below, virtually assured completion of the dam in 1950. Cross-hatched bars show monthly totals; ruled lines show accumulated totals. November 1949 was record for both excavation and embankment.



ment for the job. By equipping two of the three loaders with 10-ft. vertical side-cutting blades the contractor was able to comply with the Government's requirement that excavation would be by vertical cut wherever the borrow pit was stratified. The extra length blades and attachments were designed and constructed on the project. The remodeled loaders were each pulled by two tractors. Transportation of the excavated material to the fill was accomplished by a fleet of sixteen 13-cu. yd. and twelve 25-cu. yd. bottom-dump trucks. The capacities of these hauling units were increased to about 24 and 32 cu. yd., respectively, by the addition of sideboards. Visitors to the project at the height of the embankment operations were amazed to see truck after truck being loaded at intervals of approximately one minute by each remodeled loader.

Credit to haul roads

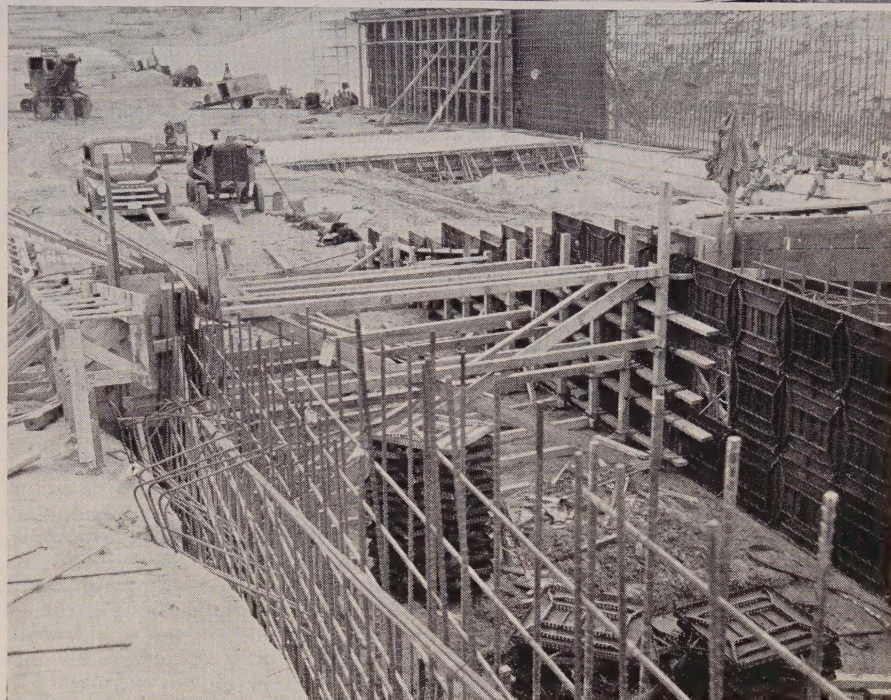
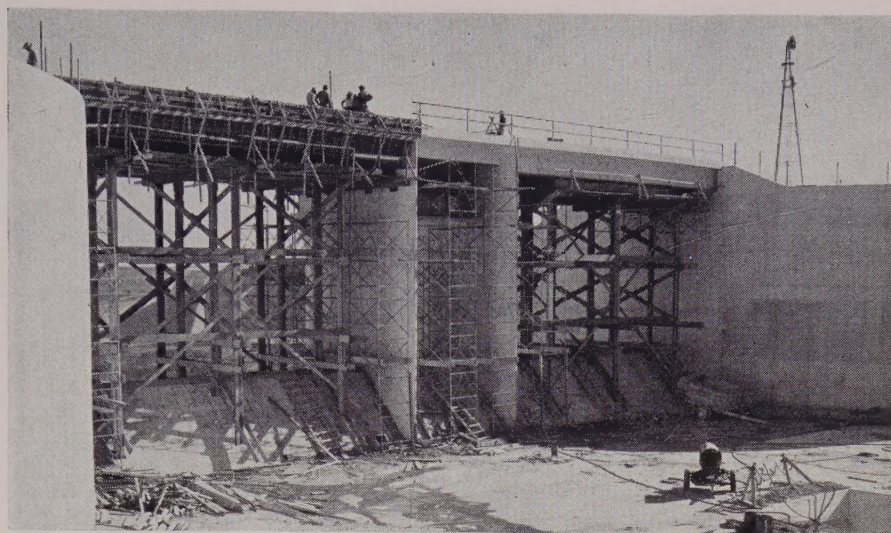
With a round trip of from 2 to 3 mi. involved in the haul from the borrow pits to the embankment and return, an exceptionally good system of haul roads was necessary in order to maintain the assembly-line regularity of operations, to avoid accidents and keep maintenance and repair costs on the hauling units to a minimum. Considerable credit for the success of the earth moving operations on the project is directly attributable to the excellent system of haul roads constructed and maintained by the contractor. For the 1950 construction season the total length of the one-way haul roads between the dam embankment and the borrow pits was increased to nearly 8 mi.

In his embankment placing operations the contractor utilized combination dozer and scarifier units for scarifying the embankment. When these units were unable to properly scarify the embankment material consolidated by equipment traffic, tractors equipped with dozers and heavy duty scarifying units were used for scarifying and also leveling the windrows of embankment material deposited by the bottom-dump hauling units. Motor patrols were used for final leveling (and mixing when necessary). Ten 6-ft. diameter rollers and two 5-ft. diameter rollers were used in compacting the earth fill.

With construction of the cofferdam, excavation and backfill of the cut-off trench, excavation for and placement of the outlet works and spillway stilling basin concrete below the ground-water level, and construction of main haul roads, office building and shops completed, the contractor started a comparatively easy job in the 1950 construction season. With favorable weather, the Utah company went "highballing" on its way to complete essentially the work by the end of the year.

Steady progress in 1950

Embankment placing operations were resumed for the 1950 season on April 21. By the end of the preceding season embankment material had been placed to a height of about 50 ft. above the second-stage diversion channel near the center



TOP—View of spillway crest showing shoring under bridge decks. BOTTOM—Feature of concrete work was use of sectional steel forms in the construction of spillway and sluiceway walls (shown). These forms, made up of 30- by 30-in. sections, were used for radial walls of spillway crest structure as well as for straight sections of the spillway wall.

of the dam, essentially converting the embankment into two separate dams. Taking full advantage of the number of equipment units at his disposal, the contractor conducted his embankment placing operations during the early part of the 1950 season as though two dams were being constructed, material for the north portion of the dam being obtained from the north borrow area and the material for the south portion from the south borrow area.

By July the embankment on both sides of the diversion channel had reached elev. 3710, about 90 ft. above the bottom of the diversion channel, and closure of the second stage diversion was initiated. By the end of the month, the embankment in the diversion channel had been placed to a depth of over 50 ft., and by the end of August the dam was virtually level. Placing of all of the Zone 1 embankment material was completed early in October of 1950. Al-

though the contractor did not equal the embankment records established during the 1949 season, progress was exceptionally good—approximately 3,400,000 cu. yd. of embankment were placed during 1950.

Concrete operations

All concrete work for Bonny Dam was accomplished by a sub-contractor, Horner and Switzer, of Denver, Colo. The batching plant, erected on the north abutment downstream from the spillway, was a four bin, manually operated plant. As the trommel screen erected over the aggregate bins failed to screen the coarse aggregates adequately, the contractor provided a shaker-type screen at the aggregate stock piles and screened the material as it was loaded into the trucks. The material was then hauled to the receiving hopper and received a final screening. A 250-bbl. cement silo with an automatic weighing



FOR PLACING RIPRAP, tractor equipped with winch lowered end-dump trucks down slope on plank mat. Orange-peel bucket dragline supported on wedge-shaped Navy pontoon sections then "hand-placed" the rock. Dragline moved extra pontoon to provide continuous level platform.

and recording device completed the batching equipment.

Fine aggregate was produced by the subcontractor from a sand deposit a short distance below the dam. However, as use of local coarse aggregates was prohibited by the specifications they were obtained from deposits along Clear Creek near Golden, Colo. Riprap was obtained from a quarry, also near Golden. The aggregates were shipped by rail to Burlington, Colo., and then transported by truck 26 mi. to the dam site. The bulk cement was also shipped to Burlington by rail from a cement company at Portland, Colo. At Burlington it was unloaded into a second 250-bbl. cement silo erected by the subcontractor to await transportation to the dam in 250-bbl. cement tank-trailers.

The concrete was mixed and transported to the point of placement in 2-cu. yd. transit mixers. It was then discharged either directly into the forms or into 1-cu. yd. buckets which were swung into position for placement by a dragline. Consolidation was obtained by electric internal type vibrators, and curing was accomplished by the application of white pigmented sealing compound. Sand blast cleanup of joints was carried out where required.

Actual placement of concrete was initiated on June 24, 1949 when placement of the cut-off collars for the outlet works (8 ft., 2 in. radius concrete horseshoe section conduit) was begun. Working as rapidly as weather conditions and his equipment would permit, the contractor had placed a total of 15,319 cu. yd. of concrete when cold weather brought concrete operations to a halt for the season on December 19. The outlet conduit and approximately 40% of the spillway was completed in the 1949 season.

Subcontractor Horner and Switzer resumed construction activities on March 9, 1950, with the placement of concrete pedestals for the 56-in. outlet

pipe in the horseshoe section conduit. As more favorable weather than the previous season was experienced, excellent progress was made in the placing of the spillway and miscellaneous structures. On October 19 the last concrete placement for Bonny Dam was made. A total of 16,126 cu. yd. of concrete had been placed during 1950.

Sectional steel forms for spillway

A feature of the contractor's concrete operations was his use of sectional steel forms in the construction of the spillway and sluiceway walls. These forms, made up of 30 x 30-in. sections, were used not only in the straight sections of the spillway wall but also in the radial walls of the spillway crest structure, for which some special sections of the metal forms were fabricated. The spillway floor panels, wall footing, and other structures were constructed using conventional wood forms.

Protection of the upstream face of Bonny Dam required a layer of rock riprap 3 ft. thick over a crushed rock or gravel blanket 18 in. thick up to elev. 3675, three feet above the normal reservoir water surface. From that elevation the riprap and gravel blanket diminish in thickness to 2 ft. and 1 ft., respectively, to the top of the flood control pool at elev. 3710. Above elev. 3710 the thickness of the riprap is 2 ft., and the gravel blanket 1 ft.

The placing of the gravel blanket and riprap was accomplished by the Cass Construction Company which initiated work on the gravel blanket item on September 9, 1949. By the end of the year, 25,834 cu. yd. of gravel and 33,677 cu. yd. of riprap had been placed on the upstream slopes of the dam embankment. The Cass company continued operations as long as there was sufficient embankment slope to allow continuous placing of riprap or gravel blanket, completing all of the available embankment slope on February 22, 1950. The placement of

gravel and riprap was resumed on May 6 and was continuous until completion in December 1950 and January 1951, respectively. A total of 93,000 cu. yd. of gravel blanket and 205,400 cu. yd. of riprap was placed for the slope protection.

The loaded end-dump trucks of gravel and riprap were lowered down the slope of the embankment on a plank mat with the aid of a tractor equipped with a winch. The gravel was dumped directly on the slope and spread by another tractor equipped with a dozer blade. The riprap, also spilled onto the slope, was then virtually "hand-placed" by a 34-yd. orange-peel bucket dragline which placed the rock on approximately 60 ft. of the slope distance. The subcontractor showed considerable ingenuity in this operation in utilizing wedge-shaped Navy pontoon sections to support the dragline. Two of these sections, their bottom slopes approximating the 3 to 1 slope of the embankment, formed a very stable and level working platform for the dragline. By utilizing four of these sections, properly spaced on the embankment, the dragline operator was provided a continuous platform at a given elevation by picking up an end section and moving it ahead or behind as desired.

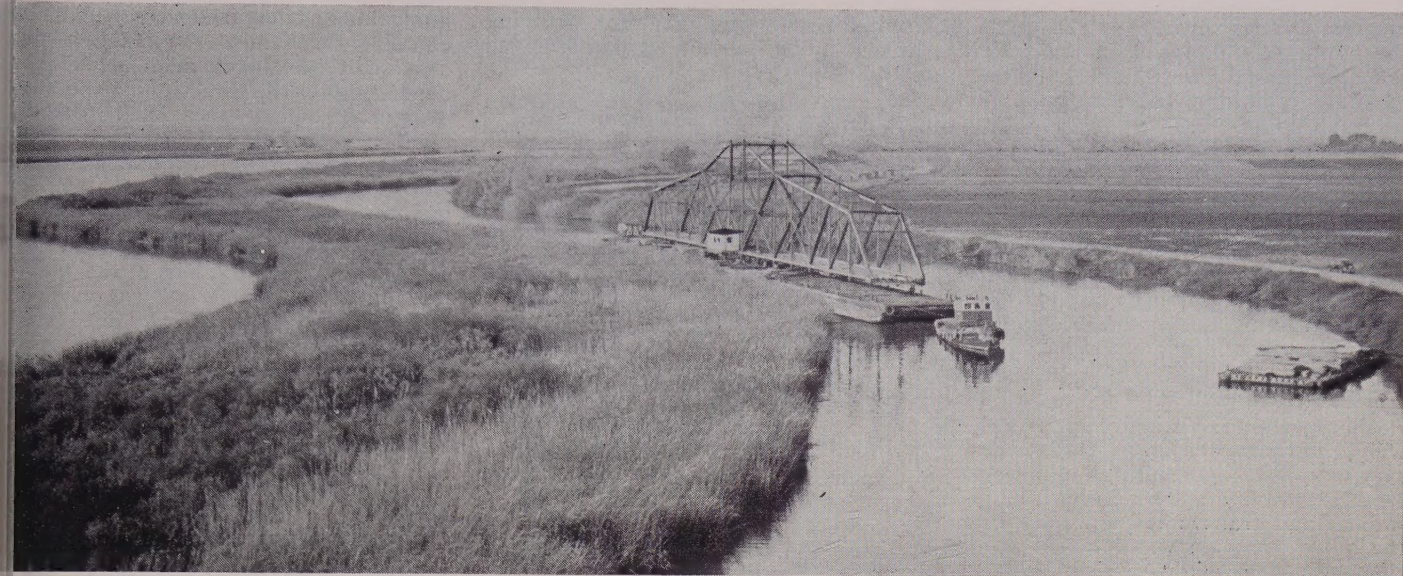
The downstream slopes of the dam were protected by seeding the topsoil-covered embankment with a mixture of crested and Western wheat grass, biennial yellow sweet clover, and barley. Placing of the foot of topsoil on the downstream slopes was begun in October of 1949. However, the actual seeding of the slopes was not begun until April 1950 when the downstream slope was seeded up to the berm at elev. 3670. The remainder of the seeding was accomplished in September and October, bringing the total seeded area to 258,000 sq. yd.

The seeding was accomplished with a 10-ft. farm drill drawn parallel to the dam axis. As soon as the seeding was completed, the seeded area was watered using a 4,800-gal. water truck equipped with a booster pump, 2½-in. fire hose, and a fog nozzle. By the end of 1950 approximately 4,350,000 gal. of water had been used in irrigating the seeded slopes.

Storage of water in the reservoir was begun in July 1950 when the contractor started the closure of his second-stage diversion channel. By the end of the year the reservoir formed a lake nearly 2 mi. long and a mile wide, containing approximately 8,000 acre-feet of water. Hundreds of ducks and geese used Bonny Reservoir as a resting place during the past fall and winter.

Personnel

Design and construction of Bonny Dam is under the direction of L. N. McClellan, Chief Engineer of the Bureau of Reclamation and Director of the Branch of Design and Construction. Wayne S. Byrne was construction engineer for the Bureau until July 1949. He was succeeded by Clifford L. Mutch, present construction engineer for the dam. James D. Fogg was project manager for the contracting organization.



State Offers Bridge, County Pays for Removal—

335-Ft. Span Floated to a New Site

Swing span weighing 192 tons barged 40 mi. and re-erected on new center pier—Actual lifting, moving and installation completed in less than 36 hours—230 tons of precast concrete deck salvaged and replaced at new site

LITERALLY for the taking, the County of San Joaquin, California, obtained a 335-ft. swing span to form the center section of a bridge to replace two cable-operated ferries owned by the county. The span was moved intact approximately 40 mi. to its new site.

The California Division of Highways had erected a new vertical-lift span across Three Mile Slough near Rio Vista to replace the swing span that was inadequate to handle the traffic load. The county was informed that the span was available on condition that it be salvaged, the timber approaches removed, piles pulled and the site cleared.

New" bridge replaces ferries

Located in California's Delta Region, San Joaquin County has a perennial water-crossing problem. A large portion of the county is comprised of rich agricultural islands separated by sloughs, rivers and large streams. When informed of the span's availability the county accepted it for use as a crossing of the Middle River at Bacon Island, about 12 mi. west of Stockton. Existing 5-ton capacity ferries at this crossing were inadequate.

Bids were called for and a \$53,536 contract was awarded to H. F. Lauritzen of Pittsburg, Calif., for (1) moving the 335-ft. span the 40 mi. to its new site, (2) construction of a new center pier and protection works and (3) removal

of the old structure at Three Mile Slough. Approaches and rest piers for both ends of the span are currently being completed under a second contract for \$105,000 by Nomellini Construction Co., Stockton.

Work started on dismantling the old bridge within two weeks after the contract was awarded. This work was followed in order by: pile driving at new site, construction of new concrete center pier, construction of the two new draw rests in the channel, cleaning of old site, moving the span, and placing concrete deck slabs, rails and other fixtures at the new site. The project was completed in 55 of the 75 days allowed.

Barging the only answer

The Smith-Rice Co., Inc., San Francisco, acted as sub-contractor for moving the bridge. Originally constructed near Courtland, Calif., in 1905-06, the span had been moved to its location at Three Mile Slough in 1926 and a precast concrete deck installed. Incidentally, it was also the second time that Smith-

Rice had been called upon to move a bridge up the Middle River.

A major problem in the moving of the bridge was the fact that, other than dismantling the bridge, there was no method that could be used to move it except by lifting it at the center and placing it on barges. This was due to an existing berm (a deposit of silt and mud covered by tules) at the new site. This berm prohibited use of two barges that could straddle the new center pier and enable the span to be lowered into place. Only one-half of the bridge will be over a navigable channel at the new site. However, during high water in the spring the berm will be under water.

Removal of deck slabs

As the moving operation got under way the span was placed on the draw rests and removal of the concrete deck slabs started. The slabs, $22\frac{1}{2} \times 9$ ft., and $4\frac{1}{2}$ in. thick, weighed about two tons each, and were attached to the span girders by six hold-down bolts, three on each side. Total weight of the slabs was 230 tons. Screw jacks raised the slabs clear of the hold-down bolts where a Hyster lift crane picked them up and carried them to the first bay on either side of the turntable in the center of the span. This procedure was necessary due to the fact that X-bracing between the two top chords blocks all bays, excepting the two on either side of the turntable. Slabs were removed from alternate sides to keep the weight of the bridge balanced. A 25-ton derrick lifted the slabs from the center of the span, up through the bay, clear of the bridge and lowered them on a pontoon barge.

A near-mishap occurred during the removal of the slabs. The pontoon barge used to carry the slabs had a rake (overhang) at the stern. Current of the ebb-

PICTURED AT TOP OF PAGE—

RIDING on three barges in tandem, the span arrives at its new home. Barge near right bank of the slough is stacked with salvaged slabs from the precast concrete deck. Tule area at left is berm.

ing tide moving over the rake caused the barge to sink lower in the water. Some of the slabs were immediately removed to eliminate the danger of the load being lost.

All slabs were numbered as to their location in the deck and replaced in the same position after the bridge had been installed at its new site. It is interesting to note that when the slabs were replaced they fitted easily in place, indicating that there had been no distortion in the structure during the transportation.

Lifting the 192-ton span

There were no existing records on the weight of the steel span so it was necessary to call in a consulting engineer to establish gravity centers on both longitudinal and transverse planes. During the move the span was handled at all times with the weight carried the same as it was when the span was in working position. That is, all weight was carried by the center table.

At the old site the span rested on six caissons tied together with I-beam struts to hold the lower circular girder. The

circular girder, machinery for swinging the span and center pin were also moved to the new site.

Two 100-ton derricks mounted on barges were used for the lift. The two barges were tied together to form a single barge with two separate derricks. Four 2,300-lb. anchors were placed upstream to keep the barge from moving in the current. Lines were also anchored to the abutments to maintain the desired position of the barge.

Slings, giving a total of four legs (lines) from each hook, were set over the theoretical center of gravity. The four 2-in. steel cables of each of the two slings were placed around the girder that held the upper rail in the center of the span, each hook and sling being to one side of the mean center of the circular centerpiece. To maintain an equal strain on all lines, the lifting cables were arranged with two fixed slings and one pair of slings in the bight, thus equalizing all four legs of the sling for load. Correction was made in the transverse support by two triple blocks, providing a six-part purchase, on each of the fixed legs. If it was necessary to move the

hook along the transverse plane to equalize the strain, the six-part purchase could be taken in or slacked off depending on the direction of the move desired. The scale on a Martin-Decker dynamometer showed that the lift, including the rigging used, was 192 tons.

Towing to the new site

As the span was lifted from its resting place the double barge was moved astern far enough to get the carrying barge in between it and the old resting place of the span. The carrying barge consisted of three rebuilt 800-ton railroad barges, set end to end and flexibly tied together. However, only the center barge carried the weight of the span. The other two provided protection for the ends, and in the event the center barge, due to an unforeseen accident, would have sunk, could have supported the span. As soon as the carrying barges were in place the span was lowered onto them. The placing of the bridge on the new center pier was the reverse of the procedure at the old site.

As soon as the span was on the carrying barge the lifting derricks were separated and one of the two tugs used during the operation towed it to the new site. The other derrick stayed at the old site long enough to lift out the center pin and circular girder, then also was taken to the new site. As soon as the tugs delivered the derricks they returned to get the bridge. One tug pulled the bridge-laden barges with the other following behind steering. The flexible connections in the carrying barges permitted easier maneuvering along the winding stream. The bridge was in the air at 1:00 p. m. of one day, arrived at the new site at 3:00 p. m. the following day, and was placed in position and the job completed by 9:30 that night. The installation to receive the span had been constructed prior to the move and the center pin and circular girder were installed while the bridge was being transported to the new site.

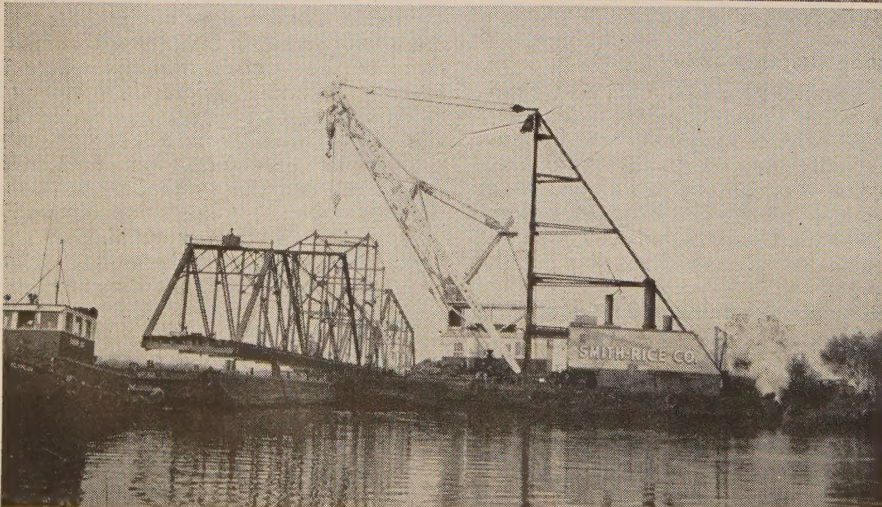
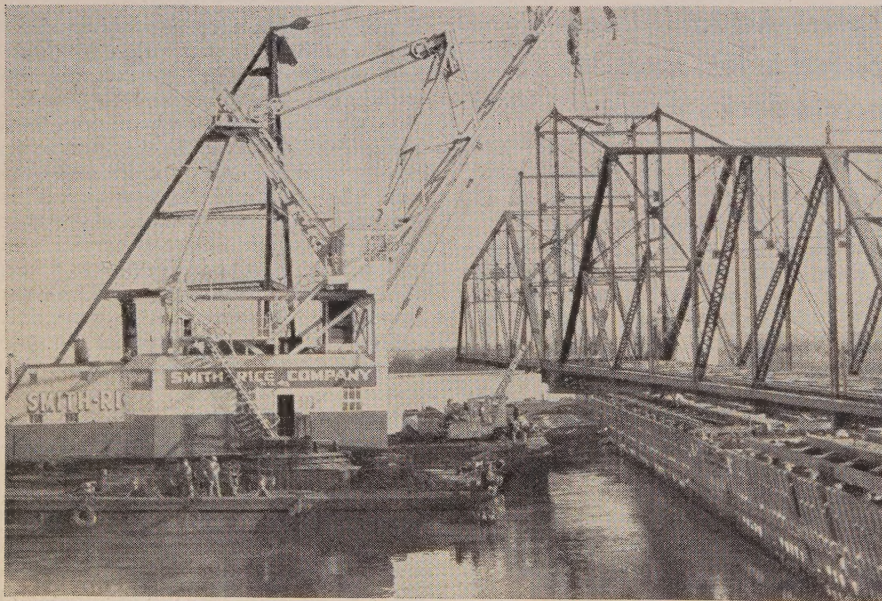
In setting the circular girder, elevations were taken around the circular center pier with instrument to determine the exact height the steel shims or chocks would have to be to hold the span level at the desired height. Shims were machined to the nearest .0001-in. The girder was fastened to the center pier with 48 anchor bolts.

Piling and pier work

Tide water proved to be the main problem during the construction of the new center pier. The base of the center pier was only 9 in. above the approximate mean low tide and required that work on cutting off piles, setting reinforcing steel and erecting falsework be done at low tide. Sometimes low tide occurred at 3:00 a. m.

The 33 piles of 15-in. diameter and 60 ft. long, supporting the center pier were laid out in concentric circles. One pile was driven in the center; four at a diameter of 7 ft., 4 in.; 12 at a diameter of 14 ft., 8 in.; and 16 at a diameter of 22 ft. Specifications required the contractor to batter the outer ring of piles radially

THE BIG LIFT. TOP—Two 100-ton derricks tied together lift the 192-ton load off draw rests onto waiting barges. **BOTTOM**—Preparing to place the span on new center piers about 36 hours later. Derricks are lifting span so barges can be towed to one side.



outward. Piles were driven with a McKiernan-Terry 9B2 double-acting hammer on swinging leads. Minimum penetration was 44.2 ft., and maximum penetration 57.2 ft. All bearing piles were driven to a minimum of 22-ton bearing. Untreated piling for the draw rests was also driven with the McKiernan-Terry hammer. The minimum penetration of these was 43.5 ft., and the maximum, 54.3 ft. The two draw rests each contained eight piles, set in a box of four at the ends of the rest, giving two sets of piles set 4 ft. apart. Two 26-ft. long 12 x 12-in. timbers capped the piles. Eleven 6-ft. lengths of 12 x 12-in. timbers were laid across the caps, four at each end and three just off center. A steel jack shoe was laid longitudinally across the short timbers. Four 4 x 8-in. timbers, 26 ft. long were used as diagonal bracing for each draw rest.

Piles for the six 4-pile dolphins that would serve as protection for the span, were driven with a 3,500-lb. drop hammer. Pile heads were treated and the four poles wrapped together with five wraps of $\frac{5}{8}$ -in. galvanized wire rope.

Forms for the center pier were made of 9/16-in. plywood with 2 x 4-in. studs. Although form work was done by the contractor's pile driving crew the quality of the finished concrete was good. Bar reinforcing steel was furnished and placed by a subcontractor.

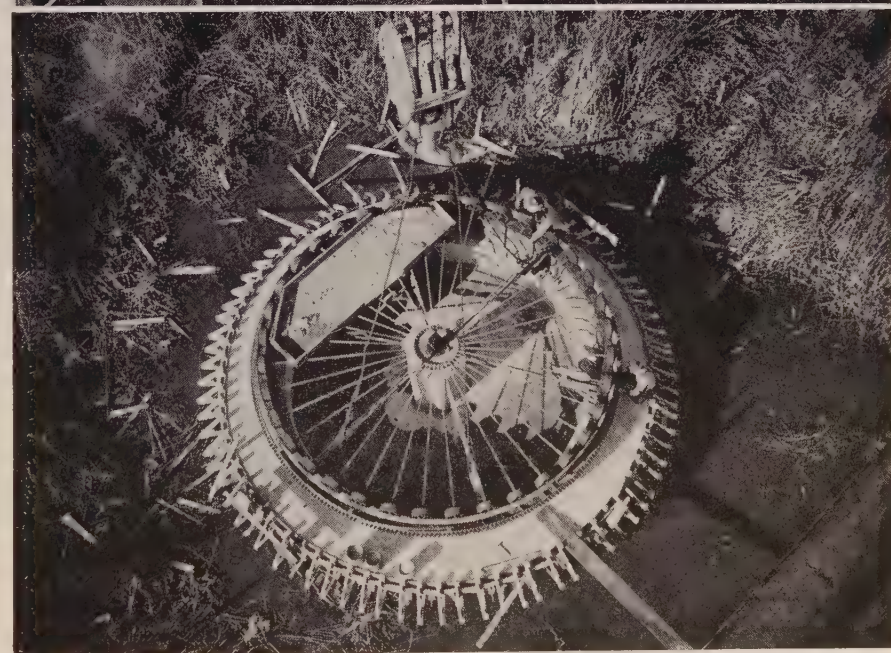
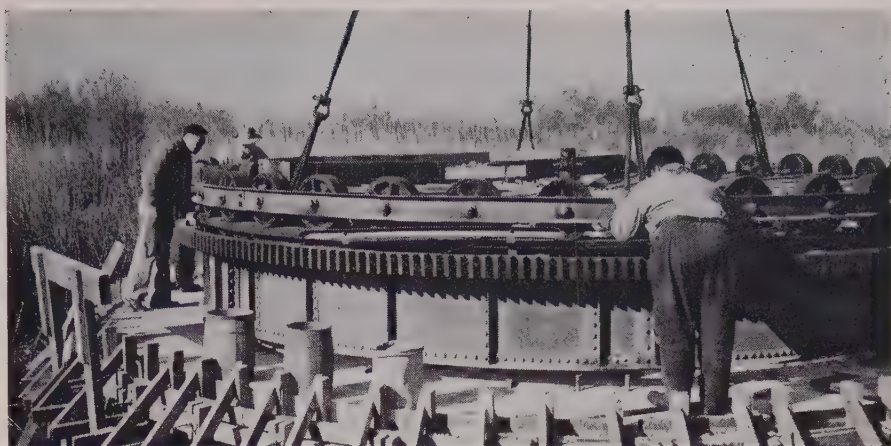
The 7 cu. yd. of transit-mix concrete required for the pier was carried from the bank of the river to the pier location by a 2-yd. bucket. Concrete work was done in one day providing a single pour for the pier.

The base of the center pier is 25 ft., 8 in., with a 1-ft. lip at the top, making the overall diameter on the top surface 27 ft., 8 in. Its total height (concrete section, piles excluded) is 5 ft., 2 in. The center of the pier, 19 ft., 8 in., is recessed 6 ft., 2 in. A 6-in. drain has been provided to permit water entering the center section to escape.

Anchoring circular girder

Anchor bolts for the circular girder were made up in 24 assemblies of two bolts each and set in six groups of four around the pier in a circle with an approximate radius of 10 ft., 10 in. from the center of the pier to the centerline of the two-bolt assembly. Six single anchor bolts were used for the center pivot. These bolt assemblies consisted of two $1\frac{1}{2}$ -in. bolts in 3-in. pipe sleeves to provide for any adjustment when the girder was set in position. The pipe sleeves, keeping the bolts at $4\frac{7}{8}$ -in. centers, were welded to a 11 x $\frac{1}{2}$ x 6-in. plate that acted as a washer for the bolts. Bolts extended 4 in. above the top of the sleeves, which were set at the level of the concrete pier. When set the center line of the bolts was parallel to the radius of the pier. Anchor bolts for the center pivot were constructed in the same manner except they consisted of a single bolt and sleeve and were welded to a 6-in. square plate.

Approaches to the span, which are now being completed, are of standard timber construction, the west approach



TOP—Lowering circular girder on center pier at new site. Shims under girder were used to level it at proper height. Bridge was enroute to new site while this work was being completed.

CENTER—2-yd. bucket swung 79 cu. yd. of transit-mix concrete from slough bank to center pier.

BOTTOM—Bird's-eye view from derrick as circular girder was placed on the center pier.

being 693 ft., and the east approach 56 ft. long. The total length of the span and trestles is 1,090 ft. between the centerlines of the two levees bordering the river.

Personnel

J. B. Manthey is San Joaquin County road commissioner; Douglas C. Nelson,

county bridge engineer; Charles Wong, resident engineer for the county. H. F. Lauritzen, prime contractor; George Mitchell, general superintendent for Smith-Rice Co., Inc. Theodore Kuss, San Francisco, consulting engineer; Kyle & Co., Stockton, sub-contractor for steel; and Yolland Co., Stockton, concrete.

A Test on the Los Angeles Aqueduct—

Mortar Lining 11-Ft. Steel Siphons



CONDITION of Placerita Siphon after cleaning. Propeller-type cleaning machine used short lengths of chain to dislodge loose material.

THE AMERICAN Pipe and Construction Company, under contract with the Department of Water and Power of the City of Los Angeles, furnished labor, equipment and material to clean and install complete mortar lining in place to the interior surfaces of Quigley Canyon and Placerita Canyon riveted steel siphons of the Los Angeles Aqueduct. Inside diameter of these siphons is 11 ft., plate thickness is $\frac{1}{4}$ in., and total length of both is 2,183 lin. ft., with grades as great as 74%.

Completed in 20 days

Machine cleaning of the pipe started February 20, 1951 and was completed March 1, 1951. The hand cleaning was completed on March 5, 1951. Machine placing of the mortar lining started February 23 and was completed March 6. Hand finishing and patching were completed on March 8, 1951. Inside cleanup of the pipe was completed and the aque-

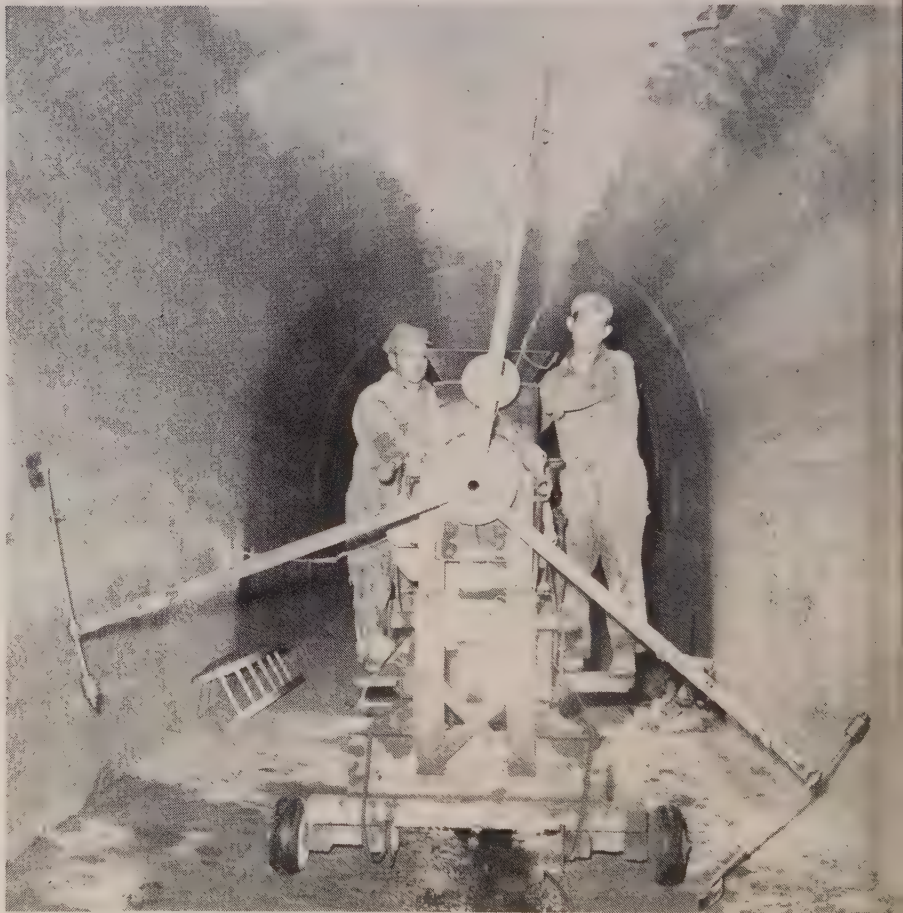
MORTAR LINING in place, Placerita Siphon. Out-of-roundness, local indentations, etc., kept troweled surface from being continuous.



First use in the West of in-place lining process for thin-walled large diameter pipe points up factors that will improve similar jobs in the future—Total of 2,183 ft. of pipe given inside coating of $\frac{3}{8}$ in. —Entire job takes 20 days

By JAMES G. COWAN

Assistant Aqueduct Engineer
Los Angeles Department of Water and Power



LINING MACHINE set up in tunnel at head of Placerita Siphon. Screw feed forced mortar into rapidly revolving head which threw it against walls of pipe. Mortar thickness was controlled by rate of travel of machine (1 ft. per min. for $\frac{3}{8}$ -in. thickness).

duct returned to service on March 9, 1951.

First operation after draining the siphons and establishing access holes was the cleaning of the interior surfaces by use of a propeller-type cleaning machine. This machine was powered by a diesel engine which drove a wheel 9 ft. in diameter rotating at approximately 80 rpm. Short lengths of chain attached to the outside of this wheel dislodged most loose material. A flow of water of about one cubic foot per second was maintained during the cleaning operations to wash down and carry away the foreign material. The speed of travel of

the machine can be varied. On this work an excellent cleaning job was obtained with a speed of 4 ft. per min. and two passes, with the direction of rotations of the cleaning wheel reversed during the second pass.

Hand cleaners using scraping hoes, picks and wire brushes followed after the machine, cleaning the spots left by the machine which were mainly around the rivets at the lap joints.

Preparing and handling mortar

The cement mortar for lining the pipe was mixed in a plaster type mixer which was mounted in the end of a mobile

n. This van housed the diesel generator which was the power source of the equipment, and also contained storage space for sand and cement. The mixer had six sacks of sand (600 lb.), five sacks of cement (Monolith Type II modified), and one sack of Colton calcium pozzolan. Enough water was added to produce a 3-in. slump. Lack of good water meter caused delays in obtaining the proper consistency.

The mortar dropped from the mixer directly into the mortar buggy inside the machine which transported the mortar to the lining machine. The buggy was designed for smaller diameter pipe and it was difficult to keep it traveling in a straight line in the larger pipe.

Placing procedure

Mortar was shoveled by hand from the buggy to an elevated platform and from the platform to the machine hopper. A screw feed forced the mortar into a rapidly revolving head which threw the mortar out against the walls of the pipe. The mortar thickness was controlled by the rate of travel of the machine. A speed of one foot per minute gave the desired $\frac{3}{8}$ -in. thickness.

To give a smooth finish to the lining, three steel trowels rotated on long arms equipped with springs and counterweights. Variations in pipe diameters due to out-of-roundness, local indentations, bend, etc., hindered the correct operation of these trowels and a smooth troweled surface was not continuous for this line.

The lining machine employed on this job seemed to be inadequate for this

ACERITA SIPHON dips under a highway. Section in background has grade of 74%.



MORTAR for lining was supplied by a plaster-type mixer mounted in mobile van, which also housed generator and supplied storage space for sand and cement. Mortar was dropped through manhole into buggy inside pipe. In this view, lining machine is being lowered into pipe.

larger diameter pipe. Modifications were made prior to the start of the work but many repairs were necessary after the lining operations started, and a great deal of time was lost making the repairs. The motor driving the machine appeared overloaded and the method of hand feeding was not fast enough to maintain continuous operation of the lining machine.

Following the machine lining, hand plasterers added mortar to cover rivet heads and smoothed and patched the lining left by the machine.

Difficulties were encountered due to unusual variations in temperature and the lack of equipment to properly combat these changes. During the placing and early curing period it is important that the temperature does not drop below freezing or rise above approximately 75 deg. F. Variations outside of this range caused severe checking and in some cases complete falling of the lining.

The level portion in the bottom of Quigley Siphon had not been reinforced with stiffener rings and it was noted that numerous falls and a great deal of checking took place in this portion. This was probably caused by increased vibration due to lack of stiffness as well as poor mechanical troweling because of the out-of-roundness of the pipe section.

Requirements for future jobs

In conclusion, the work was accomplished satisfactorily, but there are several factors that should be reviewed to improve future work of this nature. The machine used should be redesigned with this diameter pipe in mind to increase

the power output of the motor and improve the troweling mechanism.

The specifications should provide for continuous and complete sprinkling of the outside of all exposed pipe during and after lining operations. The specifications should also provide that hand patching be completed within 36 hours after machine lining and that the patches be promptly sealed with a concrete curing compound.

In order to increase the life expectancy of the mortar lining, all thin-walled large diameter pipe supported on piers should be prepared by ring stiffening prior to the application of the mortar lining.

Personnel

The work was conducted by the Los Angeles Department of Water and Power, Burton S. Grant, Chief Engineer of Water Works and Deputy General Manager. General supervision of the work was under Laurance E. Goit, Engineer of the Los Angeles Aqueduct. The American Pipe and Construction Company was represented by Robert C. Sargent, Manager, Centriline Division. The contractor is a licensee of the Centriline Corporation of New York.

USE of the Centriline method for the more conventional in-place cement-mortar lining of a smaller diameter pipeline was described in an article in the November 1950 issue of *Western Construction*.

"Tilt-Up" for Placing Precast Walls

Rapid progress in method for erecting precast concrete walls and columns illustrated by Los Angeles building job—Panels designed to simplify use of recently-developed vacuum lifter



COMPLETED building has undersides of panels (as precast) used as exterior wall face.

AS INTEREST continues to grow among designers and builders in the various applications of precast concrete for the construction of buildings, it is timely to review developments of a type which has progressed rapidly in recent years, widely known as "Tilt-Up."

The building described is typical in most respects of the practices in general use in Southern California, where a con-

siderable number of contractors specialize in tilt-up construction and many others have acquired experience in its use.

The building combines office and industrial facilities for the firm of B. F. McDonald Co., manufacturers and sup-

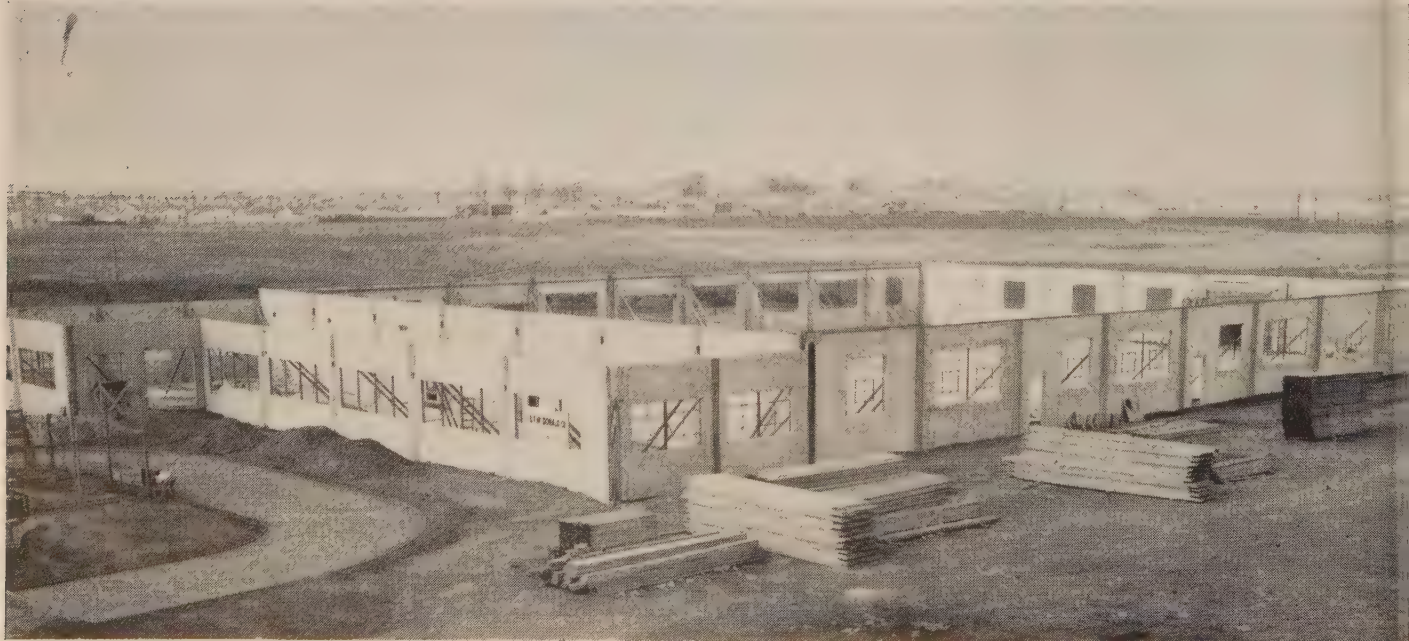
AFTER PANELS were precast, using floor slab as a casting bed, they were handled, lifted, erected and braced at a rate of three per hour.

pliers of safety equipment and appliances. Late in March the company moved into its new quarters, located at 5721 West 96th St., just north of the Los Angeles International Airport. The building is 210 x 140 ft., with an added wing of 20 x 40 ft. It provides a floor area of 30,300 sq. ft., of which 5,000 sq. ft. is allocated to office use, separated from the industrial portion by an interior fire wall.

Floor slabs, laid on compacted fill, were of 4-in. concrete in the office section, 5 in. thick elsewhere, reinforced with wire mesh and placed in checkerboard fashion in panels approximately 20 ft. square. Framing plans provided for exterior cast-in-place 12 x 14-in. columns at about 20-ft. centers and interior steel columns to support Ross-Carter tapered steel plate girders of 60 ft. span spaced at 20-ft. intervals. With these girders 2 x 10 joists, 1 x 6 diagonal sheathing and built-up roof covering were used. Indicating accepted good practice, plates and ledgers were bolted and joists tied to the walls at intervals of 4 ft.

Precasting the panels

The exterior walls and fire wall were made up of 45 precast tilt-up panels weighing 10 to 12 tons each. Panels were a little less than 20 ft. in length, 16 ft. 10 in. high in the main portion and slightly lower in the office section. Reinforced with $\frac{3}{8}$ -in. bars at 10-in. centers in each direction, the panels were $5\frac{1}{2}$ in. thick. The floor slab was used, of course, as a casting bed and separation for easy removal was achieved by application to the slab of a thin coating of Hunt Process compound. In some cases the limited use of "stacking" was made, casting panels two or three tiers high and using Hunt Process for each layer separation.



As is essential in efficient tilt-up construction, care was taken in the planning and execution of the details of forming, of providing necessary inserts and of setting correctly and securely the sash and other items built into the walls. Edge forms were of planed 2 x 6's with $\frac{1}{4}$ x 3-in. chamfered bottom strips to form inserts on the inner side. Edge forms were bored to allow the reinforcing steel to pass through, then the 2 x 6's were sawed horizontally. This facilitated placing a reinforcing mat in position on the lower half of the form, then nailing the upper half into place. The extended bars were bent so as to occupy proper position in the column section. "Cat-heads" consisting of nut and set screw were installed on the rods against the forms to hold them firmly in place during casting.

Vacuum lifting

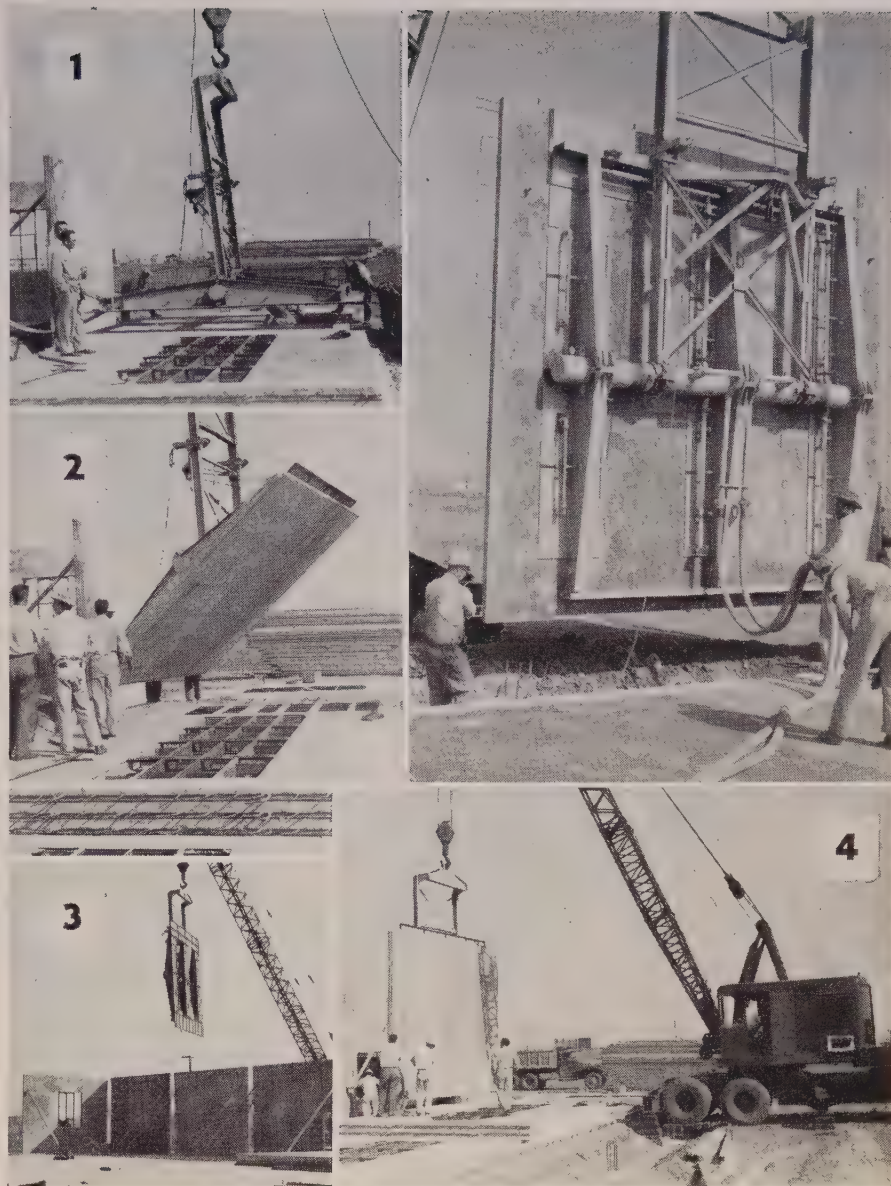
The setting of the steel sash was handled in a manner that proved highly satisfactory. Sash was set accurately flush with the upper surface—to be the inner face of the wall—by supporting it on a wood frame which rested on the floor slab. The frames had both marginal and cross members and were readily stripped out after the walls were erected. A little improvising which gave good results was a job-developed idea of a simple way of holding down the sash and preventing any displacement by the concrete or the working crew. Realizing that weight was needed, a stock of 3-gallon ice cream cartons was obtained and filled with concrete. Handles were readily made by embedding a rod or wire. Placing of these weights over the sash area proved to be effective.

When it was decided to employ vacuum lifting methods for the wall erection it was seen that it would simplify the operations if the top panel surface was kept clear. Hence, a flush insert was designed for the attachment of joist anchors. Essentially, it consisted of a piece of threaded 1-in. round stock welded to a $\frac{5}{8}$ -in. round bar 10 in. long. Accurate positioning was accomplished by tying the bar securely to the reinforcement mat.

Design features

The use of vacuum lifting on this project was an interesting feature because this method had been only recently developed for the erection of wall sections. The lifter consisted of an assembly of vacuum mats on a hinged frame, designed for rotation on a central axis so as to swing readily from the horizontal to the vertical position. A Hesse 40-ton crane was used for the work, lifting on a frame with two long arms which engaged the central axis. Slabs were cured about 7 days before lifting; an advantage of the method is the distribution of stress in the panel as compared with point pick-up, where concentration of stress must be provided for. Conditions on the site were not conducive to speedy crane operation, but on the average three panels per hour were handled, lifted, erected and braced.

On this job vacuum process methods were also applied in the construction of



THE VACUUM LIFTER in operation. Close-up at upper right gives a good view of hinged frame designed for rotation on a central axis so as to swing readily from horizontal to vertical position. Sequence views (numbered) are as follows: (1) Setting lifter in position for raising slab. (2) Lifter raising slab; stacked panels in background. (3) Crane swings panel over already placed and braced wall section. (4) Setting the panel.

the cast-in-place columns. For this purpose, special forms were employed, against which the concrete was cast. Use of vacuum treatment permits early removal of the forms, so that the same form may be reused several times in the course of a day.

Setting steel sash

Other details may be mentioned briefly in order to more fully describe the building. As is usual in the area, the under side of the panel as cast upon the slab, was used as the exposed exterior wall face. At top and bottom of columns, bars extending from adjacent panels were connected by welding. The columns were designed with the usual longitudinal reinforcement and ties. Front wall sections had brick trim and a steel canopy was attached. The roof was provided with three skylight areas. The concrete exterior of the building, which has a pleasing appearance, was finished with green Lithitex paint.

Johnson and Minasian, Structural Engineers, designed the building, with F. Thomas Collins acting as consulting engineer. The contractor was H. C. Smith Co., for whom Gus C. Klammer was job superintendent. C. D. Wailes Corp. was subcontractor for the vacuum erection and column treatment on the project.

Bill Passed Setting Up Board To License Oregon Contractors

THE OREGON State senate passed the controversial bill to license Oregon contractors by a vote of 17 to 11. A new board will be created with disciplinary powers to control contractors who violate provisions by abandoning a project, misrepresentation or failure to follow plans. The bill is patterned after a law in use in California. Passage of the bill was vigorously opposed by some of the legislators.

Run-off Forecasts— 1951 Water Supply in Western States

WATER SUPPLIES of the West promise to pattern those of 1950, although far less favorable in the southern and southwest portions and generally ample in the extreme Northwest. This is the latest summary of the water supply outlook as analyzed by the U. S. Soil Conservation Service,* from far-flung snow surveys of Western watersheds.

A brief analysis of the April first snow surveys, traditionally presented by *Western Construction*, shows unusually wide range of run-off in prospect for this season for irrigation, power generation, and municipal and industrial use.

Flood prospects

Again, as in 1950, there are possibilities of local floods in the Columbia River Basin, while the critically serious drought in the Southwest has expanded in area. Heavy mountain snow cover is reported from British Columbia. Snow conditions there and in parts of Washington are such that a cold backward spring, if such should occur, would produce damaging high water on Washington's Methow River and on Idaho's and British Columbia's Kootenai River. Potential flood stages seem in prospect on the Methow, Kootenai and Okanogan rivers even under average melt conditions. However, if present thawing continues without interruption the flood potential on the lower Columbia most

likely will not be serious. The potential there is definitely less now than last year.

Drought more serious

The long series of short water years, broken somewhat in 1949, continued in the Southwest in 1950. Unless rainfall there is abruptly magnified, critically short water supplies are foreseen for Arizona, southern and south central California, New Mexico, southern Utah, and southern Nevada.

Snow surveys indicate . . .

—Flood possibility in Northwestern States

—Drought becoming critical in the Southwest

—Liberal water supply in the Mountain States

—Generally, run-off following 1950 patterns

By R. A. WORK

Senior Irrigation Engineer
Oregon Agricultural Experiment Station
Medford, Ore.

and CLYDE E. HOUSTON

Irrigation Engineer
Soil Conservation Service
Reno, Nevada

Water supplies will be near normal or above in a wide band from the Pacific Slope to the Middle West, including Oregon, Idaho, northern Nevada, northern Utah, northern and central Colorado, and Wyoming.

Water supplies will be generously above normal in localized parts of Oregon, in parts of Washington, in most or all of British Columbia, and in most of western Montana and northern Idaho.

In the following paragraphs the water supply outlook is reviewed State by State. Three charts illustrate graphically reservoir storage and expected stream run-off.

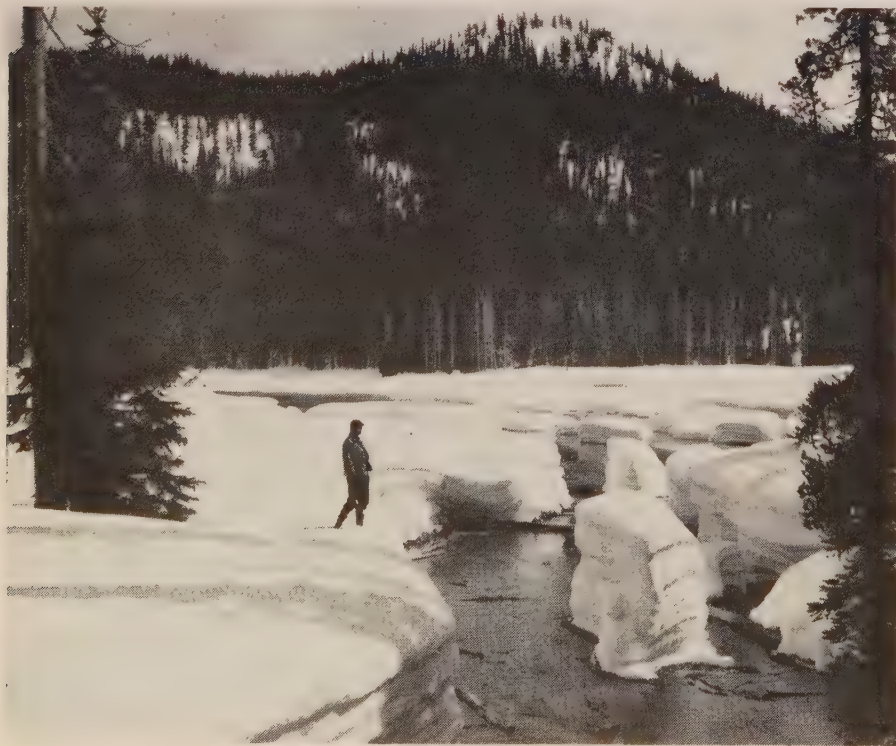
Arizona

Arizona is entering its main irrigating season with one of the poorest outlooks for water in almost a half century of record. Streams flowing into the major reservoirs of the State have carried miserly base flow during the entire run-off season. The reservoirs of the State now store water only to 7% of capacity. No further run-off from snow melt can be expected. Snow cover, short all winter, has for the most part been dissipated by high winds. February through June run-off into the major reservoirs will be approximately 16% of normal, totaling about 140,000 acre-feet of water.

The water allotment in the Salt River Project has been cut to 1½ acre-feet per acre. This means that irrigators will have to cut their acreage one-third to one-half in order to insure marketable crops. The Gila River Project will have one-half acre-foot of water per acre of land at Coolidge Dam. However, considering seepage losses, the delivered amount will be still less. Most of the farmers in the Gila River Project are

*The Division of Irrigation and Water Conservation is the Federal Coordinating agency of snow surveys conducted by its staff and many cooperators, including the Bureau of Reclamation, Forest Service, National Park Service, Geological Survey, various departments of the several Western States, irrigation districts, power companies, and others. The California State Division of Water Resources conducts and coordinates snow surveys in that State, while the British Columbia Department of Lands and Forests, Water Rights Branch, has charge of the snow surveys in that province.

ERODED SNOW on Hell Creek in Oregon will soon melt and contribute to the stream's run-off. Surveyors make careful studies of 1,000 snow courses to predict the West's summer water supply.



planting only 20% of their land and many others are not planting at all. The Gila River will probably be a dead stream by May 15. Pumping costs in both the Gila and Salt River basins will be greater this year due to the most recent 10-ft. recession in ground-water level.

The Maricopa Water Conservation District, which distributes the water from Carl Pleasant Dam (capacity 179,000 acre-feet) will receive no surface flow and will have to rely entirely on pumped water. The pump head here now exceeds 300 ft.

The Little Colorado River has experienced practically no run-off all season.

The State, as a whole, will probably enter the winter months of 1951-52 with as little reservoir storage as ever recorded. A special chart shows the 1951 water prospect for Arizona as compared with that of the preceding 21 years.

California

California's 1951 summer water supply will be deficient. Snow pack is definitely below normal over the entire length of the Sierras. On the Kern and Kaweah watersheds less snow exists as of April 1 than in the years 1931 and 1934. This is the driest season since comprehensive snow surveys began on those watersheds 22 years ago. Summer flow of Kaweah and Kern rivers will apparently be less than that of 1924, which was the lowest summer-flow year of record. The greatest deficiencies of summer flow are ex-

pected on streams that experienced their highest flood crest of record following the storms of November and December.

The snow pack on the upper Sacramento River gives promise of the best percentage of normal flow for any of the Sierra streams. However, even on this watershed run-off only 80% of normal is expected. Reservoirs are now at favorable stages, and most should fill during the early spring run-off. However, the large multi-purpose reservoirs such as Shasta and Millerton probably will not fill. Lake Tahoe is expected to reach 6,228.7 ft. elevation, the highest since 1946.

No significant rain has occurred in California since March 9 and at the time of this report the drought continues. Unless substantial rains occur during April and May summer flows forecasted herein will have to be revised downward.

Colorado

Mountain snow cover is well above normal along the Continental Divide in the northern part of Colorado. In western Colorado the high-elevation snow cover is slightly below normal. In southern Colorado the snow cover is definitely deficient. Run-off during the snow-melt season should be well above average on the South Platte and its tributaries, on the main stream of the Arkansas and on the upper Colorado River. On the Yampa, White and Gunnison rivers the summer run-off will be about normal. On the Dolores, San Juan, Rio Grande and the southern tributaries to the

Arkansas the summer run-off is not likely to exceed 50% to 60% of average. Soil moisture conditions are only fair in irrigated areas especially in the San Juan and Rio Grande basins where the soil is extremely dry.

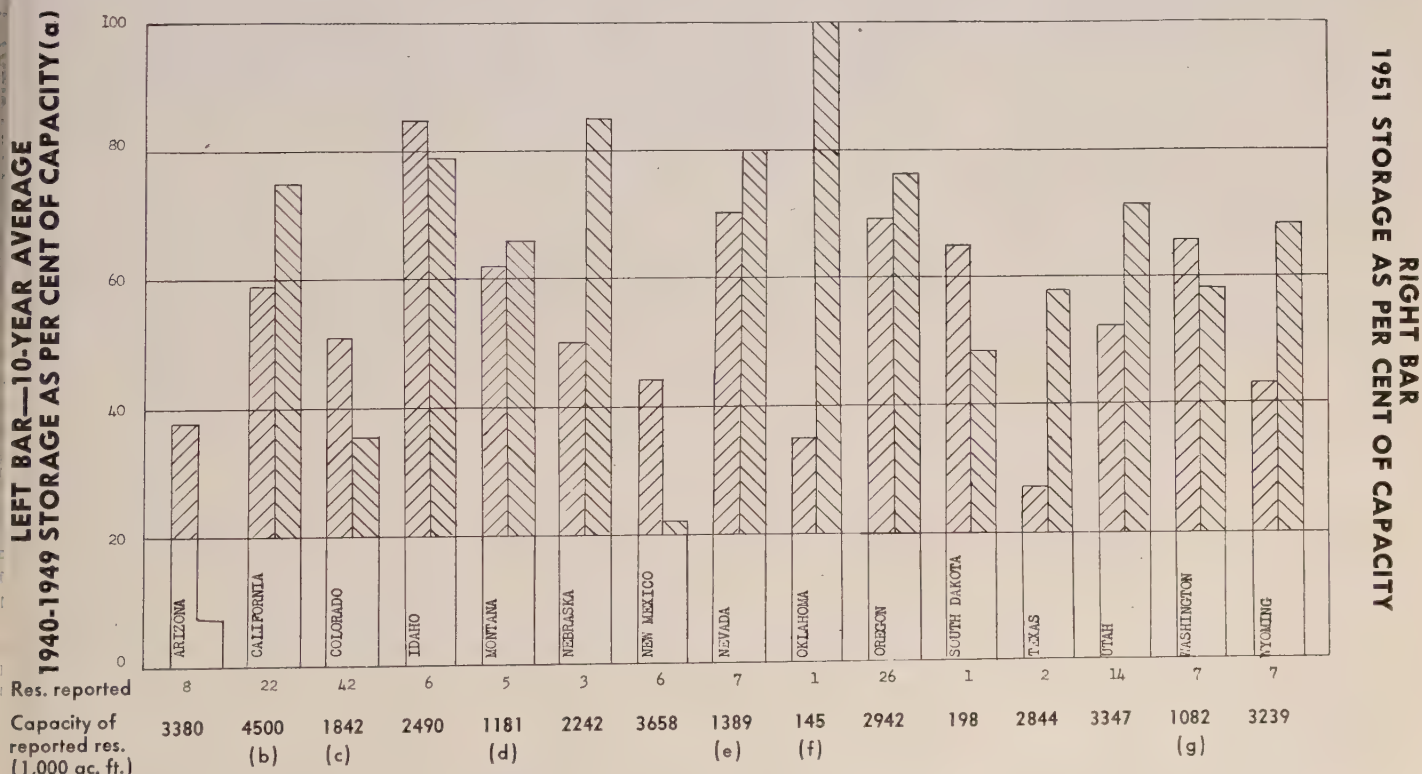
Idaho

All the rivers in Idaho, with the exception of Lost River, have snow water stored in the mountains varying from 5% to 30% above normal. This general condition assures above-average water supplies for irrigation and power throughout the State. Some snow melt during February has kept streamflow above average. Storage in some reservoirs has been lowered in anticipation of fair to good water supplies yet to come.

The high-altitude snow courses are showing relatively higher snow water content than the courses at lower elevation. This condition may promote more sustained and dependable flow of water throughout the State than usually occurs when low-elevation snow cover is heavy.

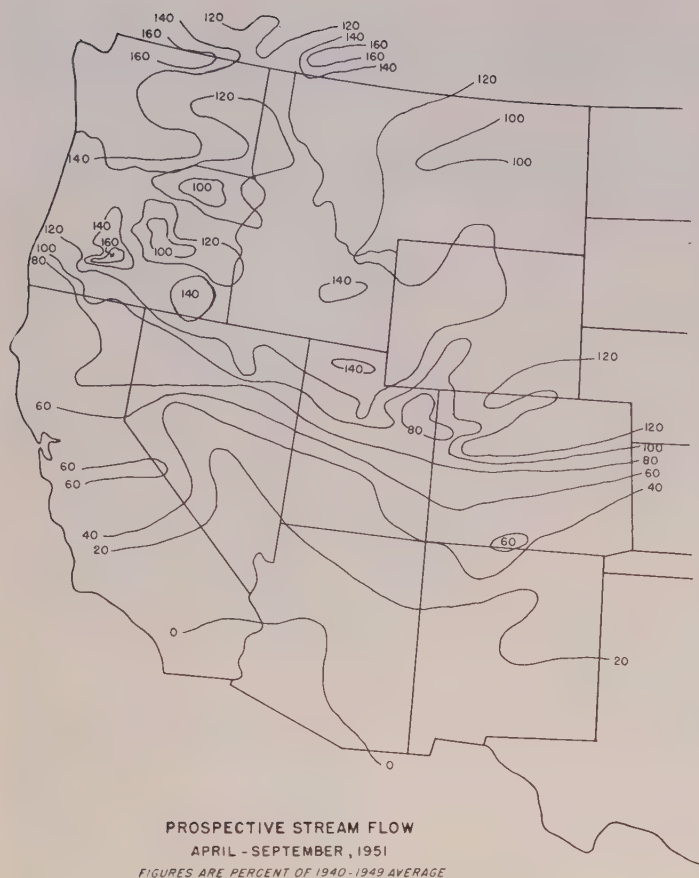
Montana

Snow pack on the upper Missouri River Basin is somewhat above average and should provide good irrigation water supplies in 1951. The pack this year is not quite as great as in 1950 or 1949, but is greater than in 1948. Thus, potential flood hazard in parts of the basin should not be overlooked. Due to orderly snow melt, controlled streamflow resulted in 1949 and 1950. The 1948 melt season was accompanied by high

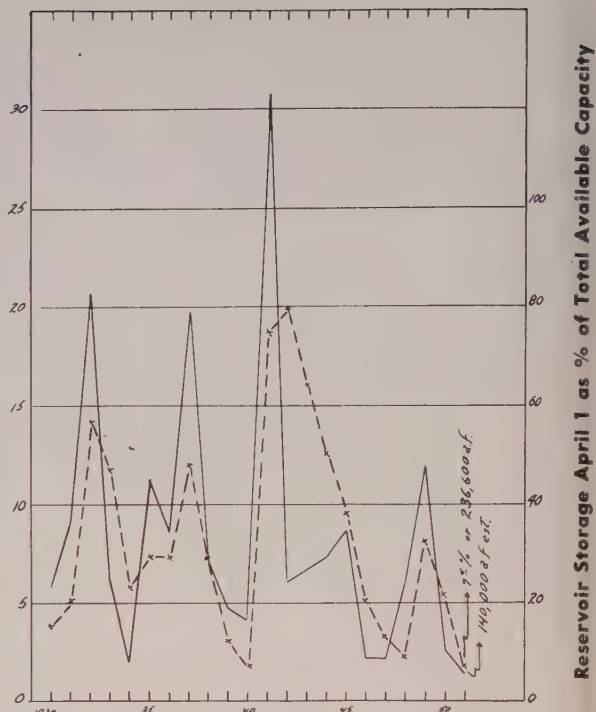


RESERVOIR STORAGE AS OF APRIL 1, 1951

Explanation: (a) Most state averages for reported reservoirs are for full 10-year period, but in a few cases reservoirs having shorter records are included. (b) Does not include Millerton or Shasta reservoirs (combined capacity, 5,020,500 acre-feet); April 1 combined storage 4,011,000 acre-feet. (c) Does not include John Martin reservoir (capacity 685,000 acre-feet); April 1 storage 80,800 acre-feet. (d) Does not include Fort Peck reservoir (capacity 19,000,000 acre-feet); April 1 storage 12,960,000 acre-feet. Does not include Flathead Lake (capacity 1,791,000 acre-feet); April 1 storage 16,806,000 acre-feet. (e) Does not include Lake Mead (capacity 27,217,000 acre-feet); April 1 storage 16,806,000 acre-feet. (f) New reservoir 1945. (g) Does not include Roosevelt Lake (capacity 5,220,000 acre-feet); April 1 storage 4,749,000 acre-feet.



Run-off (in 100,000 acre-feet), Feb.-June Inclusive
Gila, Salt, Verde and Aqua Fria Rivers and Tonto Creek Combined



Arizona Surface Water Supply, 1930-1951 Incl.

PREDICTED RUN-OFF is shown on chart at left as contours indicating percentages of normal run-off in 10-year period. Chart above shows graphically why Arizona has poorest outlook for water in almost half a century of record. Storage (dashed line) is down to 7% of capacity; run-off (solid line) is predicted to be negligible.

temperatures and precipitation in such amounts as to cause rapid snow melt, which produced floods on most rivers and tributaries. Consequently, realization of the 1951 flood potential will depend entirely upon meteorological events in the basin during the next 2 or 3 months.

Upper Columbia River Basin in Montana also shows above-normal snow pack this season. Potential flood hazard of modest proportions now exists on some headwater streams of Columbia River in Montana. The magnitude of this potential depends entirely on melting conditions during the snow-melt season. In any event, very good water supplies for the basin are foreseen.

Nevada

The drought of the Southwest is continuing its move northward into Nevada and at this time it encompasses the southern two-thirds of the State and the eastern slope of the Sierra Nevada. The only bright spot is the Humboldt River which is expected to flow 150% of normal. The floods of last November and December were a blessing in disguise for they filled reservoirs and mountain and valley soils. Run-off of snow-stored water will be less than 50% of normal from the Sierra while the central and southern part of the State will realize only from 10% to 25% of normal. Storage in Lake Mead equals 95% of last year but less than 90% of normal for this date.

New Mexico

A critical shortage of irrigation water is foreseen this season for lands along

the Rio Grande. Snow cover in northern New Mexico is very deficient with many snow courses showing the least since surveys were started in 1937. The summer flow of the Rio Grande through New Mexico will not exceed 25% of the irrigation water demand. El Vado Reservoir, supplying the middle Rio Grande area, is practically empty. Storage in Elephant Butte Reservoir and Caballo Reservoir is about 400,000 acre-feet. This amount will supply about one-half of the normal irrigation-water demand in the lower Rio Grande valley. Considerable amount of crop curtailment will be necessary. Soil moisture conditions in all irrigated areas are reported as dry.

Oregon

Water supply for 1951 will be generally good to excellent. Reservoir storage for the entire State, with few exceptions will be adequate. Many reservoirs will hold substantial reserves at the conclusion of the 1951 water season. Owyhee reservoir now holds 2 years' supply and is full for the first time since 1946. The only appreciable snow shortage on watersheds is in extreme southern and southwestern Oregon. Run-off is expected to be above normal throughout the State except for Applegate and Illinois rivers in southern Oregon and in the Grand Ronde, Umatilla River and northern Harney valleys. However, flows in the latter three areas should be nearly average.

South Dakota

Snow cover in the Black Hills has been deficient all winter. The water supply outlook is not much better than fair.

Soil moisture conditions in the irrigated areas are reported as dry. Belle Fourche reservoir now stores 94,000 acre-feet as compared to 93,000 acre-feet a year ago and 127,000 acre-feet for the 10-year average (1940-49). Angostura reservoir, newly operating, with capacity of 160,000 acre-feet, has now filled to 32,000 acre-feet.

Utah

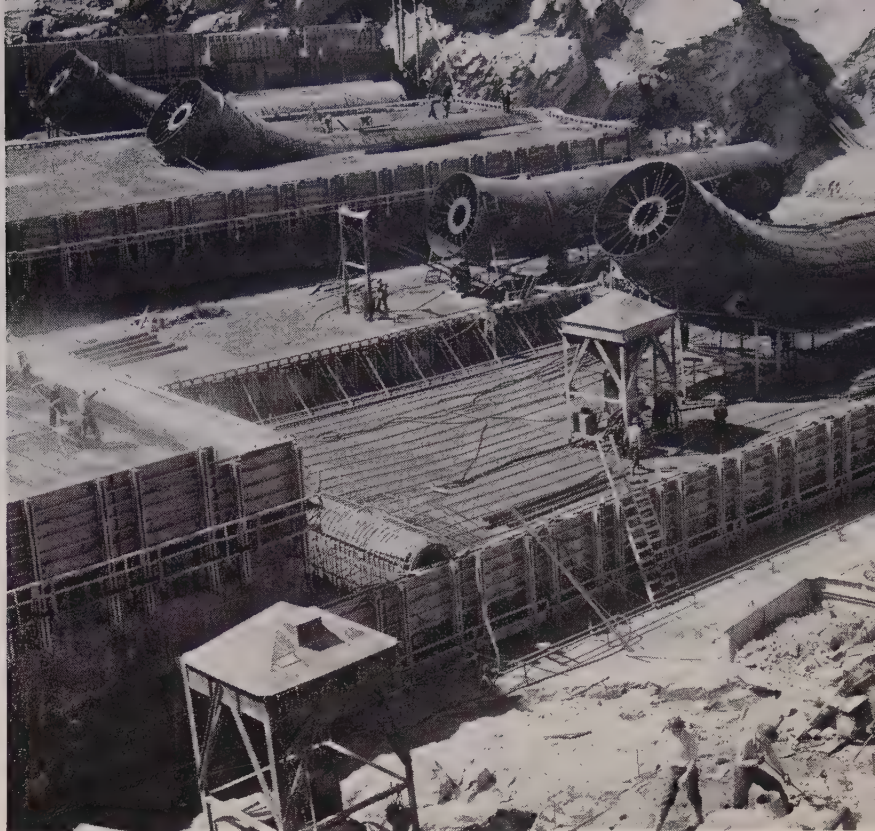
Extreme variation is shown in the water supply prospects for Utah during 1951. Severe drought faces all water users in the southern half of the State, with water supplies varying from 25% to 45% of the preceding 10-year average. In northeastern Utah on Ashley Creek, the Whiterocks and Uinta rivers, streamflow will be 65% to 70% of average. Northwestern from these areas, water supply outlook increases to as much as 40% above average as indicated by the snow blanket on the Cache and northern Wasatch forests. In these watersheds above-normal temperatures during the melt period could produce damaging peak flows. Reservoir storage supplies are excellent in northern Utah. In southern Utah, low reservoir storage will increase the severity of the water shortage.

Washington

Prospects for water supplies in Washington are fair to good. Water stored in snow ranges from 5% to 50% above normal. Snow cover on the Methow River drainage is 50% above average. This implies a serious threat of high water if a cold spring should now occur.

Concluded on page 144

Embedded in the mass concrete of the Northwest's biggest dam, four steel pipes each 469 ft. long will carry water to four 105,000-hp. turbines under a maximum head of 490 ft. — Coordination of this phase of the project with the general contractor's operations had helped work progress smoothly for the installation of . . .



13½-Ft. Penstocks at Hungry Horse

ONE of the important jobs now well under way at the big multiple-purpose Hungry Horse Project being constructed by the Bureau of Reclamation on the south fork of the Flathead River in northwestern Montana is installation of the four penstock pipes that will carry water to the four 105,000-hp. turbines to be installed in the power plant.

Since the 394-ft. long Hungry Horse power plant will straddle the old river bed at the toe of the 564-ft. high dam, the penstocks will be embedded in the mass concrete of the dam for their entire length with the exception of a short section of pipe and an expansion joint which will connect each penstock with the turbine it serves.

Installation of the penstock pipes is being handled by the Chicago Bridge and Iron Company under a \$234,925 sub-contract from General-Shea-Morrison, prime contractor for the dam and power plant. Field fabrication of the penstock sections was also handled by the Chicago Bridge and Iron Company under a \$699,200 contract with the Bureau of Reclamation. The fabrication job was started in April 1949, and completed in October of the same year.

Coordination with general contractor

The general knowledge of the entire Hungry Horse job gained during the fabrication period has enabled the C. B. & I. company to dovetail penstock installation procedures with General-Shea-Morrison construction methods, and as a result of the excellent coordination

achieved between the two contractors, the big pipe job has progressed smoothly and efficiently.

Basically, the penstock job involves installation in the huge gravity-arch dam of four steel pipes, each approximately 469 ft. long. Each penstock pipe consists of an inclined section of 13 ft., 6 in. diameter, a combined reducing bend 13 ft., 6 in. to 11 ft., 9 in. in diameter, and a horizontal section of 11-ft., 9-in. diameter. The lower end of each penstock consists of an expansion joint and short section of pipe connecting with the turbine scrollcase at elev. 3080.

The upper end of each penstock will consist of an unlined transition section changing from a rectangular opening 13.5 ft. wide by 18.93 ft. high in the face of the dam to the 13.5-ft. diameter of the penstock pipe. Centerline of the inlet to the penstocks will be at elev. 3319.

Pipe fabricated at dam site

The penstock pipes were fabricated at the project in 20-ft. long sections from rolled steel plates shipped by rail from the C. B. & I. Salt Lake City plant in half-round sections. Plate thicknesses range from 9/16 in. for sections at the upstream end of each penstock to

1-5/16 in. for the horizontal section which must withstand the pressure of a maximum head of 490 ft.

Average weight of the 20-ft. sections is about 20 tons, and the total weight of the more than 1,800 ft. of pipe is approximately 3,600,000 lb. All sections were match-marked to facilitate installation.

Fabrication of the pipe sections required approximately 8,100 ft. of automatic machine welding, done with Union Melt machines manufactured by the Linde Air Products Company, and 1,300 ft. of hand welding. All joints were power brushed before welding. More than 3,600 ft. of finished longitudinal weld was X-rayed to detect internal flaws. All imperfections were chipped out and replaced by hand-welding and again checked by Radiograph.

A major saving in man-hours was effected on machine welding by use of a special flux retriever designed and patented by Jason Welch, foreman in charge of the fabrication job for C. B. & I. Welch died in May 1950, shortly after the installation job was started.

A steel-collar-and-spoke-assembly type of spider was tack-welded in all penstock sections during fabrication to maintain proper plate curvature during storage, transportation and installation in the dam. The spiders consist of 18 spokes welded to the inside of the pipe sections and terminating in a heavy steel collar or hub. Drawn to equal tension by nuts on their collar ends, the steel spokes hold the pipe sections rigidly to the proper curvature. Plates that were

PICTURED AT TOP OF PAGE—

VIEW in early 1950 shows varying degrees of progress on all four penstocks. Double mat of 1¼-inch reinforcing bars encases each of the pipes. Horizontal section of penstock No. 3 is nearly embedded.



ABOVE LEFT—A total of 8,100 ft. of automatic machine welding was required for joints during fabrication of penstocks.

ABOVE RIGHT—More than 3,600 ft. of finished longitudinal weld was X-rayed to detect internal flaws.

BELOW LEFT—Welders work on girth seam welds on both inside and outside of pipe to minimize heat-induced stresses.

BELOW RIGHT—Wire rope sling suspended from one of project's four cableways is used to swing sections into place.



slightly deformed in manufacture or in transit to the project were easily pulled into true round during fabrication by adjustment of the tension nuts.

As a result, the task of aligning the pipe sections for welding into place in the dam has been simplified to a great extent. The steel spiders have been a major factor in speeding field assembly and in eliminating troublesome and costly delays.

The spiders are not removed until a minimum of 10 ft. of concrete covers the pipe. After the Hungry Horse penstock installation job is completed, the spiders will become the property of the Bureau of Reclamation and can be re-used on other penstock jobs.

The penstock sections are transported from the fabrication and storage yard about 3 mi. to the dam site on a timber cradle mounted on a flatbed truck. A small tractor is used to roll each section up an inclined timber ramp onto the truck. At the dam site the pipe sections are trucked up a steep access road to a materials loading area at elev. 3330 on the left abutment. A tractor follows the truck up the access road to assist in climbing the grade and to serve as a

backstop in the event the truck stalls.

At the unloading area, which is a temporary wooden bridge constructed across the excavated keyway for the dam, the pipe sections are picked up by one of the four overhead cableways and carried to the proper location on the dam.

To facilitate setting and anchoring in place of the horizontal section of each penstock, angle iron staubs were embedded in blocks 15B, 16B, 17B and 18B at elev. 3070. The pipe sections were aligned on the staubs and welded in place.

Inclined sections cantilevered

An interesting and unusual feature of the job is the fact that inclined sections of the penstocks support themselves entirely by cantilever action before they are embedded in the concrete. Temporary angle iron supports are used to hold each 20-ft. section in position while the girth seam is being welded, after which the supports are removed leaving as much as 30 ft. of pipe extending above the concrete, cantilevered at an angle of 42 deg., 30 min.

As each 20-ft. section of pipe is swung

into position with the highline, special key plates and keyhole shims, designed and patented by the C. B. & I. company, are used to pull the section into place and to maintain proper spacing between the steel plates for welding.

The girth seams are then power-brushed and hand-welded under a special procedure designed to hold heat-induced stresses to a minimum. Two welders work each joint-weld simultaneously, one working on the outside of the pipe and the other on the inside. The welders work on opposite sides of the pipe, running all passes in an upward direction and back stepping at 2-ft. intervals. It is believed that this welding sequence holds residual stresses as low as is possible without use of special stress-relieving operations.

Special forms at contraction joint

At the point where each penstock passes through the contraction joint between the upstream and downstream blocks of the dam, special wood forms were used to make the longitudinal contraction joint perpendicular, or normal, to the penstock pipe. Two metal seals were installed to isolate the contraction



TOP—Special forms were used where penstock passes through dam's longitudinal contraction joint to make joint normal to the pipe.

CENTER—Strainmeter on bottom of penstock.

BOTTOM—Expansion joints connecting penstocks, turbines to allow for deflection of dam.

joint in the area immediately surrounding the pipe, and a separate grouting system was installed to permit independent grouting of this area. A slip-joint is used at this point, wrapped with asbestos to prevent the concrete from bonding with the pipe so that the upper and lower sections of pipe will be free to move as the concrete cools and the contraction joint opens. The asbestos also prevents heat from the weld from being transferred to the concrete.

Welding and grouting joints

After the mass concrete of the dam has cooled to its stable temperature, the regular contraction joint grouting will be completed; then the slip joint in the penstock will be welded on the inside of the pipe, and the section of the contraction joint surrounding the penstock will be grouted by means of the independent grouting system.

Voids around the penstock pipes resulting from shrinkage of the concrete as it cools also will be grouted.

A double mat of 1¼-in. steel reinforcing bars, pre-formed in the steel fabrication yard, encases each penstock pipe to elev. 3200. Above that point a single mat is used.

Research for stress data

The Bureau of Reclamation is conducting special research in connection with the Hungry Horse penstock installation job in an effort to obtain stress data that will be useful in determining reinforcement steel requirements around penstocks and other openings in designs for future dams.

To record the stress data desired, instruments have been installed at two locations on penstock No. 2—one a few feet below the slip joint, and the other at the upstream end of the horizontal section just below the reducing bend. Each installation consists of four Carlson strainmeters mounted on the penstock pipe and six reinforcement meters which are Carlson elastic-wire strainmeters encased in sections of seamless steel tubing welded in place as a part of the reinforcement bars. A strainmeter and two reinforcement meters—one on each layer of reinforcement steel—are mounted at the top and bottom of the pipe. One strainmeter and one reinforcement meter are used at each side of the pipe. The leads from these instruments are brought out to terminal boards in the nearest gallery.

The instrument installation is designed to record quantitative measurements of stresses set up in the penstock and surrounding reinforcement steel during periods of transition from zero water load to full static head and from full static head to maximum flow.

As a part of its sub-contract from General-Shea-Morrison, the Chicago Bridge and Iron Company also was responsible for installation of the three 8-ft. diameter steel outlet tubes which will be used to lower the reservoir quickly when necessary to provide flood storage space. Installation of the draft tube liners also was handled by C. B. & I. Installation of the outlet pipes and the draft tube liners was completed during the 1950 construction season. The outlet pipes, which are approximately 700 ft. long, run through blocks 19 and 20 from elev. 3200 at the face of the dam to elev. 3101 at the valve house.

Water flow through the outlet tubes will be controlled by 96-in. hollow jet valves. Closure of the tubes will be effected by means of 10.33 by 10.33-ft. bulkhead gates at the upstream end and 96-ft. ring follower gates installed at the point where the pipes pass through the service bay area.

Closure of the penstocks will be effected with 13.5 by 18.93-ft. fixed wheel gates at the upstream end. Volume of flow will be handled entirely by the wicket gates on the turbines.

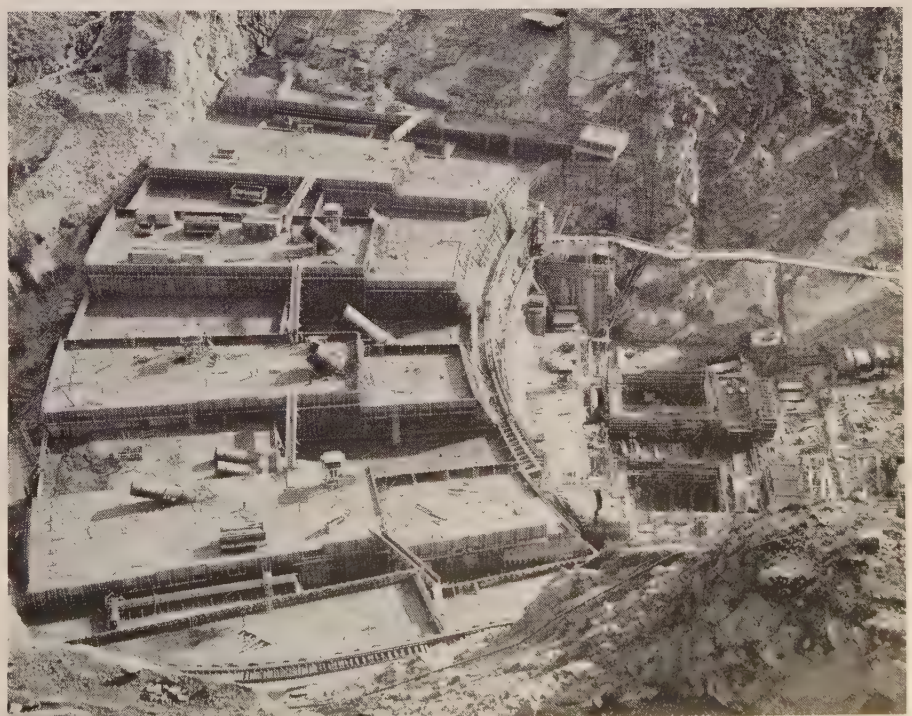
Installation of all gates and valves is being handled by General-Shea-Morrison.

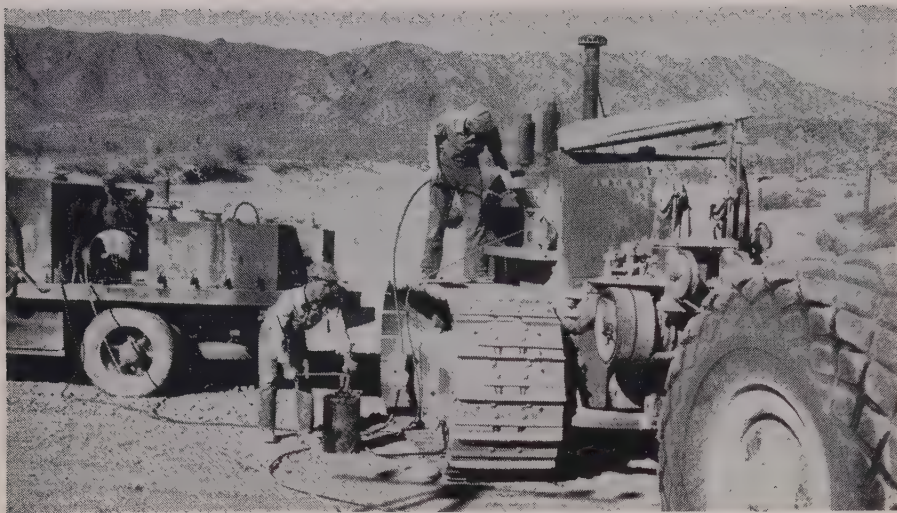
It is anticipated that the Chicago Bridge and Iron Company will complete the installation job this August.

Personnel

Foreman in charge of the penstock and outlet installation work for C. B. & I. is S. A. McCloud. Engineer in charge of the work for the Bureau of Reclamation is Michael "Mike" E. Walsh. Field engineer for the Bureau is E. J. Niemen, and construction engineer in charge of the entire Hungry Horse Project is C. H. Spencer.

1,200-FT. RADIUS ARC of the dam can be seen easily in this view from high on the right abutment. At this stage of construction the three outlet pipes (foreground) and penstocks 1 and 3 had passed through the longitudinal contraction joint between the A and B blocks.





CHECKING tracks and lubricating drive housing of an International TD-24 in the field.

Spring Tonic for Your Tractors Now Can Save Repair Dollars This Summer

THE BEST spring tonic for crawler tractors is a little preventive maintenance to insure high output during the torrid summer months ahead. Here are a few steps which if undertaken now will save repair dollars and down-time later on.

Engine lubrication is the logical place to start. Old oil, which is dirty and diluted by cold-weather starting, should be changed to recommended summer grade. It is important to drain old oil from a hot engine.

Another major step that should be done without fail is draining and flushing the cooling system. It is a good idea, after draining the antifreeze, to fill the system with a solution of from 5 to 10 lb. of ordinary washing soda and water, depending on the size of the engine. Leave off the radiator fill cap and operate the engine until the water is hot. Then drain and flush with clean water. Refill with soft or rainwater, if possible, and the recommended amount of rust inhibitor.

Next check the water hose clamps for leakage and tighten where necessary. Another excellent check for leakage is this: Remove the fan belt so that the water pump will be inoperative. Fill the radiator to the top, leave off the radiator cap, and, while the engine is running, hit the throttle hard and watch for air bubbles. If bubbles appear, it's a good indication of leakage around the cylinder head gaskets.

While conditioning the cooling system, check and adjust fan belt tension. Inspect the fan for bent and loose blades and check the fan hub mounting cap-screws for tightness. Clean the spaces between the radiator fins by blowing them out with an air hose or flushing them with a water hose. Many a cracked block has resulted from overheating due to clogged radiator fins. This simple precaution will eliminate any chance of this happening.

While you're about this spring tonic job, clean and refill the air cleaner tray.

In refilling use about $\frac{1}{2}$ oil and $\frac{1}{2}$ kerosene. This allows a better flow of air to the manifold without reducing the cleaning efficiency of the unit. Air cleaner connections should be tightened and the pipe from cleaner to manifold should be examined for holes or cracks. Abrasives entering the engine from improperly filtered air can cause serious damage to rings and sleeves.

On tractors with gasoline starting systems, it's good procedure to check the gasoline strainer, then clean and wash the bowl at the same time. Distributor and magneto points should be checked for wear and correct gap setting.

Look at the diesel fuel water trap, too. It may be time to take it apart and clean it. "Spring tonic treatment" for tractors should include replacing oil filter elements. In most crawlers, these elements

should be replaced with each oil change.

Another good tip for spring and the year around is to service your battery. Clean terminals with hot water and baking soda and steel wool when necessary. Then coat them with vaseline. Be sure that the cells are filled with distilled water to $\frac{3}{8}$ in. above the separators.

If the battery water level is constantly low, it may be a sign that it is being overcharged. The charging rate should be investigated and adjusted at once where necessary to prevent serious damage to the battery.

To insure fast starting, lubricate the magneto impulse coupling with kerosene or light machine oil.

If transmission and final drive lubricants have not been changed for a season, now is the time to do it. If the oil in the transmission and final drive has been thinned during the winter for easier operation, the lubricant certainly should be changed to a heavier grade before hot weather. Work the tractor until the lubricant is warm and drain. Then refill with the proper grade of oil in accordance with the manufacturer's recommendation.

Another item you can check by a quick inspection at this time is the track assembly. If the track is too tight or loose, excessive wear will result. Adjust tracks to the type of soil in which the tractor is operating.

These preventive maintenance suggestions are not expensive nor time consuming, and can be followed in the field. They often are postponed or overlooked with the result that real trouble develops later on, slowing down contracts and wasting man hours.

A "spring tonic treatment" for tractors is like putting money in the bank. It pays off with interest later on in keeping your crawlers producing longer with fewer delays for repairs.

—By Fred O. Schreck, Supervisor of Service, Industrial Power, International Harvester Co.

Some Tips on Keeping Earthmovers Rolling When the Going Gets Wet

INCLEMENT weather, according to Bureau of Public Roads bulletins on equipment performance, is one of the most important factors contributing to down-time of heavy equipment. Even small amounts of rain can force a con-

tractor to cut his shifts. Continued rainfall over extended periods of time can temporarily close down the job or cause him to quit work entirely until underfoot conditions are dry enough to allow reasonable progress of work.

There are, however, several things the equipment operator can do to reduce weather down-time and keep his equipment rolling throughout the rainy season. Here they are:

In anticipation of short wet spells or prolonged rainy weather, keep the haul road smooth. Use a dozer or scraper to fill in large holes or pockets that temporarily hold or impound water. Assure good drainage through the construction of adequate ditches and culverts. Keep constructed ditches and culverts clear of weeds, rocks, debris and other obstructions.

If it looks as if it's going to rain,

Concluded on page 142

START back to work earlier after a rain by first using dozer to skim off mud and drain and fill water holes.



How to Get the Most Out of Your Compressor Equipment

EVENTS of recent months and those anticipated for the near future have served to strongly re-emphasize the basic importance of American construction industry getting along with less manpower, material shortages and equipment scarcities. This means that the industry must (1) increase the efficiency of its present production procedures and (2) install additional production equipment when needed and when available.

In this critical emergency the Compressed Air and Gas Institute can be of service by providing useful information on compressing equipment. The information in this article applies to: (1) checking the performance of the compressing equipment, the distribution system and the air-power tools and equipment to assure maximum productive efficiency; and (2) selecting additional compressors and air-powered tools and equipment in case the present equipment at peak efficiency is found to be inadequate to meet production demands.

Checking performance

When judging the performance of any compressor, it is essential to recognize the real criteria of compressor efficiency. These are: the actual capacity of the compressor and the energy or power it requires per unit of air actually delivered.

The overall performance of a portable compressor is expressed on the basis of the number of units of power input (gasoline, fuel oil or electric power), per unit of air output. The input measurement should be corrected to standard units as defined below:

(a) Gasoline engine drive

Gasoline measurements should be referred to standard U. S. gallons, weighing 6.16 lb. per gal., having a heat value of 20,260 Btu. per lb.

(b) Diesel or fuel oil engine drive

Oil measurements should be referred to standard U. S. gallons, weighing 7.2 lb. per gal., and having a heat value of 19,000 Btu. per lb. (See Diesel Engine Manufacturers Association Standards.)

(c) Electric motor drive

Electric power input measurements should be reduced to kilowatts. (For test procedure see A.S.M.E. Power Test Code.)

For checking the efficiency of any particular make and type of compressor, the assistance of the manufacturer may be desirable.

Regulation of the plant

Since the demand for compressed air usually varies widely from time to time, some form of capacity control is required. Two general methods are avail-

By **EDMOND C. POWERS**

Educational Director
Compressed Air and Gas Institute

able. The first, known as speed and pressure regulation, varies the speed of the compressor according to the demand for air such as is usually done in a steam driven compressor. The second, known as constant speed regulation, operates the compressor at a constant speed and varies the capacity by any one of several types of unloading systems as is usually done in a motor-driven compressor.

For general use, control of pressure closer than a 5% range between full load and no load is unnecessary and should be avoided. Whenever possible, pressure regulators should be so selected and adjusted that large units will act as base load units and unloaded only after smaller units have been shut down. Of course, where the requirements have diminished to where one of the smaller units could handle same, the large unit should be shut down. In this way, the overall economy will be improved.

Location of units

The location of a compressed air plant with relation to the points of air use should receive study. A central plant housing all the compressors involved has advantages in unified operation and care, better supervision, and probably less labor cost. In a central plant, it is probable that no more compressors will be kept operating than are necessary to maintain pressure. The load factor and operating efficiency of each unit will, therefore, tend to be relatively high.

It is possible, however, that a central plant cannot be so located that satisfactory distribution of air and maintenance of pressure may be obtained without excessive piping costs. In such a case, it may be better to divide the compressor plant into two or more installations at or near specific load centers, interconnecting the plant piping so that air may be distributed either way to meet peak load requirements. Of course, the plant

TO HELP OWNERS and operators of air compressors get maximum efficiency and longer life out of these important tools of construction, this authoritative article has been prepared expressly for the readers of *Western Construction*. In the present National emergency, when each piece of equipment must serve a long and useful life, it is important to check your compressor operations against these recommendations coming from the manufacturers of the machines.

should be placed as close as possible to the larger load centers. This reduces piping costs and results in higher pressure at the tools with closer control of the pressure.

Distribution system

Low air pressure is an abuse of any compressed air system—a costly and wasteful practice which should not be tolerated. Ignorance of the effects of low air pressure contributes more than any other single factor to a lack of appreciation of the effectiveness of compressed air power.

By “low air pressure” is meant inadequate pressure at the tool or the device which is air-operated. It is at this point that the air is used as power. Only the pressure and volume of air available at the point of use can be effective in doing work. Most pneumatic tools, for example, are designed to operate at 90 lb. gage maximum at the tool. This means pressure at the point where the air enters the tool while the tool is operating. If the pressure is below the range of 85 to 90 lb. gage, then it should be considered too low, since it reduces the ability of the tool to do the maximum work for which it was designed.

The causes of low air pressure are easily classified: (1) Insufficient compressor capacity, (2) inadequate piping, and (3) leakage.

When it is discovered that pressure is too low, the first inclination is to install more compressor capacity. This is not necessarily the correct answer. It should first be determined whether the compressors are at full load when the air pressure is low. If they are, then more compressor capacity may be required but, even then, consideration must first be given to two other common causes of low air pressure.

The second cause is “inadequate piping.” A measure of the adequacy of piping is the pressure loss between the air receiver, where the compressor endeavors to maintain a constant pressure, and the point of use. This should not exceed 10% in a well designed system. The absolute maximum drop for the worst point in the system should not exceed 15%. If the pressure drop is greater than 10% average, and 15% maximum, throughout the entire distribution system (including hose), then attention should be given to correction of this fault before considering increased compressor capacity.

A third cause of low air pressure is leakage or loss of air without doing work. Excessive leakage is the same as exhausting the output of a compressor directly to atmosphere. Obviously, if leakage is eliminated, the compressed air formerly wasted will be available for useful work. The expense of making lines tight will undoubtedly be less than the installed cost of a new compressor, while the daily power saving may be considerable.

Effects of low air pressure

There are very few uses of compressed air not vitally influenced by low air pressure. All portable pneumatic tools, rock drills, concrete breakers, hoists, scrap-

ers, loaders, all pneumatic transfer and conveyor systems operate less effectively when the proper air pressure is not maintained.

The positive result of increasing air pressure to the proper value is: (1) Increased production, and (2) reduced unit cost. Since the two are interdependent, they will be discussed without attempting to differentiate.

Considering rock drills as a distinct class of air powered tools, it has been found that increasing air pressure at the drill from 70-lb. gage to 90-lb. results in about 41% increase in drilling speed. This is an average of eight different types and makes of drills. This increase in drilling speed is not accompanied by corresponding increase in the cost of operation. Air consumption of the drills increases only 32%, while the labor cost did not increase at all, thus greatly decreasing the total cost per unit of work done.

The economic advantages of increased air pressure, (or conversely, the losses due to low pressure), can be very nicely illustrated by considering portable pneumatic tools, such as drills, chippers, riveters, wrenches, sand rammers, etc. For example, an average increase of 37% in production can be obtained for about 30% increase in air consumption by increasing the air pressure at the tools from 70 to 90 lb.

Assuming that only one-third of the 37% increase in tool productivity can be translated into labor productivity, it is evident that 12% more work will be done with 90-lb. gage air pressure than with 70-lb. air pressure.

Analyzing this another way, when the pressure is increased to 90-lb. gage, the tools require 120 cu. ft. per min. more air. A compressor with motor and auxiliary equipment to supply about this amount of air would cost \$2,200. This saving of \$33.29 per day would pay for this new unit in 68 working days, less than 3 months.

Remedies for low pressure

The remedies for low air pressure are just as definite as the causes and effects. Faulty air power conditions are usually due to poor planning or to increased air uses without corresponding system expansion. Plant-wide analysis should determine the full extent of low air pressure and the present air flow requirements.

Pressure loss varies roughly as the square of the velocity of air flowing through the pipe. For example, a 3-in. line, 1,000 ft. long, will handle 500 cu. ft. per min. with a 2.5-lb. pressure loss, while a 4-in. line will pass about 1,000 cu. ft. per min. with the same drop. The installed cost of the 4-in. line will, however, be very little more than that of the 3-in. line, since most of the cost is labor.

Methods of increasing pipe line capacity to decrease pressure loss and improve conditions at the point of use vary with different installations. One may call for a line paralleling the original, with frequent interconnections; another may require installation of a loop system with some outlets taken off the new line to

relieve the old; still another may need a complete new system.

Branch lines and manifolds for attachment of tools, etc., should be planned "oversize."

Not the least of the problems of correct system layout is the selection of proper hose for final transmission of compressed air to the tool. Losses of 15 to 25% in air pressure are frequent in the hose alone. **Don't** use a hose longer than is necessary to make the tool available to the work and to give proper freedom of movement to the operator.

Every cubic foot of leakage eliminated is pure gain. Such losses in many systems will reach 10 to 20% of the total air compressed. An air leakage test should be run on the complete plant and every section of hose should be inspected. Although leaks are usually small, they may be numerous, having a high total effect. A single 1/16-in. hole will waste 182,000 cu. ft. per month, costing \$9.10.

The most likely locations of small leaks is around valve stems, in hose connections, unions, drains, homemade blow guns, and lines leading to inoperative tools.

Only after it has been determined that the distribution system is adequate and that leakage has been eliminated, should increase in compressor capacity be considered.

Distribution system

Any drop in pressure between the compressor and the point of use of the compressed air is irrecoverable loss. The distribution system is, therefore, one of the most important elements of the compressed air plant. In checking it, the following general rules should be observed.

1. Pipe sizes should be large enough so that the pressure drop between the receiver and the point of use will not exceed 10% of the initial pressure.

2. Where possible, use should be made of a loop system with two-way distribution to the point where the air demand is greatest.

3. Long distribution lines should have liberal size receivers located near the far ends or at the points of occasional heavy use. Many peak demands for compressed air are instantaneous or relatively very short and storage capacity near such points avoids excessive drop.

4. Frequent outlets should be provided on each header, or main, for attaching hose for air-operated equipment, always putting the outlet at the top of the pipe line to prevent carryover of condensed moisture to the tool. Frequent outlets result in shorter hose length and, therefore, less pressure drop through the hose.

5. All piping should be arranged so that it slopes toward a drop leg or moisture trap in order that condensed moisture may be removed from the piping system and prevent it from being carried over into the air tools or compressed air-operated devices where it is harmful.

Obtaining maximum tool efficiency

The importance of obtaining maxi-

mum output from tools of all kinds cannot be over-emphasized. This requires an ample supply of air at the proper pressure at the tool itself so that the tool can develop full power.

A hypodermic needle attached to an air gage will show the air pressure actually available at the tool. It must be emphasized that the pressure shown at the compressor does not indicate the pressure delivered at the tool itself while the tool is running. Such a test may indicate that only 60-lb. pressure is available at the tool, instead of 90-lb., and, if the condition is remedied, production will be increased from 25 to 50%, provided the tools are in good condition and can deliver the increased power provided by the increased pressure.

Careful consideration must be given also to the size and length of hose to use. For hose can very severely restrict the air pressure delivered to the tool. The size of hose should be as large as practicable and as short as possible.

Necessary compressor capacity

The proper plant capacity—present or future—is a question requiring careful analysis. A study of air-operated devices shows that many of these operate almost continuously but there are others which operate infrequently but require a relatively large air supply when in use. It will also be discovered that the actual amount of air used by the individual device will vary considerably in different applications.

The first suggestion is, therefore, that the average air consumption of air-operated tools be ascertained. This may be obtained from manufacturers' literature or may be closely approximated by actual test. Care must be taken not to assume that all air-operated devices consume their maximum under all conditions as otherwise a false plant size will be developed. Therefore, the Load Factor of the device must be considered.

Relatively few air-powered devices use air continuously. Pneumatic tools of all types, rock drills, hoists, blow guns, etc., operate intermittently and their net air consumption is considerably less than their maximum. The ratio of actual air consumption to the maximum continuous full load air consumption is known as "Load Factor."

The second item in the term "Load Factor" will depend on what might be called the "Work Factor," or the percent of maximum possible work output per minute, which is actually done by the device. For example, the air consumption of a grinder with full open throttle varies considerably, depending upon how hard the operator pushes it against the work. The "Work Factor" is, therefore, the ratio of the air consumption at the actual conditions of operation to the air consumption when the tool is fully loaded.

"Load Factor" is actually the product of "Time Factor" and "Work Factor."

In a large shipyard with several thousand portable tools, the actual load was only 7.6% of the load which might be expected, based on the total tools in operation, plus stock and reserves. As a

Concluded on page 118

Predicting (and Preventing) Columbia River Floods

SNOW SURVEYS can provide the basic information for regulating multi-purpose reservoirs for maximum effectiveness. This information can include predictions of (1) total runoff during months of flood-stage on the river, and (2) an approximation of the expected peak flow. Although the increasing number of reservoirs on Western streams adds to the control potential, the predicted runoff remains the key to the handling of river discharge and storage-space during the flood season. An improved technique has been proposed for using snow surveys for regulating the Columbia River. This method was developed by:

A. A. Work, Senior Irrigation Engineer and Supervisor of Snow Surveys, Division of Irrigation and Water Conservation, Soil Conservation Service;

F. Wilm, Chief, Division of Flood Control Surveys, Pacific Northwest Forest and Range Experiment Station, Forest Service;

Forlan W. Nelson, Soil Scientist and Snow Survey Leader Columbia Basin, Division of Irrigation and Water Conservation, Soil Conservation Service; (all in U. S. Department of Agriculture).

It was presented as a paper at the joint meeting of the Western Snow Conference, Columbia River Water Forecast Committee and Columbia Basin Interagency Committee, at Victoria, B. C., on April 29. Present plans call for the full paper and supporting statistics to be published as a Technical Paper by the Oregon Agricultural Experiment Station.

Features of the technique

Features of the plan are outlined briefly in the following:

With increasing development of Pacific Northwest streams for irrigation and power generation, more and more dams and reservoirs are being used for these purposes and for the control and prevention of floods. As a result, there is an increasing demand for accurate advance forecasts of runoff which will make possible the most efficient use of the reservoirs. For irrigation and power, estimates of the probable total volume of water are needed; for flood control, corresponding estimates of the most probable maximum discharges are required.

The need for such forecasts was underscored by the destructive Columbia River flood of May-June, 1948. While this flood was exceeded in crest height by those of 1894 and 1876, and probably by earlier floods, damage by the 1948 flood greatly exceeded that of 1894. According to the U. S. Corps of Engineers, damages from the 1948 flood aggregated 102,725,000 within the United States part of the Columbia River Basin, as compared to only \$5,200,000 in 1894. About one-half of the total loss in 1948 occurred in the immediate vicinity of Portland and Vancouver.

Reliable estimates of run-off and peak flow based on snow surveys of 43 selected courses in the Columbia River Basin can be the key that's needed to stop yearly flooding — Improved method is aimed at narrowing down limits to variables used in the equations for estimating

The greater damage in 1948 was due to man's encroachment upon the flood plain of the river in the intervening 54 years, which have shown a flourishing development of industrial, commercial, and agricultural enterprise along the river's channel. Therefore future floods of comparable magnitude can be expected to do very great property damage in vulnerable areas throughout the Columbia River Basin. Offsetting this danger, accurate flood forecasts will help reduce destruction to a minimum. Through the efficient use of water in multiple-purpose reservoirs, it is even possible that such catastrophic occurrences may be prevented. This goal may seem optimistic in view of the tremendous volumes of water to be controlled; yet plans to this end are beyond the blue-print stage.

Use of storage reservoir

One method may be to siphon off the extreme flood peak into storage space reserved in reservoirs suitable for such use. With the aid of forecasts of water yields, this can often be accomplished even when the reservoirs are primarily designed and constructed for irrigation or power. If the forecasts indicate that a large water yield is to be expected in some years, it will be feasible to lower the storage in such reservoirs early in the year, with assurance that they will later fill with water from snow melt. Lacking such measures, flood flows would reach full reservoirs and pass through them undiminished in volume, exerting their greatest destruction along the stream channels below. The use of the Grand Coulee reservoir alone for flood control in 1949 is estimated to have reduced the flood peak of the lower Columbia River by 30,000 c.f.s., equal to about 0.6-ft. stage reduction at Portland harbor. In 1950, the use of this reservoir for flood control is estimated to have reduced the flood of the lower Columbia at Vancouver by about 1.0 ft.; total control by all Columbia Basin reservoirs reduced the flood almost 2.0 ft.

Mountain snow surveys can be employed to predict the probable high peaks of discharge as well as seasonal flow volumes of the main Columbia River and some of its tributaries, several weeks in advance of their occurrence.

The technique for making predictions of both volumetric yield and flood discharges includes the use of available data on the water stored in snow early

in the spring, and in subsequent precipitation. By statistical means, the predictions are accompanied by estimates of their error and of the limits within which the real yield or flood discharge is likely to fall.

How variables are correlated

Predictions are first made early in April of each year, from snow survey data alone. These supply approximate estimates of flow volume and peak discharge, upon which water users and reservoir operators can base preliminary plans for water regulation. Soon after May 1 and May 15, more exact forecasts can be made with the assistance of data on additional precipitation which has fallen during the month of April or during April and the first half of May.

In preparing for these forecasts, data are obtained from 43 selected snow courses throughout the Columbia River Basin. The water equivalent of snow from these courses is averaged for each of a series of subwatersheds within the Basin, and the average multiplied by a weighting factor which expresses the relative contribution of each subwatershed to the total flow of the Columbia River Basin. The resulting weighted average for the whole Basin provides a snow-survey variable to be used in the forecasting equations. For the later two forecasts, a second variable is provided by a weighted average departure of April precipitation from normal, or by the corresponding departure for April and the first half of May.

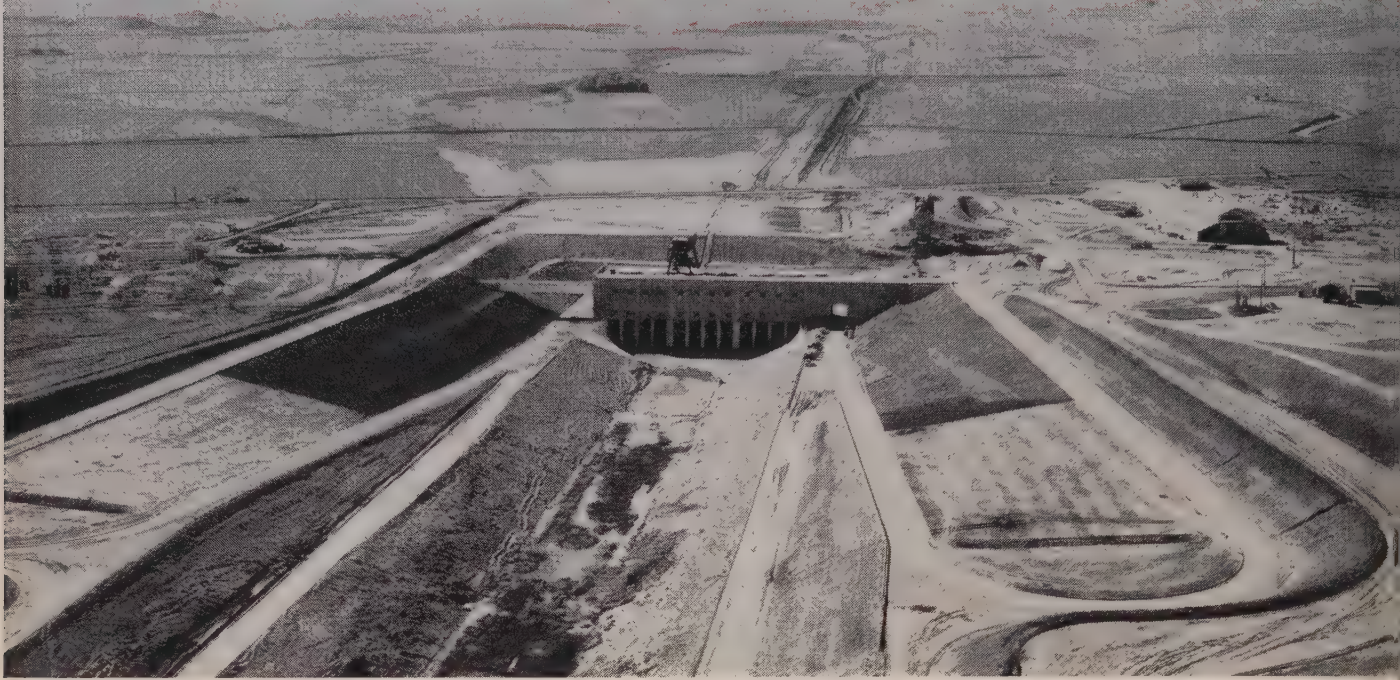
For the April forecast of peak discharges, this variable is correlated with the flow volume for April through June in each year of record. In predicting a new year, the April-June volume estimated from snow water is inserted into the resulting equation, supplying a preliminary estimate of peak discharge. For the May 1 flood forecast, the amount of water which has already flowed down the river during April is subtracted from the estimated total volume for April through June. This reduced volume is inserted into a second equation, based on the relation of peak discharge to May-June volume. A corresponding procedure is followed for the May 16 forecast of peak discharge. The error of these flood discharge forecasts is, of course, composed of both the error of predicting volume from snow water and precipitation, and that associated with the relation of peak discharges to volume.

Precision?

As to results, the April 1 forecasts are not very precise, although they are reliable enough to provide a good basis for preliminary planning. Of the total error in predicting peak discharges, approximately two-thirds is supplied by the error associated with the relation of flow volume to snow water. The later forecasts become progressively more precise, so that by May 16 the forecast error (on 0.50 odds) is only about 65,000 sec. ft.

Incidentally, the use of intensified snow surveys on May 1 and perhaps later should help supply further refinement to these forecasts.

A Pictorial Review of Tracy Pumping Plant Construction



—Photos courtesy Bureau of Reclamation

The world's second largest irrigation pumping lift is ready to go into operation as the "heartbeat" of the Central Valley Project — Water will be raised 196 feet.

THE TRACY Pumping Plant, just completed at a cost of about \$21,000,000, is an important link in the Central Valley Project. Its pumps provide the means by which Sacramento River water will be lifted into the Delta-Mendota Canal—196 ft. higher in elevation—enroute to the San Joaquin Valley. This pumping lift, accomplished with power developed at Shasta and Keswick powerplants, makes possible the transfer of surplus water, conserved and released at Shasta Dam, into the water-deficient valley, a basic purpose of the Central Valley Project.

In operation, the pumping plant works like this: Sacramento River water that has crossed the Delta through the Delta Cross Channel reaches the inlet canal at a point north-

west of the plant. It flows by gravity from the Old River (natural channel) into the inlet canal and is conveyed 2 1/2 mi. to the pumping plant building, passing through the draft tubes to the six submerged pumps in the "basement" level. The water is pumped into the three discharge pipe lines which carry it about a mile on an inclined upward grade to the Delta-Mendota Canal.

The pumping plant building is 362 ft. long and 60 ft. wide and rises about 75 ft. above the bed of the inlet canal. The six main pumps are housed on the lowest floor of the building. Each pump is coupled through a vertical shaft to the synchronous motor directly above.

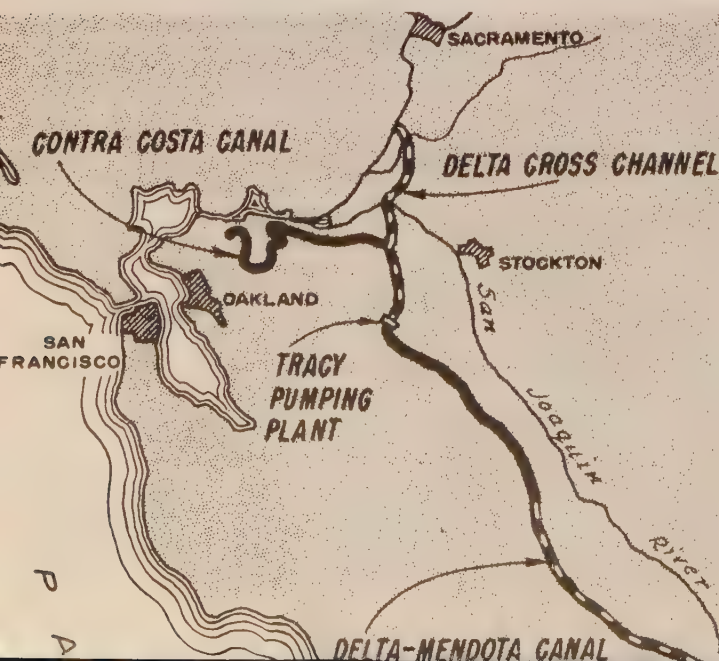
The main pumps were manufactured by Worthington Pump and Machinery Corp. They are vertical shaft, 84-in. diameter, volute-type, each rated at 767 cfs. (360,000 gal. per min.) at a head varying from 174 to 209 ft.

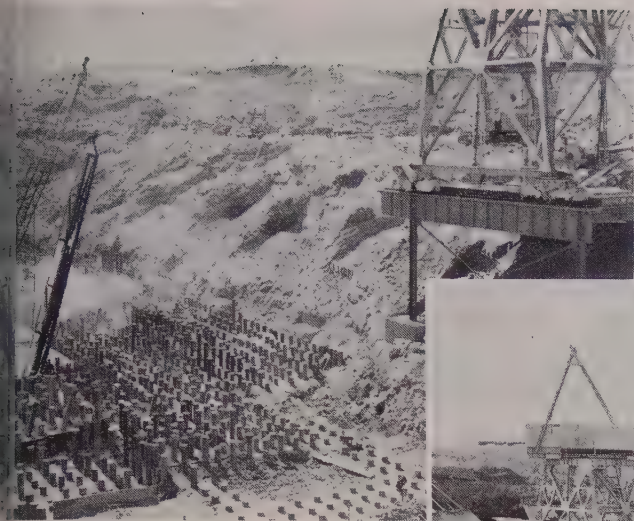
Each pump will discharge its water into a steel lined concrete discharge pipe 10 ft. in diameter. These six pipes are wye-connected in pairs as they leave the pumping plant, and merge into three discharge lines each 15 ft. in diameter which terminate at the head of the Delta-Mendota Canal.

The main pump motors, manufactured by Allis-Chalmers Mfg. Co., are synchronous type, vertical-shaft, 13.6-kv, 3-phase, 60-cycle, 22,500-hp., 180-rpm.

Three contracts to the SUHB Company of Oakland, Cal., were awarded by the Bureau of Reclamation, for construction of the plant, inlet canal and discharge lines. A fourth contract, also to SUHB, was awarded for the switchyard and control building.

Superintendent for the contractor during the early stages of construction and up to a few months ago was George Waters who was succeeded by Charles Champion. For the Bureau of Reclamation, O. G. Boden is construction engineer, B. P. Bellport is assistant to the construction engineer, J. R. Granger is resident engineer for the pumping plant and Max Johnson is field engineer.





LEFT—Pumping Plant building is a reinforced concrete structure 60 ft. wide, 362 ft. long and 82 ft. high from foundation to roof slab. First work was begun in August 1947 and more than 450,000 cu. yd. of earth were moved to expose the foundation area of almost 3 acres. In order to stabilize the foundation against earthquake shock, 2,953 piles averaging 40 ft. in length were driven.

BELOW—Layout of the construction plant is pictured during early construction of the building. While some concrete was

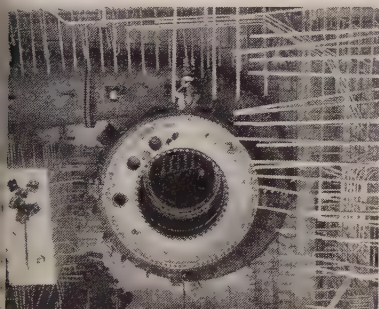
placed with the Whirley crane operating on the steel trestle, main purpose of the crane was to handle materials other than concrete. Mixing plant in background with Noble batchers, Kron scales and two Smith 56S 2-yd. mixers furnished concrete to a double Rex Pumpcrete 200S "gun" which placed most of the 33,690 cu. yd. of first stage concrete.

MACHINERY INSTALLATION (3 pictures below)

TOP—Five sections of the cast steel scroll case for one of the six main pumps in place ready to be embedded in concrete.

CENTER—Each of the main pumps is controlled by a 108-in. electric-hydraulic operated butterfly valve installed between the pump casing and the discharge pipe. With this valve equipment, each pair of pumps may be operated simultaneously or individually.

BOTTOM—Installation of the motor and shaft assembly for one of the six 22,500-hp. pump motors.

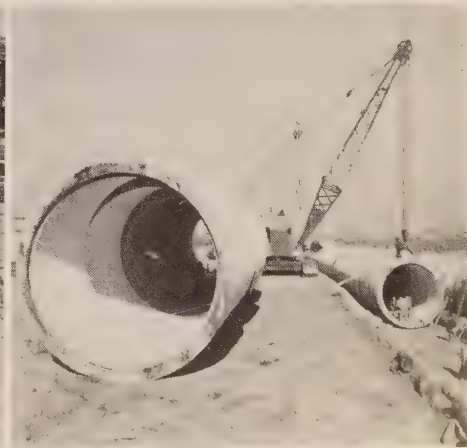
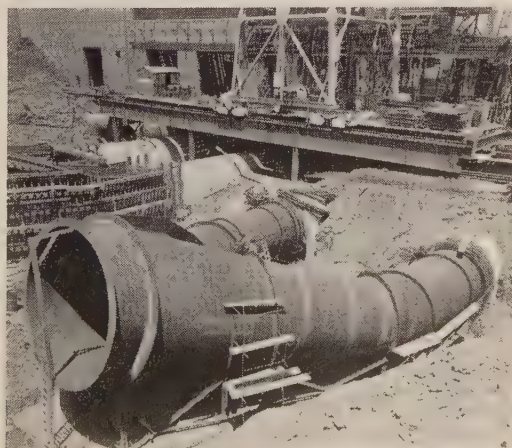


RIGHT—Machinery installation has been in progress since December 1949 when the building was completed. Atop the plant is the 100-ton gantry crane which was used to install the main pump motors and pump units and which will be used in future maintenance of the plant.

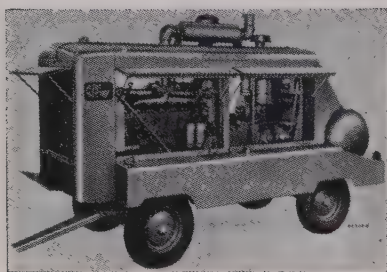


BELOW—The six 84-in. vertical shaft bottom suction twin-volute centrifugal pumps are wye-connected in pairs to three 15-ft. diameter concrete discharge lines. This view shows the steel transition which merges the twin 10-ft. diameter pump discharge pipes into a single 15-ft. diameter section. Discharge lines lead from the transitions up a mile-long incline.

BELOW—The three 15-ft. diameter concrete discharge lines were constructed partially of precast pipe sections shown in this view and partially of monolithic construction. In each 5,000-ft. discharge line the first 2,960 ft. rising from sea level to elev. 77 is precast. Each line required 244 12-ft. sections. Precast pipe sections are the world's largest, have a wall thickness of 15 in.



More Air Power in a Smaller Package



MORE AIR POWER in a smaller package, elimination of lubricating troubles and a constant delivery of air to meet the fluctuating demand of pneumatic tools in use were among the chief aims of the Ingersoll-Rand Company in developing the new Gyro-Flow 600.

Now, following a lengthy program of investigation, experimentation, development and testing, the firm has made available to the construction industry a new portable unit that contains the first major change in air compressor design during the past half century.

The new unit, rated at 600 cfm., utilizes a two-stage rotary-type compressor instead of the conventional reciprocating type. Although the idea of a rotary compressor is not entirely new, the principles of operation incorporated in the Gyro-Flow 600 by Ingersoll-Rand are new and appear to have solved problems that heretofore have made rotary compressors impractical.

Field trial of test units

Extensive factory and field tests have indicated this new piece of equipment has numerous advantages over the conventional-type compressors. These advantages, as announced by Ingersoll-Rand, include a pronounced cut in weight (in operation it weighs approximately 9,500 lb., as compared to 13,800 lb. for one 600-cfm. reciprocating-type portable now in service); cool operation with attendant reduction in wear; cool discharge air with resulting long life of delivery hoses and freedom from clogging of drill passages by fragments of rubber loosened through deterioration; full rated delivery of even-flowing, nonpulsating air at 100-110-psi. pressure; high compression and volumetric efficiencies, and sustained low consumption of lubricating oil.

Indicative of the ability and quality of the new compressor is the reception it received from the contractors to whom test units were loaned for field trial. Not one of the contractors permitted the company to reclaim the unit and one was so enthusiastic over its performance that he ordered nine. Each of the units sent out for field testing was placed on a different kind of job, from running pavement breakers to operating for rock drills in a quarry. One unit wound up

Providing the first major compressor design change in many years, the Gyro-Flow 600 weighs considerably less than a reciprocating unit of equal capacity — Lubricating troubles are virtually eliminated and a constant delivery of air meets fluctuating demands

riding piggy-back on the rear end of a crane to power hammers driving sand drain mandrels and another supplied air to eight jackhammers at an elevation of 7,200 ft. in the Colorado Rockies. Prior to being placed in the field several units underwent 40,000 hours of operation in the company shops. Tests, conducted on an overload basis (at higher pressures than would be required in the field), were carried out with various types of power plants to operate the units. These tests presented the engineers with the opportunity to iron out the bugs.

No valves, no reciprocating parts

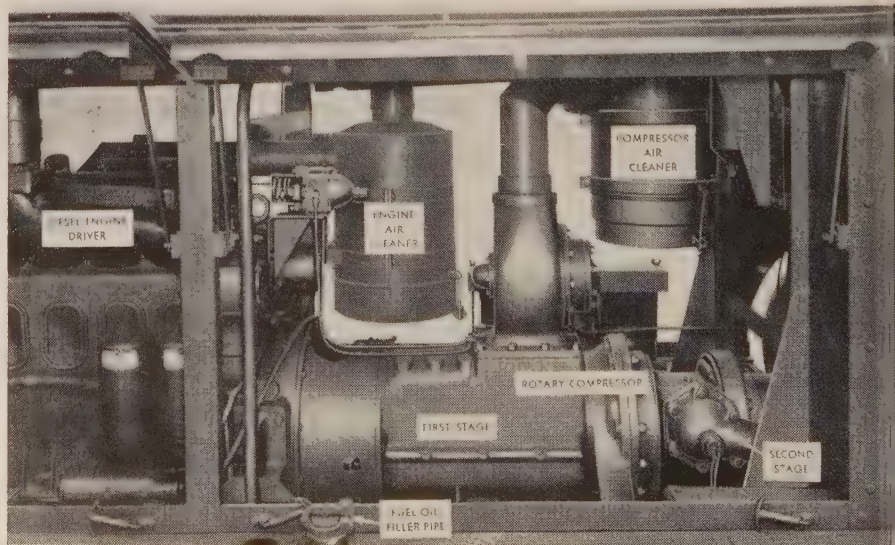
Fundamentally, the new unit consists of two rotary compressors mounted in tandem on a common drive shaft, thus providing two stages of compression. Each rotary compressor consists of a cylindrical rotor mounted off-center inside a somewhat larger cylindrical casing. The rotor has longitudinal slots into which are fitted sliding vanes. As the rotor revolves, the vanes move outward to, and are held against, the casing walls by centrifugal force. Because of the off-center mounting the spaces between the extended vanes alternately increase and decrease in size during each revolution. That is, the rotor is off-center to the point where it has only a

working clearance on one side of the casing, leaving a larger distance between rotor and casing at the other side (see illustration). Air is drawn into the pockets between the vanes at the beginning of the area having the larger distance between rotor and casing wall. As the rotor revolves, the vanes reaching this area are pulled outward by the centrifugal force. As the revolution continues the distance between the rotor and the casing wall decreases, pushing the vanes back into their slots, thus decreasing the size of the pockets and compressing the air contained. Air is discharged as the pocket approaches its minimum size. This produces a steady flow of compressed air without pulsations and, consequently, without vibration. No valves are needed and there are no reciprocating parts.

Air is taken in through a screened inlet on the roof of the housing, passes through an oil-bath cleaner for dust removal, and through a regulator that delivers it in proper volume to the first stage of the compressor. After being compressed to 30 psi., it goes to the second stage where it is further compressed to the discharge pressure of 100 psi.

Each rotor has eight vanes made of synthetic laminated plastic material that after 4,000 hours on test has shown prac-

FUNDAMENTALLY, the new unit consists of two rotary compressors mounted in tandem on a common drive shaft. Small size of the rotary unit becomes apparent when its height is compared with that of the section of the engine visible at left. The engine drives the compressor through a gear type coupling that is sealed to exclude dirt and insure long-lasting lubrication.



ally no wear. However, the material is soft enough not to erode the casing walls, and this, coupled with generous lubrication, eliminates the washboard effect that sometimes develops in rotary machines fitted with metallic vanes. In the event dirt or grit enters the compressor, the vanes and not the rotors and cylinder walls will wear.

Oil recovered from air stream

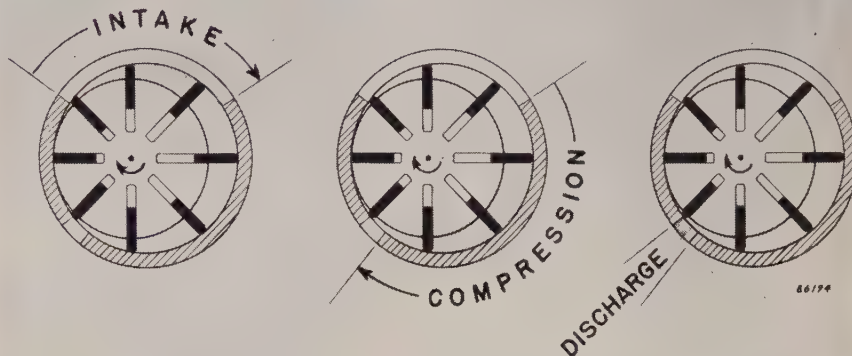
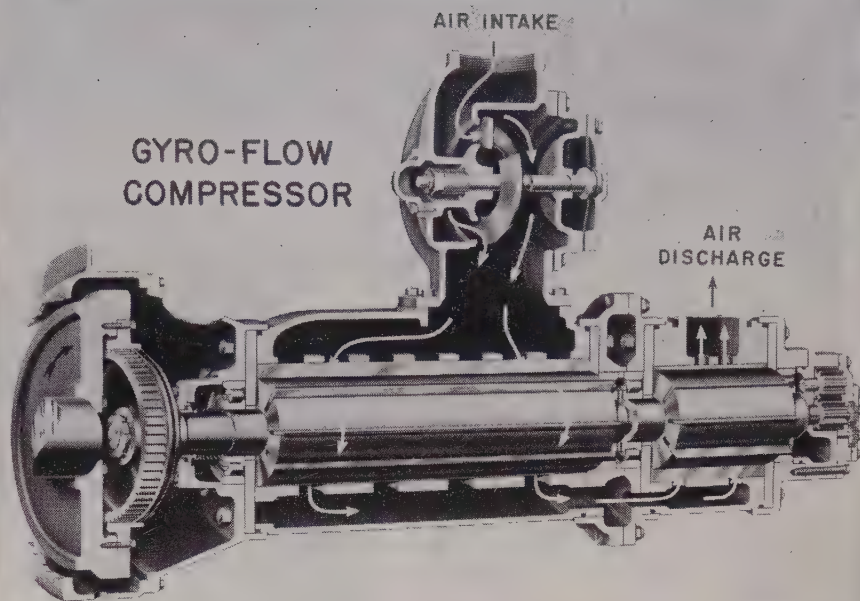
Providing oil for adequate lubrication and cooling during the compression was one of the principal problems encountered in the design of an efficient rotary compressor. As lubricating oil was carried from the machine into the air stream, previous designers held the amount to a minimum. This resulted in the compressors being starved for oil and brought about fast wear and a continual decrease in efficiency. Ingersoll-Rand did just the opposite by literally flooding the cylinder, vanes and bearings with oil, and then set about finding means of recovering the lubricant from the outgoing air stream. It was also discovered that the generous application of oil both cools the air by taking up the heat of the compression and forms a satisfactory seal between compression pockets and at the rotor ends. Oil is recovered from the air stream in a two-stage separator that takes the place of the receiver of a conventional reciprocating-type portable. Most of the oil drops out of the air in the outer section when the velocity of the mixture is reduced. The finely atomized particles that remain are extracted in a second section which has a series of chambers packed with a substance that has a high affinity for oil. The material used in the chamber will serve for a period of from two to three years.

Oil collecting in the chambers is pumped to a reservoir in the primary section of the separator, from where it begins another cycle. Cooling is carried out by four passes through a radiator mounted in front of the engine radiator. Following the cooling the oil is filtered. The filter is so located that it can be cleaned without draining the oil from the unit. From the filter the oil is pumped to shaft, seals and bearing and continues the cycle.

Records kept during tests indicate that 99.999% of the oil is reclaimed in the separator. This rate is expected to be retained during the life of the machine. This economy, the manufacturer believes, exceeds that of any other compressor now available.

Maximum fuel economy

The combination of two-stage compression and the use of lubricating oil for cooling has eliminated the need of an intercooler between stages. Discharged air never exceeds 200 deg. F. The lubricant is also given longer life as it does not carbonize and break down. The prevailing low temperature in the air circuit cuts explosion and fire hazards. As a safeguard against any damage in the event of a mishap that might cause an excessive temperature to build up, a thermal switch will shut down the engine when the discharging air exceeds



HOW the compressor works. Sketches at bottom show compression cycle. Vanes that move out of slots in the rotor as the latter turns at high speed are held against the cylinder walls by centrifugal force, forming pockets that first increase and then decrease in size. Air is drawn into these spaces as they are enlarging, is compressed as they gradually grow smaller, and discharged when the desired pressure is reached. Arrows in top cutaway mark the course of the air, which is fed from volumetric regulator at top into first stage of the compressor.

a temperature of 220 deg. F. Operation will also cease if engine-oil pressure drops below 35 psi., or cooling water temperature rises above 210 deg. F.

The General Motors Series 71 was selected to serve as engine for the Gyro-Flow 600. Designed to function efficiently at any speed from 500 to 2,000 rpm., it maintains its rated power well at high altitudes, which is important to compressor operation. The engine has an electrically-actuated starter and starts on regular diesel fuel. As the action of the rotary compressor is such that no air is compressed until the rotors gain speed, the engine starts against no load and no clutch is required.

One of the outstanding features of the Gyro-Flow is its system of regulation, the first applied to a portable compressor permitting air output to be controlled gradually and smoothly from full capacity to zero. In effect it delivers the

proper amount of air at all times to meet fluctuating demands, thus enabling maximum fuel economy.

Output regulated by engine speed

From full rated capacity of 600 cfm. down to 60% of capacity output is controlled solely by regulating the engine speed. As the demand for air decreases the pressure in the separator rises and is transmitted to a regulator on the engine governor that reduces the speed. Throughout this capacity range air pressure rises from 100 to 106 psi., and the engine speed is gradually lowered from 1,800 rpm. to 1,100 rpm. Below 60% of capacity (360 cfm.) output is controlled both by reducing the engine speed and throttling the air intake to the compressor. Throughout this range the pressure in the separator varies from 106 to 110 psi., and the engine speed goes as low as 700 rpm.

HOW IT WAS DONE...

Rows of Holes on Reservoir Slope Dug Neatly by Versatile Excavator

A MULTI-PURPOSE machine is solving an excavation problem and making itself useful for sloping and general duty during the construction of the 30,200,000-gal. Sutro Reservoir in San Francisco.

The 700 by 350-ft. reservoir, being constructed for the San Francisco City-County Water Department, is 23 ft. deep and will be concrete lined and covered with a concrete panel "roof." This roof will be supported by some 500 columns set on a concrete foundation.

The foundations, requiring a 5½-ft. square excavation 3 ft. deep, are set on 22-ft. centers with 12 rows in the bottom, running the full length of the reservoir, and two rows running all around the banks that have a 2 to 1 slope.

Excavation for these foundations presented a prime problem to Granite Construction Co., Watsonville, Calif. when they undertook the contract. Done by hand, the cost would be great, and due to the relatively small size of the holes, use of a large dirt mover would require a considerable amount of hand finishing.

It was decided that a Gradall, due to its flexibility of operation would meet the needs. Volpa Bros., general contractor of Fresno, Calif., was called upon and agreed to supply the machine and operator on a rental basis.

Mounted on a turntable on the rear of a heavy duty truck the hydraulically-operated Gradall can swing in a 270-deg. arc, enabling it, if necessary, to work alongside the truck cab. It is operated by a series of levers and is reported to be as easy to operate as any small power shovel. A boom, fixed to the turntable, extends about 7 ft. beyond the turntable. A smaller boom, or arm, slides back and forth inside the fixed boom giving a 12-ft. extension or a total of 24-ft. working reach. The boom has a 90-deg. vertical tilt, 45 deg. either up or down from center, enabling it to load from a height of 14 ft. 9 in., or dig 10 ft. below ground surface.

In excavating, the Gradall acts more like a dragline than a power shovel. Instead of digging away from the machine, it reaches out and pulls the bucket, attached to the end of the boom with the teeth pointing downward, toward the machine. The bucket can be turned from the point where the teeth are pointing straight down a 90-deg. angle to where the teeth are pointing toward the machine and the bottom of the bucket is level with the base of the excavation. It also can be turned on a 45-deg. angle



BUCKET with teeth pointing downward cuts neat square holes requiring a minimum of hand finishing. Operator can control precisely the point of entry of the bucket teeth.

either to right or left. The hydraulic boom extension permits the operator to dig to grade by pinpointing the point of entry of the bucket teeth. Once inserted at the desired point, the bucket can be turned under and the arm drawn in the exact distance required for the job. A ½-cu. yd. bucket with teeth is standard for most operations and was used for the excavations at the reservoir.

In excavating for foundations on the slopes in the Sutro Reservoir the truck is backed up the slope far enough so the bucket can reach the upper side of the area to be excavated. The boom, extended, places the bucket at the upper

edge where it is pushed in to the required depth. It is then tilted under and drawn towards the machine. In rock earth several passes are needed, whereas in plain earth only one is required. On the upper of the two rows of holes on the slope the dirt is deposited about where the lower hole will be. When the lower holes are dug their dirt and then removed from above is lifted and the Gradall turns depositing it at the base of the slope. In order to keep the Gradall busy on the foundation excavations a loader mounted on a crawler tractor loads this dirt, plus that pulled down during sloping, into trucks for removal. Each of the excavations requires from 3 to 5 min. from start of one to start of another.

In grading the 2 to 1 slope of the reservoir's banks the bucket at the end of the boom is replaced with an 8-ft. trenching blade. This blade also has full mobility and can be set at any angle, backward or forwards, and at any side angle up to 45 deg. For grading the slope the arm is extended, the blade set, and then the arm is drawn in bringing the blade toward the machine. As the blade is drawn in the boom is lifted, keeping the blade on the desired course. Very little hand finishing is required to prepare the slopes for concrete.

The Gradall was also used to excavate for the foundation of a dividing wall that stretches across the middle of the reservoir and for supplementary trenching work.

William Volpa of Volpa Bros. supervised operation of the Gradall. Oscar Soder is general superintendent for Granite Construction Company with A. E. Mitchell as construction foreman.

TWO ROWS of holes, 5½ ft. square, 3 ft. deep and running around the entire reservoir, are being excavated for foundations of 500 columns to support roof.



Lower Grade and Adequate Drainage Repair Earthquake-Damaged Road

FOLLOWING extensive study, a method for correcting some failures of Pierce County, Washington, roads damaged during the earthquake of April 1949 has been developed, according to William A. Stancer, Pierce County Road Engineer. The investigations and subsequent repairs on the most seriously damaged section, 1,200 ft. of the Ohop Lake Road between Kapowsin and Eatonville (about 25 mi. southeast of Tacoma) were completed late last fall. Extent of the earthquake and damage sustained by various types of engineering structures have been reviewed in a series of articles appearing in the last three issues of *Western Construction*.

Damage to the section of road in question required that consideration be given to the character of the soils in the area, adjacent hillside slopes, ballasting material and drainage facilities. The possibility of constructing an alternate route by-passing the seriously damaged area was considered, but discarded due to excessive costs involved.

The first step in the rebuilding was to carry out extensive soil tests through the damaged area. Test holes were put down with a 4-in. auger and a 1-in. porter soil sampler was used below the water-table or where materials were suitable for this method. This investigation was carried out for the purpose of determining the depth of the earth movement caused by the quake and the angle of the moving plane. Classification

of the local material was obtained as a by-product of these borings and used in the design for the new roadway.

At the same time an investigation was made on the steep side-hill slope (see illustration). A 20-ft. vertical displacement was found at the top of the hill and the width of the subsidence varied from 30 to 45 ft. At the base of this slip water had collected, and was subsequently removed by a system of transverse ditching.

At the start of reconstruction, the roadway grade through this area was lowered an average of 4 ft. This was done to secure adequate width for the road surface and the new drainage facilities without disturbing the steep slope of the side-hill. This slope is continually saturated with water and contains many cleavage planes which appear stable but would tend to move if the support at the toe of the slope was disturbed. A further reason for lowering the grade in the roadway was to secure fill material to load the area between the highway and the adjacent lake.

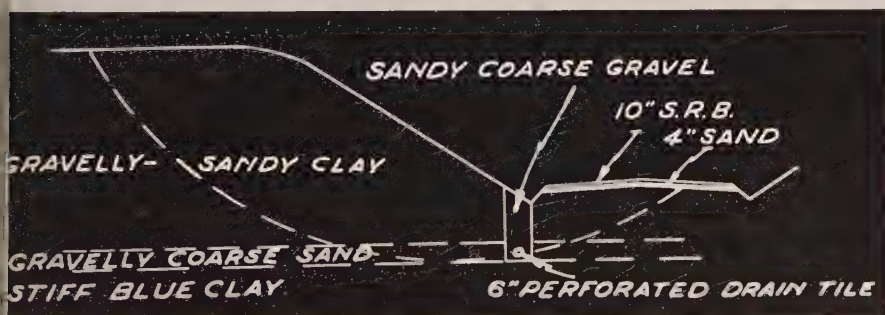
Extensive drainage was provided in the slide area. Springs on the uphill slope were intercepted and the water led under the road to the lake. The culvert design was determined by the local water conditions as measured directly in the field and from extensive experience which the County has had in draining this particular area over a long period of years. Assuming that there

might be some future movement in the foundation under the road, bituminous-treated corrugated metal culverts were used. This type of culvert was selected because it was believed that any settlement which might cause another type of pipe to break and open up would be taken care of by the flexibility of the metal pipe, thus providing additional protection.

Final rebuilding of the roadway included the placing of a 24-in. depth of well graded ballast on the excavated subgrade. Prior to placing this ballast, a 4-in. blanket of sand was spread over the clay soil. The ballast consisted of 16 inches of selected material (minus 4 in.) and an 8-in. depth of selected borrow (minus 3 in.). This ballast was laid in 8-in. lifts and compacted with a rubber-tire roller. The surface was topped off with a 3-in. course of crushed rock.

Following completion of this reconstruction program late last fall the area has been subjected to extremely heavy rains and with the exception of some minor raveling on the uphill slope no difficulty has been experienced. The roadway has remained stable and it is the opinion of Stancer that this same type of treatment, in modified form, can be used successfully to rebuild the less seriously damaged sections which have been in use since the project was completed.

The soil investigation was carried out by Byron Larsen, soils engineer in the County Engineer's office. The design of the new roadway, including the correction of the base failure, was the responsibility of E. A. White, Assistant County Engineer; Douglas McGuire, design engineer, and Byron Larsen. The project engineer in charge of construction was Robert Larson. The entire program was carried out under the general supervision of William A. Stancer, County Road Engineer of Pierce County. The contractor was William Fusco.



20-FT. vertical displacement was found at the top of the steel side-hill slope. System of transverse ditching removed water at the base of this slip (drawing above). Section of road as it appeared shortly after the earthquake is shown below.



Power Project Approved On Stanislaus River

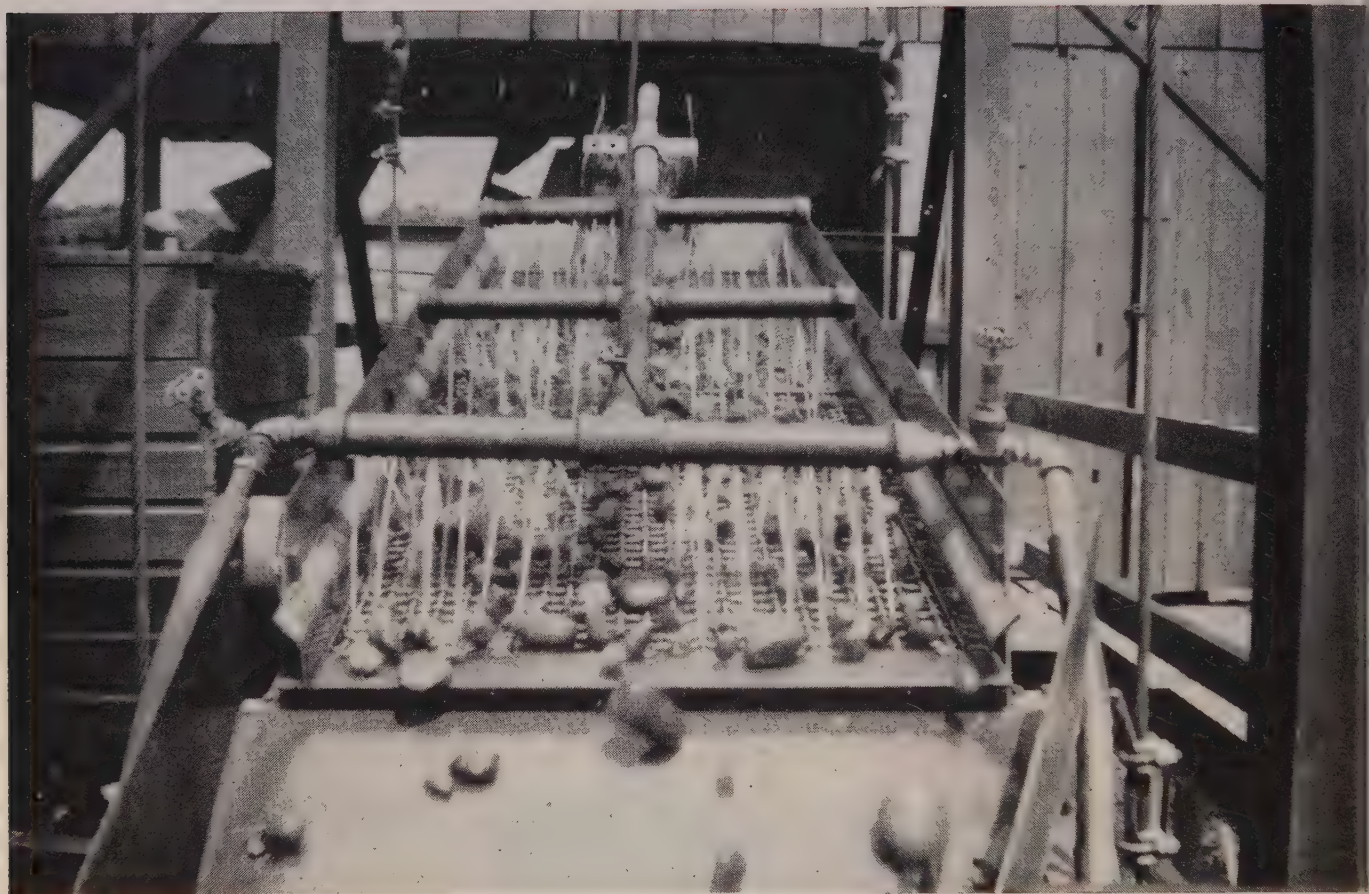
THE FEDERAL Power Commission has issued a license amendment authorizing Oakdale Irrigation District and South San Joaquin Irrigation District to construct and operate a reservoir and power project on the Middle Fork of the Stanislaus River in central California.

The project, known as the Donnels Development, will be constructed as a part of the District's Beardsley Development, for which the FPC authorized issuance of a license in July 1949. Both projects are on the Middle Fork of the Stanislaus River in Tuolumne County.

The Donnels development will consist of a dam about 300 ft. high, creating a reservoir with a surface area of approximately 430 ac.; a 38,000-ft. tunnel; a steel penstock about 2,530 ft. long; a powerhouse containing a 70,000-hp. turbine connected to a 50,000-kw. generator, and a swithyard and appurtenant facilities.

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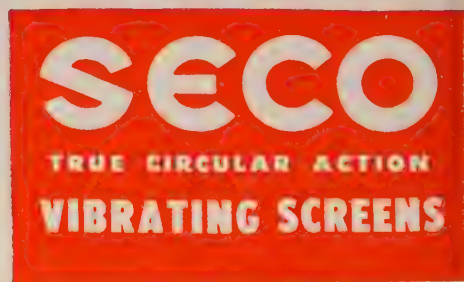
About a year ago, the 31½ deck-Seco pictured above was put into operation at the Nedrow, New York plant of the Syracuse Sand and Gravel Company, Inc. It replaced a 4' x 20' revolving screen. Here is an on-the-job report in the words of Harold Green, plant superintendent:

"Since installing the new screen, our production has increased about one-third and we are also able to produce one more grade of material which is in good demand, and was unobtainable with the revolving screen.

"We figure the screen paid for itself on one job, as we were able to meet specifications on an abrasive sand that we could not have bid on, had we been using the old equipment.

"We are very pleased with the screen and to date, other than changing screens, we have not had a wrench on it."

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Pick the Cableway That Fits the Job

WILL A CABLEWAY fit your construction job? "Not always," J. G. Tripp, member, ASCE, well known as consultant to contractors on their construction plant problems, told members of the American Society of Civil Engineers in a recent convention at the Rice Hotel in Houston, recently. "Many construction projects do lend themselves to the use of cableways," he says, "such as long cuts and adjacent fills, grading docks, deep quarries, sewage disposal plants, penstocks, and isolated high structures such as dams and bridges. Low long dams can sometimes be built economically by trestles and cranes but if a deep stream must be diverted during construction and the gap then closed, a cableway may be a 'must' selection."

Heavy duty spans of over 2,700 ft. are uneconomical. A standard 25-ton cableway with bucket traveling a distance of 100 ft. at 1,250 ft. per min., and hoisting 350 ft. per min., can be counted on to deliver the capacity of two 4-cu. yd. mixers. One such cableway can handle a 100,000 cu. yd. job provided it covers the work, by servicing the job during one shift and pouring during two. Another cableway should be added for each increment of 400,000 cu. yd. in the job. On every large job the overall time allowed to finish a job controls the number of cableways required based on average production of 65% of the above capacity.

A cableway consists of three parts, i.e., (1) the track and cable and its supports; (2) the system by which power is applied; and (3) the carriage. Track cables may be attached to stationary anchors, moving towers, stationary masts or a combination of them. Power may be applied by two hoists at the track-cable towers or masts; one to pull the carriage back and forth on the track cable, the other to wind the load-cable sheaved through the carriage. A cable can be used to transmit power from a remote hoist in one tower to a cable-driven engine mounted on the carriage. Sometimes the power may come from a self-contained unit on the carriage itself with the operator riding the carriage.

Most cableways operate on a single track cable. However, there are uses for installations operating on two or more track cables. Carriages operated on multiple track cables should have self-contained power units installed on them. Track cables on long span cableways may be up to 3 1/4 inches in diameter.

Sag in travel cables and hoisting cables is controlled by employing cable carrier frames which are alternately stored and removed from the horn on one end of the carriage as the carriage travels forward and back on the track cable. This requires the use of a button line for spacing the carriers. The horn blows up the carrier units from the track cable as the carriage runs into them and conversely the buttons pull them off as the carriage recedes. The operating lines run through sheaves in the carriers.

Carriage designs range from a simple 2 track-wheel frame carrying two hoist-

ing sheaves, up through 4-wheel, 8-wheel and 12-wheel single frames, to tandem frames of 8 wheels or more each.

"Costly as it is, cableway equipment has long life. Parts of original rigs built for dams constructed over 40 years ago

are still in use," Tripp commented, "patched up but still in use. Parts of cableways used at Hoover Dam were used at Parker Dam, then Shasta Dam and now are in use at Phillpot, Mount Morris, and Hungry Horse dams."



SMALL TRACTOR LOADS 13 1/2-FT. PIPE. The fabrication yard for penstocks at Hungry Horse Dam was 3 1/2 mi. away from the dam site, so the big pipe sections had to be trucked to the site as they were assembled. A small tractor was used to roll the 20-ft. long sections up an inclined ramp onto a timber cradle mounted on the flatbed trucks.

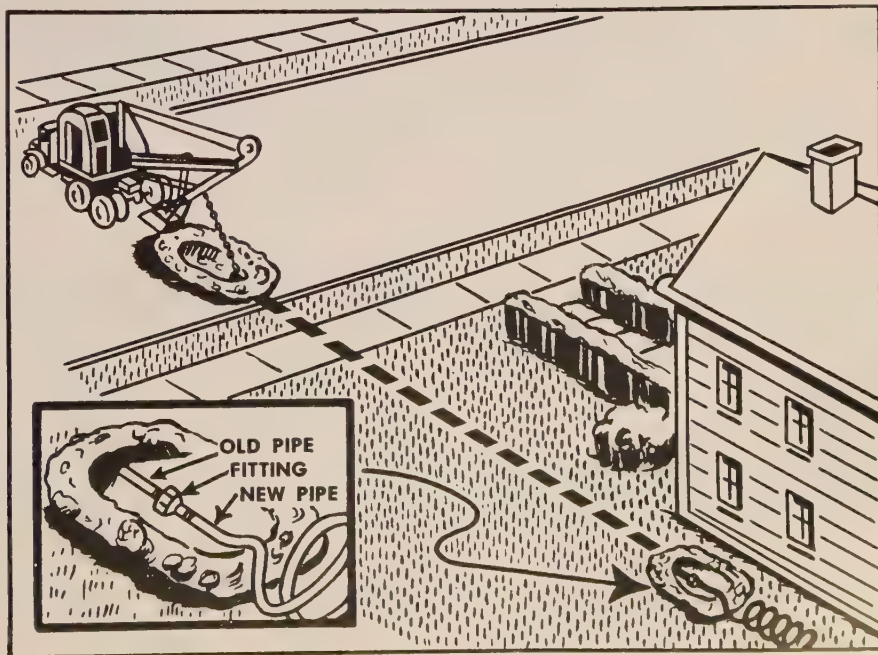
New Water Pipe Installed Leaving Landscape Intact

CIVIC IMPROVEMENTS in Miles City, Montana, called for paving, replacing curbing and gutters along 9 mi. of scattered city streets. Prior to paving, however, city officials ordered the replacement of old rusted domestic water service connections with new flexible copper pipe. Home-owners in the affected area expected the worst in damage to their lawns and shrubs by conventional trenching methods. They were pleasantly surprised, however, when they saw how Dirk Doeden and his partner, Ray Youngbouer, Miles City plumbing and sewer subcontractors, tackled the job and kept their landscaping intact.

Using a truck-mounted Schield Bantam Trench Hoe, Youngbouer and Doe-

den opened short trenches in street from main water line to curb, exposing house service connections. Shut-off valve was then closed at curbing. Old pipe was disconnected inside house and new flexible copper tubing, in rolls, was connected to it by means of a special temporary fitting. Street-end of old pipe was hooked to a chain fastened on middle of trench hoe stick, then pulled out with Bantam's drag drum. Thus, new copper tubing was automatically "threaded" through old pipe cavity fast, without damaging landscaping above, keeping taxpayers happy.

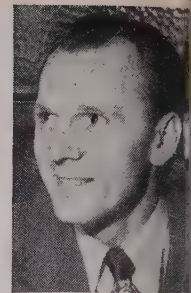
After copper pipe was installed, ditch was backfilled by special blade attached to trench hoe, then puddled with water. Ray Youngbouer took care of final leveling by driving his rubber-tired Bantam over curb and running back and forth compacting dirt with dual tires.



REPORTS

from the COURTS

By
**HOWARD S.
BURNSIDE**
Registered
Professional Engineer
Attorney at Law



Contractor Bound by Signed Letter Fixing Top Price

UNDER THE ODD set of facts in *Higby v. Hooper*¹ the Supreme Court of Montana allowed an owner to enforce a written statement of the contract which the owner had not seen or signed, and would not permit the defendant-contractor to show that the writing was for a special secret purpose.

The Contractor was to construct a house in accordance with certain plans. The agreement was oral. However, since part of the necessary funds were to be obtained as a G.I. loan to the owner, the lending institution required a written statement of the agreement. Therefore a letter was prepared which the contractor signed and delivered to the lender. This letter was addressed to the owner but did not pass through his hands. In fact, he was not present when the letter was written, signed or delivered to the lender.

The letter was brief. It referred to the contemplated construction and stated "I am hereby certifying in writing that the complete cost of the same in accordance with said plans and specifications will not exceed the sum of \$8300."

As the work proceeded toward completion the costs exceeded this sum and several subcontractor's liens were discharged by the owner. In an action by the owner for equitable relief and damages the contractor denied that his letter was intended as any kind of a contract or that there was ever any limited or contract price, but the court said, "By so

certifying the builder made certain and attested to the fact that he had contracted . . . to build . . . for a price to the veteran which will not exceed the sum of \$8300. The builder delivered the writing to the lender to induce and enable the lender to make a G.I. loan. The veteran, the builder, the lender as well as the government . . . were and are entitled to stand on the contract as written. Being in writing, the contract supersedes all oral agreements and stipulations of the parties. To make the writing to which the builder affixed his signature . . . a binding contract under the facts and circumstances here shown it was not necessary that the veteran also sign the document."

At the trial the defendant-contractor and an employee of the lender testified that it was their understanding that the letter was "for loan purposes" only. This testimony could not be considered by the court because it tended to alter the terms of a written contract which can be done only in special situations. "Under certain circumstances . . . a person may show that the document in question was intended to serve the purpose of a mere jest, joke or sham. However when, by intention of the parties, it aims at deception of other persons that intention will not be given effect. The law does not allow parties to a contract to show that it was got up as a sham to deceive and defraud."

¹ *Higby v. Hooper*, 221 P. 2nd 1043.

Who Was Employer in a Contracting "Cooperative"?

AN UNUSUAL sort of worker-cooperative was attempted and operated for several years in Utah by a group of men. The working arrangement was described in a late case in which the court had to decide whether the organization was an employer and thus required to make contributions under the employment security act.

A brick mason and a mason tender decided to form a "brotherhood" to function as a cooperative in which all who participated would share in the profits after deducting ten per cent to pay for equipment. Others taken into the organization were to share in the profits on a basis to be determined by each person's ability and experience; but there was no precise method of determining a share or unit. The "unit" of a worker would fluctuate as his efficiency improved and as the number of members changed. There was a large turn-

over of worker-members. If the group had several contracts at one time, each worker received his proportionate share in each job whether or not he performed labor on all the jobs. Payments were not made to members until the money for the contract was received from the owner. The group agreed by voice vote how long they should work and also voted on new members. At the outset there were just the two members but others were brought in during the ensuing two years (after which time four of the members formed a legal partnership). The mason had sole authority to make contracts and he controlled the finances.

Through the state administrative machinery established for such purposes the mason was held to be liable for unemployment contributions with respect to "wages" paid and he sought judicial review. He denied that he was an em-

ployer, claiming to be a partnership, joint venture or some "other kind of business" not subject to the Act.

A majority of the court affirmed the liability, however. It appeared to the court that the members did not have a voice in the management and conduct of the business nor in money matters and they were not chargeable with losses. Thus, elements of a partnership or a joint venture enterprise were lacking. "The plan contemplated using individuals who had little, if any training in the trade and having them work as apprentices, not as joint venturers. The workers had no authority to undertake contracts for themselves or for the group, and they had no authority to reject any proposed contract. A joint enterprise is a method of operation where there is a community of interest in the objects and purposes of the undertaking and an equal right to direct and govern the conduct of each other with respect thereto, and each enterprise must have some voice and right to be heard."¹

Two judges of the court disagreed with the majority opinion believing that a joint enterprise had been formed at least until the partnership was created.

¹ *Johanson Brothers Builders v. Bd. of Review, Industrial Commission* 222 P.2d 563.

Steel Weights Computed by AISC Code Allowed

PLAINTIFF gave defendant a bid for fabrication and erection of steel, defendant being the contractor for the Harbor Board. Later, after considerable negotiation, changes were made in the agreement. "Neither party was prompt in formulating a definite and full agreement, but both parties went forward with confidence that everything would work out in accordance with their own ideas and desires."¹

About nine months later a contract was signed which by its date related it back to the time of the earlier negotiations and which provided that the AISC Code was to be used in determining weights for payment.

In a controversy as to payment the Federal District Court at Honolulu held that the written contract controlled and found that the earlier oral conversations, offers and concurrences did not amount to a contract. Accordingly the allowances under the AISC Code on weights for mill over-run of 3% and for paint of 1/2% were granted plaintiff.

¹ *Independent Iron Works v. E. E. Black, Ltd.* 9 F. Supp. 6.

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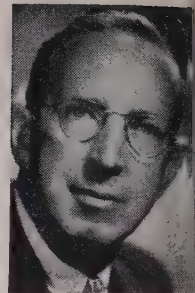
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CONSTRUCTION DESIGN CHART

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



CXXXI . . . Selecting Timber Columns of Douglas Fir

THE SELECTION of a timber size to support a given column load is apt to be confusing unless precomputed tables or charts are available. The difficulty is caused by the fact that present accepted practice utilizes a curve of safe allowable unit stresses, which is composed of more than one equation. Since no single column formula is available, the beginner is apt to fumble around in obtaining his answer. Thus we have the following:

(1) **SHORT COLUMNS**, for values of $\frac{L}{d}$ not exceeding 10

$$\frac{P}{A} = C$$

where C = Safe stress in compression, psi. parallel with the grain

P = Total column load, lbs.

A = Sectional column area, sq. in.

L = Unsupported length of column, in.

d = Least dimension of column, in.

(2) **INTERMEDIATE COLUMNS**, for values of $\frac{L}{d}$ between 10 and

$$\frac{L}{d}$$

$$K = \frac{\pi}{2} \sqrt{\frac{E}{6C}}$$

where K = The $\frac{L}{d}$ at the point of tangency of the parabolic and Euler curves

$$\text{Then } \frac{P}{A} = C \left[1 - \frac{1}{3} \left(\frac{L}{Kd} \right)^4 \right]$$

(3) **LONG COLUMNS**, for values of $\frac{L}{d}$ greater than

$$K = \frac{\pi}{2} \sqrt{\frac{E}{6C}}$$

with a recommended maximum value of

$$\frac{L}{d} = 50$$

$$\text{Then } \frac{P}{A} = \frac{\pi^2 E}{36 (1/d)^2}$$

The accompanying chart has been designed to facilitate the computation of the two curves covering intermediate, and long columns. The modulus of elasticity has been taken as $E = 1,600,000$ psi., and a value of $C = 1,000$ psi. has been assumed for the safe allowable stress parallel with the grain. The chart is solved by the use of a single straight line intersecting all scales.

Since the allowable stress is a function of $\frac{L}{d}$, it is necessary to assume a column size.

A solution line has been drawn on the chart for the following assumed conditions:

6 by 6 (rough) column of Douglas fir
Unsupported length = 13 ft.

$$\text{Then } \frac{L}{d} = \frac{13 \times 12}{6} = 26.$$

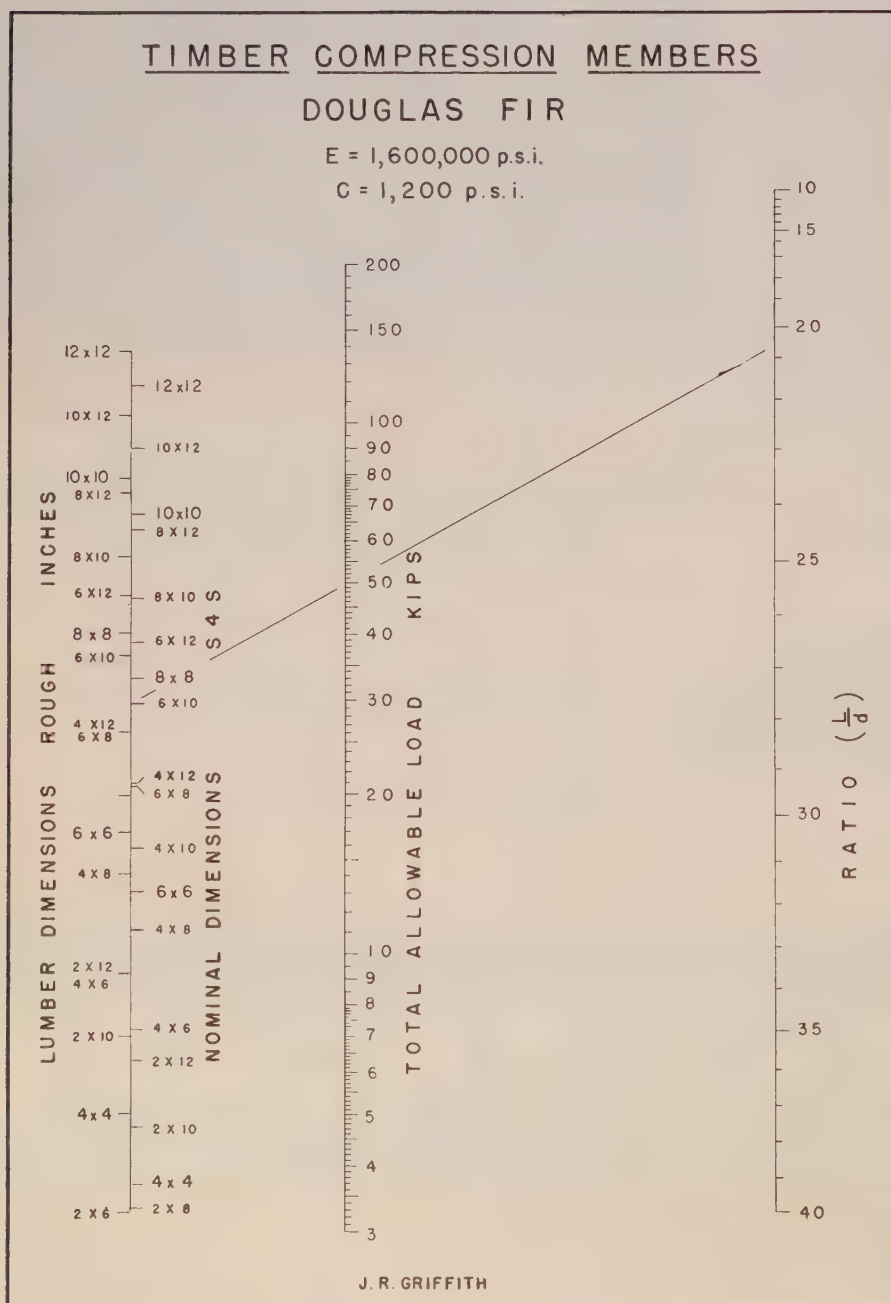
The solution line has been drawn between the 6 by 6 rough size, and the value of

$\frac{L}{d} = 26$. On the central scale, a total allowable column load of 23.3 kips will be noted.

The *Douglas Fir Use Book*¹ gives a total allowable load of 23,364 lb. for the above assumed column. By computation we have

$$K = \frac{\pi}{2} \sqrt{\frac{E}{6C}} = \frac{\pi}{2} \sqrt{\frac{1,600,000}{6 \times 1,000}} = 25.6$$

Concluded on page 142



Atom Plant Construction Starts in Colorado

THE WEST'S latest atomic energy construction project will start soon at a 4-sq. mi. site in the Rocky Flats area of Boulder and Jefferson Counties in Colorado. The Atomic Energy Commission is acquiring the land for a new production plant, estimated to cost \$45,000,000. Operations planned at the plant are secret, but the project will be administered by AEC's Santa Fe Operations Office which is responsible for research, development, production and testing of atomic weapons. Construction of the plant will begin as soon as possible under direction of the Missouri River Division of the Corps of Engineers.

The Austin Company of Cleveland, Ohio, will prepare the plant design and supervise construction. Austin conducted the site survey and engineering investigations for the AEC. W. R. Engstrom will be project manager for Austin during construction. About 2,000 construction men will be employed at the site during peak activity in 1952.

Carroll L. Tyler, Manager of the AEC Santa Fe Operations Office, says a new AEC field construction office is being established at the site with David W. Parsons of Regional Operations Division, Office of Engineering and Construction at Los Alamos, assigned as

**Low Bid \$58,416,459
For McNary Dam Finale**

TWO BIDS were opened by the Walla Walla District Corps of Engineers on April 12 for completion work on McNary Dam. Apparent low bidder is Guy F. Atkinson Company, South San Francisco, Calif., at \$58,416,459.50, in a joint venture with Ostrander and Jones.

Columbia Constructors, Boise, Idaho, made the other bid offer at \$61,972,032. Included in this joint venture are Columbia Constructors; Morris - Knudsen; Peter Kiewit Sons' Company; Henry J. Kaiser Company; Kaiser Industries, Incorporated; Brown & Root Incorporated; General Construction Company; The Shea Company; Walsh Construction Company; Macco Corporation and Puget Sound Bridge & Dredging Company.

The contract is for construction of remaining portions of the spillway, powerhouse, abutments and appurtenant structures. All work is to be completed not later than August 1, 1954. There were 194.1 bid items, and the government estimate was \$55,058,359.67.

project engineer. As far as possible, contracts will be let on a competitive lump sum basis.

Hydro Project Planned On Montana River

THE WASHINGTON Water Power Company, of Spokane, Wash., has applied to the Federal Power Commission for a preliminary permit for a proposed hydroelectric project on the Clark Fork River in Sanders County, Mont.

The proposed project would include a concrete dam at the Noxon Rapids site creating a reservoir about 17 mi. long; a powerhouse with an installed capacity of 197,000 hp., and provision for additional capacity; a 230-kilovolt transmission line connecting the plant with the company's transmission system; and appurtenant facilities.

The Montana Power Company, of Butte, Mont., has filed an application with the Federal Power Commission for a preliminary permit for a proposed hydroelectric development on the Clark Fork River in Sanders County, Mont.

The proposed project would include a concrete dam near the mouth of Trout Creek about 25 mi. downstream from Thompson Falls, creating a reservoir about 24 mi. long. The powerhouse would have an installed capacity of 175,000 hp., with provision for additional capacity.

Northwest Military Work Assigned to Walla Walla

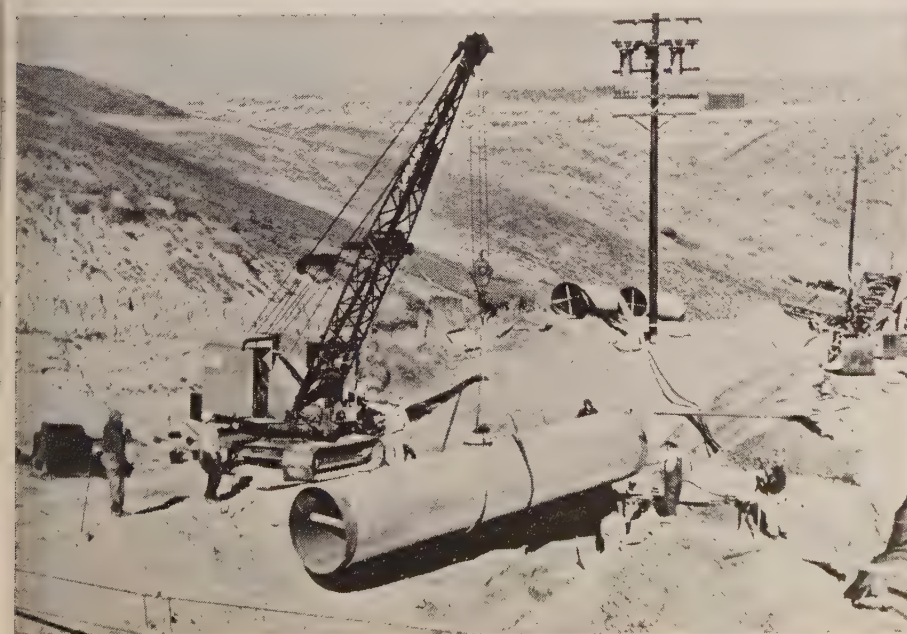
ASSIGNMENT of military construction functions to the Walla Walla District, Corps of Engineers, for the states of Montana and Idaho, and the area east of the Cascade Mountains in Washington and Oregon, became effective April 1.

Previously, responsibility for all military construction in the Pacific Northwest states had been assigned to the Seattle District in addition to civil works functions in the district area. The reassignment of some of the military construction activities to the Walla Walla District was ordered by the Chief of Engineers in Washington, D. C., on recommendation of General O. E. Walsh, North Pacific Division Engineer, to lighten the increasing workload on the Seattle District.

WASHO to Meet

The Western Association of State Highway Officials will hold its thirtieth annual conference in San Francisco, June 25-28, with headquarters at the Fairmont Hotel.

LAYING 1,500 ft. of 58-in. mortar-coated steel pipe and 1,500 ft. of 67-in. pipe from the new Baldwin Hills Reservoir at Los Angeles, a Lorain Model L-501 crane lifts a 10,000-lb. section into place. The pipeline will tie the reservoir to the city's distribution system. Humiston & Rosendahl is contractor for the project.



Bureau Tests Asphaltic Concrete and Soil Cement as Rip-rap Substitutes

FOLLOWING two years of laboratory experiments, the Bureau's Branch of Design and Construction in Denver is ready for prototype testing of asphaltic concrete and soil cement as substitute materials for riprap on earth dams. From this full-scale test program may come an answer to the problem of reducing the cost of construction of earth dams throughout the Great Plains states of the Missouri River basin.

Under an \$82,890 contract awarded to the Northwestern Engineering Company of Denver, a test earth embankment at Bonny reservoir in eastern Colorado is to be constructed this spring to evaluate the durability of asphaltic concrete and soil cement as slope-protecting materials. The contractor has 75 days to complete the work. Notice to proceed was received by Northwestern March 12.

The test embankment section is to be constructed on the Bonny reservoir shore, about two-thirds of a mile upstream from the dam. It will be about 400 ft. long and about 25 ft. high. The earth embankment will be constructed by the same methods as an actual earth dam so that full-scale tests can be carried out and evaluated. The site for the test section was selected after all of the factors affecting successful slope protection had been considered. Weather conditions at Bonny reservoir are generally comparable to those at other sites in the planning stage.

The section will be exposed to freezing and thawing, wind and wave action, reservoir draw-down, and all other severe service conditions to which slope protection is subjected.

A 3-ft. thick soil cement facing on the upstream slope will be placed for 200 ft. on the test structure. On the remaining 200 ft., asphaltic concrete is to be placed in thicknesses varying from 6 to 18 in. Although laboratory tests have established the best mixtures of soil and cement or soil and asphalt, the prototype ratio of mixes is yet to be determined on the test section.

Quantities of materials in specifications for the test embankment include about 46,000 cu. yd. of earth fill, 150 tons of asphalt, and 1,700 bbl. of cement.

Because of economies which may be realized from use of the substitute materials in lieu of riprap hauled from distant sources, the Bureau estimates that several million dollars may be saved on future earth dams in the Missouri Basin states.

On Bonny dam itself, about 500,000 tons of rock and gravel were quarried near Golden, Colo., trucked to Boulder, loaded on railroad cars, shipped to Burlington, Colo., and finally trucked to the dam, at considerable expense.

From data assembled during the tests at Bonny, the comparative economics of the various possibilities for slope protection can be evaluated and Reclamation engineers will then be in a position

to recommend the cheapest and best possible protection for earth dams.

For upstream dam faces on the Great Plains, rock for riprap must now be obtained from sources 50 mi. or more away. At some potential sites for Bureau dams, riprap would have to be hauled by train or truck up to 400 mi., making riprap an expensive part of dam construction.

The Bureau's Region 7 office in Denver is especially interested in solving the problem, in view of the more than 40 earth dams currently in the planning stage in the region. The Region 7 and Region 6 offices are financing the test.

The Bureau of Reclamation under the present development of the Missouri River Basin project has six earth dams under construction. An additional five dams have been completed since authorization of the Flood Control Act of 1944.

Unit bids for experimental installation at Bonny reservoir were as follows:

(1) Northwestern Engineering Company.....	\$82,890
(2) The Utah Construction Company.....	84,566
(3) Engineer's estimate	64,465

	(1)	(2)	(3)
25,000 cu. yd. excav. for test sect.	.40	.30	.60
6,500 cu. yd. excav. in zone 1 borrow area and transportation to test section.....	.60	.60	.50
5,400 cu. yd. test sect., zone 1.....	.50	.25	.35
9,500 cu. yd. test sect., zone 2.....	.10	.20	.20
150 ton furn. asphalt.....	20.00	38.00	45.00
2,800 sq. yd. prep. surf. for asphalt. embankment protect. ton asphalt-conc. embankment protectn.	.50	.55	.25
1,600 bbl. furn. and handling cement	6.00	9.00	5.75
1,700 cu. yd. soil-cement embankment protection	5.00	5.28	4.00

Down-time Dopes by Anderson



Drawn for Western Construction by Harold V. Anderson

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Los Angeles 22, Calif.
2648 Cherry Ave.
Long Beach, Calif.
1331 33rd St.
Bakersfield, Calif.
- CONTRACTORS EQUIP. CORP.
2727 S. E. Union Ave.
Portland 2, Oregon
- AIR-MACK EQUIPMENT CO.
614 Elliott Avenue
W. Seattle 99, Wash.
- WESTERN EQUIPMENT CO.
Boise & Idaho Falls, Idaho
& Spokane, Wash.
- FOULGER EQUIPMENT CO.
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P.O. Box 87
Salt Lake City 8, Utah
- THE O. S. STAPLEY CO.
723 Grand Avenue
P.O. Box 960
Phoenix, Arizona
- INDUSTRIAL EQUIPMENT CO.
415 North 27th Street
Billings, Montana
- NORMONT EQUIPMENT CO.
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Great Falls, Montana
- COLORADO BUILDERS
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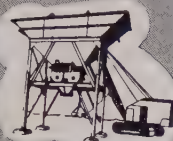
CONCRETE BUCKETS



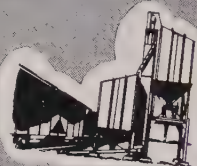
TRUCK MIXER
LOADING PLANTS



PAVING SPREADER



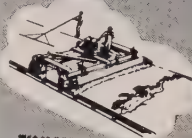
AGGREGATE
BATCHING PLANTS



BULK CEMENT PLANTS



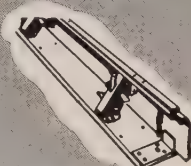
CLAMSHELL BUCKETS



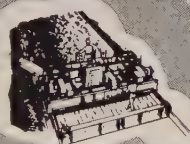
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\$65,000,000 for Military Work in the Northwest

MILITARY CONSTRUCTION work totaling an estimated \$65,000,000 for army camps, air fields, troop housing and a variety of other defense installations, is being rushed by the Corps of Engineers in the Pacific Northwest through the regular competitive bidding method.

Most of the work is located in Washington, although large Army Air Force projects in Montana and Idaho are also included in the program. Only one large Army job in Oregon, Beaver Ammunition Depot near Clatskanie, is included in the military preparedness program. Now completed, it involved rehabilitation of loading docks, replacement of dock approaches, and miscellaneous replacement of buildings and utilities, totaling \$1,300,000.

The present program includes the following projects for the Department of the Army in the State of Washington:

Fort Lewis: Telephone and signal building under construction, costing approximately \$250,000; rehabilitation of family housing quarters being completed, \$750,000; authorized under provisions of the Wherry Housing bill, but not yet under design, 750 service men's family units, \$8,000,000.

Yakima Training Center: Complete camp for 2,500 troops, mobilization type construction estimated to cost about \$5,800,000. Contracts awarded for 58 buildings for \$1,700,000.

Auburn General Depot: Water tank and sprinkler system in warehouse, now in design stage, estimated to cost less than \$1,000,000.

Mount Rainier Ordnance Depot: Administration building, two warehouses,

sand blasting and paint spray building, all under design, \$2,960,000.

Seattle Port of Embarkation: Sprinkler system on piers 38 and 39, under design, less than \$500,000.

North Richland: Rehabilitation of barracks and construction of new facilities for army camps, totaling \$6,500,000, of which approximately \$3,900,000 is under contract.

The following construction works for the Department of the Air Force are also located in Washington:

McChord Field: Runway extension, install fuel systems and construct alert hangar and lighting and landing system, totaling \$2,600,000, of which \$600,000 is under contract.

Larson Air Force Base (Moses Lake): Permanent type barracks and officers' quarters, 50-bed hospital, fueling facilities, alert hangars, airfield operations building, landing facilities and lighting, \$7,380,000, of which \$240,000 is under contract.

Fairchild Air Force Base (Spokane): New runway, permanent barracks, fueling systems and runway lighting, \$8,570,000, not yet under contract.

Geiger Air Force Base (Spokane): Alert hangar, runway extension and apron, \$375,000, not yet under contract.

Paine Air Force Base (Everett): Barracks, alert hangar, runway extension, landing systems and lighting facilities, \$1,750,000 not yet under contract.

Great Falls Air Force Base, Great Falls, Mont.: Proposed work includes new runway, permanent barracks, runway lighting system, 400 units of housing for service men's families under Wherry bill authorization, and fueling facilities, \$11,060,000.

Mountain Home Air Force Base, Mountain Home, Idaho: Proposed construction includes rehabilitation of buildings and utilities estimated to cost \$1,000,000. Contracts have been awarded totaling \$300,000.

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The business ends of Colorado Flat Blades for scrapers and dozers resist both impact and abrasion because...

- the steel is specifically selected for the job
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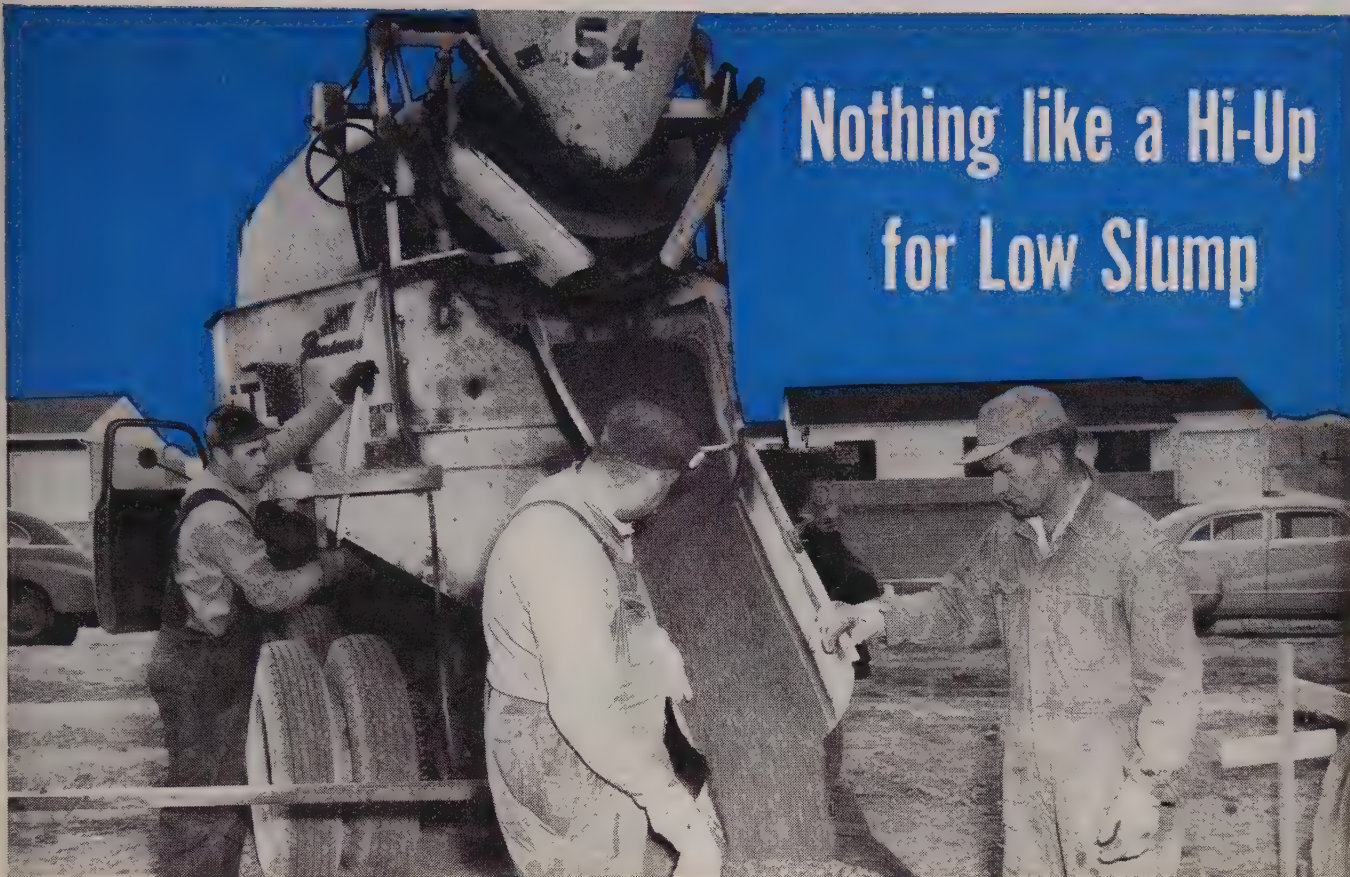


COLORADO CUTTING EDGES

FIRST 1951 BUCKET AT HUNGRY HORSE—Workmen rang up the curtain last month on the biggest construction year scheduled for the Bureau of Reclamation's Hungry Horse project since work started in July 1948. During the next 7½ months, about 1,200,000 cu. yd. of concrete are scheduled to go into the dam and power plant at the south fork of Montana's Flathead River.



WESTERN CONSTRUCTION — May, 1951



Nothing like a Hi-Up for Low Slump

All over the country, Worthington-Ransome Hi-Up Truck Mixers are out-performing other makes!



Photo of 4½ cu yd Worthington-Ransome Blue Brute Hi-Up Truck Mixer fleet operated by Concrete Inc., Denver, Colorado.



Photo of 5½ cu yd Worthington-Ransome Blue Brute Hi-Up Truck Mixers operated by Lattanzio Transit Mix Co., Inc., Schenectady.

Compare them on the basis of charging and discharging time . . . compare them on the basis of maintenance—

You'll find that Worthington-Ransome Blue Brute Hi-Ups score way ahead of other makes.

You'll surely want to experience results like these—

Fred D. Hoppe, vice-president, Concrete Inc., Denver, says, "Charging and unloading time is the lowest in our fleet of 26 units. We particularly like the way they discharge low and no-slump concrete. We experience less 'down time' with these machines than anything else in our fleet." Mr. Hoppe purchased *six more!*

Lou Lattanzio, Lattanzio Transit Mix, Schenectady, says of his 5½ cu yd Hi-Ups: "We are very pleased with the discharge rate even with low-slump concrete. There has been no appreciable mechanical trouble." Mr. Lattanzio "expects to standardize on Hi-Ups."

So join the growing list of Hi-Up fleets, which include Pine Hill Concrete Mix, Inc., Buffalo—over 40 Hi-Ups; Southern Materials Corp., Richmond and Norfolk—over 20; Buzby Brothers, Westville, New Jersey—over 20; Fenton Materials Co., San Diego—over 20.

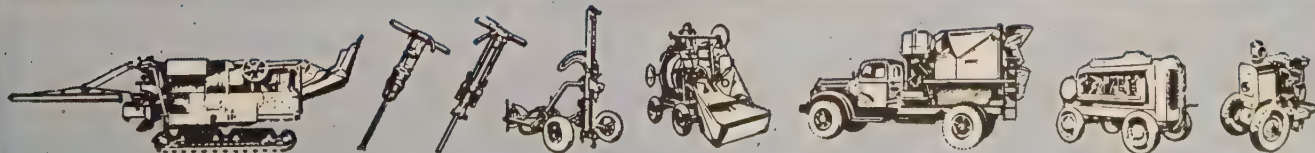
See your nearby Worthington-Ransome distributor for a demonstration. Worthington Pump and Machinery Corporation, Construction Equipment Division, Dunellen, New Jersey.

WORTHINGTON

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NEWS — IN BRIEF

Big Colorado Housing Project

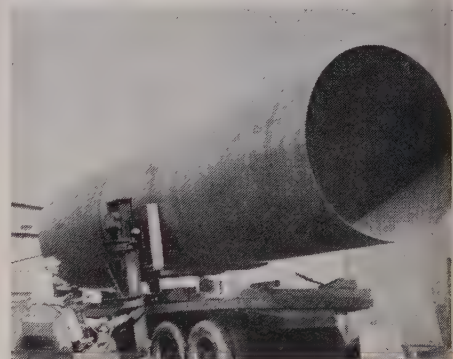
IF the Colorado Springs, Colo., city council will grant water concessions, E. W. Hayes, independent oil producer, and Howard M. Sloan, Albuquerque, N. M., will construct a \$63,000,000 housing development between Colorado Springs and Broadmoor. Water rights are essential if the investors are to obtain FHA

approval of the project. All other plans for the huge housing development are complete. Some 700 acres of land would be devoted to the proposed Skyway Park, and the project would feature the "solar type" home designed and perfected by Sloan. Prices would range from \$10,000 in the eastern section to \$50,000 and higher in the western two-thirds area. Rental units for military personnel would be among the first structures built in the eastern section.

"Rain Seeding" in Wyoming

NORTHEASTERN Wyoming and southern Montana may get an increase

in rainfall through an agreement signed by the Powder River Weather Research Corporation and the Water Resources Development Corporation, Pasadena, Calif. Seven Wyoming counties and two southern Montana counties have agreed to a "rain seeding" program of the California firm. Headquarters for the operation will be in Gillette, Wyo., and about 16,000,000 acres are covered in the contract.



TUNNEL LINERS FOR OWENS GORGE
—Completion of a contract for a 6,000-ft. section of steel tunnel liner has been announced by American Pipe & Steel Corp. The contract called for 200 joints of 1/4-in. wall pipe, 30 ft. in length, 104-in. diameter. The giant liner will be used on the Owens River Gorge project of the Los Angeles Department of Water and Power.

Watch Your Bid Bonds in Idaho!

IN IDAHO, a bill which amends the Highway Act of 1950 was signed into law by the Governor. The amendment provides that "Each bid must be accompanied by a cashier's check or a certified check in favor of the Department of Highways on some bank in the State of Idaho, or by a bidder's bond for the sum of 5% of the amount of the bid."

Plant Renamed to Honor Weymouth

IN HONOR of the former general manager and chief engineer of the Metropolitan Water District of Southern California, the Board of Directors has renamed the district's La Verne center, the F. E. Weymouth Softening and Filtration Plant. At the present time the plant has a capacity of 200 m.g.d. Colorado River water.

Flood Control Snag in Washington

PROPOSED federal improvement of the Upper Puyallup River in Washington in the interests of flood control, pending since early in 1948, hit a snag before the District and Division Engineers when a report on the situation was studied. Cost estimates were deemed to be too high to merit the eventual results. Localized erosion difficulties could be handled by the municipal areas involved. Projects already completed and now in construction along the Lower Puyallup basin are said to be sufficient to handle the problems in that area. All interested



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This truck mixer rating plate is what enables architects, engineers and contractors to confidently buy more than \$300,000,000 worth of ready-mixed concrete a year.

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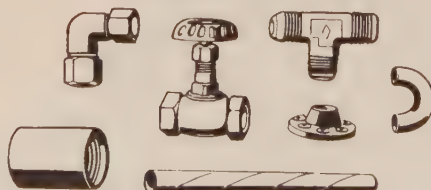


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parties have the privilege of presenting their views on the subject matter of the report to the Board of Engineers for Rivers and Harbors, Washington 25, D. C.



STRONGBACKS FOR SLENDER GIRDERS—To stiffen the two 110-ft. prestressed concrete girders for the first bridge of its type in the West (*Western Construction*, December 1950 and April 1951), the contractor added these temporary strongbacks during handling. Each girder weighs 50 tons.

Columbia River Compact Progress

ENABLING legislation providing for the creation of a Columbia River interstate compact, has been passed by all the key states in the Pacific Northwest, according to Jack V. Rogers, chairman of the Columbia Compact committee. Each state can now set up a commission to deal with the fair and equitable distribution of Columbia River water for irrigation and power needs in the Pacific Northwest. The existing committee has decided to support a piece of federal legislation pending before Congress, which provides for federal participation in the compact agreements. The first meeting of the interstate commission is expected to take place in May.

Bids for 47-Mi. Montana Road

APPARENT low bidders on the Bureau of Reclamation's contract for construction of a 47-mi. Forest Service road on the west side of Hungry Horse reservoir, Mont., are S. Birch & Sons and McLaughlin, Inc., Great Falls, Mont., combine. The bid covers all excavation and earthwork and erection of all structures, except bridges, required for construction of the road extending from the upper end of the reservoir to south and west shore of the reservoir to a point .4 mi. upstream from Hungry Horse Dam. The new road, which is scheduled for completion in 1953, will provide ac-

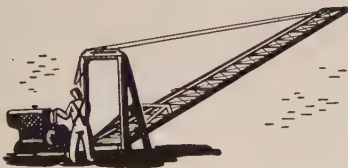
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USBR Needs Aides in Region 6

ABOUT 100 engineering aides are needed for employment in the Bureau of Reclamation's Region 6. Persons employed as a result of Civil Service examinations will be assigned to Bureau offices in North and South Dakota, Montana east of the continental divide, and the northern half of Wyoming east of the divide. Engineering aides being employed at the lower grades, paying \$2,200 and \$2,450 annually, must take a written

examination. Vacancies in the upper grades, \$2,650 and \$2,875 annually, will be filled from applications submitted. Further information is available from the Bureau's board of examiners, Billings, Mont.

Washington Highway Bond Issue

A BILL authorizing a \$66,703,620 bond issue for highway construction in Washington was signed into law by Governor Arthur B. Langlie. The governor signed the bill into law exactly as it was passed by the legislature, but expressed serious doubts as to its constitutionality. Action

will be taken within the State government to test the measure, either by the attorney general or the State finance committee.



ANDERSON RANCH SPILLS—A cascade of water plunged out of the Anderson Ranch Reservoir near Boise, Idaho, April 10 when Bureau of Reclamation engineers released the discharge for the first time over the 330-ft. high concrete spillway. At the left of the spillway is the 40,500-kw. power plant, in which the first of three 13,500-kw. generators is turning.

More Funds for Idaho Power

NEW CONSTRUCTION plans designed to further anticipate the electric needs of southern Idaho and eastern Oregon are the object of a \$22,831,000 Idaho Power Co. program. About \$16,000,000 of this year's funds will be spent for work on the hydroelectric plant construction along the Snake River at a site near Mountain Home, Ida. Work on new substations and alterations on distribution lines and transmission lines are included in the budget.

Circuit Breaker Tested at Coulee

GRAND COULEE Dam was the site of tests on the efficiency of a giant new circuit breaker. Engineers deliberately let the current, which serves about five Pacific Northwest states and part of British Columbia, leak across a tiny steel piano wire. The circuit breaker, imported from Switzerland, automatically shuts off all current and assumes the stepped-up overload resulting from the break and increased action of the generators. Bureau of Reclamation and Bonneville Power Administration engineers were pleased with the test since only a flicker resulted in the lights of the area.

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MASTER WORKER!



This versatile T7 TRAXCAVATOR working at a dam site on the Big Thompson diversion project near Loveland, Colorado, hoists its bucket high to load a big hauling unit.

Master of any construction job — the T7 works for less!

Big and powerful, the T7, largest in the TRAXCAVATOR line, has the ability to take care of any work shoved its way . . . to do the work and still turn in lowest costs per yard. The long-lived T7 expertly manages digging, loading, 'dozing, grading, pioneering, stripping — in any materials. It's built tough for a long, rough life.

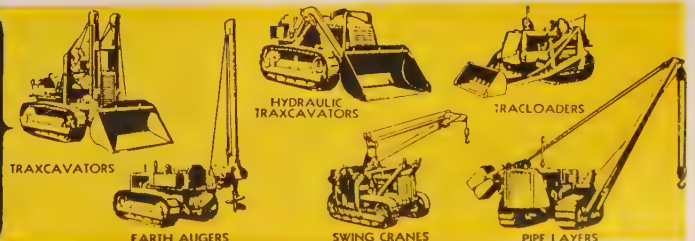
The one-man crew on the T7's seat controls 22,000 pounds of pushing power that can be applied directly to the bucket for big loads

every time. Unit engineering — TRAXCAVATOR to "Caterpillar" Diesel Tractor — assures balanced power, capacity and weight, regardless of unfavorable ground and adverse grades. The T7 can sprint — with a load — at six miles an hour . . . or it can excavate in ground-gripping low gear. High bucket-lift keeps the bucket clear of sides of big-capacity hauling units.

There are five profit-proved sizes of TRAXCAVATORS (1/2 to 4 cu. yds.). See your TRACKSON—"Caterpillar" Dealer . . . or write TRACKSON COMPANY, Dept. WN-51, Milwaukee 1, Wisconsin.

TRACKSON

TRACTOR EQUIPMENT



ENGINEERS ON THE MOVE

Herbert M. Leppich is named project engineer for the construction of the chemical processing plant of the Atomic Energy Commission's Idaho Falls, Ida., project. Leppich is a civil engineering graduate of Ohio State University and has served as construction engineer with the U. S. Army Corps of Engineers in the past.

Ralph E. Davison is the manager and **John S. McMahon** is the assistant manager of the newly established engineering and construction divisions of the General Electric Nucleonics Department, Richland, Wash.

C. M. Jackson, Bureau of Reclamation construction engineer, will leave his work at Arapahoe, Neb., on the Frenchman-Cambridge project for an assignment in Rhodesia. **Edgar E. Foster**, hydraulic engineer for the Bureau at the Denver, Colo., federal center, is also assigned to Rhodesia under foreign technical aid program.

Forrest F. Varney, formerly with the Naval Ordnance Test Station, China Lake, Calif., is now in Athens, Greece with Knappen Tippetts Abbutt Engineer Co. of New York, under the sponsorship of the ECA. He is an irrigation specialist.

Lt. Colonel Louis W. Correll becomes the new executive officer of the North Pacific Division of the Corps of Engineers. He will headquarter in Portland, Oregon.

Construction of Shadehill Dam near Lemmon, South Dakota, by the Bureau of Reclamation is nearing completion.

Personnel transfers to other projects are as follows: **D. M. Forrester**, **J. L. Baugh**, **H. J. Barber**, **M. O. Baugh** and **R. M. McGinnis** will assume duties on the power transmission line construction near Huron, S. D. Transmission line work near Watertown will have the attention of **R. C. Brown**, **P. Hardin**, **R. C. Boyd**, **J. J. Ross**, **W. L. Armstrong** and **G. O. Snow**. **G. W. Stocking** goes to Sioux Falls for transmission line construction. **D. W. Scoular's** new assignment will be at Hungry Horse Dam in Montana. **M. J. Sowell**, **R. L. Thompson**, **C. W. Fulmer**, **A. J. Olien** and **J. E. Cross** will assume duties at Keyhole Dam, Wyoming. Canyon Ferry Dam in Montana will get the services of **C. G. Hayenga** and **R. E. Morris**. **E. E. Kline** moves to an assignment at Angostura Dam, South Dakota.

Northern Rhodesia, a British colony in Africa, gets the services of **Edgar E. Foster**, hydraulic engineer, Denver, Colo., and **Clarence M. Jackson**, Arapahoe, Neb., construction engineer, of the Bureau of Reclamation. They will rec-

ommend methods of utilizing water resources for irrigation, rice production, and flood control. **Thomas C. Ahrens**, Denver, Colo., Reclamation ground water geologist, goes to Italian Somaliland to conduct a geological survey on ground water resources.

Wells R. Dickinson is appointed resident engineer for the chemical processing plant of the Atomic Energy Commission, Idaho Falls, Ida. Dickinson was resident engineer with the North Dakota State Highway Department from 1932 to 1940.

Portland, Ore., planning commission activities will be directed by **Lloyd T. Keefe**, Cleveland, Ohio, engineer. Keefe comes to Portland from the post of planning director for the Toledo-Lucas County, Ohio, planning commissions. He succeeds **Theron D. Howser**, who retires.

Harry F. Butcher becomes assistant engineer in the Salt Lake City, Utah, engineering department. He will supervise water main construction and other city projects connected with City airport projects.

D. D. Forgey returns to Seattle, Wash., as district engineer for the State Highway Department. He comes from Vancouver to assume the position left vacant by the death of **George Shearer**.



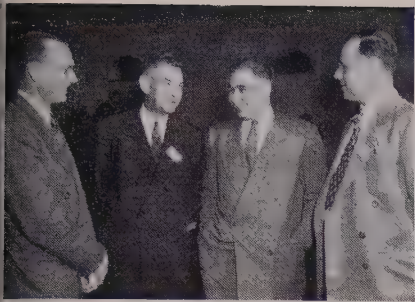
1951 NATIONAL OFFICERS of the Associated General Contractors. From left: **H. E. Foreman**, Washington, D. C., managing director of the National A.G.C.; **William Muirhead**, contractor of Durham, North Carolina, re-elected secretary-treasurer; **O. W. Maxon**, Maxon Construction Co., Dayton, Ohio, president of the association, and **Arthur S. Horner**, A. S. Horner Construction Co., Denver, Colo., vice-president.



OFFICERS of the Montana Section, American Society of Civil Engineers, for 1951. From left: **T. R. Smith**, Great Falls area vice-president; **E. O. Parsons**, Helena area vice-president; **G. J. Hoge**, Great Falls, secretary-treasurer; **W. J. Wenzel**, Great Falls, president; **R. T. Hurdle**, Billings area vice-president. **Emil Gehri**, Hungry Horse area vice-president, was not present.

CALENDAR OF MEETINGS

- May 3-5—California Sections of American Society of Civil Engineers, annual joint conference, at Ahwahnee in Yosemite National Park, Calif.
- May 16-18—Pacific Northwest Sewage Works Association, annual convention, at Hotel Vancouver, Vancouver, B. C.
- May 17-19—Pacific Northwest Section of the American Water Works Association, annual convention, at Hotel Vancouver, Vancouver, B. C.
- June 10—The President's National Highway Safety Conference, Washington, D. C.
- June 13-15—American Society of Civil Engineers, Summer Convention, at Louisville, Kentucky.
- June 25-28 — Western Association of State Highway Officials, 30th annual conference, at Fairmont Hotel, San Francisco.
- October 11-13—Structural Engineers Association of California, annual convention, at Yosemite Park, Calif.



PROGRESS and problems of Bureau of Reclamation construction were critically reviewed by the Bureau's top construction administrators convening recently in Denver for the second annual Construction Engineers' Conference. In the halls during an intermission, Assistant Chief Engineer **W. E. Blomgren** (third from left) relates a humorous experience to **J. S. Smith**, engineer at Coulee Dam, **A. F. Darland**, supervising engineer on the Columbia Basin Project, and **G. R. Rolin**, project engineer at Boysen Dam, Wyoming.

DEATHS

George H. Shearer, 65, district engineer in Seattle, Wash., died March 11 in Kirkland, Wash., after a brief illness. Well-known throughout the Pacific Northwest, Shearer had been a member of the State Highway Department since 1919. He held district engineer posts for the department in Spokane, Vancouver and Seattle.

Tom Rowley, 48, Cody, Wyoming, Bureau of Reclamation engineer, died March 12 of injuries received in an automobile accident. Rowley was in charge of power line construction in the Bureau's Big Horn district.

Edward A. Morton, 37, construction contractor, died in Salt Lake City, Utah, as the result of a tree-trimming accident on March 19.

Charles A. Kampe, 86, building contractor, died from a heart ailment in Salt Lake City, Utah, March 11.

Frank Brennan, 67, former construction supervisor for Consolidated Steel Corp., died in Los Angeles, Calif., March 17.

Edward Hungerford Nye, general building contractor, died March 9 in his Portland, Ore., home.

William H. Spitz, 49, engineer, died February 16 in San Francisco, Calif. He had been with the engineering staff of the San Francisco-Oakland Bay Bridge in California since 1933.

Sumner P. Wing, 60, foreign activities engineer for the Bureau of Reclamation died suddenly March 22, in the midst of

preparations to personally lead an engineering team on a Point Four Mission to Libya. He had served with the Bureau for 21 years.

Walter Beavers, 73, retired building contractor, died March 31 in his Phoenix, Ariz., home. Death followed a year of poor health.

Tom W. Griffith, 38, job office manager for Webb Company on the Denver Veterans Hospital project, died suddenly of a brain hemorrhage while vacationing in Phoenix, Ariz., March 5.

Howard C. Means, 75, civil engineer, died March 19 in a Salt Lake City, Utah,

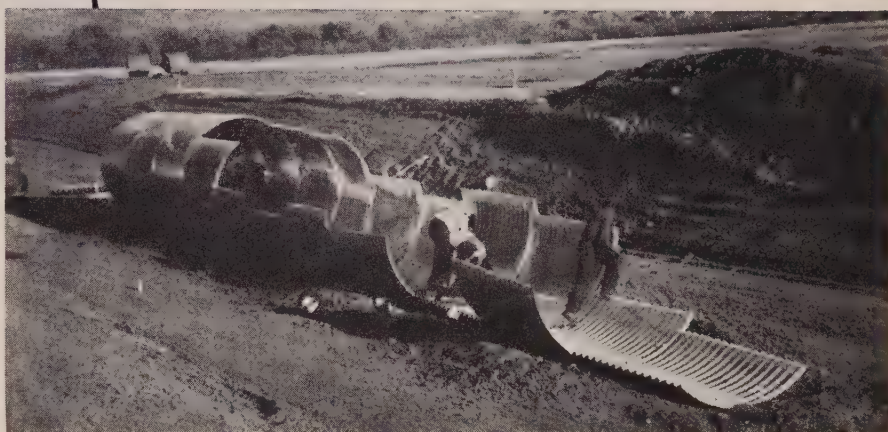
hospital. Means was a former chief engineer for the State of Utah and accomplished many irrigation and power projects during his long career in the West.

William Leyshon, 61, former state road supervisor of Utah, died March 7 in Salt Lake City, Utah.

Oscar LeRoy Amundsen, 61, building contractor, died March 3 in his Salt Lake City, Utah, home.

Lawrence Hensen Heiselt, 65, builder and contractor, died in Alamosa, Colo., March 26. He was the president of Heiselt Construction Co., Salt Lake City, Utah.

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ARMCO DRAINAGE STRUCTURES

SUPERVISING THE JOBS

J. E. Douglass is general superintendent and **H. A. "Pat" Murphy** is project engineer on highway construction near Pine Flat Dam in Fresno County, Calif. Transocean Engineering Corp., San Lorenzo, is the contractor, and **H. F. Hudson** is project manager on the \$607,000 job.

Near Arlington, Wash., where the Shoreline Construction Co. is constructing sewerage, water and steam distribution system for the U. S. Naval radio station, **Frank Bishop** is acting as general superintendent. **"Pat" Dominico** holds the position of job superintendent, and **Henry Frangello** is labor foreman. **George Clinton** is plumber foreman, and **Lt. G. G. Cornwell, Jr.**, is resident officer in charge for the Navy.

E. E. Ashlock will supervise construction for the Grafe-Shirley-Lane Co., Los Angeles, Calif., on the \$1,792,782 completion of Hungry Horse Dam, Bureau of Reclamation project.

Pacific Sand & Gravel Co., Centralia, Wash., has **Mike Morrissey** as job superintendent on the \$622,841 construction of runway additions at McChord air force base. **Don Coleman**, **Ed Siemers** and **Ray Mahaffey** are other key men on the job.

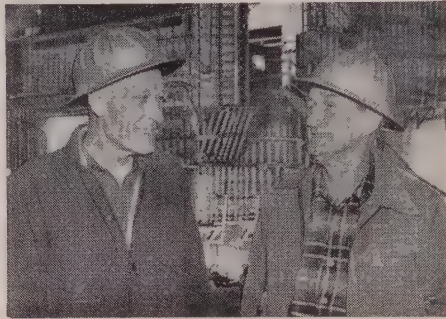
James P. Cagle is job superintendent and **A. T. Murphy** is his assistant for A. Teichert & Son, Inc., on a \$1,867,539 contract for Los Angeles River improvements. **J. O. Sheldon** is the grade foreman and **A. V. Towler** is concrete foreman. Job engineer is **J. M. Hall**. **M. P. Brotherton** is master mechanic, **R. J. Smith**, office manager and **G. P. Vannoy**, carpenter foreman.

Norman G. Wheelwright is the job superintendent for Wheelwright Construction Co., Ogden, Utah, on the construction of a ½-sq. mi. grid at Dugway, Utah. Foreman on the \$203,231 project is **Clayton Peterson**.

Sam Fritz is the project manager for Beck-Utah-Hopkins on the \$8,000,000 Wherry Housing project at Kirtland and Sandia Air Bases.

The main outlet works project at the Isabella Dam, Isabella, Calif., is being supervised by **C. D. Fox** with **Penny Pendegast** as his assistant. The H. C. Smith Co., Los Angeles, Calif., has **Kenneth Barrett**, **Ward Jenkins** and **E. O. Lauderdale** as foremen; **Al Bataiff** as engineer and office manager; **Jim Wag-**

goner as rigging foreman, **Al Merrill** as equipment foreman and **W. C. Kelly** as labor foreman. **Al Rafael** is the carpenter superintendent.



AT McNARY DAM, **George D. Terry**, graveyard superintendent for Atkinson-Jones-Ostrander, confers with **Sam P. Crump**, swing shift superintendent.

Norman Roberson is the job superintendent and **C. A. Ramsden** is the chief engineer for Pacific Coast Engineering Co., Alameda, Calif., on the \$223,751 caisson of steel plates and shapes and related work at the U. S. Naval Shipyard, San Francisco, Calif. **Will C. Hall** is the vice president and general manager and **D. F. Faber** is the naval architect.

G. C. Weeshoff is the general superintendent and **L. F. de Stwolinski** is the job superintendent for A. Teichert & Son, Sacramento, Calif., on the grading and surfacing of 6.1 mi. of highway between Peralta school and Riverside, Calif. **Paul Shaw** is the grade foreman, **Curley Noble** is the concrete foreman, **Roy Thomas**, the labor foreman and **Roy Hamm** the master mechanic on the \$917,600 project.

H. H. Vatney is the job superintendent and **R. J. Bennett** is the engineer for R. L. Moss & Co., Zenith, Wash., on the \$124,890 sewer construction project in Vancouver.

The \$1,088,604 steel tower construction at naval communications station in Arlington, Wash., is being supervised by **R. A. Bethel**. **Morrison-Knudsen Co.**, and **City Electric & Fixture Co.**, Seattle, Wash., are the contractors.

Foster Manning is the job superintendent on construction of a grain elevator at Kennewick, Wash., by **Henry George & Sons**, Spokane, Wash.

Sewer construction in Martinez, Calif. is being supervised by **Frank Jackson**

and his assistant, **Jack Williams**. **Barrett & Hilp**, San Francisco, Calif., is contractor on the project which is scheduled for completion in October of this year.

Goodfellow Brothers, Wenatchee, Wash., have **Tom Reilly** as job superintendent and **Lloyd Gadeberg** and **Ed Cunningham** as foremen on a paving project between Grand Coulee and Coulee Dam.

John W. Leonard is the job superintendent for Hunt and Willett, Inc., Brewster, Wash., on construction of permanent residences, sewerage system and street work near Mesa, Wash.

The \$650,000 State highway project near Anderson and Redding in Shasta County, Calif., is being supervised and managed by **A. M. Harsh** for **Fredrickson & Watson**, Oakland, Calif. General foremen are: **K. Fox**, **J. Naur** and **L. Walker**. **J. Passmore** is the office manager on the project which will probably be finished by July 1951.

W. A. Hogin is general superintendent on the Armory project near Concord, Calif. **C. Norman Peterson**, Berkeley, Calif., is the contractor on the \$100,000 job.

O. W. Chambers is the general superintendent and **Bob Kanouse** is the general foreman for Johnson Western Constructors on the relining of the 5½-mi. Borel Canal near Isabella and Kernville, Calif. **Al Hancock** is the gunite foreman and **Bob Hongoen** is the engineer.

Fifteen miles south of Lemmon, South Dakota, the Bureau of Reclamation's \$5,116,796 earth dam construction project is being supervised by **Ira Ison**. Managing the project for **S. J. Groves & Sons Co.** and **J. L. McLaughlin** is **H. A. Grifis, Jr.** **August Kirchoff** and **H. Koalska** are the fill foremen; **J. Dollar** and **S. Peterson** are pit foremen with **M. Serum**, and **Albert Kirchoff** is the labor foreman.

In Ft. Richardson, Alaska, where **Patti-MacDonald Construction Co.**, Anchorage, Alaska, is building a \$10,000,000 3-story central heating and power plant, **H. E. Gall** is the general superintendent and **H. Wiggen** is the job superintendent. **G. E. Lefler** is project manager.

In Fontana, Calif., the Kaiser Engineers Division of Kaiser Industries is the prime contractor for building additions to the Kaiser Steel Corp.'s plant. **Art Fisher** is the construction manager and **H. V. Zilm** is the construction superintendent with **Al Zimmerman** as his assistant. The \$24,500,000 construction project has **Wright Price** as field engineer, **Eugene W. Kower** as office engineer and **C. H. Tomlinson** as project ac-

Continued on page 119

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CONTRACTS

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

Alaska

\$264,375—**Owen J. Butcher and Walter Wilson** (joint venturers) Box 1808, Anchorage, Alaska—Low bid for clearing work at site of the communications station at Kenai; by Corps of Engineers.

\$5,786,002—**Haddock Engineers, Ltd.**, P. O. Box 390, Montebello, Calif.—Low bid for construction of composite bachelor housing at Whittier; by Corps of Engineers.

\$4,793,966—**J. H. Pomeroy & Co., Inc.**, 333 Montgomery St., San Francisco, Calif.—Low bid for the construction of 23 eight-family row-type quarters at Ladd Air Force Base and 14 similar buildings at Eielson Air Force Base; by Corps of Engineers.

Arizona

\$234,872—**W. J. Henson**, P. O. Box 471, Prescott—Low bid for construction on the Topock-Kingman highway from a point about 5 mi. southwest of Kingman southerly for a distance of approx. 10 mi., including grading, draining, select material aggregate base and bituminous road-mix; by State Highway Department.

\$973,944—**Morrison-Knudsen Co., Inc.**, 411 W. 5th St., Los Angeles, Calif.—Low bid on Schedules I and II for earthwork and canal lining and structures for the Wellton Canal, Wellton-Mohawk Division, Gila Project; by Bureau of Reclamation.

\$175,526—**J. E. Skousen**, 243 W. First Ave., Mesa—Low bid for widening the existing roadway, placing base material and bituminous surface treatment from a point about 3½ mi. north of Alpine, southwest to the Arizona-New Mexico line; by State Highway Department.

\$172,117—**Wallace & Wallace**, 1400 19th St., Phoenix—Low bid for Showlow-Springerville highway construction; by State Highway Department.

California

\$202,277—**Ralph A. Bell**, Monrovia—Low bid for construction of county highway on Penasquitas-Poway road between State Highway Route 77 and San Diego County Road, about 3.6 mi. length to be graded; by State Division of Highways.

\$1,030,127—**Dan Caputo and Edward Keeble** (joint venturers), Box 64, Rt. 4, San Jose—Awarded contract for improvements on 12th St. dam, adjacent streets, and necessary excavation, paving and sewer construction; by City of Oakland.

\$134,708—**Cox Bros. Construction Co.**, Stanton—Low bid for highway construction on portions between Dulzura and Campo, a net length of about 1.1 mi. to be graded and bituminous surface treatment to be applied; by State Division of Highways.

\$967,355—**Cox Bros. Construction Co.**, Stanton—Award for construction on girder separation structures, and grading and paving in Oceanside; by State Division of Highways.

\$425,982—**Eaton & Smith**, 715 Ocean Ave., San Francisco—Awarded contract for miscellaneous highway repairs and improvements on Lake Merced Boulevard; by the State Division of Highways.

\$205,440—**Mercer Fraser Co. and Mercer Fraser Gas Co.**, 2nd and Commercial Sts., Eureka—Awarded contract for highway construction in Del Norte County between Smith River and Winton Corners; by State Division of Highways.

\$513,375—**Fredrickson & Watson Construction Co.**, 873 81st Ave., Oakland—Low bid for highway grading and surfacing in Monterey County between Chular and Spence; by State Division of Highways.

\$330,990—**Walter C. Groshong**, 4335 California St., Long Beach—Low bid for construction on decks and approaches of wharves in Long Beach; by Harbor Department.

\$189,820—**R. E. Hazard Contracting Co.**, 2548 Kettner Blvd., San Diego—Awarded contract for highway construction in San

Diego County between Chambers St. and 2nd St. in El Cajon, about 2 mi. length to be graded and paved with plant-mix surfacing on cement treated base; by State Division of Highways.

\$2,219,920—**Peter Kiewit Sons' Co.**, 345 Kieways Ave., Arcadia—Low bid for Los Angeles River improvements, including clearing and removal of obstructions, earthwork, concrete construction, water diversion and control and drainage structures; by Corps of Engineers.

\$273,820—**Charles MacClosky Co.**, 112 Market St., San Francisco—Awarded contract for construction of a reinforced concrete and structural bridge; by State Division of Highways.

\$211,480—**Milosevich & Zarubica Construction Co.**, Montebello—Low bid for installation of sanitary sewers in Altadena; by Los Angeles Board of Supervisors.

\$277,200—**Oberg Bros. Construction Co.**, P. O. Box 640, Inglewood—Awarded contract for construction of a reinforced concrete box girder bridge on Hollywood Freeway; by State Division of Highways.

\$151,288—**Oilfields Trucking Co. and Phoenix Construction, Inc.**—Awarded contract for highway surfacing and grading in Kern County; by State Division of Highways.

\$581,121—**R. P. Shea Co.**, Indio—Low bid for improvements on San Diego River and Mission Bay floodway; by Corps of Engineers.

\$349,981—**John J. Swigart Co.**, 20530 S. Normandie Ave., Torrance—Awarded contract for highway construction in Riverside between Indio and Ave. 62, about 9.3 mi. in length; a portion to be graded and surfaced with plant-mix surfacing on cement treated base; existing pavement on remainder of the job to be surfaced with plant-mix surfacing and seal-coat applied; by State Division of Highways.

\$1,867,530—**A. Teichert & Son**, Box 436, North Hollywood—Awarded contract for Los Angeles River improvements; by Corps of Engineers.

\$1,671,177—**United Concrete Pipe Corporation**, P. O. Box 425, Baldwin Park—Low bid for Schedule II construction on the Friant-Kern Canal distribution system, Central Valley project; by Bureau of Reclamation.

\$617,725—**United Concrete Pipe Corporation**, P. O. Box 425, Baldwin Park—Awarded contract for highway construction in Merced and Stanislaus Counties, grading and paving; by State Division of Highways.

\$361,140—**Webb & White**, 7220½ Melrose, Los Angeles—Awarded contract for the construction of a reinforced box girder bridge over Wilshire Blvd., Harbor Freeway; by State Division of Highways.

\$199,640—**Webb & White**, 7220½ Melrose, Los Angeles—Awarded contract for highway grading and paving near Sunset Blvd., Los Angeles; by State Division of Highways.

\$723,510—**Clyde W. Wood & Sons**, 6900 Tujunga Ave., North Hollywood—Awarded contract for construction of Lauro Dam north of Santa Barbara in the Cachuma Project; by Bureau of Reclamation.

\$390,740—**E. L. Yeager**, P. O. Box 87, Riverside—Awarded contract for grading and surfacing about 11.7 mi. on Riverside Drive and State Route 19 and an existing bridge to be widened; State Division of Highways.

Colorado

\$1,294,700—**Peter Kiewit Sons' Co.**, Omaha National Bank Bldg., Omaha, Neb.—Low bid for construction of Willow Creek Dam in Colorado; by Bureau of Reclamation.

\$209,489—**Smith Hi-Line Company**, 1000 44th Ave. N., Nashville, Tenn.—Low bid for construction of 69-kv. transmission line, Gore Junction-Muddy Pass, Colorado-Big Thompson project; by Bureau of Reclamation.

\$821,490—**Trans-Electric Company**, 108 E. Oak St., Louisville, Kentucky—Awarded contract for construction of the Salida-Gunnison, 115-kv. transmission line for the Colorado-Big Thompson project; by Bureau of Reclamation.

\$2,240,350—**Winston Bros. Co.**, 1532 S. California Ave., Monrovia, Calif.—Low bid for the construction of Flatiron power and pumping plant and after-bay dam for Colorado-Big Thompson project; by Bureau of Reclamation.

Idaho

\$3,839,140—**Donovan-James Construction Co.**, Seattle—Awarded contract for second stage construction on Albeni Falls Dam, in-

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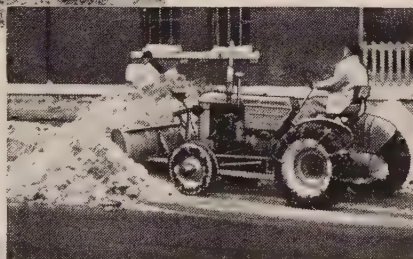
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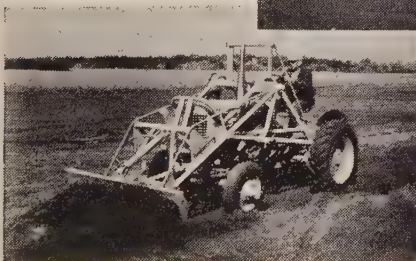
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Hilton's, Inc.....Las Vegas, New Mexico
Electric Tool & Supply Co.....San Bernardino, Calif.
Growers Tractor & Impl. Co.....Sacramento, Calif.
Farmers Machinery & Supply Co.....Reno, Nevada
Faulger Equipment Co.....Salt Lake City, Utah
Nelson Equipment Co.....Portland, Oregon - Seattle, Wash.
Wortham Machinery Co., Cheyenne, Sheridan and Greybull, Wyoming
Montana Powder & Equipment Co.....Helena, Montana



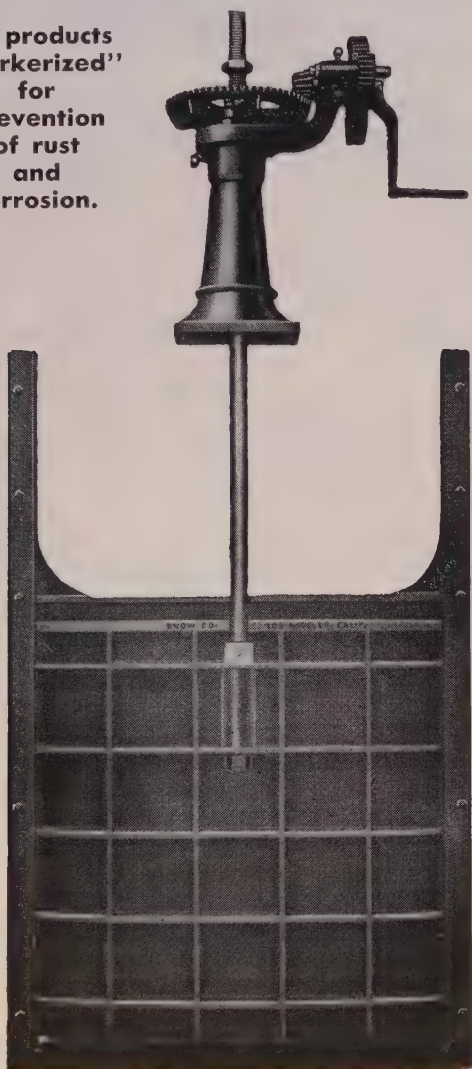
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cluding foundations for and construction of a spillway dam and related work; by Corps of Engineers.

\$506,380—**Tony Marrazzo**, Box 876, Boise—Contract for construction of a roadbed, surfacing and related work on the Stanley Highway; by Bureau of Highways.

Montana

\$557,970—**Stanley H. Arkwright, Inc.**, 1200 6th Ave., Billings—Award for construction of a highway in Park County, including grading, oiling and surfacing about 7.12 mi.; by State Highway Commission.

\$2,348,210—**S. Birch and Sons, McLaughlin, Inc., and F. & S. Contracting Co.**, Great Falls—Low bid for earthwork and structures, except bridge construction at Hungry Horse project; by Bureau of Reclamation.

\$183,118—**S. Birch & Sons Co.**, 314 Ford Bldg., Great Falls—Awarded contract for construction of a highway in Cascade County; by State Highway Commission.

\$347,770—**F. & S. Contracting Co.**, Box 4, Butte—Awarded contract for construction of a highway, Anaconda-Butte; by State Highway Commission.

\$173,370—**Lewis Construction Co.**, 405 1st Ave., Great Falls—Low bid for construction of a 16-mi., 69-kv. transmission line, Fort Peck-Whatley; by Bureau of Reclamation.

\$260,257—**McKinnon Decker Co.**, 1520 Hauser Blvd., Helena—Awarded contract for work on Bozeman-East highway in Gallatin County, 4.392 mi. to be graded and surfaced and drainage structures to be erected; by State Highway Commission.

\$325,890—**Nilson-Smith Construction Co.**, P. O. Box 1147, Great Falls—Award for highway construction in Cascade County; by State Highway Commission.

\$412,638—**Union Construction Co.**, P. O. Box 1261, Missoula—Award for highway construction in Flathead and Glacier Counties; by State Highway Commission.

New Mexico

\$556,976—**Brown Contracting Co.**, P. O. Box 1479, Albuquerque—Awarded contract for highway construction along U. S. 66, Guadalupe County, on the Newkirk-Montoya road about 8.654 mi. in length; by State Highway Department.

\$285,120—**Lowdermilk Bros.**, P. O. Box 276, Espanola—Awarded contract for highway construction along U. S. 66 in Quay County on the Newkirk-Montoya road about 3.563 mi. in length; by State Highway Department.

\$458,460—**M. M. Paul & Sons**, Albuquerque—Awarded contract for highway construction in Bernalillo County, about 11.153 mi. in length; by State Highway Department.

Oregon

\$58,416,459—**Guy F. Atkinson Company**, 10 W. Orange Ave., San Francisco (joint venture with **Ostrander and Jones**)—Contract for completion of spillway, powerhouse, abutments and appurtenant structures at McNary Dam; by Corps of Engineers.

\$1,074,349—**General Construction Co.**, P. O. Box 3860, Portland—Low bid for construction of hydraulic-emplaced Columbia River highway between Mosier and Hood River; by State Highway Commission.

\$195,736—**Tom Lillebo**, Reedsport—Low bid for structures, grading and surfacing on the Dodge Bridge section of the Sams Valley secondary highway; by State Highway Commission.

\$493,913—**McNutt Bros.**, 351½ E. Broadway, Eugene—Awarded contract for highway construction in Lane County, Judkins Point-Goshen section of Pacific Highway; by State Highway Commission.

\$400,205—**George Stacy**, Tulelake, Calif.—Low bid for dike and channel improvements along Lower Lost River, Klamath Project; by Bureau of Reclamation.

\$1,286,425—**Porter W. Yett**, 6500 N.E. Ainsworth St., Portland—Low bid for structures, grading and paving on Bunker Hill-Delmar section of the Oregon Coast highway; by State Highway Commission.

\$173,029—**Warren Northwest, Inc.**, P. O. Box 5072, Portland—Low bid for resurfacing of pavement on the Alder Creek-Philomath section of the Alsea Highway; by State Highway Commission.

Utah

\$1,382,133—**M. J. Brock & Sons, Inc., and R. J. Daum Construc-**

Co. (joint venturers), 6803 West Blvd., Inglewood, Calif.—Awarded contract for construction of Area A buildings at Dugby; by Corps of Engineers.

27,151—**Reynolds Construction Co.**, Springville—Highway construction on the Low-Knolls project, a section about 8.781 in length to be paved; by State Road Commission.

3,565—**W. W. Clyde & Company**, Springville—Award for construction work on Hinckley-Skull Rock Pass; by State Road Commission.

250,000—**Moore and Roberts and B. & R. Construction Co.** (joint venturers), 693 Mission St., San Francisco, Calif.—Awarded contract for construction of 11 buildings in Area A, Highway; by Corps of Engineers.

Washington

128,679—**Guy F. Atkinson Co.**, Bressi and Bevanda, A. Richert & Son Co., and **Charles L. Harney** (joint venturers)—Award for the construction of Ross Dam and powerhouse on the Sagit River; by Seattle Board of Public Works.

27,150—**Lee Hoffman**, P. O. Box 2028, Portland, Ore.—Low bid for construction of a transmission line in Marion County; by Bonneville Power Administration.

28,520—**Intermountain Plumbing Company**, Boise, Ida., and **Henry L. Horn**, Caldwell, Ida. (joint venturers)—Low bid for constructing approximately 12 mi. of wasteways and related structures, Columbia Basin project; by Bureau of Reclamation.

21,040—**Manson Construction & Engineering Co.**, 821 Alaskan Way, Seattle—Low bid for the construction of the Portage canal; Department of Highways.

1,930—**Matthew McCarthy**, Seattle—Awarded contract for construction of sewage treatment plant, Olympia; by City of Olympia.

90,090—**McAtee and Heath**, 3527 Trent Ave., Spokane—Low bid for the relocation of State Highway 10; other improvement work in the Coulee Dam area; by Bureau of Reclamation.

61,650—**Rockwell Monroe Line Construction Co.**, Sandpoint, Ida.—Low bid for construction of a 115-kv. transmission line between Columbia and Ellensburg in Douglas, Kittitas and Shelan counties; by Bonneville Power Administration.

15,685—**Shoreline Construction Co.**, 12519 15th Ave., Seattle—Awarded contract for steam distribution systems at U. S. Naval Radio Station near Arlington; by U. S. Navy.

466,502—**Strand & Sons**, 3939 University Way, Seattle—Low bid for general construction of Denny School, Seattle; by Seattle School District.

64,281—**Thorburn & Logozo**, 4608 36th St., Seattle—Low bid for construction of water distribution systems, roads, etc.; Yakima training center; by Corps of Engineers.

490,300—**J. A. Terteling & Sons, Inc.**, P. O. Box 1428, Boise, Idaho—Low bid for construction work in connection with the extension of East Low Canal, near Ephrata; by Bureau of Reclamation.

55,470—**Waale-Camplan Co.**, 2100 S.W. Jefferson St., Portland, Ore.—Low bid on Schedule I for road surfacing at North Richmond; by Corps of Engineers.

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PROVIDE exceptional pulling power, with the sharp energy of blow needed to vibrate and loosen stubbornly set piling. These double-acting extractors come in two standard models—heavy and extra heavy. Standardized line also contains 10 double-acting hammers and 5 single-acting hammers. Write for free Bulletin.

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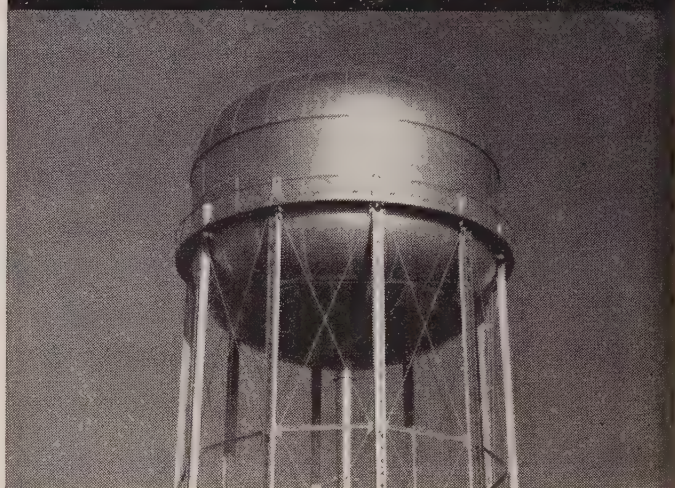
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Here's what the Robinson System has to offer: (a) proved lowest cost operation with moisture-free air and (b) no motor-driven parts in connection with the handling of the cement. Maintenance is negligible.

Our engineers will be glad to help work out a plan for you to receive cement in bulk and convey it the Robinson way from siding to storage to mixing plant. Many dam contractors, who sure have to watch their costs, and many concrete mixing plants are now Robinson-equipped.

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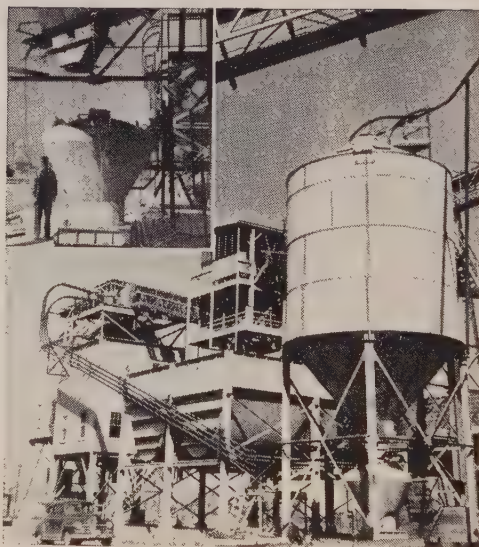
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Air-Activated

Division of
MORSE BOULGER DESTRUCTOR CO.

CONVEYOR SYSTEMS



Compressor Maintenance

... Continued from page 117

matter of fact, this yard carried many extra tools. If the air supply had been figured correctly on the tools actually in use, the air required would be 15% of the requirements for the tools in use. Determining Load Factor, care should be taken to eliminate the tools on hand in the storeroom or not in use.

It would be wise to discuss the points in detail with the tool manufacturer before finally deciding on the actual air consumption needed.

System must be tight

Some comment should be made on the practice of adding a percentage to calculate compressor capacity to provide for piping leakage. This has been done largely to the fact that compressed air is so harmless that it is not considered vitally necessary for an air system to be tight. Electrical lines must be carefully insulated—leaks cannot be tolerated. Steam lines are kept tight because of danger and also because steam leaks are objectionable. Refrigerating systems must be tight, both because leakage is expensive and the gas is frequently so noxious.

There is no more justification for allowing compressed air wastage than there is in buying a compressor without capacity control, letting it operate continuously at full capacity and discharging the surplus through relief valves to the atmosphere.

Previously, it has been customary to add an arbitrary item of about 10% for leakage. Compare this to an acceptable limit in the fuel gas distribution field—less than 1 cu. ft. per min. per mile of 3-in. line. Air lines can be made just as tight as other piping systems and can be kept tight. It pays to do so.

Provide some excess capacity

Before determining the final compressor capacity, consider carefully that once compressed air is available, its versatility will of itself lead to a magnitude of profitable uses and applications not originally anticipated. Although mechanically it is no problem to increase the size of a compressed air plant since any number of units can discharge into the same system, it is prudent to provide some excess capacity, including piping system. What this excess capacity for future growth should be will depend largely on individual conditions and total known requirements.

The number of units into which total capacity should be divided is important. Air compressors are sturdy machines, but, like all mechanical and electrical equipment, they require maintenance and must occasionally be taken out of service. Compressed air supply during maintenance periods is provided for differently in almost every installation. If the supply of compressed air is vital to continued production, the answer is usually determined by a comparison of the cost of standby capacity with the value of the production loss.

SUPERVISING THE JOBS

... Continued from page 112

stant. **R. L. Nelson** is the general carpenter foreman, **R. Merriam**, concrete foreman, **John Erwin**, equipment foreman, and **Ben Stevens** is the labor foreman.

John N. Sorbo is the general superintendent for **Carl N. Swenson Co.**, San Jose, Calif., on construction of the U. S. Armory at San Jose.

Orange County, Calif., is the site of a new state highway project to be about 1 mi. in length and **L. F. Stwolinski** is general superintendent for **A. Teichert Son, Inc.**, Sacramento, Calif. His assistant is **P. L. Shaw**, and **C. Holman** is trade foreman. **Roy Thomas** and **J. Wetterstrom** are in charge of labor. **Merley Noble** is carpenter foreman and **By Hamm** is master mechanic.

Southern California Edison Co.'s new dam plant at Etiwanda, Calif., has **W. Sheets** as general superintendent. **H. Stewart** is his assistant on the job and **K. McNeil** is the resident engineer for **Stone & Webster Engineering Corp.**, Los Angeles, Calif., contractor on the \$10,000,000 construction. **Jake Ellerboek**, **Charles Forester**, **Fred Hillman** and **P. L. Ryan** are engineers. **J. E. Haddock Limited**, Pasadena, Calif., has the contract for clearing the land, building an earthfill reservoir and dike for the floodroad and handling in all about 50,000 yd. of dirt. **Jess Black** is supervising as part of the Edison project.

The new University of California at Los Angeles art building construction is being directed by **Charles A. Robinson** general superintendent and his assistant, **J. V. Young**. **Al-Co. Co.**, Los Angeles, is the contractor.

A. G. Royther, who has supervised many projects in the Southwest, is now completing work on The Johnson Wax building in Los Angeles, Calif., for **T. S. Construction Engineers, Inc.**, Los Angeles, Calif.

Construction of contractor's temporary housing at Dugway, Utah, is being supervised by **A. M. Olson**. **Carl Edwards** is the job superintendent and **William Zwick** is job engineer. **Jacobson Construction Co.**, Salt Lake City, Utah, is the contractor for the Corps of Engineers \$799,772 project.

James S. White is the job superintendent for **Webb & White**, Los Angeles, Calif., on the grading and paving of a highway over-crossing in Los Angeles. **Eddie Kapp** is the excavation foreman.

Road construction under way fromakersfield, Calif., to Isabella Dam is being supervised by **John W. Carrel** for

Dimmitt & Taylor and **T. M. Page**, Monrovia, Calif., joint venturers on the \$400,000 contract. **Jess Overhoff** is equipment superintendent and **Frank Ogden** is master mechanic.

E. L. Knox is plant superintendent for **Inland Aggregates Co., Inc.**, Niles, Calif.

Edgar E. Bilodeau leaves the United States to become superintendent for **Foley Bros.** in Antofagasta, Chile.

Harbor Freeway bridge and underpass construction in Los Angeles, Calif., is under the general supervision of **Carl Rice** for **Winston Bros. Co.**, Monrovia,

Calif., and **Henry Kreuzer** is job superintendent. **J. H. Yount** is managing the million-dollar project and **A. E. Johnson** is the carpenter foreman.

Building construction in Berkeley, Calif., on the California School for the Deaf is being supervised by **Al Retzlaff** for **Carrico & Gautier**, San Francisco, Calif. **Milt Creager** is project manager.

Construction is beginning on bakery and warehouse buildings for **Safeway Stores**, Los Angeles, Calif. **Gus Klamm** is the superintendent with **Jim Barry** as his assistant. **H. C. Smith Co.**, Los Angeles, is the contractor.

RUNWAYS BECOME SPEEDWAYS



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...HANDLE MORE THAN 3 PUSH CARTS!
...TRAVEL 2 TO 3 TIMES AS FAST!

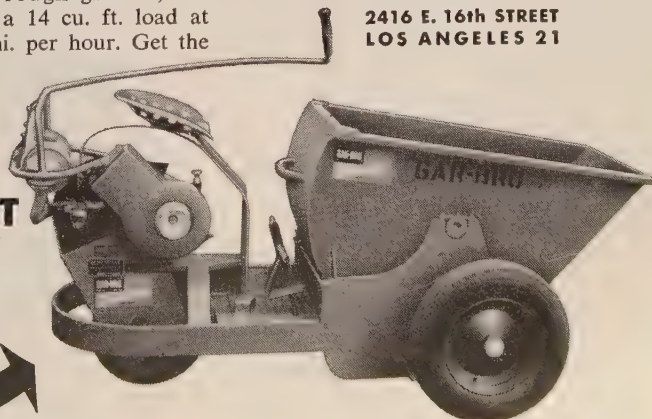
ONE MAN WITH a Power-cart can do as much work per day as 6 to 10 men with wheelbarrows. Up-hill, down-hill, over runways or rough ground, the Power-cart moves a 14 cu. ft. load at speeds up to 12 mi. per hour. Get the

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NEWS *of*

DISTRIBUTORS AND FACTORY BRANCHES

Dietrich-Collins Equipment, Ltd., 890 Southwest Marine Dr., Vancouver, B. C., is now distributor in British Columbia for the *Hercules Motor Corporation*, Canton, Ohio, and the *Construction Machinery Company*, Waterloo, Iowa, and the *Euclid Machinery Co.*

☆☆☆

New managers for the *Fruehauf Trailer Company* in Western sales and service branches are: WALTER R. PAVELA, Sacramento, Calif.; WALTER P. QUINN, Salt Lake City, Utah; L. G. CRAYTON, Phoenix, Ariz.; AMOS KIRKSEY, Oakland, Calif.; S. K. PORTER, Los Angeles, Calif.

☆☆☆

JOHN JORGENSEN, for many years associated with the construction equipment business, has purchased an interest in *Western Traction Co.*, 2230 Third St., San Francisco, Calif. HOMER KNOX, former owner will not retire completely but will remain on the board of directors. Jorgensen will be president under the new arrangement. In addition to the present lines which are: *Galion Iron Works & Mfg. Co.*, *Marmon-Herrington Co.*, *Wayne Mfg. Co.*, *Standard Steel Works*, and *Ferro Enameling Co.*, other lines will be added. *Chicago Pneumatic Tool Co.* will be one of these, according to M. C. LEHMKUHL, district manager for Chicago Pneumatic.

☆☆☆

P. G. ROWE is the new district manager at the Los Angeles, Calif., office of the *Northwest Engineering Co.*, 3707 S. Santa Fe Ave. Rowe has been in the construction machinery business for many years, chiefly in Ohio and Louisiana.

☆☆☆

E. L. BENSON, area sales manager, and HARRY JACKSON, area service manager of *Barber-Greene Co.*, recently conducted asphalt schools in Salt Lake City, Utah; Boise, Idaho; Portland, Ore.; Seattle, Wash., and Vancouver, B. C. The trip took three weeks and all traveling was done by air.

☆☆☆

E. K. CLARK assumes the duties of vice president of *Johns-Manville Sales Corporation* and merchandise manager of the firm's building products division. EARNEST M. FULLER succeeds Clark as manager of the construction department.

☆☆☆

JOHN BATTES, vice president of *Four Wheel Drive Pacific Co.*, announces the appointment of JAMES D. MADDEN to the company's sales staff. He will cover the San Francisco Bay Area, operating from

offices at 469 Bryant St., San Francisco. CHARLES A. MCPHERSON joins the firm's sales staff to cover the Valley Counties and will headquarter at Fresno, Calif.

☆☆☆

H. F. LINDER, branch manager at Seattle, Wash., for *Skilsaw, Inc.*, announces the opening of a new branch at Spokane. The new office is located at 2226 N. Division St., and is under the supervision of the Seattle branch. BYRON L. HOFFMAN is the manager. The new branch is equipped to handle service on Skiltools in Eastern Washington, Idaho and the Montana area.

☆☆☆

P. H. HAGEN, Seattle, Wash., will lend his services to the West Coast division of *Raybestos-Manhattan, Inc.*, to handle the sale of Manhattan mechanical rubber products and R-M Packings in the Pacific Northwest. Hagen's offices are at 2221 4th Ave., South Seattle.

☆☆☆

HERMAN S. SIMMONS, 53, sales manager of *Herb J. Hawthorne, Inc.*, Houston, Texas, died suddenly at the Highland Hospital, Shreveport, La. Death was the result of a heart condition.

☆☆☆

JOHN R. RANDLE joins the *Associated Equipment Distributors* in the newly created post of field secretary. His former connections were with the *Ingersoll-Rand Company*, *Cleveland Rock Drill Company*

Permanente Cement Company's giant new kiln—a revolving furnace more than one story high and a block long—begins pouring more cement for the West, but the Kaiser subsidiary announces that de-

mands already have outstripped the resulting plant capacity of 7,000,000 barrels a year. The Permanente plant expansion at Permanente, Calif., cost approximately \$3,500,000.

☆☆☆

Howard Supply Company, with thirteen distribution points in California, is the new distributor for *Construction Machinery Co.*, Waterloo, Iowa. Stocks of industrial pumps in various sizes and capacities will be carried by the California firm.

☆☆☆

PAUL H. HEBB, Portland, Ore., is establishing offices at Denver, Colo., establishing offices at warehouses for the *Denver Safway Scaffold Company*, distributor for tubular steel frame scaffolding and construction work materials. Offices of the company will be at 909 Tenth Street.

☆☆☆

Four Wheel Drive Pacific Co., San Francisco, Calif., is now California distributor for *American Tractor Co.*, Chumbusco, Ind., according to JOHN BATTES, vice president.

☆☆☆

E. L. DRAKE assumes the position of regional manager for the *Lamson Corporation*, 555 Bryant St., San Francisco, Calif. Drake comes from Chicago where he was connected with *Mechanical Conveyor Equipment* for many years. His territory will comprise the West Coast area.

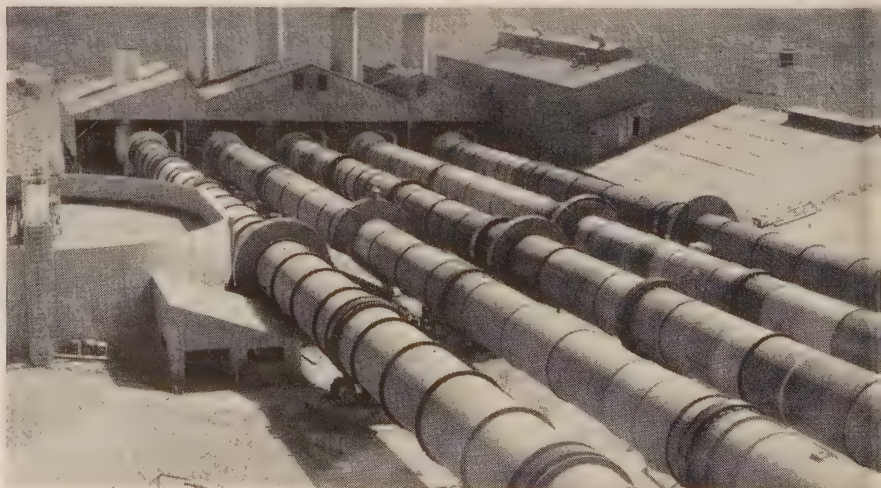
☆☆☆

The Timken Roller Bearing Company, Canton, Ohio, announces the appointment of PAUL REEVES as director of sales. Reeves served as industrial district manager in the San Francisco branch office until 1940.

☆☆☆

C. B. LEBER is the new district representative for *Caterpillar Tractor Company's* newly-created Plains division with territory consisting of Colorado, Wyoming, and portions of Montana. He will headquarter in Denver, Colo., and be responsible for contacting *McCoy Company*

FIFTH KILN, at left below, goes into operation at Permanente plant (see item above).



and Wortham Machinery Company, Caterpillar distributors in Denver and Cheyenne, respectively.

☆☆☆

Executive assignments in the A. O. Smith Corp., Milwaukee, Wis., go to: C. RIGBY, group executive in charge of Houston, Tex., plant; F. B. DUNN, in charge of personnel for both the Houston works and the company's entire southwest district administrative area; F. S. CORRELL, group executive for the Kankakee Works, Eastern Motor division at Tipp City, Ohio, and the company's heating division in Toledo, Ohio.

☆☆☆

Presidency of the Internal Combustion Engine Institute goes to W. M. HOLLAND, manager of manufacturer sales for the Industrial Power Division of the International Harvester Company.

☆☆☆

Fruehauf Trailer Company announces the appointments of AL MANERBINO, Denver, Colo., as service manager, Rocky Mountain division, and HANS HELMLE, Los Angeles, Calif., as service manager in the Northern Pacific Coast division.

☆☆☆

Crater Lake Machinery Co.'s new Klamath Falls, Ore., store opens for business. Partners in this Caterpillar-John Deere distributorship are STANLEY MILLER, president; G. C. LORENZ, vice president, and REUBEN R. LARSON, secretary. The new store at 1410 S. Sixth St. has 16,500



From left: Stanley Miller, president; G. C. Lorenz, vice-president, and Reuben R. Larson, secretary of Crater Lake Machinery Co., receive congratulations on the opening of the firm's new store at Klamath Falls, Oregon.

sq. ft. of space for service department, offices and show room facilities. Augmenting the store building on the same premises, is a 12,000-sq. ft. warehouse for general storage and implement setup, and an 8,800-sq. ft. building which houses track in press, steam cleaning and painting booth and welding shop.

☆☆☆

ERNEST A. DANIELS and EDWIN O. WILLIAMS are new members of the board of directors of the Victor Equipment Company. Daniels is the vice president in charge of sales, and Williams is vice president in charge of the Southern California district.

☆☆☆

McCoy Company, Caterpillar distributors for Colorado, add the Thew-Lorain line to their distribution. JOHN E. WOOD, former salesman for McCoy Company,

Continued on page 122



*...helps break
bottlenecks*

You can do those fastening jobs into steel, concrete, masonry in jig-time when you put RAMSET SYSTEM to work. Taking less than a minute per fastener from start to finish, RAMSET often reduces time by as much as 90% . . . cuts costs in proportion.

With the widest range of sizes and types of fasteners, with graded power charges and with the strong, sturdy, reliable RAMSET TOOLS, you have an unbeatable combination to save time and money on most fastening jobs.

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FASTER
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Pioneer in powder-actuated fastening



NEWS of DISTRIBUTORS AND FACTORY BRANCHES

Continued from page 121

now becomes sales manager for the used equipment department. DWIGHT L. TRESSLER replaces LLOYD FARIS as manager of the parts department, and CLARENCE RULE transfers from the Monte Vista, Colo., branch to head engine sales from Denver. Branch personnel changes include the appointment of GLENN MOFFITT as manager of the Sterling, Colo., branch and CHARLES CAMERON as manager of the Monte Vista branch. EDWARD BAYLES becomes sales representative for the central and northern sections of Colorado's western slope.

☆☆☆



WILLIAMS

JACK WILLIAMS becomes district representative for LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa, and his territory will be the Southwestern states. Williams formerly served on the sales staff of LaPlant-Choate sales and service, Oakland, Calif.

☆☆☆

Additional personnel for Minneapolis-Honeywell Regulator Company's industrial field staff include: MERLE O. EVERS, San Francisco, Calif., and FRANK J. STEVENS, Los Angeles, Calif. RALPH BROGIE is reassigned to San Francisco.

☆☆☆

JACK FINGLAND, formerly of Finning Tractor Equipment Company, Vancouver, B. C., joins the San Francisco, Calif., Bay Area field sales staff of Coast Equipment Co., construction, industrial and mining machinery distributor. FRANK N. DYER also comes to the San Francisco office.

☆☆☆

JOHN R. FENNIE becomes manager of the tubular products department, Joseph T. Ryerson & Son, Inc., Los Angeles, Calif., steel distributor. Fennie joins the firm after two years as assistant superintendent of Open Hearth, Kaiser Steel Company, Fontana, Calif.

☆☆☆

ROBERT H. STURGEON assumes the managerial responsibilities of the Seattle, Wash., office of the Harnischfeger Corporation, manufacturer of construction and industrial equipment.

☆☆☆

An expansion program that will increase manufacturing capacity at least one-third through enlargement of fabricating and machining facilities is under way at Hyster Company's three plants in Portland, Ore., Peoria, Ill., and Danville, Ill. The assembly building in Portland is being extended 240 ft. at the east end and 160

Continued on page 124

UNIT BID PRICES

Selected Bid Abstracts for Typical Western Projects

Building ...

Warehouse Building on Eklutna Project in Alaska

Alaska—Eklutna—Bureau of Reclamation. Sandvik and Roark, Ray F. James, Palmer, Alaska, with a bid of \$65,394, was low before the Bureau of Reclamation for constructing a warehouse building at Eklutna government camp, Eklutna project. Unit bids were as follows:

	(1)	(2)	(3)	(4)
(1) Sandvik and Roark, Ray F. James.....	\$65,394			
(2) Munter Construction Company.....	87,700			
(3) Denali Construction Company, Inc.....		\$98,980		
(4) Engineer's estimate			76,470	
5,600 cu. yd. excav. for warehouse site and drainage ditch.....	2.50	2.00	2.00	.80
450 cu. yd. excav. for structures.....	2.00	2.45	3.00	3.10
100 cu. yd. compacting embankments	3.00	1.00	4.00	3.70
260 cu. yd. compacting backfill	2.80	3.70	4.00	4.50
95 cu. yd. concrete in interior floor slab	51.00	60.00	70.00	50.00
123 cu. yd. concrete, except conc. in interior floor slab.....	105.00	105.00	95.00	75.00
300 bbl. furnishing and handling cement	11.00	16.60	11.00	6.20
21,600 lb. furnishing and placing reinforcement bars and fabric.....	.20	.27	.27	.20
100 linear feet excavation and backfill of water-service pipe trench	2.25	3.70	9.00	1.60
250 linear feet excav. and backfill of sewer pipe trenches not over 7 ft.	2.50	3.70	8.00	2.00
200 linear feet excav. and backfill of sewer pipe trenches over 7 ft. but not over 9 ft. deep	2.75	5.00	9.00	2.20
450 linear feet furnishing and laying sewer pipe	3.24	3.60	3.00	1.90
40 linear feet furn. and laying 18-in. diam. corrugated-metal pipe.....	5.72	6.40	10.00	6.00
Lump sum, erecting warehouse	\$21,000	\$40,737	\$51,000	\$46,000

System Dispatchers Building on Colorado-Big Thompson Project

Colorado—Larimer County—Bureau of Reclamation. Ring Construction Co., Colorado Springs, with a bid of \$258,423, was low before the Bureau of Reclamation for Schedule 2 construction of the system dispatchers building at Flatiron, Colorado-Big Thompson project. Unit bids were as follows:

	(1)	(2)	(3)	(4)	(5)
(1) Ring Construction Co.....	\$258,423				
(2) Mann Construction Co.....	263,208				
(3) G. L. Tarlton Contracting Co.....	275,070				
(4) John H. Keller Construction Co.....		\$282,385			
(5) Engineer's estimate			234,850		
2,030 cu. yd. excavation for building	.60	1.87	1.00	3.26	2.10
2,020 cu. yd. excavation for grading.....	.40	1.77	.75	1.65	1.20
850 cu. yd. backfill for building	.75	.80	.70	2.00	2.50
3,600 cu. yd. placing fills	.30	.70	.50	1.85	.70
280 cu. yd. gravel surfacing	5.00	6.00	5.00	7.52	2.10
570 cu. yd. concrete in building below elev. 5511.50	53.00	70.00	65.00	73.92	50.00
95 cu. yd. concrete except concrete in building	58.00	60.00	75.00	65.91	58.00
1,000 bbl. furn. and handling cement	5.80	5.37	6.00	5.76	5.10
73,500 lb. furn. and placing reinf. bars and fabric	.16	.168	.13	.154	.10
Lump sum, constructing the system dispatchers' building.....					

Sewerage ...

Sewage Pumping Station, Force Main and Treatment Plant

California—San Mateo County—Sanitary District—C. K. Moseman and Lew Jones Construction Co., San Jose, Calif., with a joint bid of \$763,129, were low before the Menlo Park Sanitary District for construction of a sewerage pumping station, force main and sewage treatment plant in San Mateo County. Unit bids were as follows:

	(1)	(2)	(3)	(4)	(5)
(1) C. K. Moseman & Lew Jones Construction Co.	\$763,129				
(2) C. N. Swenson & A. J. Peters & Son 773,105					
(3) Williams and Burrows		\$777,830			
(4) P. Sorenson			786,990		
(5) F. J. Early, Jr.....				823,630	
Pumping station—grading and paving	983.00	689.00	690.00	474.00	947.00
Pumping station—fencing	961.00	965.00	900.00	910.00	\$1,020
Pumping station—structure	\$55,099	\$46,611	\$49,680	\$54,730	\$52,760
Pumping station—grating and railing	\$4,134	\$4,575	\$4,680	\$4,906	\$5,620
Pumping station—main sewage pumps.....	\$9,820	\$7,081	\$7,100	\$11,000	\$5,420
Pumping station—float control for main pumps	611.00	583.00	700.00	625.00	454.00
Pumping station—cranes	585.00	\$1,405	900.00	600.00	793.00
Pumping station—bar racks and appurtenances	961.00	919.00	970.00	900.00	\$1,130
Pumping station—sluice gates	\$1,233	576.00	500.00	\$1,500	580.00
Pumping station—ventilating systems	729.00	565.00	\$1,800	\$1,100	902.00
Pumping station—plumbing and drainage	\$1,329	\$2,240	\$2,510	\$2,500	\$2,370
Pumping station—fresh water pressure system	\$6,368	\$6,665	\$10,200	\$11,983	\$9,360
Pumping station—fresh water system piping	759.00	642.00	700.00	700.00	932.00
Pumping station—painting	966.00	995.00	950.00	\$3,500	\$1,000
Timber piling	\$61,957	\$65,043	\$56,112	\$61,957	\$72,470
Force main—pumping station to treat plant	\$60,393	\$51,581	\$44,900	\$58,363	\$65,140
Fresh water pipeline—pumping sta. to treat plant.....	\$6,650	\$5,026	\$8,400	\$10,890	\$7,490
Protective culvert for Leslie Salt force main.....	\$2,278	\$2,592	\$2,630	\$1,999	\$2,510
Treatment plant—earthwork	\$57,460	\$81,326	\$82,500	\$34,913	\$40,440
Treatment plant—paving and curbing	\$14,254	\$20,454	\$14,200	\$13,800	\$26,820
Treatment plant—interconnecting sewage piping	\$9,724	\$8,179	\$11,900	\$13,173	\$11,000
Treatment plant—30-in. outfall sewer	\$4,934	\$3,884	\$8,100	\$4,680	\$4,890
Treatment plant—outside raw sludge line	\$6,582	\$1,564	\$1,000	\$11,568	\$2,530
Treatment plant—outside digested sludge line	\$1,701	998.00	\$1,700	\$1,650	\$1,130
Treatment plant—outside fresh water piping	601.00	574.00	850.00	\$1,103	\$1,100
Treatment plant—wash water distribution system	\$4,430	\$2,750	\$4,550	\$4,730	\$4,070
Treatment plant—compressed air system	759.00	792.00	740.00	\$1,157	648.00
Treatment plant—drainage system	\$5,050	\$7,005	\$9,000	\$10,170	\$13,610
Treatment plant—area drainage system	\$1,868	\$3,030	\$2,200	\$1,749	\$2,870

(Continued on next page)

SEE YOUR **MICHIGAN** DISTRIBUTOR

STEFFECK EQUIPMENT CO., INC.

P. O. Box 584
Helena, Montana

MODERN MACHINERY CO., INC.

P. O. Box 2152
Spokane 2, Washington

WESTERN EQUIPMENT CO.

2244 N.W. Savier St.
Portland 10, Oregon
also

1360 West First Ave.
Eugene, Oregon

SPEARS-WELLS MACHINERY CO.

1832 West Ninth St.
Oakland 7, California

SMITH BOOTH USHER COMPANY

2001 Santa Fe Ave.
Los Angeles, California

THE SAWTOOTH CO.

715 Grove Street
Boise, Idaho

HEINER EQUIPMENT & SUPPLY CO.

501 West 7th South
Salt Lake City 4, Utah
also

3301 Walnut St.
Denver 5, Colorado

WILSON EQUIPMENT CO.

P. O. Box 218
Cheyenne, Wyoming
also

WILSON EQUIPMENT & SUPPLY

Box 519, 414 S. Elm Street
Casper, Wyoming

MICHIGAN SALES & SERVICE CO.

1506 Fifteenth Avenue West
Seattle 99, Washington

CONTRACTORS' EQUIP. & SUPPLY CO.

P. O. Box 456
Albuquerque, New Mexico
and
P. O. Box 2039, El Paso Texas

JAMES CASHMAN

107 N. Main Street
Las Vegas, Nevada

NEIL B. MCGINNIS CO.

P. O. Box 3615
500 South Central Ave
Phoenix, Arizona

SMITH, INC.

1620 First Avenue North
Fargo, North Dakota



**EVER WIN A
COMPETITIVE BID
BECAUSE OF A
TRUCK CRANE?**

Here's one contractor who did! As an example of the advantages inherent in MICHIGAN Truck Cranes, Mr. Gurtzweiler of Henry Gurtzweiler, Inc., Toledo, cited a competitive-bid job.

Other contractors figured on the necessity of using a large crane with long boom to reach from outside a building being erected. Gurtzweiler, taking advantage of his MICHIGAN'S compact size and maneuverability, planned to work from a central point *inside* the building. Result? Henry Gurtzweiler, Inc. got the job . . . another of the many on which the MICHIGAN has given them a competitive advantage.

Moreover, Mr. Gurtzweiler states that although the truck crane is five years old and never has had an idle day, it is still in perfect condition and has had very little maintenance. Why settle for less? Next time you need a truck crane . . . get a MICHIGAN!

MICHIGAN POWER SHOVEL COMPANY

430 Second Street, Benton Harbor, Michigan, U. S. A.

NEWS of DISTRIBUTORS AND FACTORY BRANCHES

Continued from page 122

ft. at the west end to provide more space for present assembly equipment and centralization of the plate shop. The east end extension will span a railroad spur to further facilitate the receiving of raw materials and the shipment of Hyster Lift Trucks and tractor attachments.

☆☆☆

Caterpillar Tractor Co.'s Western sales division will have WALDO J. MORDINI as engine sales supervisor. He will headquarter at the firm's San Leandro, Calif., plant. Mordini succeeds J. J. SIMKO, who becomes assistant manager, sales engineering division, Peoria, Ill.

☆☆☆

Los Angeles, Calif., division of the *Four Wheel Drive Pacific Company* is now located in its new quarters at 2700 to 2714 S. Broadway, Los Angeles. Show room, larger office space, a modern repair department, and a new and larger parts department highlight the new facilities.

☆☆☆

Curtiss & Smith Mfg. Corp., 123 East Fourth St., Pottstown, Pa. become manufacturers and distributors of tools and equipment for servicing the complete line of *Cummins Diesel Engines*. All Curtiss & Smith tools are available coast-to-coast through dealers and distributors.

NEWS of MANUFACTURERS

Johns-Manville Corporation announces the appointment of three new vice presidents, J. A. O'BRIEN, general manager of the industrial products division, HAROLD R. BERLIN, general manager of the J-M building products division and A. S. ELSNBAST, general manager of the J-M Celite division. They will take an active part in the work of the new company planning board, which will seek to analyze the policy and coordinate the activities of the various J-M divisions. CLIFFORD F. RASSWEILER, newly appointed vice chairman of the board, is in charge of organizing and directing the new planning board.

☆☆☆

Several changes are taking place among the branch managers of *Independent Pneumatic Tool Company*, Aurora, Ill. JOHN B. DEMPSEY goes to the Detroit, Mich., branch, succeeding ROBERT C. FAVERTY, who becomes managing director of *Armstrong-Whitworth and Co., Pneumatic Tools, Ltd.*, England. EDWARD KRANTZ, New York, replaces Dempsey at Pittsburgh, and WILLIAM J. MCGRAW, Cleveland, replaces Krantz at New York.

Continued on page 126

UNIT BID PRICES . . . CONTINUED

	(1)	(2)	(3)	(4)	(5)
Treatment plant—painting	\$9,803	\$10,076	\$9,950	\$10,500	\$10,740
Treatment plant—equipment and supplies	\$3,719	\$4,160	\$3,300	\$3,500	\$3,510
Inlet works—structure	\$12,475	\$7,772	\$9,300	\$8,590	\$8,910
Inlet works—grating and railing	\$7,910	\$8,073	\$9,500	\$12,000	\$13,710
Inlet works—automatic bar screen and grinder	285.00	\$2,162	\$1,500	\$1,200	253.00
Inlet works—grit collection system	376.00	\$2,792	\$2,500	\$3,500	440.00
Inlet works—sewage flow transmitter	102.00	314.00	250.00	500.00	210.00
Inlet works—sluice gates	285.00	192.00	350.00	270.00	73.00
Pretreatment tanks—structural	\$18,387	\$12,940	\$14,555	\$16,426	\$14,810
Pretreatment tanks—grating and railing	\$5,545	\$5,975	\$6,400	\$10,500	\$12,410
Pretreatment tanks—grease flotation units	432.00	\$1,151	\$1,500	\$1,500	360.00
Pretreatment tanks—scum collection systems	\$5,068	\$4,585	\$3,500	\$5,231	\$3,010
Sedimentation tanks—structure	\$54,347	\$43,705	\$47,700	\$48,585	\$52,410
Sedimentation tanks—grating and railing	\$16,880	\$34,768	\$20,200	\$30,000	\$36,910
Sedimentation tanks—scum collection units	\$1,338	\$2,586	\$2,770	\$2,069	\$1,310
Sedimentation tanks—sludge collection units	\$2,249	\$6,397	\$1,200	\$7,000	\$3,210
Sedimentation tanks—sludge air lift systems	\$1,113	\$1,548	\$1,500	\$1,450	\$1,440
Sedimentation tanks—raw sludge pumping system	\$1,271	\$1,116	\$1,700	\$1,800	\$1,610
Sedimentation tanks—effluent troughs	\$5,074	\$4,220	\$5,500	\$4,097	\$2,010
Sedimentation tanks—sluice gates	337.00	161.00	450.00	400.00	141.00
Sedimentation tanks—architectural plumbing	345.00	683.00	510.00	850.00	\$1,010
Sedimentation tanks—ventilation system	292.00	225.00	350.00	450.00	364.00
Operations building—structural	\$40,368	\$42,086	\$31,820	\$44,190	\$48,510
Operations building—grating and railing	\$6,857	\$7,390	\$8,480	\$9,500	\$11,310
Operations building—sludge heating system	\$4,831	\$2,500	\$6,100	\$4,500	\$3,010
Operations building—sludge circulation system	\$3,695	\$2,521	\$2,340	\$4,500	\$2,710
Operations building—sludge sampling system	970.00	343.00	500.00	600.00	635.00
Operations building—supernatant system	\$1,730	\$1,876	\$1,700	\$1,700	\$1,210
Operations building—sludge gas system	\$2,901	\$2,774	\$2,500	\$3,372	\$3,290
Operations building—emergency fuel oil system	480.00	187.00	500.00	\$1,145	433.00
Operations building—digester control indicating meters	\$1,040	\$2,436	\$2,800	400.00	\$2,510
Operations building—heating and ventilation	\$3,072	\$2,378	\$2,850	\$2,500	\$3,810
Operations building—architectural	\$1,808	\$2,820	\$3,700	\$4,800	\$4,510
Operations building—lab. equip., furniture, apparatus, chem.	\$5,481	\$6,466	\$14,800	\$4,883	\$5,830
Operations building—miscellaneous furniture	\$1,141	\$1,020	\$2,520	\$1,125	\$1,310
Operations building—garage equipment and supplies	\$1,193	\$2,023	\$1,100	\$1,105	\$1,200
Digester—structure	\$49,944	\$57,000	\$51,700	\$46,033	\$46,210
Digester—access stairs	\$2,034	\$2,545	\$2,425	\$2,400	\$2,510
Digester—piping to outside wall of tank	\$2,305	\$2,650	\$3,410	\$5,200	\$3,010
Digester—floating cover and accessories	\$39,251	\$33,680	\$35,800	\$36,218	\$37,610
Digester—floating cover position, transmitter and temp. transmitter	932.00	\$1,100	\$2,550	\$1,695	\$1,610
Sludge beds—concrete work	\$26,494	\$16,000	\$32,635	\$21,199	\$27,000
Sludge beds—gravel and sand filtering material	\$13,560	\$17,000	\$13,770	\$10,800	\$17,210
Sludge beds—sludge distribution lines	\$2,085	\$2,700	\$2,200	\$3,800	\$2,210
Sludge beds—underdrainage system	\$11,498	\$9,000	\$9,900	\$7,074	\$4,710
Chlorine building—structure and equipment	\$3,356	\$5,700	\$4,800	\$10,456	\$10,310
Wash water reservoir	\$4,002	\$2,800	\$3,500	\$3,264	\$3,800
Drainage sump structure	\$4,184	\$3,200	\$3,390	\$3,785	\$4,110
Treatment plant and pump station—electrical works	\$57,105	\$58,000	\$54,500	\$53,000	\$62,500

Bridge and Grade Separation . . .

Steel and Concrete Bridge in Los Angeles

California—Los Angeles County—State Division of Highways. Charles MacClosky, San Francisco, winner of a bid of \$273,820, was low before the State Division of Highways for construction of a bridge, reinforced concrete and structural steel, across San Gabriel River on Beverly Blvd. Unit bids were as follows:

(1) Charles MacClosky	\$273,820	(3) John Struna	\$295,110
(2) George W. Peterson and Jack W. Baker	274,970	(4) J. E. Haddock, Ltd.	335,370
		(5) Macco Corporation	344,300

	(1)	(2)	(3)	(4)	(5)
1,880 cu. yd. imported borrow	.70	1.50	1.50	1.80	1.10
1,450 cu. yd. structure excavation	2.00	6.00	13.26	20.00	5.10
42 M.F.B.M. treated Douglas fir timber	320.00	350.00	290.00	350.00	350.00
305 cu. yd. Class "A" P.C.C. (footing block)	20.00	25.00	30.70	22.00	20.00
2,320 cu. yd. Class "A" P.C.C. (structure)	50.00	42.00	51.54	53.00	63.00
47,000 lb. structural steel	.195	.21	.22	.24	.21
28,500 lb. miscellaneous steel	.35	.30	.27	.34	.61
2,000 lin. ft. furn. treated Douglas fir piling	2.00	2.25	2.00	2.40	1.80
6,675 lin. ft. furn. cast-in-place conc. piling	3.20	3.40	3.20	3.90	4.80
267 cu. driving piles	84.00	80.00	74.00	103.00	100.00
3,100 sq. ft. steel sheet piling	3.00	4.50	2.30	3.50	3.00
160 cu. yd. light stone riprap	7.00	12.00	15.93	12.00	20.00
444,000 lb. bar reinforcing steel	.095	.095	.10	.11	.10
Lump sum, chain link fencing and gates	\$2,300	\$4,300	\$2,530	\$5,000	\$4,500
780 lin. ft. steel railing	11.20	12.00	11.44	11.50	15.00
Lump sum, gaging station	\$2,300	\$2,000	\$1,274	\$2,300	\$3,920
Lump sum, office facilities	\$1,200	\$3,000	\$2,000	\$1,400	\$1,500

Concrete and Steel Bridge at Centralia, Washington

Washington—Lewis County—Department of Highways. Anderson Bridge Construction Co., Tacoma Wash., with a bid of \$314,475, awarded contract by the Department of Highways for the Skookumchuck River bridge in Centralia. Unit bids were as follows:

(1) Anderson Bridge Construction Co.	\$314,475	— J. A. Troxell	\$347,850
(2) MacRae Bros.	314,769	— Bennett Campbell	358,795
(3) Valley Construction Company	329,499	— Donald M. Drake Company	361,940
(4) General Construction Company	338,413	— Neukirk Bros.	365,359
(5) David Nygren	341,338	— W. J. Park & Sons	366,090
(6) N. Florio Co.	342,312	— Guy F. Atkinson	406,400
— Lockyear & White	342,395	— Roy T. Early Co.	437,860
— M. P. Butler	346,058		

	(1)	(2)	(3)	(4)	(5)	(6)
20,900 cu. yd. common excav., incl. haul of 600 ft.	.58	.60	.60	.40	.50	.70
4,500 cu. yd. stas. overhaul	.03	.04	.02	.02	.02	.00
20 day tamping roller	50.00	75.00	50.00	40.00	50.00	75.00
2,640 cu. yd. structure excavation	2.00	3.70	5.00	4.00	7.00	4.00
Lump sum, shoring and cribs	\$20,000	\$25,300	\$40,000	\$37,500	\$30,000	\$30,000

(Continued on next page)

DAM FACE-LIFTING

Veteran NOBLE Plant Batches Concrete For Diablo Dam

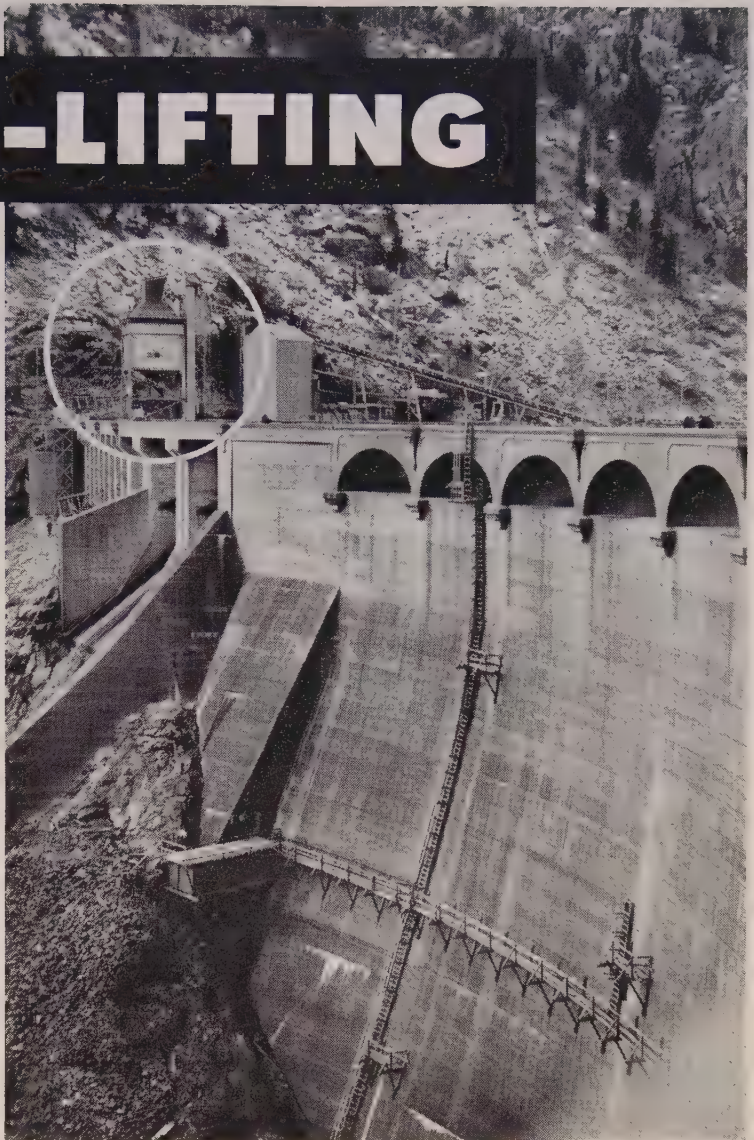
PORTABILITY SOLVES MOVING PROBLEM—When Morrison-Knudsen took the job of face-lifting Diablo Dam for the Seattle Department of Lighting, they decided to move in a NOBLE CA354 batching plant from Boysen Dam, to do the job. The only practical way to reach Diablo Dam is by special railroad and a 68% funicular lift. All NOBLE plants are built for easy dismantling and transport, so moving the CA354 was accomplished quickly and without mishap.

MEETS EXACTING SPECIFICATIONS PROFITABLY—

This plant batched rich cement for grouting age cracks, and mass concrete for spillway extensions, and for covering eroded rocks. No matter what the specifications, NOBLE's automatic cement weigh meets them accurately... no under-weighing to get you into trouble with inspectors; no over-weighing to run up costs.

SIZES TO FIT ALL NEEDS—Standard NOBLE units include aggregate bins from 80 to 1500 tons; cement silos from 500 cu. ft. to 7500 bbls., weigh hoppers from 1 to 4 yds.

Like Morrison-Knudsen, you can have a NOBLE plant that meets your special needs, engineered from these standard units — usually at stock model prices. Wire, write or phone NOW. No obligation.



Diablo Dam with scaffolding and ladders in place for grouting. NOBLE 350-ton batching plant sits on crest of dam, has 4-compartment bin and 500-bbl. cement batch silo. Hood over aggregate bin keeps gale-like winds from scattering aggregate coming off conveyor.

Job Use Proves NOBLE Value

Here are a few of the recent dam and water projects and contractors using Noble-batched concrete...

McNary Dam
Big Creek Dam
Main Canal, Columbia Basin
East Low Canal, Columbia Basin
Grand Coulee Pumping Plant
Friant-Kern Canal
Westpoint Powerhouse
Garrison Dam
Boysen Dam

McNary Dam Contractors
Morrison-Knudsen & Bechtel
Morrison-Knudsen
J. A. Tertling
Morrison-Knudsen & Peter Kiewit
Peter Kiewit Sons
Utah Construction
Peter Kiewit & Morrison-Knudsen
Morrison-Knudsen

DESIGNERS AND BUILDERS OF

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

NOBLE CO.

1860-7th STREET • OAKLAND 20, CALIFORNIA • TELEBAR 2-5735

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

NEWS of MANUFACTURERS

Continued from page 124

land, Ohio, succeeds Krantz in New York. CLARENCE B. BERGREN, service engineer, St. Louis, Mo., succeeds McGraw at Cleveland.

☆☆☆

FREDERICK W. THOMAS and GEORGE R. Fox take over new positions with the *Joy Manufacturing Company* of Pittsburgh, Pa. Thomas becomes director of purchases for the company. He was formerly general manager of purchases for *Worthington Pump and Machinery Corporation*, Harrison, N. J. Fox is now vice president in charge of the company's plant expansion program. He has been with Joy since 1945.

☆☆☆

JOHN N. BYRNE is the new superintendent of *Pabco Products, Inc.'s* asbestos-cement plant at Redwood City, Calif. A chemistry graduate of the University of California, Byrne has been with Pabco since 1941.

☆☆☆

Shepherd Tractor & Equipment Co., Los Angeles, Calif., proceeds with the rehabilitation of 228 pieces of heavy duty construction equipment out of Port Hueneme, Calif., at the direction of the United States Navy Bureau of Yards and Docks. The work involves a contract in excess of \$1,000,000, and covers the repair and rebuilding of earthmoving equipment to be used by the Seabees in their activities.

☆☆☆

JOHN MIKULAK is the new assistant vice president in charge of manufacturing for *Worthington Pump and Machinery Corporation*, Harrison, N. J.

☆☆☆

WILLIAM A. BURNS, JR., vice president and sales manager of the *Trailmobile Company*, Cincinnati, Ohio, and J. B. WHARTON, JR., Trailmobile vice president and treasurer, are elected to serve on the company's board of directors.

☆☆☆

DALE D. SPOOR, manager of the equipment sales department of *Air Reduction Sales Company*, New York, N. Y., takes a leave of absence from the company to serve with the *National Production Authority*, Washington, D. C. Spoor will head the group which concerns itself with welding equipment, apparatus, supplies, electrodes and welding rod.

☆☆☆

LESLIE M. CASSIDY is the new chairman of the board and chief executive officer of *Johns-Manville Corporation*, and ADRIAN R. FISHER is the president of the corporation. Cassidy succeeds the late LEWIS H. BROWN.

☆☆☆

WILLIAM R. WILKINSON is now vice president for sales and KENNETH W. HUFFINE is appointed vice president for production of *Johns-Manville Corporation*.

Continued on page 128

UNIT BID PRICES CONTINUED

BRIDGE	(1)	(2)	(3)	(4)	(5)	(6)
622 cu. yd. concrete Class A in place.....	70.00	64.00	57.50	72.50	80.00	65.60
900 cu. yd. concrete Class F in place.....	40.00	29.00	50.00	31.00	40.00	50.00
1,000 cu. yd. concrete Class H in place.....	24.00	18.50	20.00	20.00	15.00	15.60
177,000 lb. steel reinforcing bars in place.....	.105	.11	.12	.115	.11	.11
707,000 lb. structural carbon steel in place.....	.21	.22	.19	.23	.22	.22
7,700 lb. cast steel in place.....	.55	.63	.70	.55	.60	1.40
104 lb. copper seals in place.....	2.00	3.00	1.00	2.00	2.00	3.40
12 only bridge drains complete in place.....	75.00	75.00	70.00	100.00	60.00	75.60

Highway and Street...

Access Road to Los Alamos Project in New Mexico

New Mexico—Los Alamos—Bureau of Public Roads. Jack Adams, Santa Fe, with a bid of \$270,900, was low before the U. S. Bureau of Public Roads for construction of an access road for the Atomic Energy Commission's Los Alamos project. Unit bids were as follows:

(1) Jack Adams.....	\$270,900	(4) J. W. Jones.....	\$301,000
(2) Lowdermilk Bros.....	261,830	(5) J. F. Byrd.....	325,000
(3) J. E. Skousen.....	270,836	(6) W. T. Bookout Construction Co.....	329,400

	(1)	(2)	(3)	(4)	(5)	(6)
45 acre clearing and grubbing.....	100.00	150.00	250.00	290.00	200.00	200.00
100,000 cu. yd. unclassified excavation.....	.30	.34	.45	.40	.38	.38
275 cu. yd. unclassified excav. for struts.....	2.00	4.00	2.00	5.00	2.00	3.80
58,000 cu. yd. unclassified excav. for borrow, Case 1.....	.30	.38	.25	.35	.36	.36
50,000 sta. yd. overhaul (1,000-ft. free haul).....	.02	.02	.03	.02	.03	.03
35,000 cu. yd. M. special overhaul of borrow (1,000 ft. free haul).....	.25	.20	.20	.20	.05	.05
Contingent sum, obliteration of old rdways. to be paid for as earned.....	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
6,300 unit watering embankment, Item 29.....	2.00	1.50	1.50	2.00	4.00	2.20
850 unit watering of base course, Item 52A.....	2.00	1.50	2.00	2.00	4.00	2.20
Lump sum, providing and maint. water plant or plants.....	500.00	500.00	\$1,000	\$1,500	400.00	1.40
1,050 hr. rolling of embankment, Item 29.....	5.00	9.00	4.50	7.00	10.00	8.00
170 hr. rolling of base course, Item 52A.....	5.00	9.00	5.00	6.00	7.00	8.00
36,000 ton selected borrow for subgrade.....	.60	.55	.65	.80	1.00	1.10
20,500 ton crushed gravel or crushed stone base course, Class 2, Grading C-1.....	1.25	1.75	1.40	1.90	2.00	1.10
62,000 gal. M.C. cutback asph., Grade 0 or 1, for prime coat.....	.165	.16	.18	.16	.14	.14
1,100 ton cover aggre. for Type 3 seal coat, grading B.....	6.00	5.00	7.00	6.25	6.00	6.00
40,000 gal. R.C. cutback asph., Grade 2, 3, or 4, for seal coat.....	.165	.17	.19	.18	.17	.17
9,300 ton (Cl. F pavement, Type F-1) plant mixture, grading B.....	5.00	5.00	5.25	5.50	6.75	6.00
530 ton asphalt (Grade 200-300) for Type F-1.....	35.55	37.50	40.00	34.50	42.00	50.00
305 cu. yd. conc., Cl. A (air-entrained conc., low-alkali cem.).....	40.00	37.50	40.00	70.00	50.00	50.00
800 lb. reinforcing steel.....	.20	.25	.20	.20	.20	.20
1,158 lin. ft. 24-in. C.G.S.M. culvert pipe.....	5.00	5.25	6.00	5.80	6.50	6.00
68 lin. ft. 30-in. C.G.S.M. culvert pipe.....	10.00	7.50	7.00	5.75	7.50	7.00
36 ea. 24-in. metal pipe end sections.....	150.00	50.00	50.00	50.00	50.00	47.00
150 ea. timber guide posts with warning reflectors (treated).....	6.00	7.50	6.00	6.00	5.50	10.00
1,200 lin. ft. remove and rebuild wire fence.....	.10	.25	.20	.25	.40	.40
13,000 lin. ft. remove and rebuild telephone line.....	.001	.001	.0001	.001	.0001	.00

Grading, Asphaltic Concrete Paving and Oil Mat Surfacing

Oregon—Hood River County—Oregon State Highway Department—Vernie Jarl, Gresham, Ore., with a bid of \$928,820.00 was low bidder for grading and paving of 3.7 mi. and 1.89 mi. of grading and oil mat surfacing on the Herman Creek Section of the Columbia River Highway in Hood River County. Unit bids were as follows:

(1) Vernie Jarl.....	\$ 928,820.00	(5) Parker Schram Co.....	\$1,015,928.00
(2) Peter Kiewit Sons' Co.....	973,600.50	(6) McNutt Bros.....	1,030,332.00
(3) Guy F. Atkinson Co.....	984,143.00	(7) J. N. & M. J. Conley.....	1,096,855.00
(4) Leonard & Slate Oregon Ltd. & E. C. Hall Co.....	998,300.00	(8) Kuckenberg Construction Co.....	1,115,767.00

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lump sum, clearing and grubbing.....	\$40,000	\$52,000	\$93,000	\$80,000	\$87,000	\$69,375	\$95,000	\$112,500
700 cu. yd. struct. excav., unclass.....	3.00	5.00	6.00	4.00	5.00	9.00	4.00	7.00
722,000 cu. yd. gen. excav., unclass.....	.84	.88	.81	.84	.87	.92	.95	.95
2,320,000 cu. yd. sta. short haul.....	.015	.01	.006	.02	.01	.01	.015	.01
53,000 cu. yd. sta. long overhaul.....	.50	.50	.42	.50	.60	.50	.40	.40
3.70 mi. finishing r'dbed & slopes.....	500.00	600.00	600.00	\$1,000	\$1,000	\$1,500	\$1,000	\$1,000
9,300 lin. ft. rounding cutbanks.....	.15	.10	.15	.20	.20	.30	.15	.15
100 lin. ft. 18-in. corr. metal pipe.....	4.00	4.00	4.20	4.00	4.25	4.35	4.00	4.00
380 lin. ft. 24-in. corr. metal pipe.....	6.00	6.00	6.20	6.00	6.30	6.45	6.00	6.00
890 lin. ft. 24-in. corr. metal pipe, extra str.....	7.00	8.00	8.80	7.00	9.00	8.10	8.00	8.00
130 lin. ft. 36-in. corr. metal pipe, extra str.....	12.00	13.00	14.00	13.00	14.30	14.75	12.00	12.00
170 lin. ft. 12-in. conc. pipe.....	3.00	1.60	2.00	2.50	2.10	2.10	2.00	2.00
790 lin. ft. 18-in. conc. pipe.....	4.00	3.60	3.60	4.00	3.80	3.85	3.50	3.50
130 lin. ft. 24-in. conc. pipe.....	6.00	6.50	5.00	5.50	5.20	5.30	5.50	5.50
160 lin. ft. 24-in. conc. pipe, extra strength.....	7.00	7.20	6.00	6.00	6.00	5.85	6.00	5.50
180 lin. ft. 30-in. conc. pipe, extra strength.....	8.00	8.80	7.50	7.50	7.65	8.10	7.00	7.00
100 cu. yd. Class "A" conc.....	60.00	67.00	75.00	55.00	60.00	60.00	67.00	70.00
15,000 lb. metal reinforcement.....	.12	.13	.13	.12	.14	.125	.13	.13
1 only conc. catch basins.....	75.00	85.00	100.00	100.00	75.00	300.00	85.00	100.00
1 only Type "A" manholes.....	300.00	350.00	360.00	200.00	250.00	400.00	350.00	375.00
150 only conc. sight posts.....	10.00	10.00	10.00	10.00	12.50	9.00	11.00	10.00
55,700 cu. yd. 3-in. - 0 matl. in base.....	1.50	1.50	1.90	1.70	1.80	1.10	1.85	1.10
9,900 cu. yd. 3/4-in. - 0 matl. in base and shoulders.....	2.00	1.65	2.40	1.95	2.20	2.75	2.35	2.00
1,400 M. gal. sprinkling.....	2.00	3.00	3.00	2.50	2.50	1.50	1.80	2.00
3.70 mi. prep. of base, main hwy.....	200.00	350.00	500.00	200.00	200.00	600.00	275.00	200.00

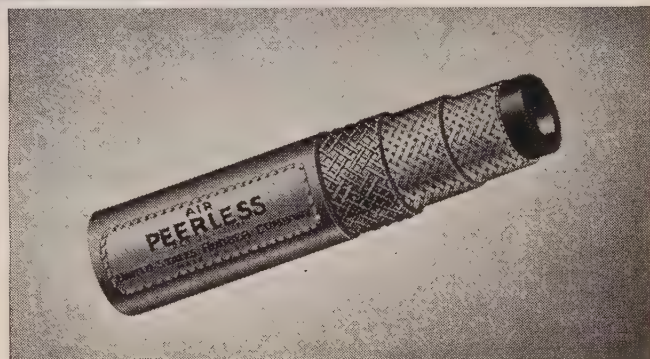
(Continued on next page)

What's U. S. Rubber doing to save you precious time?

CONTRACTORS PREFER "U. S." Suction and Discharge Hose because it is so flexible and strong, yet lighter in weight than the ordinary hose. It can readily be rounded out, if crushed or flattened.



Contractors today, on big jobs or small, all over the nation depend on "U. S." products to speed up their work, and cut down operating costs. Each of these products is engineered for the particular job, depending on the service requirements. They are located in convenient branch stocks throughout the country for quick supply and delivery. Each product has been developed and perfected by "U. S." experts in construction work, men who have at their disposal the finest laboratories and immense research facilities. You may place the utmost confidence in "U. S." products for the construction industry.



U. S. PEERLESS Air Hose has oil-resistant synthetic rubber lining, and a tough, flexible, rubber compound cover with a resilient surface workman like to handle. Withstands both hot or cold oil in the air line.



U. S. WIZARD Square Braided Asbestos Packing is specially designed for reciprocating rods and plungers, valve stems, and centrifugal pumps handling steam, air, ammonia, oil, hot and cold water, chemicals and some acids. Provides the proper density and minimizes friction and wear of rods and shafts.

PRODUCTS OF

U. S. RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

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

NEWS of MANUFACTURERS

Continued from page 126

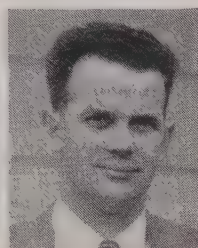
Both men have been with the firm for 26 years and offer wide experience to their new positions. Wilkinson comes from the position of general merchandise manager of the building products division, and Huffine was director of the company's general engineering department.

☆☆☆

MAURICE J. ERISMAN becomes chief engineer of the *Link-Belt Company's* Pershing Road Chicago plant. HOMER J. FOYE, a University of California mechanical engineering graduate, replaces Eris-



ERISMAN



FOYE

man as chief engineer at Los Angeles, Calif. Foye started in the company's San Francisco, Calif., plant in 1935 and moved to Seattle, Wash., as chief engineer in 1947.

☆☆☆

WALTER A. RENTSCHLER, vice president in charge of *Lima-Hamilton Division* of *Baldwin-Lima-Hamilton Corporation* with plants in Middletown, Hamilton and Lima, Ohio, announces the appointment of HENRY BARNHART as general manager of the Lima, Ohio, plant and J. F. CONNAUGHTON as assistant general manager. Both men have been with the company since 1928.

☆☆☆

JOHN T. MONAHAN is now assistant sales manager of the Safety Products Division, *American Optical Company*, Southbridge, Mass. Monahan joined the company in 1943 as a development engineer and worked on the development of respirators.

☆☆☆

Independent Pneumatic Tool Co., Aurora, Ill., announces the purchase of *Armstrong-Whitworth and Company, Pneumatic Tools, Ltd.*, Gateshead-on-Tyne, England. The British company now becomes an affiliate of the American producer of Thor portable power tools, which operates in London, England, Aurora, Ill., and Los Angeles, Calif. The concern has 20 branches in the United States and Canada.

☆☆☆

FRANCIS K. McCUNE takes over as manager of engineering of *General Electric Company's* Large Apparatus division. He was formerly assistant general manager of the company's Nucleonics department with

Continued on page 130

UNIT BID PRICES . . . CONTINUED

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.89 mi. prep. of base, detour and service road	250.00	350.00	500.00	250.00	250.00	400.00	300.00	300.00
730 cu. yd. ¾-in. - 0 matl. in bndr. course	3.50	3.60	4.50	3.50	2.85	3.75	3.70	4.00
120 ton furn. and placing RC-3 asph. in binder crse.	42.00	48.00	44.00	40.00	44.00	45.00	42.50	43.00
750 cu. yd. furn.-and placing aggr. 65 ton furn. and placing 150-200 asph.	3.80	4.10	4.50	3.95	4.50	6.00	3.70	4.00
11,000 ton Cl. "B" asph. conc.	40.00	45.00	43.00	38.00	47.00	80.00	40.00	40.00
50 ton RS-1 emuls. asph. in seal coat	5.90	7.00	7.00	6.30	5.75	7.00	7.00	6.00
290 cu. yd. aggr. in seal coat	40.00	50.00	55.00	43.00	46.00	50.00	43.50	40.00
	4.25	4.10	4.40	4.50	4.50	5.00	4.00	5.00

Portland Cement Concrete Paving on Cement-Treated Subgrade

California—Merced and Stanislaus Counties—Division of Highways. United Concrete Pipe Corp., Baldwin Park, Calif., with a bid of \$617,724, was low before the Division of Highways for construction of a State highway between Merced River Bridge and Turlock overhead about 5.6 mi. in length, to be graded and paved with Portland Cement concrete on cement-treated subgrade. Unit bids were as follows:

(1) United Concrete Pipe Corp.	\$617,724	(5) Harms Bros.	\$737,000
(2) Guy F. Atkinson	693,448	(6) Fredrickson & Watson Construction Co.	898,970
(3) M. J. B. Construction Co.	724,262		
(4) Ball & Simpson	728,343		

	(1)	(2)	(3)	(4)	(5)	(6)
2,390 cu. yd. removing concrete	3.00	2.70	3.00	3.50	4.00	4.00
297 sta. clearing and grubbing	40.00	46.00	60.00	80.00	55.00	55.00
90,000 cu. yd. roadway excavation	.30	.34	.45	.48	.40	.30
1,200 cu. yd. structure excav.	3.00	3.20	3.00	3.20	3.00	4.00
60 cu. yd. ditch and channel excav.	1.00	4.20	2.00	2.40	1.50	3.00
2,330,000 sta. yd. overhaul	.005	.005	.004	.004	.004	.004
126,100 sq. yd. compacting original ground	.04	.05	.05	.05	.04	.04
38,500 cu. yd. imported borrow	.75	.90	.80	.85	.80	1.20
37 ton straw cover matl. (erosion control)	50.00	50.00	60.00	66.00	70.00	60.00
2,000 lb. seed (erosion control)	.20	.22	.28	.33	.40	.70
Lump sum, dev. wat. supply and furn. wat. equip.	\$8,500	\$4,150	\$10,000	\$4,000	\$2,500	\$5,600
9,500 M. gal. applying water	1.25	1.45	1.00	1.25	1.20	1.50
297 sta. finishing roadway	12.00	11.00	15.00	22.00	15.00	36.00
83,000 sq. yd. mixing and compacting (C.T.S.)	.22	.21	.22	.21	.22	.20
3,820 bbl. Portland cement (C.T.S.)	4.50	3.50	4.20	4.76	4.20	4.50
40,700 ton untreated rock base	1.75	2.25	1.95	1.91	2.40	2.80
142 ton liq. asph. SC-2 (pen. tr. & pr. ct.)	25.00	27.50	32.00	31.00	30.00	35.00
250 ton asph. emuls. (pt. bdr. sl. ct. & curing sl.)	40.00	41.50	40.00	48.00	40.00	45.00
550 ton screenings (sl. ct.)	5.00	5.00	5.50	6.05	5.50	7.00
890 ton sand (pr. ct. & sl. ct.)	4.00	3.40	4.00	4.78	5.00	7.00
22,950 ton min. aggr. (P.M.S.)	3.00	4.15	5.05	4.07	4.10	6.50
1,147 ton paving asph. (P.M.S.)	20.00	27.75	5.05	24.20	23.00	26.00
160 lin. ft. raised traffic bars	2.00	1.50	2.00	1.38	1.50	1.70
15,430 cu. yd. P.C.C. (pav't)	12.00	11.80	14.00	13.55	14.00	16.00
10,800 ea. pav't tie bolt assemblies	.40	.60	.60	.60	.65	.70
2,530 cu. yd. P.C.C. (base)	11.20	12.50	14.00	13.55	14.00	16.00
60 cu. yd. Class "A" P.C.C. (structs.)	60.00	97.00	70.00	65.00	80.00	78.00
415 cu. yd. P.C.C. (curbs and gutters)	35.00	54.50	48.00	43.00	44.00	50.00
140 ea. right-of-way monuments	4.00	6.00	6.00	8.00	7.00	7.00
175 lin. ft. salv. existing guard railing	2.00	.60	1.00	1.20	1.00	2.00
425 ea. culv. markers and guide posts	4.00	6.90	5.50	7.50	5.00	6.00
50 ea. horizontal reflector units	5.00	8.50	7.00	9.50	10.00	8.00
4 mi. new property fence	\$1,000	\$1,700	\$1,600	\$1,638	\$1,800	\$2,600
16,500 lin. ft. chain link fence	1.30	1.15	1.20	1.10	1.30	1.50
321 lin. ft. 12-in. reinf. conc. pipe	3.00	3.00	3.00	2.70	2.75	2.90
3 lin. ft. 12-in. corr. metal pipe (16 ga.)	3.50	5.10	5.00	4.50	10.00	5.00
724 lin. ft. 18-in. corr. metal pipe (16 ga.)	4.10	3.30	4.10	3.60	3.50	3.70
6 lin. ft. 36-in. corr. metal pipe (14 ga.)	6.30	11.00	20.00	8.40	25.00	12.00
1,280 lin. ft. 22-in. x 13-in. C.M.P. arch (16 ga.)	4.20	3.60	4.40	4.20	3.75	3.80
66 lin. ft. 29-in. x 18-in. C.M.P. arch (14 ga.)	5.50	6.60	6.30	6.50	6.00	5.00
52 lin. ft. 12-in. metal pipe	2.60	2.50	3.00	2.90	3.00	5.00
13 ea. cast steel drop inlet covers and frames	65.00	90.00	80.00	90.00	80.00	100.00
3,330 lb. bar reinf. steel	.10	.15	.15	.19	.15	.10
60 lin. ft. drainage sump excav.	2.00	8.70	7.00	9.50	25.00	20.00
40 cu. yd. rock filter material	5.00	7.80	6.00	7.50	4.00	6.00
Lump sum, Engineer's office	\$2,000	\$3,000	600.00	\$3,000	\$4,000	\$4,250

Dam . . .

Completion of Hungry Horse Dam, Power Plant and Switchyard

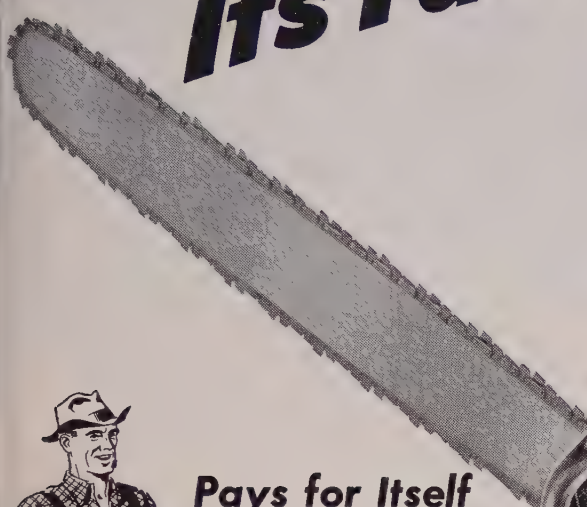
Montana—Flathead County—Bureau of Reclamation. Grafe-Shirley-Lane Company, Los Angeles, Calif. with a bid of \$1,792,782, was low before the Bureau of Reclamation for completion of the Hungry Horse dam power plant and high-voltage switchyard. Units bids were as follows:

(1) Grafe-Shirley-Lane Company	\$1,792,782	(3) General-Shea-Morrison	\$1,893,220
(2) Donovan, James, Wismer and Becker	1,846,108	(4) Guy F. Atkinson	1,893,230
		(5) Engineer's estimate	1,112,520

SCHEDULE 1—DAM AND POWER PLANT	(1)	(2)	(3)	(4)	(5)
3,000 ton transporting materials	10.50	13.10	8.00	22.00	6.00
340 cu. yd. excavation for duct line	12.90	12.40	12.00	7.00	8.00
270 cu. yd. backfill	2.80	3.30	3.50	4.00	1.00
2,600 lb. furn. and placing reinf. bars, ½-in. round and smaller	.17	.25	.20	.16	.20
70 cu. yd. concrete in duct line	60.00	54.50	70.00	54.00	40.00
30 sq. ft. furn. and placing preformed bituminous-fiber joint material	1.00	1.50	1.00	1.50	2.00
4,000 sq. yd. 1½-in. to 2-in. colored bonded concrete finish on floors, stair landings, and hatch covers	6.40	6.60	10.00	14.50	8.00
380 sq. yd. 2½-in. to 3-in. colored bonded concrete finish on floors and hatch covers	8.90	6.55	12.00	20.00	9.00
150 sq. yd. colored banded concrete finish on stairs	12.00	7.25	50.00	18.00	14.00
390 lin. ft. colored bonded concrete curb caps	1.50	1.35	4.00	3.00	6.00
5,100 lin. ft. colored bonded concrete wall bases	2.00	.88	5.00	1.70	3.00
1,340 sq. ft. furn. and installing asphalt tile	.34	.50	.60	.70	.60
345 lin. ft. furn. and installing asphalt cove base	.25	.50	.80	.70	.70

(Continued on next page)

**It's Lighter...
It's Faster...It's Tougher**



It's the NEW
HOMELITE
ONE MAN
Chain Saw

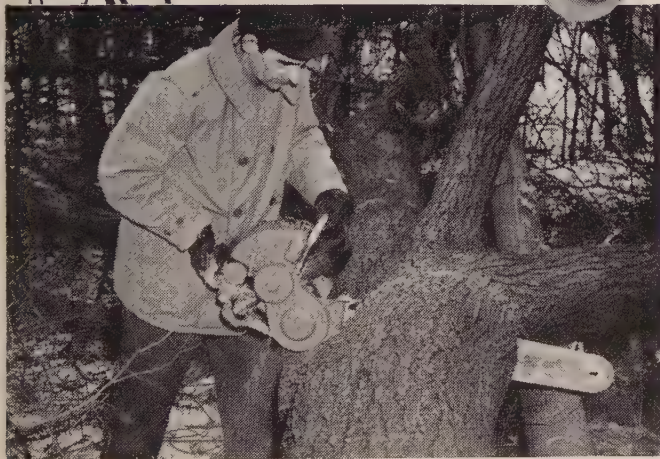


**Pays for Itself
in No Time
Clearing Out
Wooded Land**



**27 Pounds
4 Horsepower**

**More Power Per Pound
than any other saw**



It's a one-man saw that does the work of other two-man saws. Cuts an 18 inch tree in 16 seconds. Cuts trees 48 inches or more in diameter. Has simple, safe controls; automatic clutch; automotive type carburetor; rainproof magneto and chrome-plated, perma-sharp, narrow kerf chain.

Remember, you can't start any building or construction job until the location is properly cleared. And with this new Homelite One Man Chain Saw, you can do your clearing in less time . . . with less labor . . . and at less cost. It's the fastest cutting, easiest handling saw ever developed. And it's a rugged, dependable saw that needs less maintenance, fewer repairs, than any other saw.

Weighing only 27 lbs . . . and perfectly balanced, with most weight close to operator's body . . . a Homelite handles perfectly on all types of cuts. Any man can operate it easily. Send for new, complete bulletin.

CARRYABLE

**PUMPS • GENERATORS •
BLOWERS • CHAIN SAWS**

PERFORMANCE • DEPENDABILITY
HOMELITE
CORPORATION
SERVICE

1305 RIVERDALE AVENUE • PORT CHESTER, N. Y.

NEWS of MANUFACTURERS

Continued from page 128

headquarters at Richland, Wash., and received his electrical engineering degree from the University of California in 1928. He succeeds ERNEST E. JOHNSON who is now general manager of G-E's General Engineering Laboratory.

★ ★ ★

New technical consultant to the *Richkraft Company* of Chicago, Ill., is CHESTER A. ARENTS. He is coordinator of research at the Illinois Institute of Technology and was once a test engineer for the City of Portland, Ore. Arents was electrical engineer for the Bonneville Power Administration, and served in a technical capacity with Oregon State College and Montana State College.

★ ★ ★

CARL BLOM is a new vice president of the *Byron Jackson Co.*, Los Angeles, Calif. A specialist in hydraulic engineering, Blom has contributed his efforts to many major projects which include the designing of the world's largest pumps for Grand Coulee Dam. Blom joined the firm in 1924 and advanced to the position of chief engineer of the pump division in 1940.

★ ★ ★

Purchase of the *Rome Grader Division* of *Union Fork and Hoe Company*, Rome, New York, is announced by E. J. SEIFERT, president, *Pettibone-Mulliken Corporation*, Chicago, Ill. For the present time, the Rome plant will continue to manufacture the four sizes of Rome graders, but the Chicago plant of Pettibone-Mulliken will begin at once to manufacture, distribute and service all sizes.

★ ★ ★

EVERETT A. UTECHT becomes assistant chief engineer for the *Davey Compressor Co.*, Kent, Ohio. In his new position, Utecht will be in charge of the design and engineering of both new and standard line Davey air products.

★ ★ ★

Standco Brake Lining Company enters the clutch facings field. The Houston, Tex., company is now producing and marketing a new heavy-duty clutch facing in both the gear tooth and plain discs types for use in the oil production, marine, earth-moving and heavy transportation equipment industries.

★ ★ ★

ERNEST S. THEISS is now chief engineer of the *Davey Compressor Co.*, Kent, Ohio. He leaves the position of assistant chief engineer to replace W. W. WARNER, who becomes company vice president.

★ ★ ★

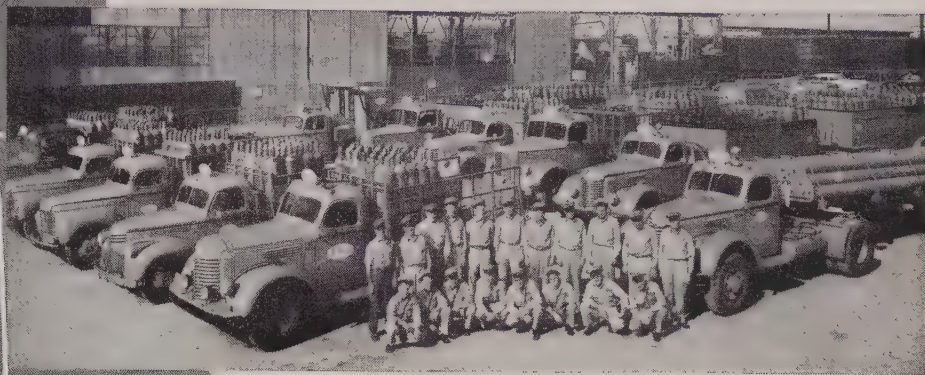
The newly-created post of manufacturing manager of the *General Motors Truck and Coach Division*, Pontiac, Mich., goes to PHILIP J. MONAGHAN. He comes to his new job from the Oldsmobile division of GMC where he was engaged in manufacturing and sales activities.

UNIT BID PRICES . . . CONTINUED

	(1)	(2)	(3)	(4)	(5)
2,210 sq. ft. furn. and installing rubber tile.....	.80	1.21	.80	1.40	1.00
110 lin. ft. furn. and installing rubber cove base.....	.34	.50	1.00	1.00	1.00
330 sq. ft. furn. and install. fixed glass with metal glass settings in metal lath and plaster partitions and concrete walls.....	6.00	4.60	3.00	5.80	4.00
9,000 lb. installing miscel. metalwork for power plant and elevator-towers of dam.....	.30	.27	.50	.45	
950 lin. ft. installing metal stair treads and nosings.....	2.00	1.00	3.00	1.00	
28,000 lb. installing metalw'k for cable trays in pwr. plant.....	.175	.27	.31	.24	
2,750 lin. ft. installing asbestos cement sheets for cable trays in power plant.....	.68	.77	1.70	1.50	
11,000 lb. installing steel handrailings.....	.87	.45	.60	.60	
87,000 lb. installing steel gratings, cover plates, floor plates, hatch cover, hatch cover banding angles, bulkhead and rotor erection plate in power plant in dam.....	.18	.26	.40	.17	
150,000 lb. installing metal platform for electrical equipt.....	.12	.184	.15	.14	
290 sq. ft. furn. and installing glazed metal partitions.....	6.00	3.83	5.00	5.50	10.00
185 lin. ft. furn. and installing metal toilet-stall partitions, urinal parts, and toilet-rm. screen parts.....	21.00	11.30	50.00	30.00	25.00
3,600 sq. ft. installing steel swinging doors.....	2.40	3.03	3.00	2.50	2.00
93 sq. ft. installing metal fire doors.....	2.40	4.50	3.00	5.00	3.00
210,000 lb. erecting take-off structure.....	.12	.147	.11	.095	
Lump sum, installing and testing four 105,000 horsepower hydraulic turbines.....	\$654,000	\$313,377	\$200,000	\$472,000	\$200,000
115,000 lb. installing and removing special speed ring bulkheads on 2-hydraulic turbines.....	.065	.0485	.06	.105	
Lump sum, installing and testing four 200,000-ft. pound governors.....	\$8,160	\$29,832	\$9,150	\$28,000	\$12,000
9,000 lb. installing jet pumps.....	.20	.60	.45	.11	
23,700 lb. installing flanged strainers.....	.32	.392	.25	.105	
1,000 lb. installing motor-driven gear-type oil pumping units.....	.50	1.50	.32	1.80	
9,400 lb. installing motor-driven centrifugal-type water pumping units.....	.10	.37	.12	.40	
2,000 lb. installing chlorinating equipment.....	.35	.775	.65	1.70	
4,200 lb. installing duplex-type sewage disposal unit.....	.50	.54	.35	1.30	
24,000 lb. installing motor-driven 100-psi air compressor.....	.11	.20	.16	.21	
1,500 lb. installing motor-driven 350-psi air compressor.....	.60	.455	.20	.80	
1,550 lb. installing after-coolers and moisture separators.....	.50	.62	.26	.14	
14,800 lb. installing air receivers.....	.12	.186	.16	.15	
Lump sum, installing indicating and recording instruments.....	\$11,985	\$3,400	\$2,590	\$2,500	\$3,500
Lump sum, installing carbon-dioxide fire-extinguishing systems for generators.....	\$1,012	\$4,043	\$3,600	\$5,600	\$3,000
Lump sum, installing carbon-dioxide fire-extinguishing system for oil-purifier and oil-storage rooms.....	506.00	\$3,038	\$2,600	\$1,300	750.00
Lump sum, installing carbon-dioxide spare cylinder bank.....	506.00	836.00	700.00	850.00	300.00
Lump sum, installing portable fire extinguishers, hose reels, and hose reel cart.....	\$1,615	\$1,200	\$1,000	\$1,600	800.00
18 cabinets installing equipment in fire hose cabinets.....	10.00	59.50	50.00	64.00	25.00
Lump sum, installing one portable oil purifier and one filter-paper drying oven.....	440.00	966.00	332.00	\$2,000	300.00
Lump sum, furnishing and installing steel workbench.....	237.00	300.00	363.00	140.00	250.00
100 name plate installing name plates.....	2.00	12.65	4.00	7.00	5.00
7,000 lb. installing sump pumps, control, and piping.....	.30	.51	.22	.60	
92,000 lb. installing make-up pieces.....	.30	.384	.20	.22	
Lump sum, installing machine tools.....	\$8,070	\$13,206	\$13,300	\$12,000	\$7,000
9,000 lb. furn. and install. class A piping systems 2 inches and smaller in nominal diameter.....	.75	2.30	2.20	2.25	
96,000 lb. furn. and installing class A piping systems 2½ in. and larger in nominal diam.....	.80	1.17	1.00	1.15	
2,000 lb. furn. and installing class B piping systems 2 in. and smaller in nominal diam.....	1.00	3.90	3.70	2.50	
5,600 lb. furn. and installing class B piping systems 2½ in. and larger in nominal diam.....	.80	3.04	3.00	1.75	
50 lb. furn. and installing class D piping systems.....	1.20	30.00	27.00	13.00	1.00
200 lb. furn. and installing class E piping systems.....	1.20	5.70	5.00	11.00	
43,000 lb. furn. and installing class F piping systems 2½ in. and larger in nominal diam.....	.80	1.30	1.20	1.50	
4,000 lb. furn. and installing class L piping systems 2 in. and smaller in nominal diam.....	1.40	2.03	1.70	2.60	
26,000 lb. furn. and installing class L piping systems 2½ in. and larger in nominal diam.....	1.00	1.76	1.65	2.10	
4,000 lb. furn. and installing class N piping systems 2 in. and smaller in nominal diam.....	.85	3.72	3.25	2.30	
10,500 lb. furn. and installing class N piping systems 2½ in. and larger in nominal diam.....	.63	1.18	1.10	1.20	
600 lb. furn. and installing class P piping systems.....	.85	4.00	3.50	2.30	
500 lb. furn. and installing class Q steel piping systems ¾-in. and smaller in diam.....	1.20	4.30	3.85	2.40	
2,900 lb. furn. and installing class Q steel piping systems 1 in. and larger in nominal diam.....	1.00	1.45	1.20	2.00	
50 lb. furn. and installing class Q brass piping systems.....	2.00	14.00	13.00	12.00	2.00
16,000 lb. installing special valves and special fittings.....	.70	.33	.23	.50	
500 lb. furn. and installing flexible hose connections.....	6.00	18.20	18.00	11.00	2.00
18,000 lb. furn. and installing pipe hangers and supports.....	1.20	4.17	4.00	2.45	1.00
Lump sum, furn. and installing heating and ventilating systems in power plant.....	\$46,000	\$109,300	\$200,000	\$120,000	\$60,000
Lump sum, furn. and installing heating and ventilating systems in elevator towers.....	\$43,700	\$6,035	\$13,900	\$6,300	\$4,000
5,100 lb. installing heating and ventilat'g systems in dam.....	.70	1.02	2.65	1.50	
22 fixtures furn. and installing lavatories.....	60.00	200.00	175.00	100.00	100.00
20 fixtures furn. and installing water closets.....	83.00	180.00	155.00	125.00	140.00
8 fixtures furn. and installing urinals.....	102.00	244.00	210.00	90.00	150.00
5 fixtures furn. and installing service sinks.....	84.00	321.00	280.00	300.00	175.00
1 fixture furn. and installing kitchen sink.....	82.00	561.00	500.00	120.00	150.00
1 heater furn. and installing 60-gal. capacity electric storage water heater.....	150.00	598.00	540.00	400.00	150.00
1 heater furn. and installing 40-gal. capacity electric storage water heater.....	120.00	538.00	480.00	320.00	125.00
3 heaters furn. and installing 20-gal. capacity electric storage water heaters.....	100.00	293.00	260.00	300.00	110.00
3 heaters furn. and installing 10-gal. capacity electric storage water heaters.....	100.00	280.00	250.00	220.00	100.00
8 coolers installing electric drinking water coolers.....	20.00	100.00	90.00	90.00	75.00
20 accessories furn. and installing toilet-paper holders.....	5.00	34.00	30.00	22.00	15.00
14 accessories furn. and installing cabinets for folded-paper towels.....	10.00	43.00	40.00	43.00	20.00
500 lb. installing chromium-plated pipe and accessories.....	2.00	4.00	3.60	2.70	1.00

(Continued on next page)

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Variety of Subjects at Utah Highway Conference

FEATURING an extensive display of road building and construction equipment, the Twelfth Annual Utah Highway Engineering Conference was held in Salt Lake City, April 2-4. To accommodate the display of equipment, the conference was moved from the campus of the University of Utah, where previous sessions had been held, to the State Fair Grounds.

The technical sessions included papers covering a wide variety of subjects relating to highway engineering and construction. The annual banquet was addressed by Jennings Randolph, Assistant to the President of Capital Air Lines, Washington, D. C., and formerly Congressman from West Virginia.

Under the general direction of A. Dieffendorf, head of the Civil Engineering Department, University of Utah, the several sessions were presided over by engineers or others allied with highway development.

In addition to many local speakers, Professor Dieffendorf had arranged for several papers from outstanding national authorities covering their particular field of interest in highway engineering or construction. These included:

Bernard E. Gray, President, The Asphalt Institute, New York, N. Y., who addressed the meeting on "What Loads on What Roads."

A. A. Anderson, Manager, Highways and Municipal Bureau, Portland Cement Association, Chicago, Ill., who spoke on the subject of "Annual Costs—The Measure of Road Value."

H. A. Endres, Assistant Manager of Research, Goodyear Tire & Rubber Co., Akron, Ohio, and **H. B. Pullar**, President, Berry Asphalt Co., Chicago and Magnolia, Ark., who jointly presented a paper on "The Use of Rubber in Bituminous Pavement."

H. E. Hilts, Deputy Commissioner, U. S. Bureau of Public Roads, Washington, D. C., who delivered a talk on "The Turkish Highway Program."

Lowell Larson, Western Sales Manager, Barber-Greene Co., Aurora, Ill., who spoke on "Bituminous Laying Equipment."

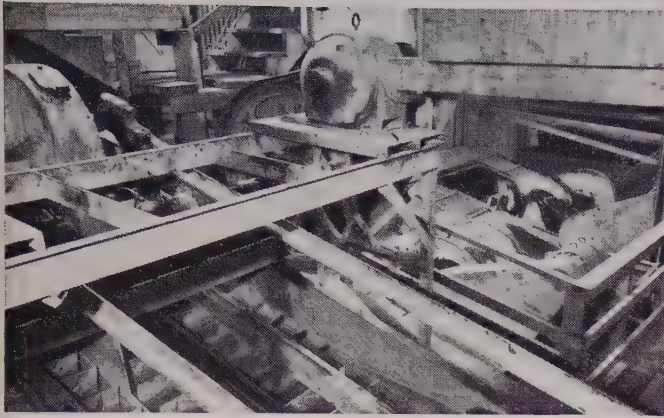
Ralph N. Tracy, Division Engineer, Armco Drainage & Metal Products, Inc., Denver, Colo., who delivered a paper "Stronger But Lighter Material in Construction."

The display of equipment was a feature initiated at this particular Conference and was sponsored by the equipment distributors of Salt Lake City. They asked permission of the Conference to display some modern machinery used in highway building as their contribution to the educational features provided by the meeting. The display not only filled the Coliseum of the fair grounds, but also occupied a large area outside the building where demonstrations were carried out. Those attending the Conference were able to inspect these latest models of machines which provide the means for both construction and maintenance of modern highways.

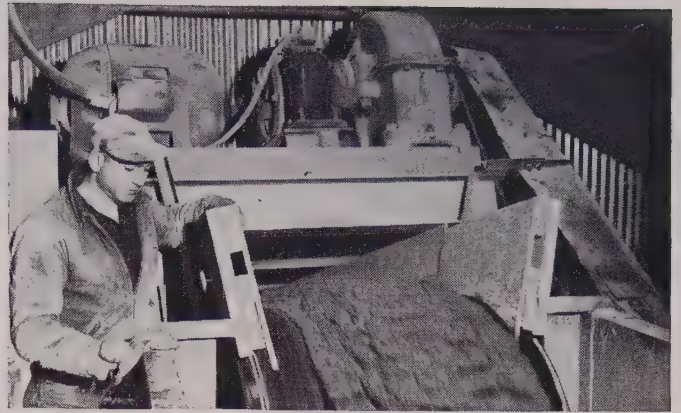
UNIT BID PRICES... CONTINUED

	(1)	(2)	(3)	(4)	(5)
15,900 lin. ft. installing exposed electrical metal conduit 1½ in. or less in diam. in the power plant and dam and appurtenant works	1.00	1.27	1.90	1.20	.8
8,900 lin. ft. installing exposed electrical metal conduit larger than 1½ in. but not larger than 2½ in. in diam. in the power plant, and dam and appurtenant works	2.00	1.97	3.20	2.60	1.2
1,050 lin. ft. installing exposed electrical metal conduit larger than 2½ in. in diam. in the power plant and dam and appurtenant works	3.00	4.28	5.40	4.00	2.0
2,000 lb. installing and connecting exposed grounding conductors in dam and appurtenant works	1.30	1.84	1.10	1.25	1.0
1,700 lin. ft. installing exposed elect. nonmetallic conduit in the power plant	1.50	2.20	1.82	1.45	.7
6,200 lin. ft. installing embedded nonmetallic conduit 2-in. in diam. betw. manholes EYB and EYC	1.00	.51	.88	.90	.6
660 lin. ft. installing embedded nonmetallic conduit 4 in. in diam. betw. manholes EYB and EYC	1.40	.78	1.10	1.00	1.2
135 lin. ft. removing temp. wooden bypass enclosure from temp. bypass cable route betw. manhole EYB and manhole EYC	1.00	1.16	1.00	1.10	3.00
59,200 lin. ft. installing No. 12 AWG 600-volt insulated electrical conductor in power plant and dam and appurtenant works	.06	.07	.12	.105	.06
89,700 lin. ft. installing No. 10 AWG 600-volt insulated electrical conductor in power plant and dam and appurtenant works	.07	.082	.15	.105	.06
29,200 lin. ft. installing No. 8 AWG 600-volt insulated electrical conductor in power plant and dam and appurtenant works	.09	.095	.11	.14	.06
1,400 lin. ft. installing No. 6 AWG 600-volt insulated electrical conductor in power plant and dam and appurtenant works	.11	.11	.21	.15	.1
8,700 lin. ft. installing No. 4 AWG 600-volt insulated electrical conductor in power plant and dam and appurtenant works	.13	.15	.21	.20	.1
14,000 lin. ft. installing No. 2 AWG 600-volt insulated electrical conductor in power plant and dam and appurtenant works	.15	.11	.25	.23	.1
5,800 lin. ft. installing No. 1 AWG 600-volt insulated electrical conductor in power plant and dam and appurtenant works	.17	.21	.25	.27	.1
1,600 lin. ft. installing No. 1/0 AWG 600-volt insulated electrical conductor in power plant	.20	.24	.40	.30	.2
2,400 lin. ft. installing 400,000-circular mil, 600-volt insulated electrical conductor in power plant	.35	.45	1.10	.55	.40
900 lin. ft. installing 600,000-circular mil, 600-volt insulated electrical conductor in power plant	.40	.59	.80	.60	.50
500 lin. ft. installing 500,000-circular mil, 5,000-volt insulated electrical conductor in power plant	.50	2.04	.90	1.30	.5
500 lin. ft. installing No. 4/0 AWG 5,000-volt insulated electrical conductor in power plant	.45	1.80	.80	1.20	.40
400 lin. ft. installing No. 2/0 AWG 5,000-volt insulated electrical conductor in power plant	.40	1.65	.48	1.20	.3
2,600 lin. ft. installing No. 1/0 AWG 5,000-volt insulated elect. conductors in power plant and dam and appurtenant works	.35	1.35	.40	.95	.3
550 lin. ft. installing No. 8 AWG 5,000-volt insulated electrical conductors in power plant	.20	.63	.60	.90	.1
1,000 lin. ft. installing No. 2/0 AWG 600-volt insulated electrical conductors in power plant	.20	.25	.52	.40	.2
1,800 lin. ft. installing No. 3/0 AWG 600-volt insulated electrical conductor in power plant and dam and appurtenant works	.21	.28	.44	.45	.2
1,700 lin. ft. installing No. 4/0 AWG 600-volt insulated electrical conductor in power plant and dam and appurtenant works	.24	.33	.70	.50	.3
1,200 lin. ft. installing 250,000-circular mil, 600-volt insulated electrical conductor in power plant	.25	.35	.70	.55	.3
900 lin. ft. installing 300,000-circular mil, 600-volt insulated electrical conductor in power plant	.30	.39	.60	.60	.3
350 lin. ft. installing 500,000-circular mil, 600-volt insulated electrical conductor in power plant	.40	.51	.80	.80	.4
400 lin. ft. installing 750,000-circular mil, 600-volt insulated electrical conductor in dam and appurtenant works	.50	.70	.70	1.00	.75
800 lin. ft. installing 15,000-volt power cables from the generator bus to the station service transformers in power plant	2.00	2.21	2.85	3.30	3.00
4,000 lin. ft. installing single-conductor No. 19/25 AWG 600-volt insulated electrical cable in power plant	.09	.13	.12	.11	.15
6,000 lin. ft. installing 3-conductor No. 19/25 AWG 600-volt insulated electrical cable in power plant	.12	.21	.12	.20	.20
8,000 lin. ft. installing 5-conductor No. 19/25 AWG 600-volt insulated electrical cable in power plant	.16	.354	.25	.26	.24
5,900 lin. ft. installing 7-conductor No. 19/25 AWG 600-volt insulated electrical cable in P.P. and dam and appurtenant works	.20	.505	.25	.38	.30
1,800 lin. ft. installing 7-conductor No. 19/25 AWG 600-volt insulated, armored electrical cable in dam and appurtenant works	.30	.655	.57	.38	.40
3,000 lin. ft. installing 9-conductor No. 19/25 AWG 600-volt insulated electrical cable in power plant	.40	.53	.51	.45	.36
5,000 lin. ft. installing 12-conductor No. 19/25 AWG 600-volt insulated electrical cable in power plant	.50	.66	.82	.52	.45
4,800 lin. ft. installing 15-conductor No. 19/25 AWG 600-volt insulated electrical cable in P.P. and dam and appurtenant works	.50	.73	.85	.65	.50
1,500 lin. ft. installing 3-conductor No. 19/22 AWG 600-volt insulated electrical cable in power plant	.20	.21	.12	.18	.20
2,000 lin. ft. installing 5-conductor No. 19/22 AWG 600-volt insulated electrical cable in power plant	.20	.35	.26	.28	.24
1,300 lin. ft. installing 7-conductor No. 19/22 AWG 600-volt insulated electrical cable in P.P. and dam and appurtenant works	.30	.50	.30	.40	.30
250 lin. ft. installing 7-conductor No. 19/22 AWG 600-volt insulated, armored electrical cable in dam and appurtenant works	.40	.69	.50	.50	.40
1,000 lin. ft. installing 9-conductor No. 19/22 AWG 600-volt insulated electrical cable in power plant	.40	.53	.60	.40	.36

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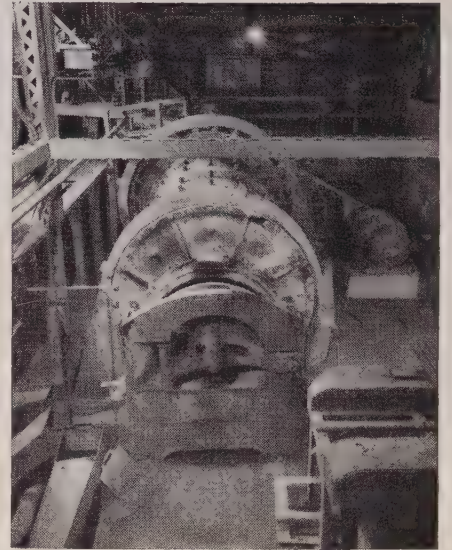
Aggregate under 6 inches is separated in shakers at screening plant. A G-E 5-hp motor drives shakers. Plant is completely automatic.



Carrying cement mix along this indoor conveyor system is a crucial step in construction of the dam. Sturdy G-E 100-hp motor drives the belt.



Aggregate for batching plant at Hungry Horse Dam is carried 1600 feet up the canyon wall by conveyor, driven by reliable G-E 100-hp motors in wooden sheds at intervals of 250 to 300 feet.



This Marcy rod mill, used in the gravel-crushing operation at the screening plant, is driven by a G-E 200-hp motor (right center). The motor is protected against heavy dust.

push-button aggregate processing at 700 tons/hr.

... *Electrically*

General-Shea-Morrison, contractors for the Bureau of Reclamation's Hungry Horse Dam, are going all-out with electric equipment. Best example is their aggregate plant with its network of interconnecting conveyors geared to process 700 tons of raw aggregate every hour. It's one of the most modern installations of its kind in the country—strictly a push-button operation from raw aggregate handling to mixing. Only with modern electric drives can this world's fourth largest dam be completed on schedule in 1952.

As time goes on, contractors are discovering more and more that it pays to electrify. With co-ordinated use of G-E motors and control and G-E power-distribution systems, they're getting safer, more flexible, and more efficient operation.

Apparatus Department, General Electric Company, Schenectady 5, N.Y.

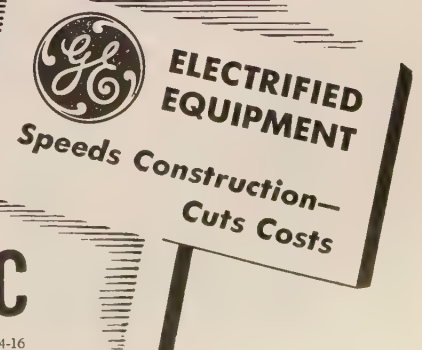
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UNIT BID PRICES . . . CONTINUED

	(1)	(2)	(3)	(4)	(5)
450 lin. ft. installing 15-conductor No. 19/25 AWG 600-volt insulated, armored electrical cable in dam and appurtenant works	.50	.70	1.00	.80	.60
6,000 lin. ft. installing 3-conductor No. 12 AWG, stranded, 600-volt insulated elect. cable in power plant	.20	.20	.12	.18	.20
1,500 lin. ft. installing 3-conductor No. 10 AWG, stranded, 600-volt insulated elect. cable in power plant	.20	.21	.13	.22	.23
400 lin. ft. installing 2-conductor No. 8 AWG, stranded, 600-volt insulated elect. cable in dam and appurtenant works	.20	.165	.20	.17	.17
500 lin. ft. installing 3-conductor No. 8 AWG, stranded, 600-volt insulated elect. cable in power plant	.20	.234	.30	.30	.25
1,500 lin. ft. installing 3-conductor No. 6 AWG, stranded, 600-volt insulated elect. cable in power plant	.20	.30	.30	.30	.28
5,000 lin. ft. installing 3-conductor No. 4 AWG, stranded, 600-volt insulated elect. cable in dam and P.P. and appurtenant works	.20	.391	.30	.32	.33
500 lin. ft. installing 3-conductor No. 2 AWG, stranded, 600-volt insulated elect. cable in power plant	.40	.435	.34	.40	.38
450 lin. ft. installing 3-conductor No. 1/0 AWG, 5,000-volt insulated, jacketed elect. cable in dam and appurtenant works	.40	1.85	.36	1.50	.53
850 lin. ft. installing 3-conductor No. 1/0 AWG, 5,000-volt insulated, armored elect. cable in dam and appurtenant works	.40	3.30	.36	1.50	.68
2,250 lin. ft. installing single-conductor insulated elect. cable for drain heating	.40	.386	.40	.26	.25
135 lin. ft. installing single-conductor No. 2/0 AWG 600-volt insulated elect. cable in duct bank from manhole EYB to EYC	.40	.25	.60	1.00	.30
540 lin. ft. removing single-conductor No. 2/0 AWG 600-volt insulated elect. cable from temporary bypass cable route	.40	.125	.30	.35	.15
405 lin. ft. installing single-conductor No. 1/0 AWG 600-volt insulated elect. cable in duct bank from manhole EYB to manhole EYC	.40	.24	.60	.50	.25
1,650 lin. ft. removing single-conductor No. 1/0 AWG 600-volt insulated elect. cable from temporary bypass cable route	.40	.11	.24	.24	.15
1,300 lin. ft. installing 3-conductor No. 16 AWG 600-volt insulated elect. cable in power plant and dam and appurtenant works	.30	.186	.26	.20	.20
500 lin. ft. installing 5-conductor No. 16 AWG 600-volt insulated elect. cable in power plant	.30	.252	.32	.30	.24
1,000 lin. ft. installing 7-conductor No. 16 AWG 600-volt insulated elect. cable in power plant	.30	.34	.32	.40	.30
500 lin. ft. installing 9-conductor No. 16 AWG 600-volt insulated elect. cable in power plant	.30	.426	.46	.40	.36
500 lin. ft. installing 12-conductor No. 16 AWG 600-volt insulated elect. cable in power plant	.30	.53	.80	.55	.45
500 lin. ft. installing 15-conductor No. 16 AWG 600-volt insulated cable in power plant	.30	.57	1.00	.70	.50
1,200 lin. ft. installing 37-conductor No. 16 AWG 600-volt insulated elect. cable in power plant	.40	.78	1.86	1.35	.75
135 lin. ft. installing 5-conductor No. 19/25 AWG 600-volt insulated elect. cable in duct bank from manhole EYB to EYC	.20	.36	.40	.50	.24
540 lin. ft. removing 5-conductor No. 19/25 AWG 600-volt insulated elect. cable from tempo. by-pass cable route	.20	.11	.25	.15	.15
135 lin. ft. installing 7-conductor No. 19/25 AWG 600-volt insulated cable in duct bank from manhole EYB to EYC	.30	.50	.60	.50	.30
500 lin. ft. removing 7-conductor No. 19/25 AWG 600-volt insulated elect. cable from temp. bypass cable route	.30	.11	.30	.13	.15
270 lin. ft. installing 12-conductor No. 19/25 AWG 600-volt insulated elect. cable in duct bank for manhole EYB to EYC	.30	.58	1.00	.50	.45
1,000 lin. ft. removing 12-conductor No. 19/25 AWG 600-volt insulated elect. cable from temp. bypass cable route	.30	.114	.30	.20	.22
270 lin. ft. installing 3-conductor No. 19/22 AWG 600-volt insulated elect. cable in duct bank from manhole EYB to EYC	.17	.25	.20	.30	.20
1,000 lin. ft. removing 3-conductor No. 19/22 AWG 600-volt insulated elect. cable from temp. bypass cable route	.10	.114	.12	.13	.15
135 lin. ft. installing 9-conductor No. 19/22 AWG 600-volt insulated elect. cable in duct bank from manhole EYB to EYC	.50	.53	1.00	.50	.36
540 lin. ft. removing 9-conductor No. 19/22 AWG 600-volt insulated electrical cable from temp. bypass cable route	.30	.114	.30	.15	.18
Lump sum, installing and testing generator bus structure in power plant	\$12,500	\$30,668	\$80,000	\$20,000	\$30,000
Lump sum, installing circuit breakers and potential transformers in power plant	\$12,500	\$14,681	\$15,000	\$5,800	\$13,000
Lump sum, installing neutral grounding equipment in power plant	\$10,500	\$6,531	\$9,000	\$3,300	\$2,000
Lump sum, installing Government camp unit substation on transformer deck of power plant	\$5,000	\$2,930	\$2,150	\$2,200	\$6,800
55,000 lb. installing 115-kilovolt oil circuit breakers on transformer deck of power plant	.14	.078	.07	.025	.07
17,000 lb. installing deicing power transformer on transformer deck of power plant	.10	.042	.07	.05	.07
30,000 lb. installing 196-kilovolt disconnecting switches on take-off struct. on transformer deck of power plant	.13	.09	.25	.025	.08
16,500 lb. installing 115-kilovolt disconnecting switches on take-off struct. of transformer deck of power plant	.13	.105	.21	.06	.08
27,000 lb. installing 196-kilovolt lightning arresters on take-off struct. on transformer deck of power plant	.15	.088	.20	.035	.10
740 lb. installing 15-kilovolt current transformer in neutral circuit of 115-kilovolt and 230-kilovolt power transformers on transformer deck of power plant	1.00	.355	1.60	.40	.25

	(1)	(2)	(3)	(4)	(5)
3,000 lb. installing 115-kilovolt coupling capacitors on transformer deck of power plant	.20	.23	.32	.16	.15
300 lb. installing coupling capacitor potential device adjustment units in cable spreading room of the power plant	1.00	.39	1.07	1.50	.30
1,000 lb. installing 400-amp. wave traps on take-off struct. on transformer deck of power plant.....	.50	.10	.40	.11	.15
1,400 lb. furn. and installing 1-in. iron-pipe-size copper tubing, connectors, and fittings for buses on transformer deck of power plant	3.00	5.05	3.90	2.20	1.50
3,450 lb. furn. and installing 1½-in. iron-pipe-size copper tubing, connectors, and fittings for buses on transformer deck of power plant	3.00	3.67	2.40	2.20	1.30
400 lin. ft. furn. and installing cable for high-voltage buses on transformer deck of power plant.....	6.00	12.65	21.50	21.00	2.00
665 lin. ft. furn. and installing No. 4/0 AWG bare stranded copper cable for high-voltage buses on transformer deck of power plant	3.00	13.85	11.00	3.00	1.50
450 lb. installing one 15-kilovolt deicing bus disconnecting and grounding switch on take-off struct. on the transformer deck of the power plant	.55	.30	3.40	.20	.30
1,478,100 lb. installing power transformers on transformer deck of power plant	.02	.0153	.035	.013	.03
12,000 lb. installing main control board CCA in permanent location	.16	.105	.13	.65	.15
6,000 lb. installing recording board CCB	.20	.105	.13	.75	.20
10,000 lb. installing line relay board CCC in perm. location	.22	.104	.15	.47	.15
12,000 lb. installing unit control boards C1A, C2A, C3A, and C4A	.20	.104	.13	.35	.20
12,000 lb. installing main control board CCA in temp. location	.20	.075	.17	.50	.15
5,000 lb. installing line relay board CCC in temp. loca.	.22	.076	.17	.64	.15
2,000 lb. installing annunciator relay cabinet CCD in temp. loca.	.22	.076	.17	.40	.20
2,500 lb. installing battery control board CSA and 2 motor generators	.22	.170	.18	.65	.20
3,000 lb. installing annunciator cabinets CSB and CCD in perm. loca.	.22	.17	.14	.45	.20
10,000 lb. installing one 60-cell station storage battery	.20	.167	.12	.19	.10
166,500 lb. installing 3-double-ended sta.-serv. unit substa.	.15	.04	.07	.035	.10
13,000 lb. installing one heating power unit substa.	.20	.08	.09	.07	.15
25,050 lb. installing heating and power control centers MSA, MSB, MSC, MSD, MSE, MSF, M1A, M2A, M3A, M4A, NSA, NSB, NSF, NCB, and N4A	.20	.47	.31	.36	.20
2,250 lb. installing direct-current power distribution boards BSA and BSB	.30	.47	.20	.54	.20
1,100 lb. installing main lighting and heating distribution panels L1A, L2A, L3A, L4A, and NSC.....	.22	.49	.20	.60	.30
1,000 lb. installing CO ₂ control cabinets C1B, C2B and C4B	.22	.48	1.20	1.10	.30
400 lb. installing drain heating control panels NSD and NSE	.35	.64	1.20	.70	.30
300 lb. installing 2 sump-pump float switches	.30	.81	.46	.45	.40
1,000 lb. installing laboratory test panel CCE	.35	.47	.44	.55	.30
1,000 lb. installing misc. elect. equip.	1.00	.40	2.00	.70	1.00
6,700 lb. installing heating and lighting distribution transformers K2D, K2E, K3D, K3E, and KCB	.35	.10	.34	.30	.25
5,100 lb. installing machine shop bus duct	.40	.53	.27	.15	.30
5,200 lb. installing machine shop crane runway conductrs.	.30	.53	1.10	.12	.75
150 connections making ground connections to equip., metalwork, and machinery installed in the power plant by others.....	8.00	11.65	10.00	8.00	10.00
270 lin. ft. furn. and installing buried No. 4/0 AWG bare stranded single-conductor copper grounding cable and adjacent to duct bank from manhole EYB to manhole EYC	2.00	.96	.90	.90	1.50
270 lin. ft. removing No. 4/0 AWG bare stranded single-conductor copper grounding cable from temporary bypass cable route betw. manhole EYB and manhole EYC	.30	.11	.10	.30	.20
70 fixtures installing incandescent lighting fixtures in dam and appurtenant works, except incandescent lighting fixtures in parapets of dam.....	7.00	8.00	12.00	12.00	10.00
60 fixtures installing incandescent lighting fixtures in parapets of dam	10.00	13.75	12.00	12.00	20.00
70 fixtures installing fluorescent lighting fixtures in dam and appurtenant works	10.00	17.63	16.00	21.00	20.00
3,600 lb. installing elect. distrib. panels and automatic transfer switches in dam and appurt. works.....	.35	.35	1.00	.33	.40
1,700 lb. installing dry-type distribution transformers in dam and appurt. works	.35	.42	1.05	.31	.25
11,000 lb. installing 2,400-volt lighting and power distrib. transformers in dam transformer vaults	.20	.075	.42	.06	.15
300 lb. installing motor control cabinets in dam and appurt. works	.30	.85	1.30	1.70	.40
Lump sum, installing crane trolley conductor system in valve house	\$2,000	271.00	\$1,100	260.00	\$1,000
2,500 lb. installing misc. metalwork for mounting elect. distrib. equip. in dam and appurt. works	.40	.46	.72	.50	.30
800 fixtures installing incandescent lighting fixtures, including floodlights in power plant	7.00	12.95	13.40	10.00	10.00
57 fixtures installing fluorescent lighting fixtures 48-in. long in power plant	10.00	15.80	17.00	13.00	20.00
94 fixtures installing fluorescent lighting fixtures 72-in. long in power plant	10.00	19.60	25.00	25.00	25.00
138 fixtures installing fluorescent lighting fixtures 96-in. long in power plant	15.00	23.60	33.00	33.00	30.00
33 recesses fin. lighting panel board, main lighting distrib. panel, and CO ₂ control cabinet recesses in P. P.	15.00	52.55	42.00	14.00	15.00
26 panel boards installing flush-type lighting panel boards in concrete recesses in power plant.....	200.00	25.20	55.00	100.00	25.00
1 panel board installing surface-type lighting panel board in power plant	200.00	69.00	50.00	70.00	25.00
52 supporting installing angle-iron board supports for lighting panel boards in conc. recesses in power plant	5.00	25.25	18.00	6.50	15.00
20,000 sq. ft. furn. and applying paint to generators in the power plant	.30	.253	.22	.32	.25
3,000 sq. ft. furn. and applying paint to control room ceiling and walls above proposed louvered ceiling in the power plant	.120	.151	.25	.30	.10
52,500 sq. ft. furn. and applying paint to outlet pipes and bellmouth castings	.55	.76	.58	.55	.20

SCHEDULE 2—SWITCHYARD (Unit prices for this phase of the project will appear in a later issue).

THERE'S AN AMAZING SAVING IN MATERIALS AND LABOR...AND A

Sensational Improvement in your concrete work

WHEN YOU USE THE

WORLD'S FOREMOST "SHAKE-DOWN ARTIST"

Vibration now is recognized as the most efficient and most economical method of placing concrete. It permits use of a materials-saving harsher mix. It results in a most homogeneous distribution, potentially bonded to reinforcing steel and at joints. And it reduces labor costs up to 60%.

But—there is a very real difference in the effectiveness of various types of vibrating equipment.

For general use, the one-man **Vibro-Plus** Rollgear Internal Vibrator is especially practical. Electrically, gas-engine or pneumatic driven, its simple design and super-flexible shaft allow the operator to get in anywhere—around corners, over forms, into tight and confined areas.

Exclusive patented features assure trouble-free operation over long years of service. For example, the **Vibro-Plus** vibratorhead is unique: it never needs lubrication, yet cannot seize-up. Without interruption, this **Vibro-Plus** Vibrator will continue to produce better concrete construction at lowest cost wherever it is used. Write for complete details and name of nearest distributor.

VIBRO-PLUS Internal Vibrator —one of the complete line made by the pioneer in vibrating and compacting.



The **Vibro-Plus** Rollgear Vibrator is available in models delivering from 11,000 to 15,000 vpm. Type MRSB is gas-engine driven. ERSB is electrically operated. Shafts and vibrator tubes are interchangeable.



VIBRO-PLUS PRODUCTS, INC.

54-11 QUEENS BOULEVARD
WOODSIDE, L. I., NEW YORK

NEW EQUIPMENT

MORE COMPLETE INFORMATION about any of the new equipment or products briefly described on the following pages may be obtained at no charge. Send your request to Equipment Service, Western Construction, 609 Mission St., San Francisco 5, Calif. For quicker service, designate items by number.

501

Toothed transmission belt halts slipping, aids timing

Features claimed: The Gilmer Timing Belt, fabric and rubber with teeth, will not slip and permits split-second timing. It will attain speeds up to 16,000 ft. per min., and operates more quietly than precision gears running in an oil bath. Pulleys can be produced by die casting, sintered metal, pressed metal or machined.

Manufacturer: United States Rubber Company, Rockefeller Center, New York, N. Y.

502

Trackson earth auger available for Caterpillar D4 tractor

Features claimed: A fast, dependable earth boring and pole setting machine, the Trackson earth auger assures construction firms, telephone, telegraph and power companies; railroads, and highway departments

a full range of boring positions for drilling holes vertically or at any usable angle. The Trackson Model EA4 will drill holes of 9-in. to 24-in. diameter, to a depth of 8 ft. with the standard 13-ft. bar, or to a depth of 11 ft. with the optional 16-ft. bar. The solid auger bar is square, permitting full bearing contact through the driving head. It has a 5,000-lb. capacity which handles poles up to 50 ft. in length.

Manufacturer: Trackson Company, P. O. Box 728, Milwaukee, Wis.

503

Perfected high-conductivity concrete aggregates

Features claimed. This new development is expected to substantially reduce the cost of radiant heating and broadly enlarge its field of application. The invention basically comprises a formula of special aggregates which are blended and then added to concrete and other plastic masses. Heat conductivity and wearing qualities of com-

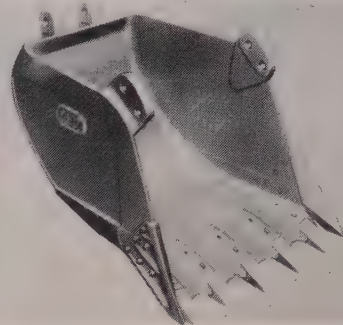
mercial concretes are greatly increased. Savings in pipe usage is one result of the higher heat-conductivity in the concrete.

Manufacturer: Products Planning Co., Bakewell Bldg., Pittsburgh, Pa.

504

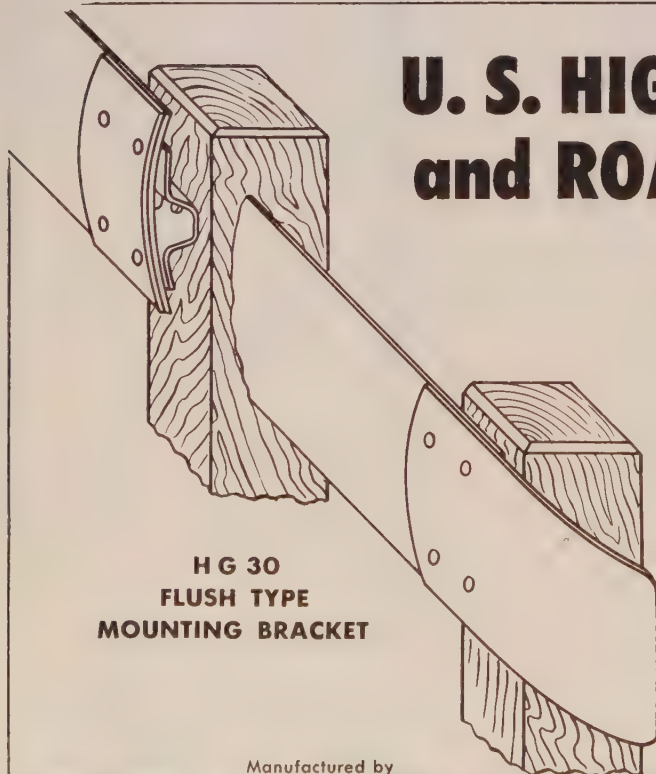
Curve in new hoe dipper cuts drag and heeling action

Features claimed: The Fastback Hoe Dipper's integrally cast tooth holders in a long projected lip produce a clean bite,



cradle and carry with ease. Six widths of side cutters are available for each dipper. Sizes are interchangeable on 1/4-yd. lip to 2 1/2-yd. dippers. The heel of the dipper has been practically eliminated by a long streamlined curve cutting down drag and heeling action and giving rise to the registered name "Fastback." Cutting edge of the dipper does the digging, leaving clearance for the rest of the bucket through the arc of its pass. Greatest shock and abrasive forces are taken by the case alloy lip, teeth, side cutters, top and bottom corner cast-

U. S. HIGHWAY GUARD RAIL and ROAD CENTER DIVIDER



HG 30
FLUSH TYPE
MOUNTING BRACKET

The HG 30 FLUSH TYPE MOUNTING BRACKET is designed for use with U. S.

Metal Plate Guard Rail where space is limited, as on bridges, etc. When mounted with this bracket, the face of the rail extends approximately 3" from mounting post.



Write for folder describing different types of U. S. Highway Guard Rail installations and specifications.

Manufactured by



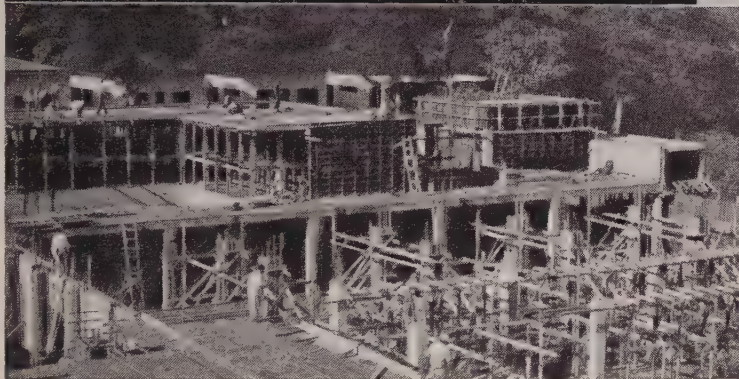
UNITED STATES SPRING & BUMPER Co.

4951 ALCOA AVENUE • LOS ANGELES 11, CALIFORNIA

**Estimated Forming
Material Costs
—\$80,000⁰⁰***

**UNI-FORMS
did it for
\$43,251⁴⁰†**

**UNI-FORMS
saved \$36,748⁶⁰**



TUBERCULOSIS HOSPITAL, Rio Piedras, Puerto Rico

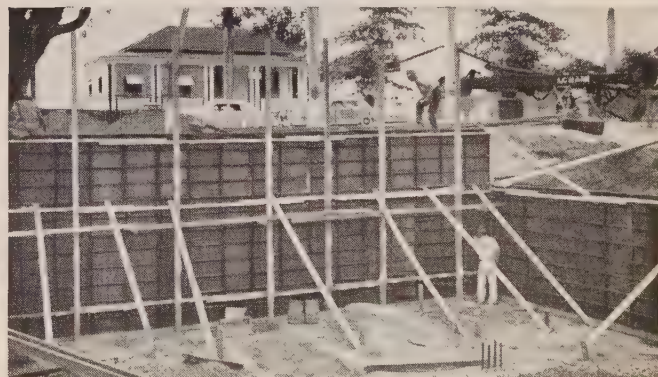
ARCHITECT: Isador Rosenfield

CONTRACTORS: Mendez, Grillasca, Nolla, Galib and Marquez, Inc.

UNI-FORMS built this 800 bed hospital in record time . . . formed walls, slabs, beams, columns, tunnels, retaining walls . . . and saved \$36,748.60 in forming material costs alone!

UNI-FORMS reached the job ready to use . . . provided faster, smoother forming cycles . . . labor costs were 1/2 the estimate . . . possible only with UNI-FORMS!

You can use UNI-FORMS . . . to form any type of concrete . . . to save time, labor and material . . . to assure more profit on every yard of concrete you pour.



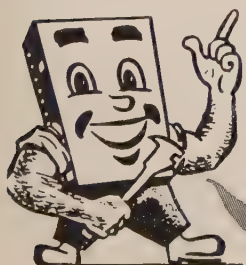
**BILL OF MATERIAL FOR FORMING CONCRETE
ON TUBERCULOSIS HOSPITAL, RIO PIEDRAS, PUERTO RICO**

***ESTIMATED:**

1,000,000 Bd. ft. of lumber required for forms, walers, alignment, etc., @ \$.10 per Bd. ft. . . .	\$100,000.00
LESS 20% lumber salvage	20,000.00
TOTAL ESTIMATED COST	\$ 80,000.00

†UNI-FORM COSTS:

22,500 sq. ft. of UNI-FORMS	\$ 37,256.80
400,000 bd. ft. alignment and bracing lumber actually used	40,000.00
SHIPPING UNI-FORMS TO JOB	3,800.00
	\$ 81,056.80
Less Contractor's valuation of UNI-FORMS at end of job. 80%	\$ 29,805.40
LESS 20% LUMBER SALVAGE	8,000.00
TOTAL ACTUAL MATERIAL COST	\$ 43,251.40



**UNI-FORMS
SAVED 1/2
ON LABOR, TOO!**

UNIVERSAL FORM CLAMP CO.

SAN LEANDRO (San Francisco), CALIF.

2051-59 WILLIAMS ST., SAN LEANDRO

Phone: Lockhaven 2-2051 Enterprise 1-0132

GENERAL OFFICES AND FACTORY 1236-38 N. KOSTNER, CHICAGO 31, ILL.

Phone: Capitol 7-1600

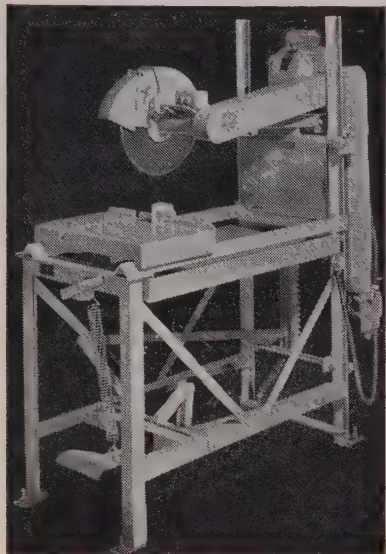
ings and cast steel stick connections with manganese steel bushings.

Manufacturer: Electric Steel Foundry Company, 2141 N.W. 25th Ave., Portland, Ore.

505

Device easily saws all masonry materials

Features claimed: Easily portable, and all steel engineered, the new Supreme



Speed Kut Masonry saw, in both wet and dry types, will saw any size, type or hardness of masonry materials. Abrasive or diamond type cutting wheels are employed.

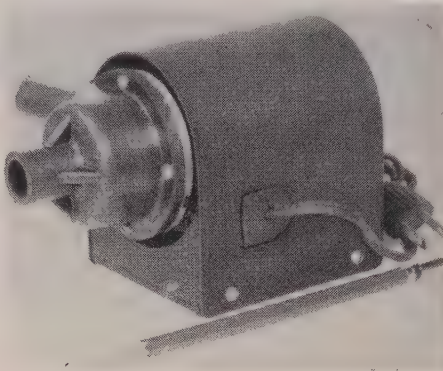
A waist-high handcrank automatically controls and fixes the positive self-locking wheel-positioning mechanism from the lowest to the highest known wheel cutting position. Proper grinding wheel pressure is maintained regardless of pressure on foot pedal.

Manufacturer: The Supreme Equipment Corporation, 12415 Euclid Ave., Cleveland, Ohio.

506

Pumps handle corrosive, non-corrosive liquids

Features claimed: Compact and powered by tiny electric motors of from 1/200 to



1/35 hp., these new centrifugal pumps handle both corrosive and non-corrosive liquids. They can be held on the flat of the hand and weigh only 2 to 4 lb. Available in all-rubber models, or in rubber and bronze or zinc. Three types are: enclosed and skeleton units, motor-driven, and belt-drive units. Capacity range is from 504 gal.

per hr. at 2-ft. head, to 78 gal. per hr. at 10-ft. head.

Manufacturer: The Gorman-Rupp Company, Mansfield, Ohio.

507

Nail cutting saw designed for portable saw machines

Features claimed: This nail cutter cuts (by milling action) through corrugated asbestos-cement board, other abrasive building materials, dirty form lumber, wire-reinforced wall boards, and flooring containing common nails.

Manufacturer: Carbide Saw and Tool Company, 327 S. LaSalle St., Chicago, Ill.

508

Trench roller offers new design features

Features claimed: The Galion Trench Roller is said to have many important features which make for ease of operation and more effective compaction. These features include hydraulic mechanism for operating the dual steering wheels which ride on the pavement, hydraulically controlled leveling wheels, and extra-large diameter variable weight compression roll. The manufacturer states that adjustments are provided to quickly level roller to suit any trench requirements. Frame has sufficient clearance to enable roller to work in any depths to 25 in. Hydraulic control, through the use of a single lever, keeps the machine on a level or horizontal plane from 6 in. above to 25 in. below road surface. It is further pointed out that the unusually large diameter of the compression roll eliminates "shoving" of materials being compacted. Compacting effort varies from 310 lb. with

WELLMAN *Williams Type*

MORE YARDAGE PER DAY

● Elimination of excess materials and careful weight distribution permit rapid, rhythmic operation of Wellman Dragline Buckets. Operators can cover a wider digging radius with this streamlined bucket.

Built of special alloy steel, using strong welded design, Wellman buckets provide strength and stamina for long-term economy. Perforated designs also available. You'll do better with Wellman.

Want Facts? Write for free descriptive bulletins



Dragline, Clamshell, Custom-Built Buckets Stone and Wood Grabs

THE WELLMAN ENGINEERING COMPANY
7000 Central Avenue • Cleveland 4, Ohio

ARIZONA—Lee Redman Company, Phoenix, Ariz.
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

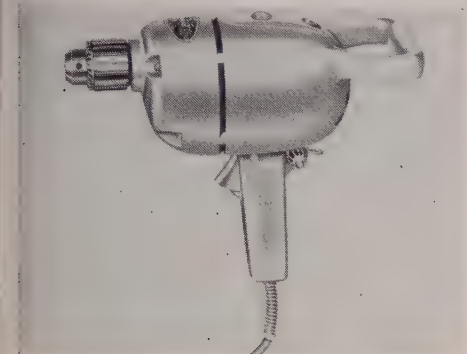
roll empty up to a maximum of 370 lb. (per lineal inch of roll width) with roll ballasted. The compression roll is equipped with front and rear tension scrapers and mats for moistening the roll when compacting finish materials.

Manufacturer: Galion Iron Works & Mfg. Co., Galion, Ohio.

509

Drills designed for work on toughest metals

Features claimed: Designed for constant day-in and day-out production drilling of



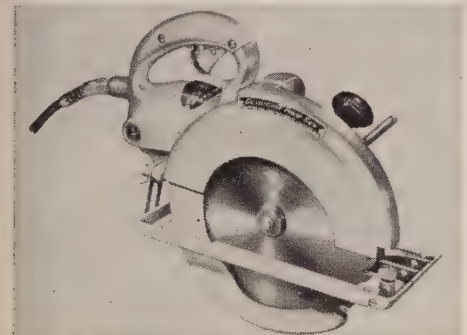
tough metals, Model 427 drill has the maximum power and performance required by many users. Capacity in metal is $\frac{3}{4}$ in.; in hard wood $\frac{3}{4}$ in.; no load speed 1750 rpm.; Jacobs Model 7B geared chuck; length, $12\frac{1}{4}$ in. overall; weight, 6 lb.

Manufacturer: Cummins-Chicago Corporation, 4740 N. Ravenswood Ave., Chicago, Ill.

510

Power saws designed for heavy construction jobs

Features claimed: Model 905 Power Saw with 8-in. blade, weighing 19 lbs., makes a



square cut of $2\frac{5}{8}$ in., and cuts through 2-3/16-in. lumber at 45 deg. It handles all framing operations on 2-in. rough lumber, has Universal AC-DC motor, 115 volts, 220 volts special Model 1000 (shown in illustration) cuts 1 in. to 3-7/16 in. at 90 deg., and $\frac{3}{4}$ in. to 2-13/16 in. at 45 deg.

Manufacturer: Cummins-Chicago Corporation, 4740 N. Ravenswood Ave., Chicago, Ill.

511

Radial supports introduced for rapid saw conversion

Features claimed: Skil Saw Models 77, 87, 800 or 825 can now be converted to an effective radial saw in a matter of minutes with the new Radial Support. Using this device all radial cuts can be made with speed and accuracy. Cut-offs, bevel cut-offs, bevel rips, miters, bevel miters, dados and ploughs are made without waste of time or material. Gang cutting and pre-

forming in the field are possible since the 175-lb. support is light enough to be carried from job to job by two men.

Manufacturer: Skilsaw, Inc., 5033 Elston Ave., Chicago, Ill.

512

New paints eliminate sanding of glossy surfaces

Features claimed: Pabco Paint Bond, Preserv-Wood and Redwood finish are now available for use. The paint bond, a clear, non-abrasive preparation, removes grease, wax, polish, etc., from the old surface, and creates a temporary "tack" to which the new paint or enamel can bond firmly. Preserv-Wood fights insects which attack window and door-sills, floor-joists, etc. Redwood finish is designed to maintain the original beauty of redwood in building. It

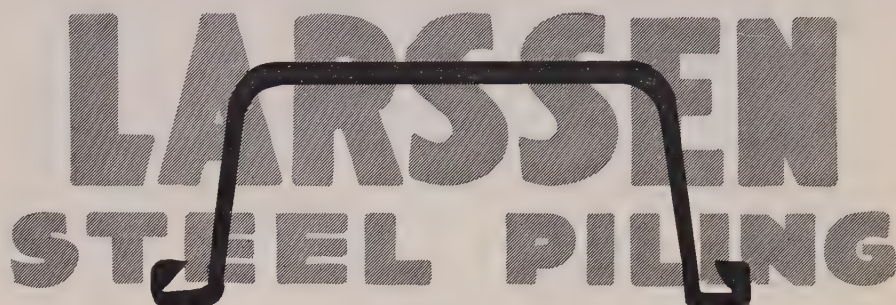
is clear, dries to a high gloss, reduces the tendency of the wood to darken and can also be used to give this effect on other woods where a natural finish is desired.

Manufacturer: Pabco Products, Inc., 475 Brannan St., San Francisco, Calif.

513

"Trafficcones" guide motorist around construction work

Features claimed: Trafficcone is a new rubber guide which warns a motorist of construction ahead while he is still far enough from the scene to change his position on the highway. The steel-like barriers form an impressive path for the driver to follow. Trafficcones can be dropped from a moving truck by one man, and large areas can be properly protected with only a few stacks. Cones are durable and practical.



for Docks, Piers, Bulkheads, Seawalls, Beach Protection Works, Jetties, Groins, Locks, Cutoff Walls, Core Walls, Levees, Dams, Spillways, Shaft Linings, Bridge Pier Foundations, Bridge Fenders, Cofferdams

16 ECONOMICAL STANDARD SECTIONS

Ranging from: 9.6 lbs. per sq. ft. of wall (section modulus 2.42 in.³ lin. ft. of wall)

To: 64 lbs. per sq. ft. of wall (section modulus 93.0 in.³ lin. ft. of wall)

The original deep arch web section with a record of 45 years of successful performance

Pacific Coast Agents

NORTH AMERICA E. B. & CO.

315 West 9th Street

Los Angeles 15, Calif.

TRinity 1389

BUY MASTER TO STEP-UP CONCRETE FINISHING PROFITS



1 MASTER SCREED
Strikes-off and Compacts
6,000 sq. feet per hour.

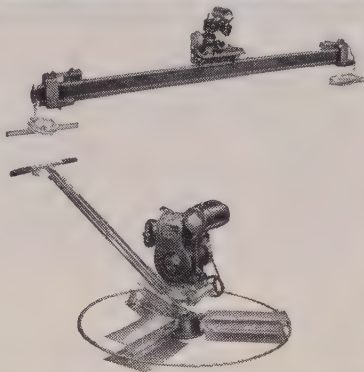
2 MASTER TURN-A-TROWEL
Finishes 800 sq. feet
per hour.

FOR FASTER STRIKE-OFF & VIBRATION

1 ... the MASTER SCREED has no equal. No additional vibration required. All sizes adjustable. A quality product that saves labor, saves finishing, saves cement. Write for MASTER SCREED Catalog No. 492.

FOR SMOOTHER, EASIER FINISH

2 ... the MASTER TURN-A-TROWEL provides quick changing from wide compacting trowel to trowel finishing. Covers more area with more paste brought to surface for faster final finish. Write for MASTER TURN-A-TROWEL Catalog No. 939.



MASTER

BETTER PRODUCTS FOR BIGGER PROFITS

MASTER VIBRATOR COMPANY

101 Davis Avenue, Dayton 1, Ohio

TRACTOR OPERATORS Do more work- Do better work-In less time with SILVER STEERING BOOSTERS

Step-up manpower efficiency and save TIME and MONEY with Silver Steering Boosters. This cleverly engineered attachment reduces the required pull on clutch steering levers from 125 pounds to less than 15 pounds! It permits the opening of

clutches "full travel." It also reduces slipping of clutches and increases the life of brakes by eliminating their excessive wear.

Equip your tractor now! with Silver Steering Boosters ... for increased life and greater operating efficiency.

Quickly Installed ...

Silver Steering Boosters are easily installed by any mechanic in 30 minutes. No difficult adjustments and no alterations to be made on your tractor.

Easily Operated ...

Powerful springs and absolute mechanical operation reduce operator fatigue to a minimum.



Available for Cats, International and A. C. Tractors

COMPLETE YOUR TRACTORS



Installed In 30 Minutes
... no adjustments or
alterations necessary

WITH SILVER STEERING BOOSTERS

Order From Your Tractor
Dealer or Write Direct

Silver Booster MANUFACTURING COMPANY

132 W. VERDUGO AVENUE • BURBANK • CALIFORNIA

Manufacturer: Interstate Rubber Products Corporation, 1638 W. Jefferson, Los Angeles.

514

Rotary casting chutes give greater snow stream control

Features claimed: Directing streams of snow coming out of a rotary plow is a problem now solved by the new "complete



circle" hydraulically controlled casting chutes. Indiscriminate throwing of snow can cause considerable damage under certain conditions, but these hydraulically controlled revolving casting chutes can be aimed by the rotary operator in any direction, both chutes together or each one individually. They turn a full 360 deg., are of 10-in. diameter and 30 in. high. Chutes are mounted on ball bearings to give free-running rotation with no sticking or sluggishness.

Manufacturer: Wm. Bros Boiler & Mfg. Co., 1057 10th Ave., S.E., Minneapolis, Minn.

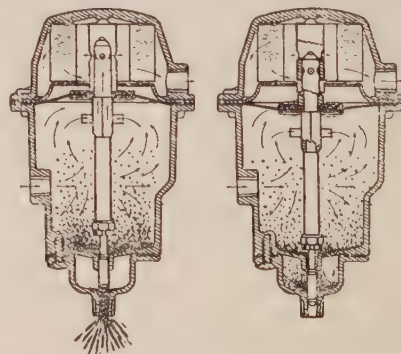
515

Automatic valves remove air line contaminants

Features claimed: Contaminants and precipitates are automatically removed from

"ON" CYCLE
UP POSITION

"OFF" CYCLE
DOWN POSITION



compressed air lines, after-coolers, sumps, tanks and air brake systems. Manual attention is eliminated. The new line includes automatic separators and drains and has been field tested in industrial installations and mobile equipment. The cross-sectional view shows the diaphragm operated valve. When air line is not in use the diaphragm

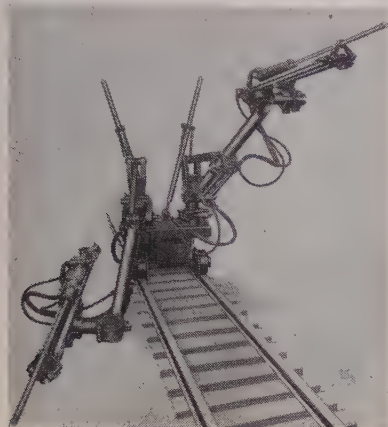
is forced down by back pressure with the O-ring sealing the sump bottom. As air is used the pressure differential raises diaphragm and shaft, seals bottom of middle chamber, opens bottom of sump and blasts out contamination.

Manufacturer: Wilkerson Corporation, 1749 So. Broadway, Denver, Colo.

516

Ingersoll-Rand offers new "Boom Jumbo" drilling rig

Features claimed: This standard machine is designed for high-speed driving of drifts, cross-cuts and tunnels. The Boom Jumbo drilling rig is capable of working in an



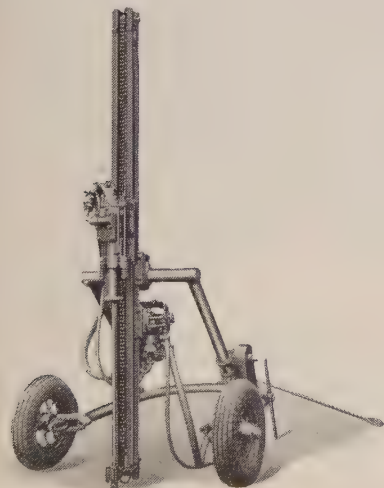
opening with a maximum height of 10 ft., and a width of 12 ft. Booms can be purchased separately for mounting on Jumbos for large tunnels and are raised or lowered into drilling position in a matter of seconds by powerful I-R air motors, relieving the operator of all manual lifting. Booms are controlled against settling, creeping or dropping and can be rigidly held in a desired position by a double-tapered clamp.

Manufacturer: Ingersoll-Rand Company, Dept. RD, 11 Broadway, New York 4, N. Y.

517

Versatile wagon drill for tough construction jobs

Features claimed: Unlimited drilling positions of the tower or drill guide are offered in this New Wagon Drill for road



building, construction, quarrying and foundation work. The unit permits easy drilling in any position encountered in modern rock excavation. Yoke can be lowered within the frame itself, placing the drill in the lowest desired position for toe hole work.

Continued on page 143

Dependable

CLEVELANDS



FIT
more
TRENCHING
JOBS

Many-purpose CLEVELANDS with their wide range of trench sizes equip you to tackle any trenching job at a close competitive figure... drainage—irrigation—cable and conduit—footings and foundations—utility main extensions and house services—pipelines large and small. Contractors depend on CLEVELANDS for steady, low-cost schedule-beating production under any and all working conditions. Above all, owners count on rugged CLEVELANDS for more job-time that pays off, instead of downtime that costs money. Rock, mud and tough off-season digging—narrow city clearances—short, scattered jobs with close deadlines—these are some of the problems CLEVELANDS are built to handle. Get the full story today. The Cleveland Trencher Co., 20100 St. Clair Avenue, Cleveland 17, Ohio.



SEE YOUR LOCAL DISTRIBUTOR

Albuquerque, New Mexico	J. D. COGGINS CO.
Billings, Montana	INDUSTRIAL EQUIPMENT CO.
Cheyenne, Wyoming	WILSON EQUIPMENT & SUPPLY CO.
Denver, Colorado	H. W. MOORE EQUIPMENT CO.
Great Falls, Montana	NOR MONT EQUIPMENT CO.
Los Angeles, California	SMITH BOOTH USHER CO.
Phoenix, Arizona	SHRIVER MACHINERY CO.
Portland, Oregon	LOGGERS & CONTRACTORS MACHINERY CO.
Salt Lake City, Utah	J. K. WHEELER MACHINERY CO.
San Francisco, California	EDWARD R. BACON CO.
Seattle, Washington	BOW LAKE EQUIPMENT CO., INC.

Wet Weather Maintenance

... Continued from page 82

smooth up the fill, cut, borrow pit or haul road at the end of shift. This can be done easily with a scraper by dragging the blade on the return trip or by back blading with a dozer.

Watch your drainage

Watch your drainage in the borrow area. Load down hill in the direction of lines of natural drainage. Keep the borrow area free of pockets or low spots that encourage ponding. Eliminate ruts by smoothing the borrow pit, or by going from the borrow to the haul road over different routes of travel.

Rooters are useful for securing bigger loads in the borrow or cut area. If conditions are wet or if it looks like rain, don't root material too far ahead of the scraper. Keep the area as solid as possible. Loose, rooted areas absorb water rapidly and get too wet to work. Settle for smaller loads rather than shutting down entirely.

For good drainage, keep cuts low at the sides and high in the center. Good operators construct cuts in this manner primarily because it's the only right way to maintain proper slopes.

Spread loads in thin layers

Keep the fill compacted as solidly as practicable. Do this by spreading the loads in thin, even layers. Compact by changing the path of travel of each load. For proper fill construction, build the

fill so it's high on the shoulders and low in the center. During wet seasons, it's a good idea to level the fill and give it some crown for drainage at the end of the shift. Following the proper procedures before rain, can save a lot of job down-time.

If working in rough, hilly country, it's easy to cut a few ditches with dozer or grader and thus keep water off the cut and fill.

Use more dozers after rain

Start back to work earlier after a heavy rain by putting available dozers to work a few hours ahead of other equipment. Use the dozer to skim off mud, drain and fill water holes and ponds. If there is a penalty existing against the job completion date, you can get to work faster by wasting, stockpiling, or spreading out to dry, mud or materials too wet to go on the fill. This material, if worth saving, can be picked up later a little at a time along with drier material. By doing this, too much wet material won't be placed in the fill at any one time.

Where showers have wet the top inch or so of the haul road, making it dangerous for rubber-tired units to work at top speed, pick up a load of sand or cinders or get some dry material out of the cut or borrow area and spread a thin layer over the haul road. If the haul road is too long to make this method practicable or if wetness has penetrated three or four inches below the surface, it can be scraped off with scrapers. Heavy grades

on the average construction road get slippery faster and stay slippery longer. For best performance, reduce grades to a minimum.

Soft spots in haul roads that bog down machines can be patched by mucking them out with the scraper or dozer and filling them with dry dirt from the cut.

Adjust tire pressures within recommended load-carrying limits for best job operation. Lower air pressure and reduced speed can be used where underfoot conditions are soft, spongy and rubbery to extended depths, and where flotation would be of first consideration. Use higher tire pressures to cut through shallow mud to get to firmer footing.

Following these procedures will help keep construction equipment working in bad weather. The foregoing tips were prepared by LeTourneau field engineers (R. G. LeTourneau, Inc.).

Construction Design Chart

... Continued from page 98

Since the ratio $\frac{L}{d} = 26$ exceeds this value

of $K = 25.6$, a long column is indicated, and the allowable stress would be

$$\frac{P}{A} = \frac{\pi^2 E}{36 (L/d)^2} = \frac{\pi^2 1,600,000}{36 (26)^2} = 649 \text{ psi.} = C_c$$

Then

$$P = C_c A = 649 \times (6)^2 = 23,364 \text{ lb.}$$

¹West Coast Lumbermen's Association.

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A hoisting mechanism easily raises the drill in a few moments. Vertical drilling close to a face is easy because the drill extends out beyond the limits of the carriage when the roller-bearing swivel-mounted wheels are turned 90 deg. The unit handles 6-ft. steel changes and is good for holes up to 24 ft. deep.

Manufacturer: Ingersoll-Rand Company, Dept. RD, 11 Broadway, New York, N. Y.

518

Smaller soil stabilizer for any size projects

Features claimed: The model EA-56 single pass soil stabilizer is designed to



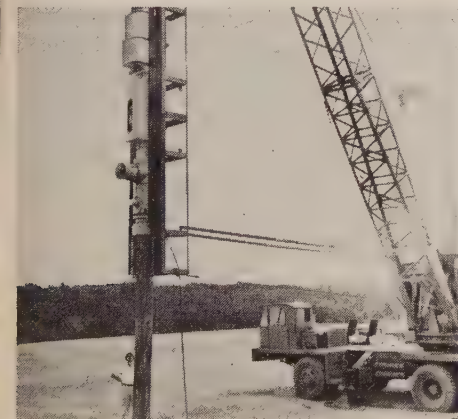
make the P & H method of processing stabilized base available for small projects. The device has a 5-ft. width, and can be used for all types of stabilized base construction, including soil cement, cement treated base, various combinations of cut-back asphalt or asphalt emulsions or tar with soil. The width offers advantages on smaller roadway, street or alley jobs. Two or more of the stabilizers can be used to advantage on larger projects.

Manufacturer: Harnischfeger Corporation, Milwaukee, Wis.

519

Diesel pile hammer requires no auxiliary equipment

Features claimed: Steam boilers and air compressors to maintain pressure are not required in the operation of this self-con-



tained diesel pile hammer. The tool is 15 ft., 6 in. long, of 20-in. diameter and weighs 11,000 lb. The hammer delivers driving energy at the rate of 16,000 ft. lb. per stroke and is capable of 84 strokes per minute. The weight of the ram or the striking part is 5,400 lb.; the maximum power stroke is 4 ft.

Manufacturer: Syntrol Company, 919 Lexington Ave., Homer City, Pa.

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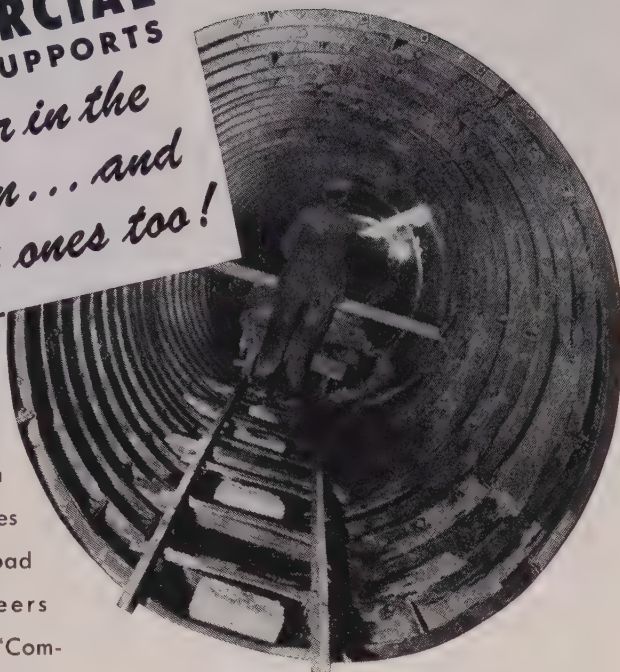
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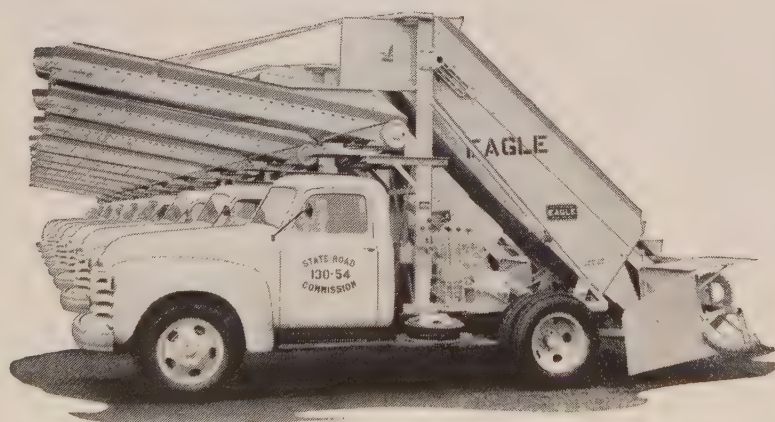
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Run-off Forecasts

... Continued from page 78

and delay snow melt until late in the season.

Water stored as snow in British Columbia, (nearly one-half of the flow of the main stem of the Columbia River comes from British Columbia), is slightly greater than at this time in 1950, being 30% above normal. However, water stored in snow on other rivers contributing to the Columbia, is generally less than in 1950. Even so, a cold late spring coupled with heavy precipitation would cause serious high water on the Columbia again.

Wyoming

The irrigation water supply outlook for both the Green and North Platte River watersheds in Wyoming is excellent. On the Green River the snow cover is 150% of normal. Soil moisture conditions are reported as excellent. The summer discharge of the Green River will probably not be as high as a year ago because of the heavy snowfall during April 1950.

On the North Platte drainage the snow cover is about 110% normal and on the Laramie drainage about 130%. The irrigation water supply for lands below the major reservoirs on the North Platte is assured. Storage in these reservoirs is now about 1,700,000 acre-feet. This is a record high storage and represents two times the past ten-year average. Soil moisture conditions in the upper Laramie Valley and in the Wheatland area on the same stream are relatively poor. Similar soil moisture conditions exist along the North Platte in eastern Wyoming and western Nebraska.

Snow covering the high watershed of the Snake River in western Wyoming varies from 24% to 27% above normal as of April 1. This insures the Jackson Hole area and adjacent lands below in Idaho of a good water supply for the 1951 season.

British Columbia

Water supply prospects for southern British Columbia are very good and far better than average. The Okanogan and Kootenai areas can expect unusually high run-off. Orderly snow melt has already started, but since snow cover is far above average, any interruption of the spring thaw by unseasonably cold weather would almost surely result later in extremely high flows. The flood potential must therefore be recognized although it cannot be so clearly defined now as a month hence. If the present thawing weather continues through April the flood potential will be materially lessened by May first. However, in any event, quite high flows are in prospect for Kootenai and Okanogan rivers due to the tremendous snow pack on those watersheds.

CHANGES in the West's outlook for water supply and run-off will be reviewed in the June issue of Western Construction.

NEW BOOKS . . .

Automotive and Construction Equipment

—By C. W. Lindgren. Published by C. W. Lindgren, Box 3620, Washington 7, D. C. 290 pages, 9 x 11 in. Price \$4.50.

Here at last is a book that gathers into its pages basic information about construction equipment and the use of it. Here at last is a book that recognizes construction as a unique field of business that must be learned by starting at the bottom—not at the top. The author, as a contractor, owner and civil engineer for thirty years, has supervised the work of practically every type of construction, from coast to coast. And his intimate knowledge of the tools of construction is evident in this book. The subject material is intended to acquaint the reader with basic information first—knowledge of equipment operators, mechanics, shops, engines and power, types of equipment and their use—all things which should be learned by those intending to manage investments that go into large fleets of trucks and construction equipment. Each major category of construction equipment is covered in a separate chapter under these four headings: discussion, types, uses, capacities. Approximately 50% of the book is devoted to construction equipment in the following categories: paving equipment, air compressors, trenching machines, rollers, graders, tractors, hoisting equipment, dump trucks, heavy duty trucks, medium duty trucks, light trucks, tank trucks. Another major portion of the book is devoted to a discussion of every phase of operating automotive equipment on construction jobs. Other chapters cover such subjects as: the

short haul, the long haul, fuels and lubricants, preventive maintenance, etc. Over 120 illustrations are included.

A Factual Discussion of Motor Truck Operation, Regulation and Taxation—

Published by the Bureau of Public Roads, U. S. Department of Commerce, U. S. Government Printing Office, Washington 25, D. C., 113 pages, 9 x 6. Price 30¢.

This bulletin presents in summary form the factual records and other data available to the Bureau, with discussions of their significance, which prove useful in any study and investigation of the transportation problem. The growth of motor vehicle registration and use; effects on the geometric design and traffic capacity of highways; axle loading effect on roads and legal limitation; vehicle weight and its effect on bridges; character of overloaded vehicles and their pay loads and allocation of highway tax responsibility are topics discussed in the informative publication.

The Mathematical Theory of Vibration in Suspension Bridges—

Published by the Bureau of Public Roads, U. S. Government Printing Office, Washington 25, D. C. 450 pages, 6 x 9. Price \$1.25.

This paper-bound book is a report of a study undertaken through the auspices of the Advisory Board on the Investigation of Suspension Bridges. Established after the collapse of the Tacoma Narrows Bridge in 1940, the board has sponsored a series of investigations to determine the

causes of suspension bridge vibration. The book develops the mathematical analyses of the dynamic problem and suggests experimental data needed to support them. Topics discussed in the study include a history of suspension bridge dynamic stress effects, frequencies, modes of vibration, and energy storage in freely vibrating suspension bridges with continuous stiffening frames, and application of the energy method to the analysis of the frequencies, modes of vibration and energy storage capacity. The flutter theory of truss-stiffened suspension bridges under wind action is included along with the linearized deflection theory developed for suspension bridges having tower stays. The book closes with an experimental verification of the linearized deflection theory. Extensive formulæ are contained in an appendix.

Heating, Ventilating and Air Conditioning Guide—

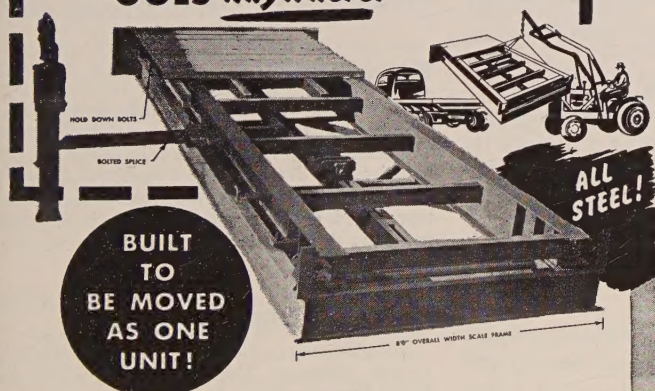
By the American Society of Heating and Ventilating Engineers, New York, N. Y. 1,048 pages. Price \$7.50.

The 1951 edition of this guide is completely revised and incorporates several special features which are valuable to the field. Its fifty chapters include such topics as fundamentals, human reaction, heating, and cooling loads, combustion and consumption of fuels, systems and equipment, special systems and instruments and codes. A system of cross-indexing has been employed to facilitate reference to the technical section and the manufacturers feature product section. Important charts and tables highlight the textual material which has been revised to incorporate new developments and techniques.

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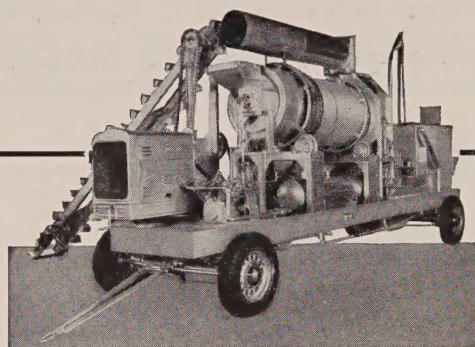
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NEW LITERATURE

YOU MAY OBTAIN any of the publications reviewed below. Send your request to **Western Construction**, 609 Mission St., San Francisco 5, Calif. The literature is free, unless otherwise indicated. Please designate the desired items by number.

520
Anchoring and drilling products

U. S. Expansion Bolt Co., York, Pa., offers Bulletin 140 as a guide to its line of masonry, anchoring, fastening, drilling and allied products. The condensed folder, pocket size, includes prices, illustrations and descriptions of the company's complete line.

521
Industrial and marine hardware

A new, revised and enlarged data book, combining valuable engineering information with an extensive catalog of the firm's complete line of wire rope and chain fittings is now offered by **The Thomas Laughlin Company**, Portland, Maine. Detailed working characteristics of each prod-

uct to remove guesswork in selecting the proper fitting and tables and charts for reference combine to make 44 pages of valuable assistance for engineers, architects, riggers and safety directors. Catalog No. 150.

522
Hand-held rock drills

Models WJ-45 and WJ-55 hand-held rock drills are the subject of a bulletin issued by **Worthington Pump and Machinery Corporation**, Harrison, N. J. Descriptions, specifications and photographs are included in the bulletin.

523
Liner plate tunneling

A bulletin entitled "Why Hire a Wrecking Crew to Install Underground Structures" discusses the use of **Armco Liner Plate** for tunneling jobs. On-the-job photos show the use of liner plate as water and utility line tunnels, and the physical properties are listed in a table.

524
Pumping concrete

Now revised and ready for distribution is a bulletin on **Rex Pumpcrete**, produced by the **Chain Belt Company**, of Milwaukee, Wis. The machine itself and the method of pumping are completely described in the booklet. The bulletin indicates on which types of jobs the device will work to best

advantage; what type mixes it will handle, and the height and distance requirements of a placing job. Bulletin No. 51-31 explains how concrete can be transported, elevated and placed in one operation.

525
Piloted type couplings

The **Falk Corporation**, Milwaukee, Wis., is offering a new bulletin which discusses the **Steelflex** piloted type couplings. Photographs and drawings are used to show the reactions of the couplings to various situations and a dimensional chart is included for easy reference by coupling users.

526
Peerless pump pamphlet

In a 26-page, glossy papered, fully illustrated bulletin, **Peerless Pump Division**, **Food Machinery Corporation**, Los Angeles, offers complete data on its broad line of general purpose pumps. Featured are the company's horizontal **Fluidyne** pump line, of the horizontal, end-suction centrifugal type.

527
Equipment operators' guide

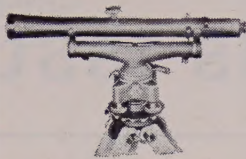
A booklet employing four colors and a comic book format thoroughly discusses the operation of bull-dozers, scrapers, rippers and cable controls, plus additional material on tires and grade stakes. Cleverly presented for easy reading and understand-

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 - 1—GMC Tractor Model ADCW, with Weber 45-Ton FX6 Trailer, with 60,000 lb. Winch mounted
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528

Diesel electric sets

Important design, operating and performance features of the company's four largest Diesel Electric Sets are presented in a new 16-page booklet issued by the **Caterpillar Tractor Co.**, Peoria, Ill. "Caterpillar Diesel Electric Sets" deals specifically with the D397, D386, D375 and D364 engines. Included are essential features of construction, operation, cooling and lubrication.

529

Spreading bituminous materials

Twin aids to better highway surfacing are described in two folders issued by the **Wm. Bros Boiler and Manufacturing Company**, Minneapolis, Minn. The Bros Bituminizer for clean smooth distribution of bituminous materials and the Bros Spraymatic Bar method of controlled pattern, straight starting and non-clogging application are fully explained and diagrammed in these two new bulletins.

530

Glued laminated lumber information

For those interested in complete technical data on structural glued laminated lumber, the **West Coast Lumbermen's Association**, Portland, Ore., has issued a fine

publication called "Standard Specifications for the Design and Fabrication of Structural Glued Laminated Lumber." Basis for the specifications in the 8-page booklet is data developed during several years of research by the Forest Products Laboratory of the Forest Service of the United States Department of Agriculture. Applications of the laminating process in modern construction are explained, and consideration is given the special effects which can be achieved in arches, beams, stringers, etc., by use of the material.

531

"Cummins Powered Euclid Equipment"

This new 16-page booklet, issued by the **Euclid Road Machinery Company**, Cleveland, Ohio, describes five Cummins Diesels and 11 standard models of Euclid equipment which they power. Models ranging from 165 hp. to 300 hp. in Euclid equipment from the 15-ton rear-dump Euclid to the 40-ton bottom-dump coal hauler are described.

532

Complete Caterpillar history

"The Endless Track," a new 16-page fully illustrated booklet, tells the story of Caterpillar track-type tractors, their origin, the reasons behind their construction and

performance, and the methods of the Caterpillar dealer organization. The success story has just been issued by the **Caterpillar Tractor Co.**, Peoria, Ill.

533

Material handling unit

The combination yard crane and "Swing" loader produced by **Mandt Manufacturing Company**, Columbus, Ohio, is thoroughly profiled in a new bulletin issued by the company. Features of the equipment, specifications and illustrations answer questions on performance and construction.

534

Logging equipment information

Fruehauf Trailer Company, Detroit, Mich., is issuing a 12-page folder detailing features of its special line of logging equipment. "Fruehauf Loggers" gives complete specifications on medium duty, heavy duty and extra heavy duty loggers and explains features of the logging trailers built by the firm.

535

Termite drill folder

Termite rotary masonry drills are briefly described in a pocket-size folder issued by the **Concrete Termite Drill Company**, Pasadena, Calif.

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