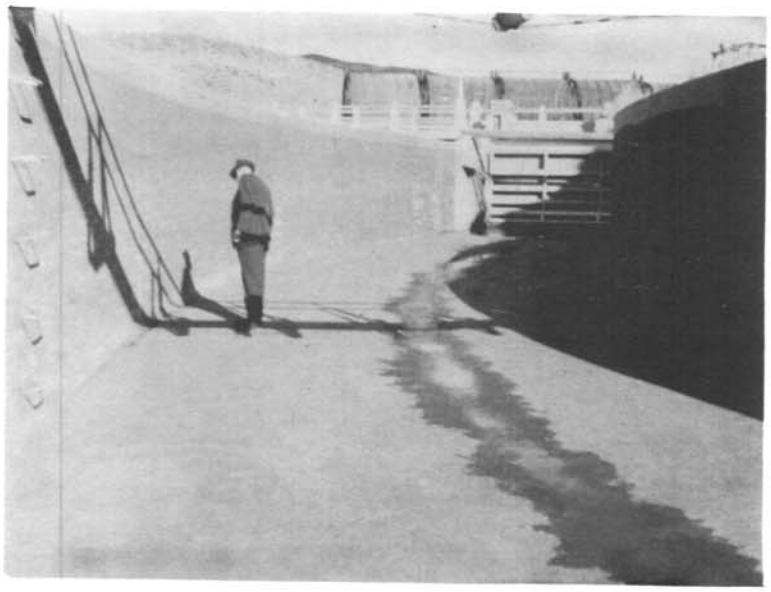
CONTROL OF ALGAE AND BLACK FLY ATTACHMENT TO CONCRETE FLUMES

Release No. 6 of the bulletin for September-October 1953 reported problems encountered with algae and naiad concoons on concrete flumes of the Black Canyon Canal, Payette Division, Boise Project, Idaho. The problem continues to be a very troublesome one in that the carrying capacity of the flumes is seriously reduced because of the attachment of algae and concoons to the sides and bottom surfaces of the flumes.

Several surface coatings have been applied to the concrete surfaces over the years to reduce the attachment of the foreign adherents; among these are CTP-3 paint, catalytically-blown asphalt, and more recently an antifouling paint. In addition to the paints and coatings of asphalt, chemicals which inhibit or retard the growth of algae were mixed with CTP-3 paint, and again more recently, a roof has been placed over a short reach of one flume to determine the effect sunlight has on the algae.

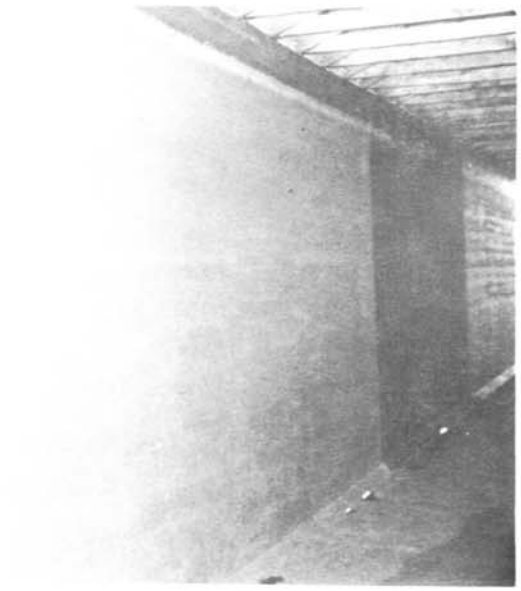
In commenting on the more recent attempts at control of both algae and concoon attachment, Mr. John Walker, Manager, Black Canyon Irrigation District, who is responsible for the operation and maintenance of the project facilities, states that covering the flumes will not control the black-fly activity and that the concoons do appear in tunnels and siphons. The infestation is usually heavier on rough surfaces. Turbulence or high velocity of water flowing in the flumes and tunnels reduces the problem.

The antifouling paint seems to inhibit the growth of the black-fly concoons to some extent, but whether this is because of the characteristics of the paint or smoothness of the surface has not been established by trials. The heaviest infestation this past year has been in a tunnel 9 miles from the head of the canal.



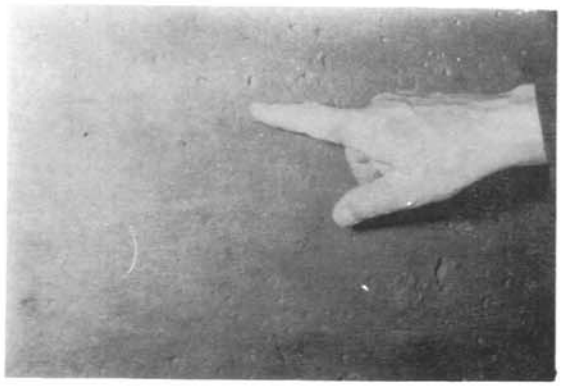
The antifouling paint applied to the bench flumes has given generally good results. The first flume immediately below the point of diversion, Station 0+00 to 6+30, is in fairly good condition, as shown at left, and the coating is expected to last through another year, the third irrigation season since application. The second flume, Station 86+52 to 102+00, will have to be

repainted again this spring. More difficulty is encountered in keeping this second flume in condition. The antifouling paint has only served for two irrigation seasons and it is contemplated that it will be painted prior to the beginning of the irrigation season with the antifouling paint at the rate of 1 gallon per 200 square feet.



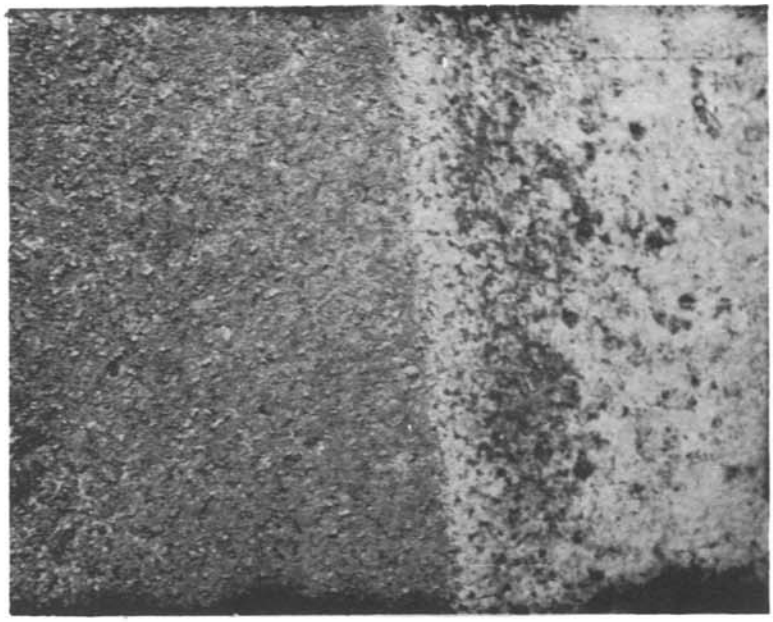
Covering the flumes with a shed roof definitely has advantages. The antifouling paint in the shade of the roof, as shown at left, is in much better condition than that exposed to the direct sunlight as shown in the photograph on the preceding page. An estimate of the annual cost of maintenance with the shed roof is close to that for more frequent painting.

It is estimated that the annual cost of painting is now $1.08 per linear foot of flume. The cost of the shed-type structure to cover the flume is estimated to cost $20.00 per linear foot. Some painting would have to be done under the sheds at about 6 to 7 year intervals. Interest on the investment would have to be added to the cost as well as the cost of maintenance. A distinct advantage, however, and an important one, is that the shed could be constructed during the winter and it would not be necessary to clean and paint the flumes during the rush period just before the start of the water season, when weather suitable for the painting operation permits.



In the photographs above, the condition of the paint with and without the protection of the shed are illustrated. The smooth, adhering paint under the shed in the left photograph, that has been in service two irrigation seasons, is in sharp contrast to the scaling, peeling

and deteriorating surface shown at right that has been in service for a similar length of time, but exposed to the sunlight.



The photograph at left shows the blackfly cocoons adhering to the concrete at the inlet to a siphon, although the concrete surfaces were treated with the antifouling paint.

Preparations for repainting must include the removal of adhering algae and cocoons as well as loose deteriorated concrete and other foreign matter.

* * * * *

ALUMINUM MARKERS FOR TRANSMISSION TOWERS
(Suggestion R2-57-116)

As a result of a suggestion of Electrical Engineer William Eckhoff, that aluminum decals be used in the marking of transmission line towers, automotive equipment and other property, the Bureau's Regional Office in Sacramento, California, decided to try the idea for a year in the marking of identification letters and numbers on transmission line towers, as shown at left.

Regional Supervisor of Irrigation and Power Martin Blote, has announced that the tests have proved the markers satisfactory and that this method of marking is now being used region-wide at a savings of some $1,500 per year over the previous practice of stencilling the identifying letters and numbers.

Further information on the use of the markers can be obtained by writing the Regional Director, U. S. Bureau of Reclamation, Sacramento, California.

* * * * *

SPREADER BOX ON DOZER BLADE
(Suggestion R2-57-9)

A spreader box mounted on the dozer blade of a tractor was constructed to spread roadway base material on the canal bank operating roads of the Lindsay Unit, Fresno Operations Field Branch, Central Valley Project, California. The box provided a uniform spread depth and width of material end dumped on the roadway from trucks, and was a joint suggestion of T. R. Meyer, Canal Superintendent, and Equipment Operators Lee Goodson, and J. B. McPhetridge.

With reference to the above photographs, the side panel of the spreader box was constructed of 3/8-inch plate steel about 24 by 30 inches in size and further cut to fit and welded to the dozer blade with a spread width of 10 feet. The side panels were later lengthened to about 4 feet to better carry the material in the spreading operation. (The top of the side panels had not been cut off at the time the photograph was taken.) The panels were braced with 3/8-inch by 2-inch strap iron, extending from the midpoint of the panel to the dozer blade.

Shoes were welded to the outside of the side panels with the bottom of the shoe flush with the bottom of the side panel 4-1/4 inches below the dozer blade. The shoe cut into the roadway surface about 1/4 inch giving a finished spread depth of material of about 4 inches and a sharp shoulder to the surfaced roadway.

Many improvements could be made in the box, according to the project employees responsible for the idea and its fabrication. A heavier steel angle, say 3/8-inch by 2-inch by 2-inch, at the top and bottom of the panel would have been more satisfactory in preventing the box from warping out of position when spreading around curves. Shoes of different depth could be provided for spreading thinner or thicker layers

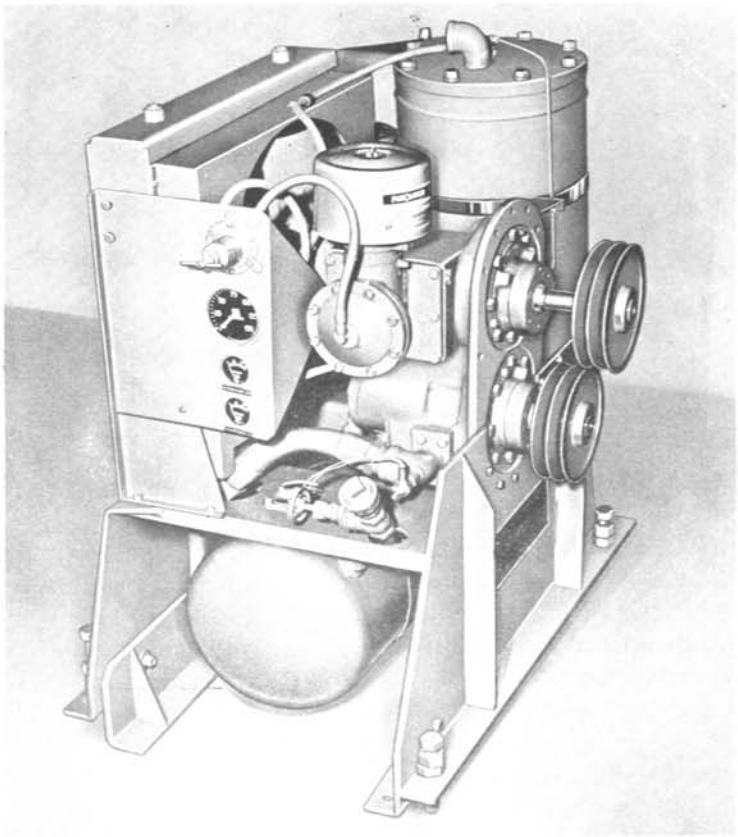
of material. Constructed of scrap material by O&M forces in 4 hours of welding time, the idea saved in equipment operation and did a very satisfactory job in meeting a maintenance need.

The method of spreading speeded up the truck haul, as the trucks were able to travel over the spread material, where otherwise the surface would not have been prepared for travel until all material had been spread.

* * * * *

NEW COMPRESSOR ADAPTED TO TRUCK MOUNTING

One of the leading manufacturers of air compressors has introduced a 125-cfm rotary model adapted to mounting in a maintenance truck with power for driving the compressor provided by the power takeoff of the truck.



This could be a very convenient arrangement for maintenance crews needing considerable quantities of compressed air in their work, but who for one reason or another find it inconvenient to trail a conventional wheel-mounted compressor.

Utilizing the truck's power also results in a considerable saving in first cost as well as in equipment maintenance cost. An idea of the compactness of the unit may be obtained from the photograph at left.

The cost of the 125-cfm rotary compressor unit as shown is about $2,700 in Denver, Colorado. The split shaft power takeoff to drive the unit is priced at about $400. Further information on this piece of equipment may be obtained by writing the U. S. Bureau of Reclamation, Code 400, Denver Federal Center, Denver 25, Colorado.

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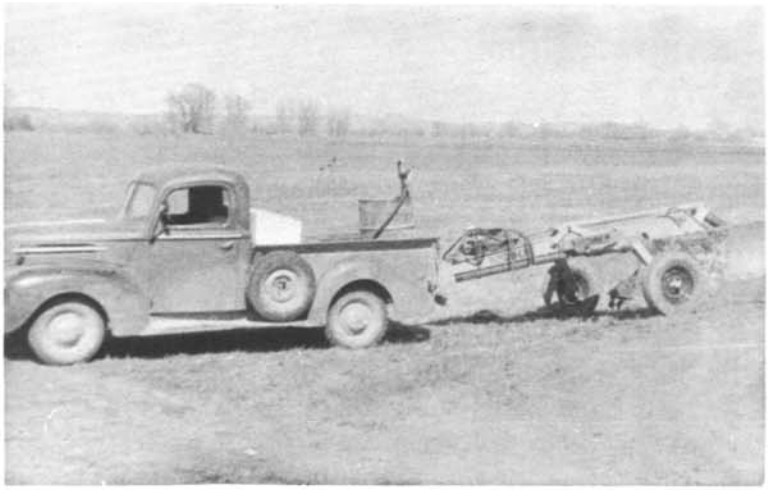
ONE-MAN DITCHER

Mr. Axel Persson, retired manager, Lower Yellowstone Project, Sidney, Montana, states that one big advantage of the ditcher shown below and on the following page is that it is coupled directly to the power unit and hydraulically operated, making the work accomplished with the ditcher a one man operation.

Commenting further on the piece of equipment, Mr. Persson states that there has been a need for improved mechanized maintenance equipment to increase the efficiency in maintenance on irrigation systems and at the same time reduce labor costs to a minimum. Due to the limited demand for certain types of maintenance equipment, manufacturers have been slow in developing this type of equipment; however, more recently, efficient and very useful equipment is now being developed. The ditcher described and shown here and bank slopers described in previous issues of the bulletin are comparatively recent equipment developments aimed at irrigation maintenance problems.

The ditcher has two hydraulic controls; one on the plow and one on the traveling gear. The dimensions of the ditcher are: 10.6-foot blade, 10-foot wing spread, and 30-inch depth of blade. The ditcher can be adjusted to clean any size ditch from 1 foot to 4 feet in depth, and can be raised to clear the average structure or ditch bank that the power unit can clear. The ditcher shown in this article and in use on the Lower Yellowstone Project, is mounted on a crawler tractor. With the quick breakaway hose connections and hitch, the ditching unit can be dismantled in two minutes.



The mobility of the ditcher is shown in the photograph at left. Attached to the pick-up truck, it can be moved from place to place quickly and with a minimum of effort or lost time.

An example of the clean job performed by the piece of equipment is shown in the two lower photographs on this page.

Mr. Persson reports that the ditcher will cost approximately $1,500 f.o.b. the factory, plus extras that may be required for attachment. This year the project was able to clean approximately 150 miles of ditch and surface drains at an average cost of $8.00 per bank mile. The one-man operation is a saving in man power alone of more than the cost of the ditcher. Work performance is considered superior to any other ditchers the project has owned.

The ditcher is not carried in stock by the manufacturer, but will be made up on order in approximately 30 days. If further information is desired, write U. S. Bureau of Reclamation, Code 400, Denver Federal Center, Denver 25, Colorado.

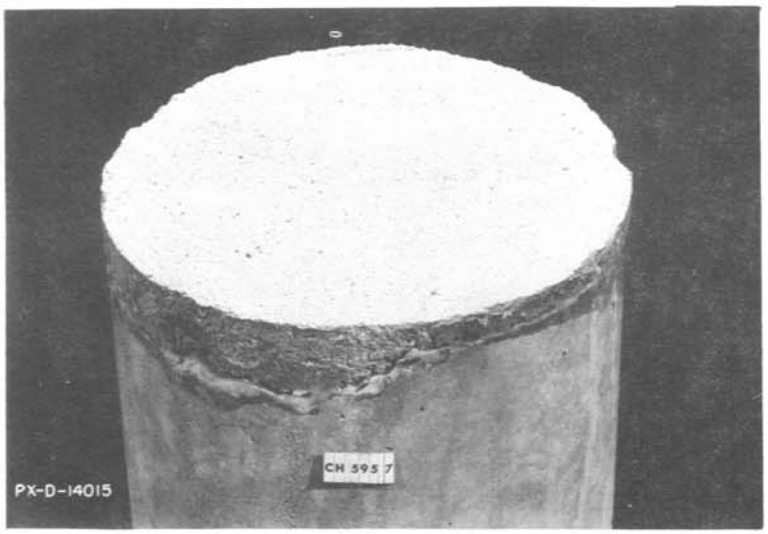
* * * * *

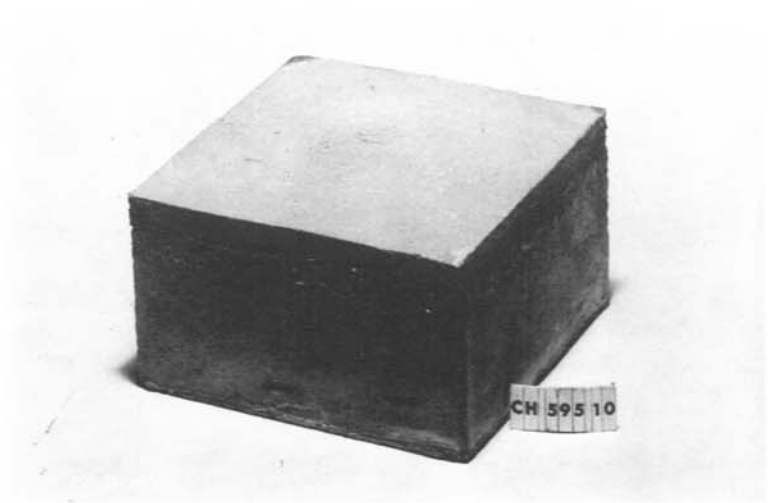
CONCRETE BONDING AGENTS

Tests preliminary to more exacting evaluation of concrete bonding agents have been conducted by the Engineering Laboratories of the Commissioner's Office, Denver, Bureau of Reclamation. From these preliminary tests some outstanding results have been obtained by using an epoxy-polysulfide bonding agent.

The tests included the bonding of fresh mortar to old concrete, bonding of old concrete to old concrete, and the patching of holes in concrete. Of the materials included in the tests, the epoxy-polysulfide bonding agent proved superior to other bonding agents and generally showed the bond to be stronger than the original concrete.

Bonding Fresh Mortar to Old Concrete





Two types of specimens were used in the tests, as shown at left, 6- by 12-inch cylinders and 3- by 3- by 1-1/2-inch mortar blocks. One half of the top surface of each cylinder was chipped; the other half was left as formed. The surfaces to be patched (capped) on all specimens were then etched with a 5 percent hydrochloric acid solution and rinsed.

Control specimens on which the patch was applied without a bonding agent were thoroughly dampened prior to application of the mortar. Specimens to be patched with the epoxy-polysulfide bonding agent were air-dried before application of the mortar patch.

The mortar for the patch was a 2:1 sand-cement dry-pack mixture. No. 30 sand was used in

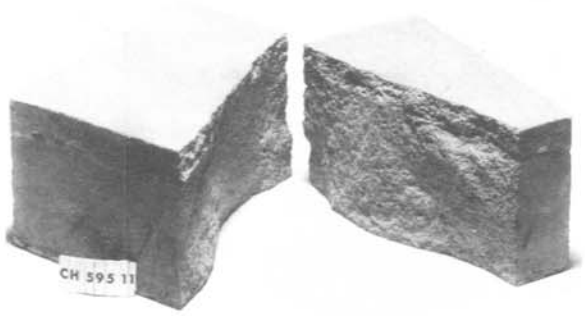
the patches for the cylinders; No. 50 sand for the blocks. The patches were 1/4-inch thick.

The patched cylinders were left at room temperature overnight, then placed in a fog room for 4 days. The block specimens were placed in a fog room for 4 days immediately after initial set had taken place in the mortar patch. The specimens were air-dried for 1 day after removal from the fog room before being subjected to test.

Impact tests, which are often used to evaluate the adhesion of one material to another, were used in these preliminary evaluation studies. The force of an impact blow causes disbonding proportional to the adhesion when such factors as elasticity, flexibility, structure of the joining materials, etc., are considered. When similar topping layers are compared, a correlation between impact resistance and adhesion exists. For the test, a 600-gram steel ball was dropped onto the patch. The ball was dropped from a height of 8 feet above the base of the specimen. Distance of travel to the cylinder patches, therefore, was 6 feet 11-3/4 inches, and 7 feet 10-1/2-inches for the cylinders and blocks, respectively. The cylinders were struck in two places; one on the patch over the chipped base area and one on the unchipped base, each blow about 1-1/4 inches from the edge of the cylinder. The block specimens were struck near the center of the patch.

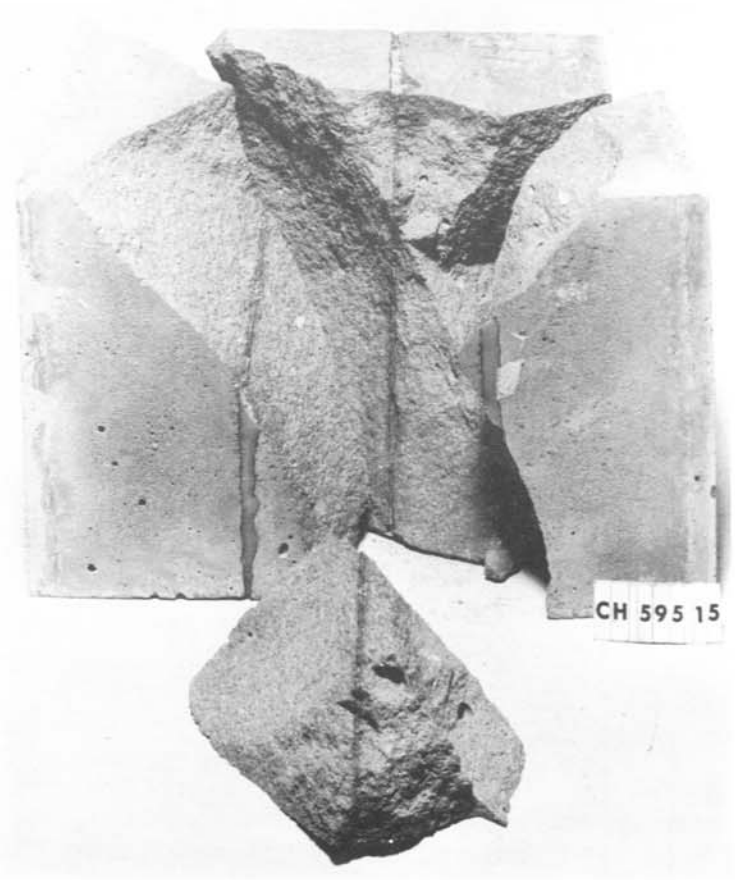
The control or blank specimen, fabricated by applying mortar directly to the surface to be patched without a bonding agent, as stated previously is shown at left. A segment of the patch was broken and disbonded upon each impact of the steel ball on the cylinder patch. The patch to the cylinder after the epoxy-polysulfide bonding agent had been applied as a brush coat to the surface is shown in the upper photograph on the preceding page. No apparent damage was evident after impact on the specimen and the points of impact can be clearly seen as depressions in the patch.

The patch applied to the control or blank block specimen is shown in the photograph at left on the following page. The patch was completely disbonded from the specimen on impact and it will be noted that a crack extends through the patch and block. The photograph at right, also on the following page, shows the result of impact on the block specimen the surface of which was treated with the bonding agent



prior to placement of the patch. The specimen broke cleanly through the patch and block. There was no evidence of disbonding in the adhesive layer or in the patch.

Bonding Old Concrete to Old Concrete

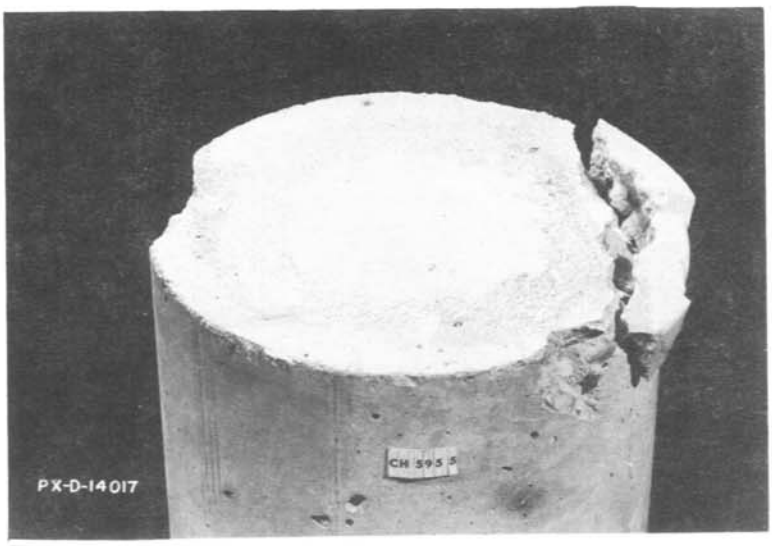


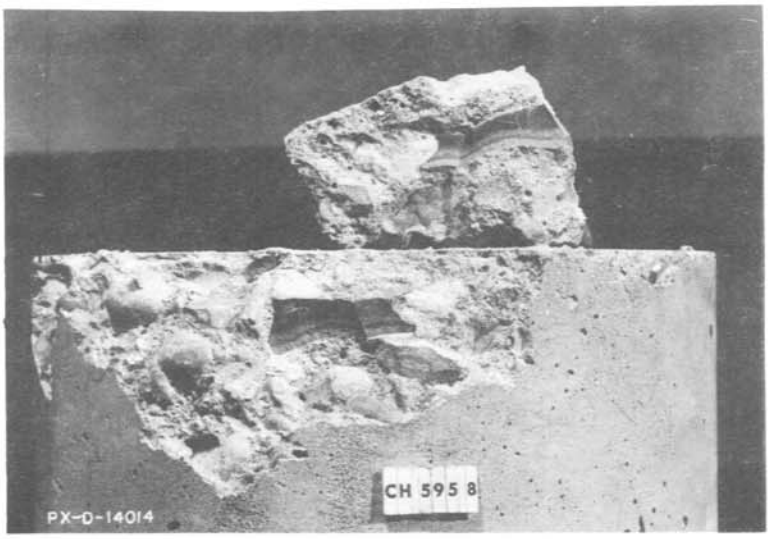
To obtain some idea on how the epoxy-polysulfide would perform as a bonding agent between old concrete and old concrete, two 3- by 3- by 1-1/2-inch blocks were cemented together, cured, and then tested under impact. The surfaces of the two blocks were cleaned, etched, rinsed, and then dried. The bonding agent was brush-applied lightly to each of the surfaces to be joined, again following recommended procedures. The blocks were then placed together and left at room temperature to cure. No pressure was applied to the joint during curing. After 6 days, the impact test was made, with the point of impact being on the joint.

The photograph above shows the result of three impact blows on the joint. No loss of adhesion is evident. The break in the specimen is as if a single solid block were broken.

Concrete Patching

A brief test was made on a catalyzed epoxy resin patching material that had been made available. The material, which contains an inert filler, was applied to a hole chipped in the top of a cylinder specimen and as an edge patch to a chipped edge. After curing, the impact tests were run.





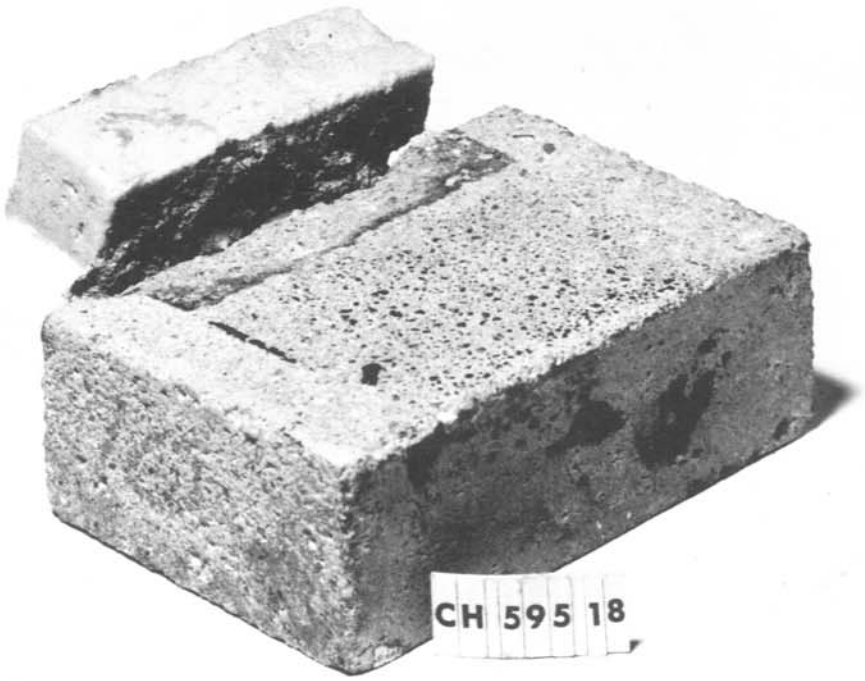
Results of the impact tests are shown in the photographs at left. No apparent damage is evident in the center patch. The concrete base of the edge patch broke rather than the patch after three impact blows. At the left edge is a break in the concrete edge caused by one impact blow on the original concrete to the specimen. Regular impacts on these materials will be made on specimens similar to the mortar patches, rather than on a restrained patch.

The lower photograph shows the broken concrete base of the edge patch shown in the upper photograph at the right side.

The photograph on the following page shows part of a specimen fabricated for extension tests and shows the break in the mortar block rather than at the interface or within the resin mass when the specimen was broken. The material is the same catalyzed epoxy resin compound used in the above cylinder patching tests.

Additional studies on the epoxy-polysulfide bonding agent, the epoxy patching materials, and other materials for use as bonding agents and patching materials are being continued in the laboratories. The studies will include tests made after alternate wetting and drying, after

freezing and thawing, and after normal aging. The more exacting evaluation of those compounds and materials which show promise in impact screening tests will be by shear bond tests similar to but smaller than those used by Mr. Earl J. Felt, reported under "Resurfacing and Patching Concrete Pavement with Bonded Concrete, "Highway Research Board Proceedings, Volume 35, page 444, 1956.



Field Applications

On the basis of the tests made to date, and since other laboratory data are not available yet on a variety of compounds, the Bureau's Laboratory has suggested the epoxy materials be used in limited applications for concrete repairs in the field. The bonding agents are relatively expensive at present, one gallon of the material costing about $20. That is enough material to treat about 250 square feet of surface area. The filled patching materials of course are used at lesser rates depending on the thickness of the patch to be applied.

It is suggested that all proposed trial applications be approved by this office. Certain procedures and precautions must be followed in the use of these materials. Proper handling is necessary to avoid hazards to the health and wellbeing of personnel that come in contact with them. Sources of the materials and proper handling directions can

be obtained by writing the Commissioner's Office, U. S. Bureau of Reclamation, Denver Federal Center, Denver 25, Colorado.

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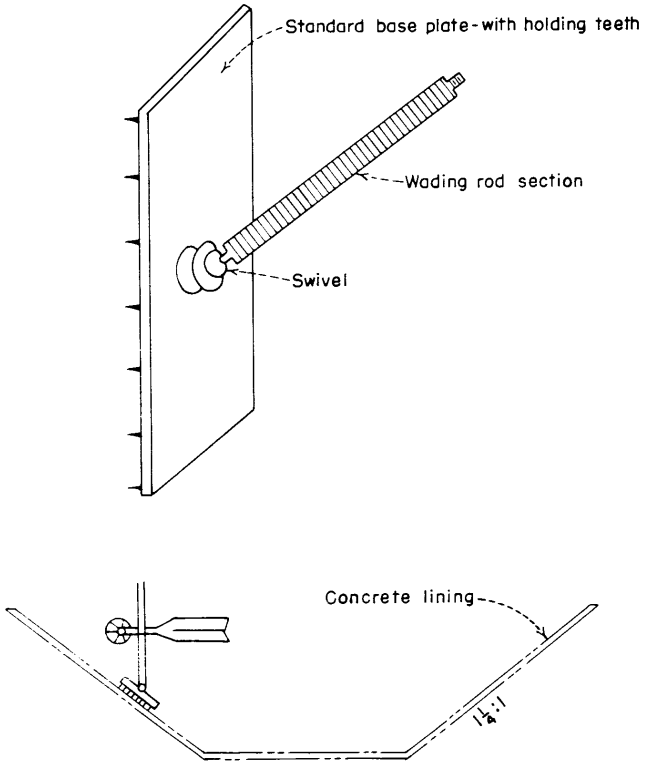
BASE PLATE FOR CURRENT METER ROD
(Suggestion R2-59-160)

A steel toothed, swiveled, current meter base plate for making wading rod current meter measurements in the sloped concrete-lined canals is being used on the Contra-Costa Canal System of the Central Valley Project, California. The device is a suggestion of Donald J. Berry, Supervisory Engineering Technician, of the Tracy Operations Field Branch.

Considerable difficulty has been experienced in the past during current meter measurements of small flows by the wading rod method in small, lined canals. The difficulty arose when the straight rod was placed on the side slope of the canal and held in a vertical position. The rod was susceptible to sliding down the steep, relatively smooth slope, thereby causing erroneous readings of current and depth at a particular station or interval being measured.



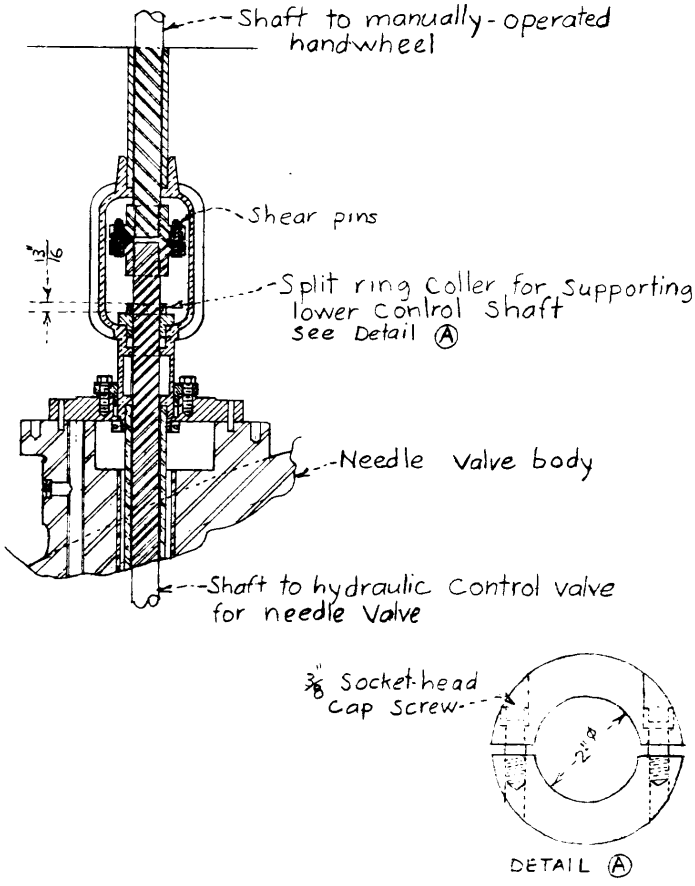
The device consists of case hardened steel teeth on the bottom of a metal base plate as shown in the sketch above and aids materially in holding the rod steady on the sloping concrete. A swivel permits positioning of the wading rod and current meter in a vertical position. Holding the meter properly allows the hub bearing to turn freely on the pin.

* * * * *

SPLIT-RING COLLAR SUPPORTS OPERATING SHAFT
(Suggestion R3BC-58-133)

Outlet works at Hoover Dam, located on the Colorado River and a part of the Boulder Canyon Project, include eleven 84-inch and twelve 72-inch needle valves which are hydraulically operated by use of water at penstock pressure. The control stands are located on a floor above the needle valves and the 4-way piston type control valves are located under the needle valves. Shafting passing completely through the needle valves is used for connecting the control stands to the 4-way control valves.

The bearing that supports the lower section of the control shaft is inside the 4-way control valve. Consequently, this section of the control shaft must be supported from above before the control valve can be dismantled. Because of the corrosive action of the Colorado River Water, the piston-type valves must be dismantled and cleaned annually. Cleaning operations include removing the loose rust and scale which is deposited in the water passageways and removing a lime coating which collects on the machined surfaces.



HOOVER DAM
SUPPORT FOR CONTROL SHAFT
ON NEEDLE VALVES

A device that has been permanently installed on each of the large needle valves at the Hoover Powerplant and which has been very satisfactory is a split-ring collar shown in the sketch at left. Support for the lower shaft in the manner indicated was a suggestion of Houston I. Wheeler, Powerplant Mechanic, who headquarters at Boulder City, Nevada.

People responsible for maintaining needle valves of the type described on other Bureau works have probably encountered similar problems and can depend upon the suggested device supporting the weight of the lower operating shafts.

* * * * *

CLEARING FLOATING LOGS FROM RESERVOIRS

Winter storms bring a huge pile of logs and other debris into Shasta Lake, the 4,493,000 acre-foot reservoir created by Shasta Dam on the Sacramento River in northern California, and an integral part of the Central Valley Project. The logs are a threat to navigation and a menace to life and must be cleared away. Clearing is done by "snaking" the logs by boat to shore where they are fastened to trees or other logs so fastened, and where they can be burned when the water level in the reservoir is lowered.

Faced with the big operation involved in clearing the logs from the lake, Marine Foreman W. Evert Rice, Tugboat Operator Arthur M. Parks, and Motor Boat Operator Meral A. Elliott, began devising a means to do the work faster, easier, and in a less expensive manner. They devised a hinged platform that enabled them to work at water level from the boat while tieing the logs together; a drum to hold scraps of wire used for tieing the logs together; and a jig for making eye bolts from big spikes that are driven into the logs and through which wire is threaded for the towing operation.

Water Level Working Platform

The working platform shown in the photograph at left swings over the side of the boat and provides a platform on which a crew member can stand while driving bolts or spikes into the logs for towing to shore, either one at a time or several fastened together. Without the platform, the whole operation would be extremely difficult and hazardous, because one could not reach the logs and drive the bolts from deck level.

Eye Bolt Jig

Eye bolts of the size necessary cost 25 cents or more each. By devising a jig from pipe and by clipping the heads off spikes

with a bolt cutter, the spikes can be used instead of eye bolts, at a cost of only about 4 cents each, which includes the cost of labor for bending and cutting. The jig for bending the spikes and one of the finished spikes are shown in the photographs below.

In addition to the saving in the cost of material, there was an additional saving of time in the use of the pointed spikes which were easier to drive into the logs. The U-shaped open end formed in the spike made it possible to drive the spike into a log part way, and a tie line, which may be holding several logs together, can then be snapped under the hook end of the spike before driving it completely into the log over the wire. With a closed eye-bolt, the end of the long towing line would have had to have been threaded through the opening in the eye-bolt.

Cable Drum for Holding Wire Scraps

Various kinds of scrap wire is used for tying the logs together--old telephone wire, power line wire, fence wire, etc. There had to be some device for holding and dispensing such scrap wire and the cable drum made from scrap and shown on top of the boat cabin was fabricated by the resourceful employees.

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GPO 933308