New Ways to Apply Aquatic Herbicides

PART II

This is the second of two articles prepared by the Phelps Dodge Information Service on the various types of equipment in current use for application of copper sulfate and other common chemicals for control of algae and aquatic weeds. The first installment appeared in February.—Ed.

Helicopters

PROBABLY the newest technique involves the use of helicopters. The East Bay Municipal Water District, Oakland, California, undertook some experiments at San Pablo Lake in 1963. The work was done under the general supervision of G. L. Laverty, Supervising Sanitary Engineer, Cali'copters of Stockton, California.

The equipment used by Cali'copters is basic agricultural dry-chemical feeding apparatus, consisting of a Bell 47G-2 Helicopter, two 250-lb.-capacity saddle hoppers, automatic gates, blowers, and ducts. The system is capable of putting out 2,000-2,500 lbs./hour. On all but one of the treatments, the effectiveness of the helicopter was superior to that of the boat-and-sack method on the basis of biweekly plankton samples which were routinely taken from the lakes. Analysis of these samples indicated that East Bay could anticipate fewer treatments during the year using a helicopter rather than a boat. The one treatment which was unsuccessful involved using powdered $CuSO_4$ in an effort to find an acceptable grind. The criteria for the $CuSO_4$ grind are (1) it must be compatible with the feeding equipment, (2) dissolve in the top 10 feet of the water, (3) create a minimum drift problem, and (4) be commercially available at an economical price.

The calculation of the total dosage is based on the amount of water in the lake in the top 10 feet for a given elevation. To this total amount of water was added $CuSO_4$ in the proportion of 4 lbs. per million gallons. For calibration of the feed equipment these total pounds can be converted to pounds-per-acre with the aid of area capacity tables for the lake. The pounds-per-acre will be virtually constant for the deeper parts of the lake and will be less for the shallower regions.

Exact calibration of the feed can be made by relating helicopter heights and speed to hopper opening for the required dose. The hopper opening is set by making a catch of material with the blowers turned on for a given length of time and weighing it. Usually, however, the pilot, equipped with the knowledge of the pound/acre dose and the lake area, or the total pounds for each lake, adjusts his hopper settings based on experience.

The $CuSO_4$ does not leave an immediate trail by coloring the water which the pilots could use as a guide, and, therefore, there have been some alignment problems. However, permanent shore markers would be a possible solution.

Airboat

Another possibility involving the use of equipment that can be purchased rather than made is the airboat. One of the newest developed utilizes ducted fans rather than an open propeller. This particular equipment is manufactured by Aquanautics, 966 Commercial Street, Palo Alto, California, under the trade name of the "Swamp."

The Swamp (Shallow Water Aero Marine Propulsor) class equipment (Swampcat and Swampfox) are moderate-sized planing hulls constructed for operations in shallow water, marshes, and swamps. There are no under-the-hull protrusions to limit their passage and they are propelled by a ducted fan system.

The ducted fan delivers nearly twice as much thrust as an open propeller. When used as a distributing means for liquids or powders it provides a controlled and directed beam, allowing uniform distribution of the material.

The equipment can be fitted with bogie wheels which can be raised and lowered by hand for ease in going in and out of water and for highway trailering. Twin tiltable water rudders are provided for steering.

Two methods of material distribution can be provided. Solid particle material is delivered to the back side of the ducted fan by a pneumatic blower system with its own power source. Liquids are pumped to a small nozzle system mounted behind the ducted fan. Provision can be made to inject powders into the liquid system to reduce airborne loss or unwanted distribution.

(For other airboat suppliers, see *WTT*'s Suppliers Guide in the December 1964 issue—Ed.)

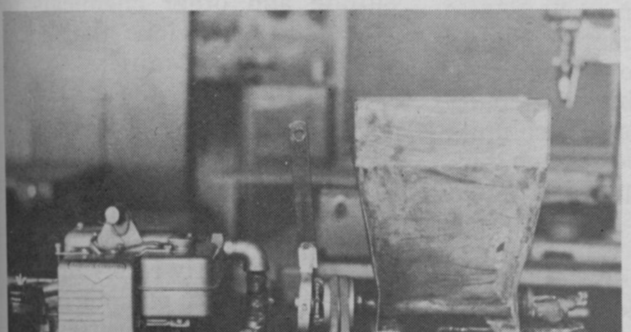
Underwater Delivery

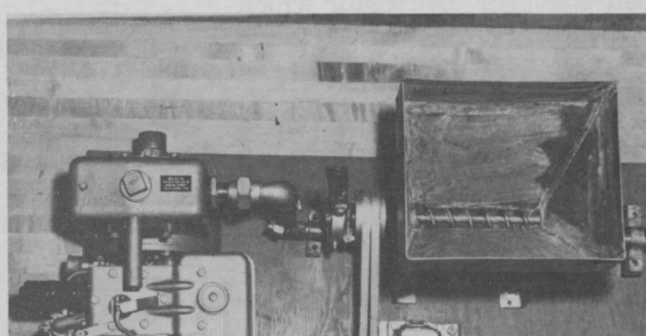
Although the majority of applications are concerned with the upper levels of water there are occasions where conditions dictate depositing a concentration of algicide within 6" of the lake bottom. This is particularly desirable when controlling the snails and cercariae responsible for swimmer's itch.

The State of Michigan Water Resources Commission has developed equipment to release a slurry just above the lake floor.

The equipment consists of a Briggs & Stratton air-cooled gas motor coupled directly to a pump. This pump not only serves as an intake but the discharge is passed through a venturi to generate the pressure needed to carry the subsequent slurry to the outlet hoses. These

From basic boat-and-hopper outfits to such sophisticated rigs as those mounted on helicopters, aquatic weed controllers have a wide choice when deciding how to apply weed control chemicals. Above is equipment designed by the Michigan Water Resources Commission for combatting swimmer's itch. Helicopters, such as the one at right, are finding their way into the aquatic arsenal, although this particular unit is rigged for land use. Below are two views of a device built by the Michigan Water Resources Commission to deliver copper sulfate slurry to underwater outlets. Side view is at left, top view on the right of the page below. In this system, copper sulfate crystals are fed from hopper by worm drive to flushing cone where they are mixed with water and passed into a discharge pipe. A jet nozzle and venturi in the discharge line build up the necessary pressure to deliver the slurry under water. Water used in this process is drawn from the lake by a Homelite pump. Other methods were discussed in the first part of this article which appeared in February '65 WTT, page 18.





hoses are adjustable to serve a depth of 3′ to 12′. By means of a V-Belt, gear reducer and clutch, the motor also drives a worm-screw feed in the bottom of a hopper. This hopper is located over the discharge line.

The hopper is filled with granular material which is fed into the water discharge line by means of the worm.

The complete rig is mounted on two pieces of ¾″ marine plywood and clamped to the boat. A "Y"-connection on the discharge line leads two hoses to a seven-outlet pipe across the stern of the boat.

The rate of application is 2 lbs. per 1,000 sq. ft. of a mixture of 8 parts granular-grade copper sulfate with 1 part hydrated lime. The slurry is released subaqueously just above the beach floor which results in a concentration of 32 ppm in the first foot of water over the lake bottom, or 87 pounds per acre.

Belt Conveyor

Frequently it is desirable to utilize large crystals of copper sulfate penetrating to a greater depth before dissolving, particularly if deep water growths of weeds and algae are a problem. Conversely, at certain periods of the year, the fine grind is needed to combat microscopic organisms near the surface or in shallow areas.

The Department of Light and Power of the City of Los Angeles has designed and built a belt conveyor distributor which provides great flexibility.

By a minor adjustment of the feed slot the belt conveyor machine allows the operator a range of from 1.2 pounds to 200 pounds per minute in the feed of the chemical used. It is a light machine of approximately 120 pounds in weight and is in two sections, making it possible for one operator to transfer the machine from a truck to a boat if required. The belt conveyor feed operates very evenly. It drops the chemical into the propeller wash of the boat and the distribution of the chemical is not wholly dependent on weather conditions. The hopper is very low, 28″ from the boat deck, which means a minimum of effort required to fill the hopper with chemical. The belt conveyor trough is adjustable in height, and will fit the stern of practically any boat. This machine, after the initial adjustment of chemical feed, requires very little attention from the water-treatment operator. This allows the operator more time for directing the boat operations to get the required distance between boat lanes and full coverage of the reservoir.

Continuous Feed Solution

When it is necessary to maintain a constant copper (or other chemical) residual in a body of water, or when it is desirable to treat water being drawn from a stream, continuous feed equipment frequently will serve the purpose.

This is the second and final article on equipment available to contract applicators for application of chemicals to aquatic areas. Part I appeared in the February issue.—Ed.

Pondweed and duckgrass growths are controlled in reservoirs of the Los Angeles Water and Power Company using continuous flow equipment.

The solution feed units range in capacity from 1,200 to 15,000 pounds and are of sufficient size to hold a minimum of five days' supply of large copper sulfate crystals. This allows the operator to visit the installation on a semiweekly basis. These units consist of a redwood storage tank and a water supply tank. On opposite sides of the redwood tank 4″ by 6″ screenboxes are constructed extending the full depth of the tank. The lower section of each box is perforated with a number of ¼″ diameter holes. These are large enough to allow the free flow of inlet water and outlet solution but will restrict the large copper sulfate crystals (1″ by ½″) from clogging the inlet and outlet lines. The water supply is furnished by a constant level tank, and the flow is regulated by an adjustable outlet. All pipe fittings on the copper sulfate solution side are of hard rubber or plastic. The water level in the bottom of the redwood tank is maintained at a depth of about 12″. The rate of feed is determined by the flow of water from the adjustable head box through the tank, and the concentration of the copper sulfate in the saturated or nearly saturated solution is dependent upon the temperature of the water.

For treating water drawn from a river, the system developed by the Terre Haute Water Works is inexpensive to construct and requires no attention except for replenishment of the chemical.

The copper sulfate is added at a receptacle made out of a concrete tile, 18″ in diameter and 24″ in length, set on a concrete base, with a perforated copper ring installed at the bottom of the tile. An inlet line delivers the water supply to the copper ring, furnishing a jet action inside the tile, where copper sulfate is placed, resulting in the copper sulfate solution feeding continuously from the outlet, through a 2″ plastic pipe.

Flow of water from inlet line to copper ring is regulated to control feeding rate of the solution.

While this article has touched on some of the varied types of equipment used to apply copper sulfate and other chemicals to water, it is obvious that local conditions frequently dictate modifications of the machines and changes in operating procedures.

The Phelps Dodge Refining Corporation Information Service at 300 Park Avenue, New York City, is constantly receiving data on systems and equipment developed and used by waterworks and commercial applicators. The advent of advanced techniques and new developments relating to water treatment are part of continuing studies by the Information Service and will be made available to those concerned with water management.