houses, the plants needing water only about every two weeks.

5. The plants stay dormant 2 to 3 weeks longer in the white houses, breaking dormancy about the same time as plants left outside.
6. Foliage color is a little better on plants in the white houses.
7. The clear plastic is much stronger than the white plastic. The white plastic on all the houses covered for the winter of 1964 failed before March 15, 1965. This was a serious problem and forced us to abandon the use of white plastic. However, it is possible we used an inferior grade of opaque plastic in our tests.

MODERATOR KLUPENGER: Our next speaker is Mr. Henry Mollgaard, Mollgaard Floral Co., Snohomish, Washington who will speak to us on mechanization of propagation structures. Mr. Mollgaard:

MECHANIZED GLASS STRUCTURES

HENRY B. MOLLGAARD
Mollgaard Floral Co.,
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In a structure where three to six crops of potted plants are being transported during a year, provision for moving plants quickly and easily is essential. One effective means of operating a greenhouse efficiently is to mobilize equipment, using trucks, hand, and electric carts.

Easy accessibility around, to, and in the greenhouse must be provided for this equipment. Roads and walks inside and around the greenhouse should be either blacktop or concrete. The first is the least expensive, but gives some problems resulting from the weight of heavy equipment and from its softness during warm weather. The packing shed, too, should be completely surfaced.

Inside most new pot plant greenhouses the benches run crossways with a wide access aisle going the long way. As an example, a 37½ foot wide house may have a 5½ foot aisle and 32 foot long benches. The 5½ foot aisle provides enough space for an electric cart. Between the houses, a sheet of plastic is sometimes used to help control the heat. It can be raised for moving plants on the bench. Through this arrangement the plants are only carried as far as the center of the bench, which is 16 feet. A road wide enough to accommodate trucks crossways through the middle of the house will also cut down loading and unloading time. Of course, the gutters have to be high enough for the top of the truck to clear. The greenhouse doors used most often preferably should be electronic with the electrical carts and trucks equipped with devices to operate the doors. This will enable the driver to move swiftly about the greenhouses.

A roadway through the greenhouses makes it possible to move pallets of pots and potting tables or wagons close to the area where the potted plants are being finished. Also, potting tables where one side can be lowered can be used to sterilize the soil after it has been mixed in a concrete mixer or by a conventional soil shredder. In some instances, of course, soil is moved by tractors with scoop shovels and the pallets moved with tractor attachments. Conventional hand carts, electric carts, and fork lifts are also used.

In northern regions, where weather conditions are a problem during a short period of the year, more attention must be given to greenhouses in achieving good control of temperature and humidity. Control of air circulation and heat, plus the use of CO_2 has seen a marked change during the last few years. A real effort has been made to make the controls automatic. Thus it would be possible to set a dial for the correct temperature and this would be achieved automatically by a step-controller. These have up to 10 steps with high to low temperature alarms. Two steps of heat, one louver, three exhaust fans, and one pump for pad and fan air-conditioning. One sensing unit per house will switch on, in turn, the units in the right sequence as needed.

More than one thermostat or control per house usually leads to complications and unsatisfactory results. In heating greenhouses, polyethylene tubes have been used for convection-ventilation for forced air circulation, for heating systems, and for CO_2 distribution. Since only one or two tubes are able to take care of all of these functions they are economically feaible to use.

In pot ranges, as well as cut-flower ranges, watering of plants is being controlled more and more by time clocks operating individual tubes going into each pot with the main plastic distribution pipes being turned on by section. Clocks of the type used for golf course watering work well and are readily available in all price and quality ranges. Each section can be watered from one control station with a maximum of accuracy and a great savings in time.

Boilers, of course, are all automatic and can be operated by gas or oil just by the flick of a few switches. Here, we can take advantage of the low, interruptible, rates.

Electric time clocks can control the shading of mums with one clock and motor operating a shade cloth cover for a whole range. Electric clocks permanently installed can also control the lighting schedule for mums. Electric timers, too, can control the misting schedule for cutting propagation.

MODERATOR KLUPENGER: Our next speaker is a past president of the California Association of Nurserymen. He is with Perry's Plants, Inc., La Puente, California. This is a very unique operation, another one of California's great enterprises.