4. The cubes are then conveyed to a storage area where they are ground to the desired particle size by a hammer mill. This produces the final product which we call "Strawdust".

This process changes the straw in six ways:

1. It is made longer lasting.
2. The pH is changed, ranging from 5.8 to 6.0.
3. It is sterilized.
4. Nitrogen in a slow-release form is added.
5. It is compressed to keep it from shrinking in the container.
6. It is made non-flammable.

Uses for Strawdust:

1. A container growing medium.
2. Soil builder in landscape jobs and gardens.
3. A mulch, to protect plants from heat, cold, and drying.

Strawdust is less expensive to use than bark or sawdust because of the fertilizer value it contains. Also, the pH has been adjusted and it has been sterilized.

Strawdust has been used in our nursery since 1979 and has been under test by Oregon State University since 1981. These tests shows that a mix of 70% Strawdust, 15% peatmoss, and 15% pumice, with no fertilizer or amendments added, has out-performed bark mixes with all the normally recommended amendments added.

Strawdust has U.S. and foreign patents pending.

COMPUTER CONTROLS FOR GREENHOUSE ENVIRONMENTS

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INTRODUCTION TO COMPUTERS

I am basically a nurseryman and I want to have a smooth, efficient controlled nursery operation. My major problem was finding a reliable system for watering and heating my nursery beds. Having a fair background in electronics, I turned to this field to solve my problem and I feel that it has been nicely accomplished.

Mention, the word COMPUTER and a lot of people seem to get nervous. "Computerphobia" it is called. Accompanied by comments such as — too complex" — "too expensive" — "too everything" —. Nonsense. If you can tie your shoes or drive a tractor, you can operate a computer.

A computer and a shovel had one thing in common. Initially they both need you at one end to start working. However, unlike a shovel, you can walk away from a computer and it will keep on working until you tell it to stop. The computer itself has no intelligence, no mind of its own; it is simply an electronic tool, serving a real purpose by following your instructions to the letter, instructions you give it called PROGRAMMING. We will consider programming later.

A computer in reality is a very simple device. It understands only two commands, YES and NO, or TRUE and FALSE. With these two simple commands, the computer can do all the fantastic things that you have heard and read about and more. The computer can also be referred to as the the dumbest device devised by man. Why? Because when the computer is first turned on, it will just sit there and do nothing. It has no intellegence, no mind of its own; it does not know what to do, until told. If the computer is that simple, and dumb, how can it do all the things is does? PROGRAMMING is the key.

Todays computer can be divided into three groups.

GAME COMPUTERS: for example, the type your children play games with, such as ATARI.

BUSINESS COMPUTERS: big business types, as IBM or small business types, as RADIO SHACK.

The last type: the one we are interested in is the COMPUTERIZED CONTROL SYSTEMS.

For a computer to control machinery, for example, it must be customized. It must be built to do the type of controlling that the customer wants. So it is built especially to those requirements. Aircraft systems are computerized to a great degree today. Another special field, one of the most sophisticated type of control is that used for satellite orbiting. Space probes would also stand very high in the list of sophisticated controls. Still another type of customized controller is the environmental control systems for homes, business, and nursery facilities.

TERMINOLOGY

At this point it is necessary to introduce a few terms. They will help to clearify some of the statements to be made.

CPU — CENTRAL PROCESSING UNIT. The heart of the computer. It does all the processing of instructions, logic analysis, arithmetic, and many other functions.

I/O — INPUT/OUTPUT DEVICE. This unit talks to the outside world and lets the outside world talk to the computer. Instructions come into the computer and back out again. An example would be the information from a thermometer; it tells the computer that it is too hot and that cooling water is needed. This is input. Upon receipt of this information, the processor, through the program, knows that it is time to turn on a cooling spray, so a signal is sent to a solenoid valve and the water is turned on . This is output.

RAM — RANDOM ACCESS MEMORY. Memory locations that can be written to and read. It is usually a temporary location for temporary data.

ROM — READ ONLY MEMORY. A memory location that you can only read but can not change. This is the type of memory that is used to store the program that will operate the controller.

MPU — MICROPROCESSING UNIT. This is the system as a whole. Those parts that go to make up an operating unit.

HARDWARE — SOFTWARE. Hardware is the physical parts of the computer — the boards, power supply, resistors, capacitors, and the chips. The software is program.

SYSTEM CAPABILITIES

At this point I am going to stop using the word COMPUTER. Instead the word CONTROLLER will be used because that is what we want to do, to control various functions in the greenhouse in the most reliable and economical way.

It can be stated safely that the system has unlimited possibilities. Actually, anything that you can think of for the unit do, if can do, but it must have guidance. It must be programmed. If you can think of a function, it can be written into the program and the controller will carry out the instruction. In the development of this system I have taken into account the problems that I had: reliability, accuracy, and the economical aspect of the equipment. These factors I feel have been found and are reflected in the equipment that I have designed.

ENVIRONMENTAL CONTROL IN THE GREENHOUSE

In designing and developing a control system, the present stage of development allows for control of propagating bed heating, watering, variable times on and off for each bed up to 16 beds, turn on and turn off time, if desired, and a battery

backup system. This backup system will go into operation if the main power source fails. It will keep all internal functions going, time keeping, data on each bed, and will return to normal running when commercial power has been restored. It will continue from the point where it stopped. Other functions that can be added are cooling of the air in the greenhouse by turning on fans, opening louvers, or another desired method of cooling. If the greenhouse drops below a predetermined temperature, heat will be introduced into the greenhouse. Normal ventilating can also be controlled by the use of a thermostat that the controller will read and turn on and off as needed. The applications of liquid fertilizer through the water nozzles can be applied in the amounts determined by the operator. This can be done daily, weekly, monthly, or at any predetermined time. This list can go on and on.

CUSTOMIZING

In order for the controller to carry out the functions that the customer desires, it is necessary to sit down with the propagator and find out in detail what he wants the equipment to do. It must be remembered that this controller can easily replace one or two or more individuals that are now doing the work of watering, fertilizing, checking the bed heat, and making adjustments as needed, and many other duties. The controller can do all these things and more. All data coming in through the input port is checked as many times as once every 200,000th of a second, so nothing passes by the controller without action being taken, if action is needed.

Once all the objectives have been stated that the grower wants, the programmer goes to work. Programming is detailed work and requires time to arrive at the end results. However, because a lot of the basic programming has been done, it will only require some tailoring to make it fit the new conditions. The unit that I have designed takes into account all the things that I have thought of plus suggestions from others, so any new function can usually be added with little trouble. Now that the program has been written, it is time to go to the next step.

DEBUGGING

Once the program has been written and stored in a ROM, now the fun begins. You just do not turn on the controller and the water comes on, the fans start to go, and all the other factors go to work. If this happened the first time the unit is powered up, I think that all the programmers in the world would drop dead. It would truly be a miracle to have a program work in its entirety the first time. The operation of

DEBUGGING is the process the programmer goes through step by step, to see if the program does what the designer wants it to do. If it doesn't, then a change is made until the unit functions correctly. This can be a tedious job and sometimes very time consuming. Finally all parts work correctly and the final program is stored in the PROGRAM ROM and the controller is ready to go to work.

EQUIPMENT DEVELOPMENT

The first controller that I developed is called a SEQUENTIAL CONTROLLER. It is a sophisticated timer, microprocessor controlled. It allows the grower to set the number of beds to be watered, the time the bed is watered, and the interval between watering. Each bed is watered in sequence. When the last bed has been watered, the controller will start over again, the cycle is repetitive within the limits set by the grower. The setting of the limits is easily done by "thumb wheel switches". The number is displayed in a window next to the switch, so at all time the grower can see what limits have been set in the controller. There is a safety feature built into the controller which tells you by a flashing red light, if you have set the "on" time greater than the interval time. This SEQUENTIAL CONTROLLER was designed for the grower who has limited water pressure and can only run a limited number of sprinklers. For the grower who has more or less unlimited water pressure and volumes, another, second controller has been designed.

The second controller is a PARALLEL CONTROLLER, with or without high and low temperature warning. This controller is designed for the grower who has sufficient water volume and pressure to run any or all the propagating beds at a time. Really a better term to use than "beds" is "stations" because the controller is not limited to propagating beds, but can be used for field areas, can yards, or or any combination. This unit is settable for 99 stations and each station can be set independently of all others as to the cycle "on" and the cycle "off". With this arrangement, sooner or later in a day, all stations will be on at the same time. Hence the word PARALLEL CONTROLLER. An added feature built into the unit is "start" and "stop" time. For example, if you want the system to start at 8:00 a.m. and stop at 6:00 p.m., this information is entered into the system by the operator. The entry of data is done by the use of a touch pad and looks very similar to a touch type telephone except there are 20 key pads instead of the 12 found on a standard telephone. This should cause no confusion as the extra pads are marked as to their function. Now a mention of "with or without" high and low temperature warning. This function is, at the present stage of development,

only a warning circuit and will give an indication to the operator that the temperature is higher than some predetermined setting or has reached some predetermined low temperature. For the present, the operator will be required to take corrective action, such as turn on the heater, or turn on the cooling system. This will all be done by the controller in a later model.

With these two models, it is felt that a fairly large segment of propagators and growers should find them very useful and reliable tools. The controller is more reliable then doing the work manually. There are two other models in the offing, which will be even more helpful. Model 3 will have all the features of the "Parallel Controller" but with the added capability of moisture sensing. This means that the grower can set the controller to give him the moisture that he needs for the best growing conditions, and the controller will maintain these conditions until directed to change. This is set by the grower the way he wants it. The fourth controller will provide the grower with a video screen that will keep him informed at all times about conditions at each station, what the "on" and "off" time are, or how much time is left in a cycle then in progress. If there are failures, such as water pressure, high heat, low temperature, a malfunction of a fan or pump and many other data, this will be displayed on a video screen for all to see. If an emergency exists, additional devices can be activated to warn the grower what and where the malfunction has occurred; for examples. ring a bell, flash a light, blow a horn, etc. If needed, this information can be displayed in English and Spanish simultaneously. There is no limit as to what can be done to make the job of propagating and growing easier and more reliable. A controller will not forget, nor will it make a mistake. The grower has to enter the instructions to the controller through the use of the key board and the controller will do the rest. If you enter the wrong data, the results will be wrong, so great care must be taken in passing on the instructions to the controller, but this is not difficult.

SUMMARY

In summarizing this discussion on computers and controllers *it is probably suffice to say that controllers that are micro*-processor-designed will do many things for the grower that are now done with less reliability and accuracy, and certainly at a greater savings in money and time. As I stated in the beginning, I designed a controller as a matter of necessity after having experienced the loss of my first crop of seedlings. I further wanted a system that was solid state, which means — no moving parts. At least no moving parts in the controller.

Externally there are solenoid valves and other devices that have moving parts but these can be kept to a minimum. Relays are a source of many problems; now the technology provides a means of avoiding such problems. The microprocessor has given me the reliability and flexibility that I need. Prsently I have one system running as a test installation to determine if there are any bugs in the program that need to be changed. Through the kindness of Ed Schultz of Calorwash Nursery, Aurora, Oregon I have been able to test my prototype with complete success. I wish to thank him for his patience and help.

WESTERN REGION 1983 AWARD OF MERIT

Presented by Phil Parvin at the
Western Region Annual Banquet

The Western Region's 1983 Award of Merit recipient is a distinguished scientist and a former Professor of Horticulture at Rutgers University in New Jersey. He has been a nurseryman in Long Beach, Washington, for many years. He is the author of numerous articles in garden publications and has lectured to garden clubs across the country. He is the author of "Small Fruits for Your Home Garden" and "Getting Started with Rhododendrons and Azaleas". He is a Past-President of the Washington State Nurseryman's Association and was on the Board of Governors of the American Association of Nurserymen. He is a Past-President, and has been a National Director, Executive-Secretary, Editor of the Quarterly Bulletin, and recipient of the Gold Medal Award of the American Rhododendron Society. He is a Board Member of the Rhododendron Species Foundation. He is a past member of the Executive Committee and a Past President of the IPPS Western Region. Our 1983 Award of Merit Recipient is Dr. J. Harold Clarke of Sun City, Arizona.