Secretariat Phytotronique
Phytotron-C. N. R. S.
91 -GIF- sur-YVETTE
(France)

Gif-sur-Yvette, May 1972.

# *PHYTOTRONIC NEWSLETTER N° 2*

The distribution of the Phytotronic Newsletter N° l in November 1971 brought us a large number of letters. We thank all those who wrote, or encouraged us. We hope, one day, to find financial aid to continue a regular diffusion of the Newsletter and to transform it into a periodical.

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In response to a great number of correspondants, this second number will be devoted to "Growth Cabinets". The different manufacturers have written a summary of their fabrications which will be reproduced hereafter.,

Many laboratories or research establishments have not enough money to buy these expensive climatic units. For this reason, we ask our readers to send us a list of references, or reprints with the descriptions of models which can be self-assembled. We hope to be able to reproduce these informations in the near future and to complete list of manufacturers whose models have not appeared in this issue.

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In nearly all-countries there are specialized research centers which study plant environment. Beltsville center, in U.S.A., asked us to reproduce the following paragraph:

"if you plan to travel around Washington, D. C. and would like to visit our USDA Phyto-Engineering Laboratory at Beltsville, Maryland, let us know by letter or phone. Dr. D.T. KRIZEK, Mr. H.H. KLUETER and I will be pleased to help you in anyway possible and discuss research problems of mutual interest concerning controlled environment and its effects on plants. "

William A. BAILEY, Leader, Crop Structures Investigations, Phyto- Engineering Laboratory, U.S. Department of Agriculture, Plant Industry Station, Beltsville, Maryland, 20705 -- Phone (Area Code 301) 474-4483.

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We announce publication of the proceedings of the Symposium "Phytotronics and Horticultural prospects", Tel-Aviv, March 1970, by GAU'I'HIER-VILLARS Editors (55, quai des Grands Augustins PARIS VII - France). Price : 120 francs.

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To be sure of continued good contact with our readers, please notify any change in your address.

Thank you.

P.CHOUARD N. de BILDERLING

## GROWTH CABINETS and GROWTH CHAMBERS.

Manufacturers are listed by country and alphabetical orders.

### I - GERMANY

a) - Brown Boveri-York, Kalte Klimatechnik GmbH - Postfach 346
6800 Mannheim I (Deutschland)

Brown Boveri-York supplies : Phytochambers - Phytocells - Phytocabinets - Greenhouses, fully air-conditioned and complete Phytotrons outline of Phytosystems.

Brown Boveri York offers phytosystems of different size and capacity to suit different research purposes. Various types of Brown Boveri-York-phytosystems are available. The stationary walk in type is called a phyto-chamber the transportable walk-in type a Phytocelle and the still smaller non walk-in type a Phytocabinet, The Brown Boveri-York-phyto program also comprises a system making use of natural light - a fully air-conditioned green-house. Phytosysteme together with the necessary extensions such as greenhouse, storage rooms, cold storage rooms etc. are called Phytotron. As phytosystems are used for scientific experiments they have to meet high demand as to the degree of simulation and reproducibility of natural conditions and to the accu-racy of test data. The Brown Boveri-York phytosystems reach the high standards required by research scientists. Brown Boveri-York chose for their phytosystems a vertical airflow to guarantee reproducibility, horizontally equal air-conditions for all plants and stability of the micro climate. In phytochambers, phytocells and phytocabinets the air flows upwards. Vertical air velocity in the plant area is kept below 0, 15 m/s, thus not exceeding the velocity of natural convection, The phytosystems use re prod;ictible artificial lighting provided either by fluores-cent lamps, high-pressure mercuryvapour lamps, or Xenon-lamps.

b) – Rubarth and Co. - Fabrik med. and elecktr. Apparate. Ikarusallee Z - I) 3000 Hannover (West Germany) - Tel. 63 2783,

Plants, micro-organisms and parasites react to different environ-mental conditions. For more than 20 years the Rumed photo-thermostate was used for perfect and exactly regulating experiment conditions.

Cold and high temperatures, thermoperiodicity, humidity, photo-periodism, light intensity and CO2-content can be varied. This basic equipment can be supplied with special accessories adapted to individual necessities.

Photothermostate from 0 up to + 60°C (other temperatures too) with illumination_ and the following capacities

| Height | Width | Depth | Price |
|---|---|---|---|
| 750 mm | 550 mm | 550 mm | D. M. 5. 660 |
| 750 ” | 980 | 550 | D. M. 8. 517 |
| 1. 300 | 650 | 490 | D. M. 11. 500 |
| 400 " | 2. 000 | 750 " | D. M. 13. 800 |

Working capacity from -20° up to + 70°C, 300 1 volume, with illu-mination : D. M. 4.500.

For bigger plants, Phytotrons, transportable tents and bigger rooms with higher light-intensity and regulating air-currents may be delivered. Special requires can be considered.

c Frnst VOTSCH -'Kalte and Kiimatechnik - KG Box 40 - 7462 Frommern (Wurth) - West Germany.

E. VOTSCH produces : 1 . Miniphyt type VTPH bench-top model with growing area of 0,6 m2 temperature + 5 to + 45°C, radiation 30 000 lux,

controlled humidity optional. Z. Vario_ phyt type VAPH for bigger plants of agriculture, forestry etc. 1.4 m2 growth area and I, 3 m growing height, temperature from + 5 to 45°C, radiation 40 000 lux, this type also available as walk-in chamber up to 5 m2 growth area and 2 m high. 3. Ecophyt type VEPH, very efficient and versatile for botanical, biochemical and zoological research, growth area approx. 1 m2 and 1 m high, temperature from - 10 to + 50°C, radiation 35 000 lux, controlled humidity from 40 to 95 % r. h. Electronic control of temperature humidity, of radiation on request. 4. Phytotron type VKPH, cabinet type of highest precision and efficiency with light intensities up to 80 000 lux, to be used in connection with gas device, wide temperature range in line with minimum tolerances of temperature, humidity and radiation, many optional* available, best suited for scientific research. 5, Phytotron walk-in chamber type VKZPH, consisting of prefabricated elements with a 0, 6 m raster for growth areas between 2, 5 and 10 m2, due to flexible assembly of prefabricated machine parts walk-in phytotron chambers can be constructed for every request, 6. Phytotrons specially designed according to customer's specification.

d) - Karl WEISS - Plant Growth Test Cabinets and Chambers.
D 6301 - Lindensthruth - Giessen (West Germany)

For many years, WEISS in Germany (affiliate companies in Austria and Switzerland, nearly 700 employees, annual turnover DM 40 millions) is concerned with units for environmental testing as well as with problems of light-climate chambers for plant growth especially considering the physical technique of conditioning of plant growth test cabinets, Special advantage by ensuring high accuracies, low operational costs and, at the same time, definable adjustment of temperature, humidity and light.

Conditioning system based on indirect condensate-free brine-conditioning as well as on humidification by evaporation, WEISS SYSTEM aerosol-humidification by water or steam injection is not applied with this system.

Production range : seed test benches, seed test cabinets, plant growth test cabinets and chambers, complete phytotron units, special designs like plant growth measuring test cabinets for fumigation with $SO_2$ and other gasses, special cabinets for application of radioactive $CO_2$, chambers for highenergy radiation devices ($CO_{60}$ radiation sources).

For technical documents and information, please contact Karl Weiss Giessen, Germany.

2 - BELGIUM,

Thermotechnique LOUBRIAT - 9, Place A. Rijckmans - 5000 Namur
(Belgique) - Tel : (081) 267-32.

Our collapsible climatic chambers have the modulating dimensions of : 0,40 x 0,40 m. Delivered in 2 types

a) Reach in Cabinet with work table, minimum dimensions 0, 80 x 0, 60 m and 2 small doors.

b) Walk in Cabinet with a large door of 1, 80 x 1, 70m. Internal dimensions from 2,40 x 2,60 m.

Lighting equipment is arranged in a special space with separating glass and filtered air for cooling. Fluorescent lamps or high pressure halogens discharge lamps. Lamps and glass are detachable and cleanable. Ventilation by ascending or lateral flow. At option variable air speed, Production of cold, heat and vapour for humidification are individual or by central feeding for numerous cabinets. Electronic regulation is individual with or without recorder. Price depends on equipment and option. Please write,

3 - CANADA.

a) - Controlled environments Ltd. , 661 Century St. Winnipeg, Canada H 3H OL9 - In Europe : 20-21 St. Dunstan's Hill, London, England EG3R 8PH - In U.S.A. : 601 Stutsman St. , Pembina, North Dakota 59271.

CONVIRON equipment is installed in 25 countries throughout the world from single installations to large Phytotrons. Sixteen basic models of plant growth chambers, growth benches, seed germinators, incubators and environmental rooms. Hundreds of options allow selection of equipment to suit requirements of the individual scientist. Many outstanding features make them different and unrivalled for ease and accuracy of reproducibility of environmental conditions.

Growth chambers range in size from 0. 7 m2 with 0. 7 m height up to 3.3 m2 and 2.4 m height. Lighting intensities up to 100,000 lux. Special low temperature growth chambers for - 5°C. Prices range from approximately $ 3,000 to $ 15,000, depending on size and selected options.

Specializing only in this type of equipment, controlled environments has established a world-wide reputation for innovation and technological leadership in bio-science research departments of universities and government research institutes.

b) - Coldstream Ltd, - 1855 Sargent Ave - Winnipeg 21 - Manitoba R3H OE: Canada.

They are manufacturers of :

I Laboratory Rooms : Walk-in Rooms 1. 1 x 1. 8 x 2. 1 M High and Larger Temperatures -75 to +.60°C standard ranges - Humidity -10 % to 95 % standard ranges - Lighting, air movement, to specification - Programming to specification - Many installations for incubation, freezer, cascade systems.

2. Plant Growth Chambres : PG5I1 3.25 Sq. M. - 2M growth height - 50, 000 lux. Other sizes available,

3. Germinators : RG30L 1500FC ; 30 shelves, 0. 3 Sq. M. per shelf - 15, 000 lux or 5.000 lux..

4. Incubators : I R40RT - 0. 8 Sq. M. /shelf, 4 shelves - Standard.

-1 - FRANCE.

Cie Climatechnique 67. rue, Morat 68 - Colmar Francc)

89 41 . 39, 29

Construct climatized cabinets and collapsible phytotrons to offer units Particularly simple, economic, and viable

They are constructed by assembling materials of great diffusion

as well known marks, which allows a great flexibility in the dimensions and eventual repair of mechanical breakdown

Guaranteed performances :

| | |
|---|---|
| Lighting programmable.....•- | to 30. 000 lux |
| Temperature programmable | 5 to 40 C (+/- 0.5 C) |
| Humidity programmable | From dew point at 4 C to 90 % RH |
| Renewal air | adjustable from 0 to 30 vol/hour. |

Prices of Phytotron, having the mentioned performances :

| | |
|---|---|
| Model 200L ..... | about 16. 000 F. T- F. |
| Model 6 m3 with complete stand | about 3S. 000 F. T . F. |

Other sizes and characteristics on command.

li) - FACTS S. A. - 85, rue Chaptal - 92, I.cvalloix (France')
--- Tel'. : 73 7. 75. 05 - 737. 95. 39.

Cabinets and collapsible climatic chambers, Climatic cabinet for research of plant physiology. Temperature : -10°C to +60°C 0, 3'C. Relative humidity : 30 %° to 95 r h ± .1 %. Lighting : fluorescent, incandescent or Zenon lamps. Capacity 1 60 litres to 10.000 litres. Price : from 18. 000 F.

c) - FROILABO - SOGEV. - 3 et 5, Rd de I,evallois - 92, Neuilly-sur-Seine France' - Tel. : 637.47.20+

The .cxpcrience that FROILAI3O-SOGEV has acquired during more than 25 years of work in the practical application of environmental systems (cold, hot. vacuum, pressure, hygrometric, special situations, sterilization) ensures that it has a special role to play in the manufacture of rooms and chambers designed for botanical and agronomic research.

We will not speak here about our well-known range of standard materials but of it chamber which is it real innovation and which is designed for very gerioia5 and advanced research.

This chamber, specifically designed for research into mushroom culture can also be used for other purposes. it offers the following advantages temperature controllable between +5°C and +50'C, to within } 0. 2 ; hygrometry

controllable between 20 and 95 %, to within +/- 3% ; absolute filtration (99. 99 %) at product level ; air renewal controllable by pre-filtres ; monitoring of the rate of CO2 ; speed of air controllable from 10 cm/sec to 60 cm/sec ; night and day renewal of cycles ; special system of humidification for earth in containers. This process allows a constant hygrometry to be maintained and avoids the need to sprinkle during times when tests are being carried out. This system is patented.

We would like to make clear that the above parameters are not exclusive and can be combined with other requirements needed for research,

We have commercial and industrial resources of the most modern kind. Much of our time is spent developing recognized systems and we consider very carefully all proposals submitted to us.

Exclusives agents in France for :
TENNEY Eng, (U. S.A. ) - Environmental equipment and installations

d) - L'HUMIDIFERE CRAPEZ - 79, Vasles (France)

Builds a "UNITE PHYTOTRON" It is a small green-house in which the humidity and the temperature are automatically regulated. The temperature may have two levels periodically, e. g. day and night. The flow of the nutrient solution is automatic and the flow of fresh air is also provided. Interior dimensions of the green-house : 1. 6 x 1.0 x 0.9 m high. With an ambient temperature of 20°C (68°F) it is possible to reach a maximum of 38°C (100°F) and a minimum of 6°C (43°F) and a relative humidity varying from 60 to 85 %. The "UNITE" may be equipped with a lighting installation : I - artificial lighting 30. 000 lux provided in three stages and distribution in red/blue radiation. 2 - "NOCTUEL", an opaque shutter assembly reducing day time length, Price example for France, (for foreign countries, please consult us). A "UNITE PHYTOTRON" with artificial lighting F 34, 339. 00 taxes included. Air condition equipment for a laboratory room or other locale from F 9, 996. 00 all taxes included.

e) - Le_Materiel Physico_ Chimigue (FLAM et Cie). - B. P. n°4 - 25, rue Robert Schumann - 93, Neuilly sur Marne. Tel. : 935. 28. 7E

Le Materiel Physico-Chimique, well known in manufacturing high precision environmental testing materials for aviation, electronic and space industries, makes likewise rooms for raising plants, with adjustable temperature humidity and lighting. Moreover, a clock permits to realize diurnal and nocturnal climate with adjustable duration. Two types are standardized,

The society realizes, on application, rooms for raising plants, with larger dimensions, using prefabricated elements permitting, for a reasonable price, the best adaptation wanted.

These informations appear in a 150 pages catalog given out by this society.

f) - Messrs. NESSI Brothers et Cie. - 43, rue de la vanne - 92, Montrouge (France) - Tel. 253.48.00
or 735.84. 10

Messrs. NESSI Brothers and Cie are building phytotrons since 1960, large and small, with or without lighting and/or humidity control. References : C:. N. R. S. (National Center for Scientific Research) and C. E. N, C, (Nuclear Center of Cadarache). For instance : - Phytotron at Gif-sur-Yvette 20 large plant growing rooms ; exactly controlled temperatures from 14 F to 104 F, 6 % to 100 % R. H. Automatic day-night changeover. - Super-greenhouses at Gif-sur-Yvette : divided into small plant growing compartments ; usual temperatures from 50 F to 104 F, including humidification and automatic darkness control. - Automatic self-containing cabinets : 8' x 9' x 6' with control of lighting, heating, refrigeration, humidity. Temperatures from 50 F to 86 F. Automatic day-night changeover. - Several full air-conditioned greenhouses, with automatic darkness control. Plant growing cells at the radio-ecology department, with very sophisticated controls.

Messrs. NESSI brothers and Cie are also undertaking particular studies for prototype equipment or small series with regard to plant culture under every conditions. Quotation on request.

g) - REALIS. - 30, rue Etienne Dolet - 94, Villejuif (France)
Tel. : 726.16.90

Air-conditioned closed spaces (cold - hot- dampness.- photo-periods). Heat-proof metallic chests with internal box made of stainless steel. Heating : by armored resistances - Incorporated refrigerating system. Hycrometry : by evaporators giving off water vapor, adjustable up to saturation point - Photo-periods with luminous ceiling or luminous walls controlled by a timer. Ventilation : internal. Regulation : by modulated static and electronic regulators with platinum sounding- rod and galvanometric temperature-meters. Hygrometric regulated by electronic regulators with wet sounding-rod, operating as a psychrometric device with the temperature regulators. Useful standard capacities : 80 dm3, 150 dm3, 270 dm3, Prices : from 15.000 F to 18. 000 F duty free (ex works prices). Larger capacities up to 2, 5 and 3 m3 : estimates, At request dawn and twilight device, programmers, recording instruments for temperature and dampness, etc.. .

h) - SAPRATIN-ENVIRONNEMENT. - 30, rue Raspail - 95, Argenteuil (France), Tel. 961. 59. 94.

SAPRATIN-Environement's biological department is specialized in the realization of test chambers for studying new agricultural processes, and for productions in controlled environment. The materials range is very large, as well for performances as for capacities :
- microphytotron - 3 m3 - fluorescent lighting mixed ball, xenon ; from 60.000 to 90.000 F. - Germination cell : 1, 5 m3, 600 samples ; 64. 000 F. - Vernalisation cell ; 6. 500 F_ - Thermotherapy chamber ; price on tender. - Large climatic chamber : 25 m3 : 200. *000* F. - Working bench with laminar no-dust air flow ; from 8. 000 to 15.000 F. Vacuum cooling - Movable xenon ceiling lighter - air cooled out of dust atmosphere ; 23.000 F. - and all engineering studies is asked.

5 - United KINGDOM.

Fisons_Scientific_Apparatus_ - Bishop Meadow Road - Loughborough Leic-.
.LEIIORG (England). Tel. Loughborough 5781

Fisons Scientific Apparatus is part of the Fisons Group of Companies which is well known for its activities in agricultural and horticultural research. The range of climatic and growth cabinets extends from simple seed germination cabinets of 140 litre capacity costing less than £ 600 to large units of 4,000 litre capacity costing ,!p to £ 10,000 depending on the facilities fitted.

Of particular interest in the Model 140GZ growth cabinet which has a capacity of 280 litres. With the optional cooling unit (mains water can be used for cooling to around ambient temperature) the total cost is less than £ 1 000. The temperature control is from 5°C to 40°C (- 0. 5°C) and provision is made for humidity enrichment. Light intensity is 20,000 lux at 25 ems from the tubes and day length is controlled by a 24 hour time clock. Because of their relatively low cost it is possible for a number of these cabinets to be used together to give a series of different growing conditions. At the other end of the scale 2 large cabinets of 2,640 litres capacity have just been made for the Scottish Horticultural Research Institute. Models of this type can be made with simple contact thermometer control or with sophisticated control systems such as cam programming of temperature, humidity and light intensity and separate root box control.

6 - JAPAN.

Kato Industries Ltd, Environmental Control Division. - 1-16-6 Miyamae
Suginami-Ku - Tokyo (Japan)

KOITOTRON Growth Cabinet

| | Walk-in Type | | Reach-in Type | |
|---|---|---|---|---|
| | Model KG | Model S | Model HN | Model KB |
| Light intensity (lx) | 1 5, 000<br>30,000<br>50,000<br>80,000 | using natural sun-light | 1 2, 000<br>20,000<br>30,000 | using natural sun-light and or 30,000 |
| Temperature control range (°C) | 7-35°C<br>20- 35° C | 7-35°C and etc. | 10-35°C | 10-35°C |
| Relative humidity control range RH) | 55-80 % | 55-75 % | 55-80 % | about 60 7° |
| Effective - -- dimensions (m) | -- 1,2xl,2x1,75HI,Oxl,Ox1,511 2, 3xl,65xl,8HI,5x1,5xI,7H | | O.6x0,6x0,8H I,2x0,8x1,OH 2,0x2,Oxl,814 | 0,6x0,6x1,OH 1,Ox0,6x1,011 |

7 - UNITED STATES of AMERICA.

a) - Environator Corporation. - 24024 Gibson Drive - Warren
--- -- -- Michigan :48489 U; S: A•.

Environator Corporation is the marketing division of Custom Controls, Inc., the manufacturer of the Environator line of environment simulators. Headquarters for both companies is as-written above.

All of the following models are of the-dependable-and serviceable modular design.

| Model | Unit HP | List Price |
|---|---|---|
| **Counter Top Environators** | | |
| CTE-3230 | 1/5 | 875.00 |
| CTE-3248 | ¼ | 1,395.00 |
| CTE-3248XL | 1/3 | 1,525.00 |
| **Micro Environators** | | |
| E-3448 | 1/3 | 1,625.00 |
| E-3448XL | 1/2 | 1,775.00 |

| Model | Unit H.P. | List Price |
|---|---|---|
| **Environator Reach-Ins** | | |
| E-3458 | ½ | 1,895.00 |
| E-3458HL | ¾ | 2,100.00 |
| E3458XL | ¾ | 2,495.00 |
| E-3486 | 2-1/2 | 2,995.00 |
| E-3486XL | 2-1/2 | 3,495.00 |
| **Environator Envirotrons** | | |
| E-98 | 4 | 6,200 |

Environator does the work of labs costing up to twice as.-much. Listed models include lamps and condensing units.

b) - Environmental Growth Chambers. - P. O. Box 407, Chagrin Falls, Ohio 440ZZ (U.S.A.)

E. G. C. manufactures a complete line of plant growth chambers from reach-in to walk-in sizes which incorporate many unique design features not found in competitive brands. EGC chambers are the only available chambers in which conditions are guaranteed (with the exception of Models M- 31 and M- 32) when their chambers are being ;operated with a full plant load.

| MODEL | Floor or bench space | Price without options |
|---|---|---|
| M- 31 | 8 square feet | $3,000.- |
| M-32 | 8 square feet | 2, 500:-. |
| M-13 reach irk | 12 square feet | 4,900.- |
| M-2 reach-in-3 doors | 27 square feet | 11, 500.- |
| M-15 walk-in | 32 square feet | 12, 500 |
| M-1148 | 48 square feet | 16. 800.- |
| M-1175 | 75 square feet | 19,000.- |
| M-1196 | 96 square feet | 24,000 |

All walk- in chamber models provide a 7 foot high growing area, Many of these models utilize a special refrigeration system (20dx) which eliminates the need for all on-off components such as relays, solenoid valves, and

electric strip heaters. The elimination of these failure prone components makes F.GG chambers the most dependable available. Chambers with extended temperature and humidity ranges as well as *very* high intensity lighting systems are available.

c) - Hotpack International, Cottman and Melrose Streets - Philadelphia -- - --'---- l'a 19135 (Lt. S. A. )

Hotpack lnternational is the designer and manufacturer of controlled Environmental equipment, We have been actively engaged in this market for over 60 years and have achieved a reputation of providing superior quality and reliable Units. Our product line includes Refrigerated/Humidified Incubators, Growth Chambcrs ranging from 15 to 215 Cu. ft. and controlled environmental rooms. The Hotpack units that should be of interest to all phytotronists are as follows

1 Model I733RS - 25 Cu. Ft. Reach-In Growth Chamber equipped with rotating --helve.> that provide uniform tight distribution for true phototropism. Unit also has a programmed temperature/humidity control for day/night cycling operation. Temperature range from 0 to 60 C with control of ± 0. 1 C.

2. Model 1736 - Walk-in Growth Chamber. Temperature range 38 to 90 F and ambient to 90 0o relative humidity. Interior size 7'8" wide x 5'8" deep x 6'8" high. Maximum illumination with full light is 5500 ft, candles 18" from lamp bank to Z=,50 ft, candles 60" from bank,

3. Models i527Z0 - These units afford dual combination use as Growth Chamber and Incubator. Model 352720 hag 15 cu. ft. and the Model 352620 a 19 cu. ft. capacity, Temperature range 20 to 50 C. and equipped with 4 banks of Z tamps each, two 20 watt fluorescent lamps per shelf provide 10,000 lux, For complete specifications, literature and pricing write to R. J. BI,!CALO, export-manager.

d) - Instrumentation Specialties C1 (ISCO) - P. O, Box 5347 - Lincoln_ _ _--__-_- _ - --- - Nebraska b8505 - [?• S• A. )

ISCO plant growth environmental chambers provide extremely precise control of both temperature and humidity regardless of plant transpiration and light load. Control is obtained through a simplified computer system which anticipates temperature-humidity interactions and compensates for them before they can adversely affect the programmed climatic conditions in the chamber. The patented system does not require vaporizers or steam. Two available controllers offer timed step or continuous variation of temperature and humidity throughout the day. Lighting options include fluorescent lamps with incandescent supplement, or high intensity Metal arc: lighting which produces plant growth more similar to field conditions than can be obtained with other artificial lighting, ISCO chambers can be obtained with controlled CO2 and other features for specialized research, Two reach-in and one walk-in models are offered, as well as an air handling unit which will provide the. same quality of temperature and humidity control in a previously built room lacking good control= An illustrated catalog as well as technical bulletins describing the Metal arc lighting system and CO2 controller are available,

e) - Percival Manufacturing Cy. - P. 0. l3ox 249 - Boone - Iowa 50036 USA

Percival Manufacturing Company offers a complete line of biological incubators with photo-period control in "three sizes", .23 cubic meters, .7 cubic meters, and 1. 1 cubic meters. Also offered are plant growth chambers with illumination of 20,000 to 100,000 lux, and in sizes from.23 cubic. meters to 6. 5 cubic meters. Prices available upon request.

f) - Sherer_Dual Jet Division. - Kysor Industrial Corporation MARSHALL Michigan 9 9068 (U. S, A. )

"SHERER".....Controlled Environment Equipment.

"SHERER" offer the most complete range of controlled environment equiprnent available from one manufacturer. "SHERER" provide the widest choice of models in Growth Chambers and Rooms for teaching, experimentation and rCse:lrCh in the plant growth environment field. "SHERER" rooms and chambers are used, for example, in the control and programming of temperatures : control and programming of light intensities :Testing of insecticides, herbicides, pesticides, etc. , Animal research - :Aga.: growth - incubation - Plant growth experiments at lower than ambient temperatures - Dark rooms -Light rooms - Refrigerators, etc. "SHERER" have been established in the U, S. A. for over 1 00 years. "SHERER" have been actively engaged with particular reference to the manufacture and provision of controlled environment equipment for over 40 years. "SHERER" provide humidity control systems, as optional extra equipment, as required in their growth chambers. Whatever your particular requirement for controlled environment equipment the experience of "SHERER" is at your service.

Represented by : Laboratory Equipment Consultants Ltd. I Shore Road, Ainsdale, Southport (England)

L} - Stults Scientific Eng Corp,. - 331 3 S. 66 Freeway - Springfield Illinois 62703 (U. S. A. ).

Manufacturers of all- stainless steel, da-lite or dark water curtain temperature and humidity control germinators. All units are completely automatic, no hand watering, with 1'F temperature controller with averaging sensor complete photo period control ; built-in temp. indicator either centigrade of Fahrenheit scales: automatic high limit setting ; keyed magnetic door locks, removable trays racks, 19" x 20" anodized aluminum trays. We manfacturer 4 standard models ;

| | |
|---|---|
| -Model 4855 Sr, Duplex, capacity 56 trays, 2chambers completely independent of the other, Da- Lite or Dark , price | $ 5271.00 |
| Model 30 Z door single chamber, 56 trays | $ 4456.00 |
| Model JS I8 single chamber, 28 trays | $ 3018.00 |
| Model 12, single chamber, 20 trays | $ 2575.000 |

All prices quoted here-in are subject to change and are FOB Springfield, Illinois USA. Overseas crating will be added to the above price.

h) – Tenney Engineering Inc. - 1090 Springfield Road - UNION - New Jersey 07083 - U. S, A,
Tel. : 20I-686-7870,

Tenney is the oldest and most prominent U. S. manufacturer of environmental chambers and carries a complete range of products for almost any environment, A wide variety of accessories and instrument options are available. to suit individual requirements,

HIGH - LOW TEMPERATURE TEST CHAMBERS
CLIMATIC TEMPERATURE - HUMIDITY TEST CHAMBERS
TEMPERATURE - HUMIDITY VACUUM COMBINATIONS
SPACE SIMULATOR CHAMBERS.

PLANT GROWTH ROOMS and CLIMATIC ROOMS IN
MODULAR KNOCKED DOWN CONSTRUCTION
BIOMEDICAL LOW TEMPERATURE STORAGE CABINETS
MECHANICALLY REFRIGERATED TO -1100C
GROWTH INCUBATORS.

All sizes available from small bench models to large walk-in rooms.