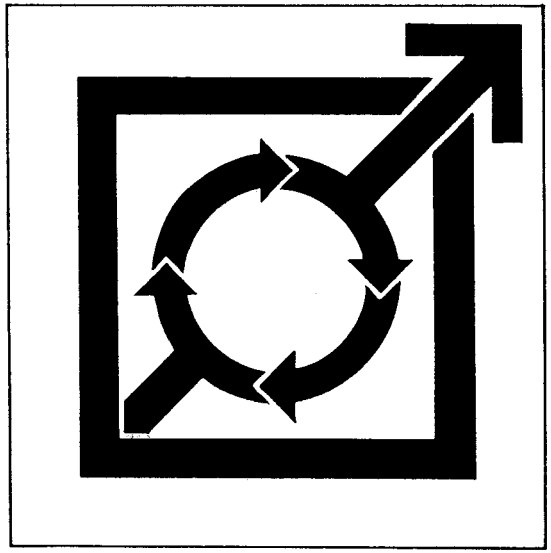
OPERATING INSTRUCTIONS

OPERATIONAL MANUAL
FOR
WATER-HEATED SUCTION TABLE

WIESLAW MITKA



DET KONGELIGE DANSKE KUNSTAKADEMI
KONSERVATORSKOLEN . KUNSTLINIEN

Operational Manual
for
Water-heated Suction Table
Scool of Conservation
Royal Academy of Fine Arts
Copenhagen
1987
Layout & drawings W. Mitka
Internal didactic material

CONTENTS

Construction of the table

The working surface of the table consists of a flat aluminium perforated sheet, 1 mm thick, 1.5 X 2.5 m, with perforations of 1 mm in diameter located every 2 mm, forming a triangular pattern. The sheet is placed directly on the heating element, which is comprised of a series of square brass tubes, 11 X 11 mm, running parallel to each other, with a space of 1.7 cm between each. Both ends of the tubes are connected to side canals, 3 X 3 cm, which enable the introduction and exit of water through the heating system. At each end of the canals are located entrance and exit valves. Heat is transmitted to the top plate by circulating hot water through the heating element. Located directly below the heating element along two sides are two main air manifolds, 2.5 m long, 10 cm wide, 2 cm high. Perforations of 6 mm in diameter are distributed every 2.8 cm along the inside walls of the air canals. The canals are connected by pipes 50 mm in diameter to the vacuum source. Air manifolds are supported by a formica-laminated masonite board, 29 mm thick, which is covered by a heat-reflecting aluminium foil. Excess fluids used during conservation are collected on this board and empty through two drains on the west side (the table is erected with a 3% inclination towards this side). On the edge of the east side of the table is a 7 mm opening pipe which serves as a connection to the vacuum pump for high pressure. The top plate, heating element, air canals and supporting board are encased in an aluminium

L-profile, forming a 7 cm high frame around the table. An isolation of silicon 5 mm thick is placed along the sides of the heating element, separating it from the the aluminium. The frame is supported by a Porse-system construction. Located under the table is the follow equipment: ventilator, vacuum pump, moisturing chamber, heating generator with circulating pump and cooling coil, and air and water distributing pipes with valves. Located on the south side of the table is the main control panel with switches and regulators.

The top cover for the table, functioning as a moisture chamber (and dust protector), is constructed of a plexiglass sheet 1.5 X 2.5 m, 6 mm thick in an aluminium frame, 10 X 2 cm, with perforations 5 mm in diameter every 2,5 cm along the inside wall of the frame. This frame acts as an air canal. There are four 50 mm in diameter openings in the frame fitted with pipes that connect the top cover air canals to the air canals in the table, thus allowing for the circulation of air between the areas above and below the perforated plate. The plexiglass sheet is also supported by a network of aluminium T-profiles, 5 cm high. The entire top cover can be raised by means of a winch and suspended above the table when not in use.

Brief discription of functions

Heating and cooling (water circulation)

Two methods of water circulation can be acheived by the manipulation of certain valves in the pipe system. In the closed system a constant amount of water (25 l) is circulated through the radiator tubes passing through a heating generator. A gradual cooling effect is produced by activating a refrigerating coil in the heating generator. In the continual water flow system, the table is heated by feeding hot water into the radiator tubes from a wall faucet. The water subsequently exits into a drain. A rapid drop in temperature of the working surface can be acheived in about two minutes by setting the faucet thermostat on minimum.

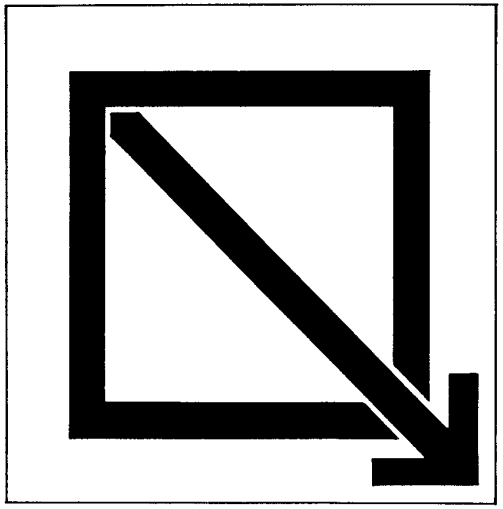
Suction

Low pressure can be acheived by two means, connecting the air pipes to either a vacuum cleaner or ventilator, with the possibility of combining both methods. When top cover is in use pressure must not exceed -100 mb. High pressure can be acheived by covering the perforated sheet with melinex, creating air canals with canvas strips, sealing the painting with another sheet of melinex and employing a vacuum pump. This envelope can be furthermore secured to the surface of the table gradually by using suction from the ventilator or vacuum cleaner.

Moisturing

The table contains two moisturing systems. Moisturing above the perforated sheet takes place when a cover is secured over the top of the table and connected to the pipe system and the moisturing chamber under the table. The ventilator then circulates moist air from the moisturing chamber to the enclosed area above the perforated sheet. Circulation is also posible below the perforated sheet by directing moist air from the moisturing chamber to a main air canal on one side of the table which then flows to the other main canal on the opposite side of the table.

OPERATIONAL INSTRUCTIONS & DIAGRAMS



Operation: closed circulatory system

Heating

1. Insert both electric plugs into the two main electric outlets on the east wall (main el. I, main el. II).
2. Open entrance valve (3) located in the north-west corner of the table.
3. Open exit valve (4) located in the south-east corner of the table.
4. Open exit valve (8) located on the heating generator under the table on north side.
5. Put water-directing handle (7) to position: cooling coil.

Caution: valves (2) and (1) must be closed.

6. Turn on circulating pump switch (3) (orange) located on main control panel.
7. Check level of water in heating generator lifting cover by handle. Fill using plastic container (note required level of water).
8. Set desired temperature on thermostat (d) located on heating generator under the table on the east side. Activate (Heat I), (Heat II) and (Heat III).

Natural cooling (cooling time 60 C - 20 C approximately one hour)

1. Turn off all switches (Heat III), (Heat II), (Heat I) and switch (3) (orange) on main control panel.

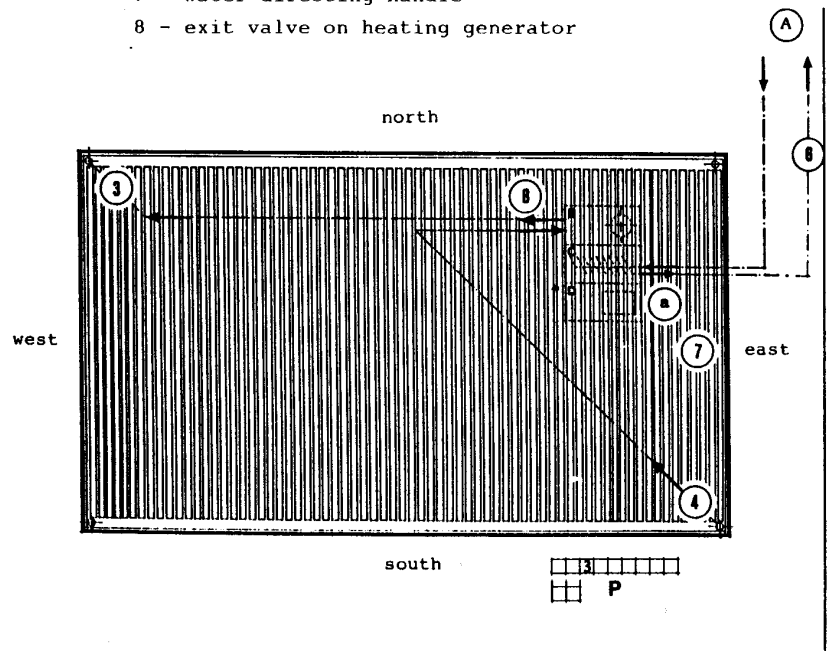
Diagram I - location of valves and switches employed in closed circulatory system

M I - main electric plug 380 volt
M II - main electric plug 280 volt

B - circulating pump
C - cooling coil
D - heating generator
P - main control panel

a - Heat I and pump switch
b - Heat II switch
c - Heat III switch
d - thermostat

3 - northwest entrance valve
4 - southeast exit valve
7 - water-directing handle
8 - exit valve on heating generator



Operation: accelerated cooling by activating cooling coil

(cooling 60 C - 20 C approximately 30 min.)

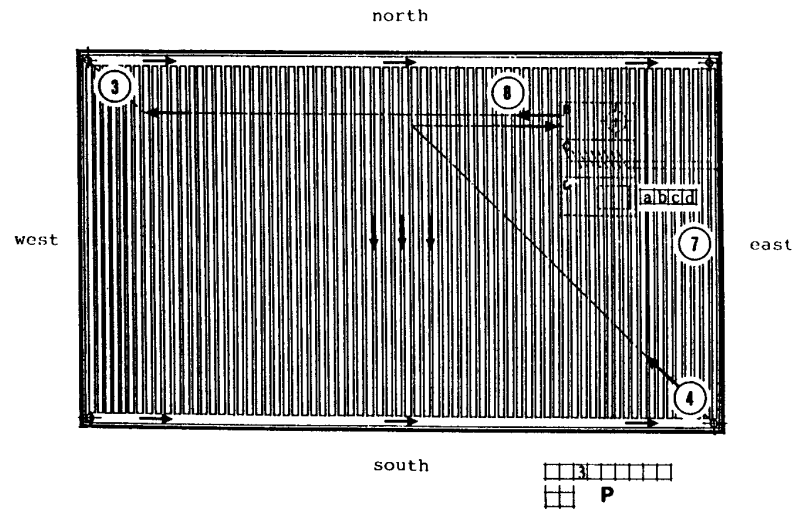
1. Set thermostat (d) on heating generator to minimum.
2. Turn off (Heat III) and (Heat II).
3. Leave (Heat I) and circulation pump switch (3) (orange) on main control panel on.
4. Turn water-directing handle (7) located under table on east side to position: cooling coil.
5. Open valve (6) located on wall by east side of table.
6. Set thermostat (d) to minimal temperature on wall faucet (A).
7. Turn on wall faucet (A).
8. When operation is completed turn off wall faucet (A), close valve (6), turn off (Heat I) switch, turn off circulating pump switch (3) (orange) on main panel, shut valves (8), (4), (3).

Diagram II - location of valves and switches employed in cooling by activating coil

A - water faucet on north wall
B - circulating pump
C - cooling coil
D - heating generator
P - main control panel

a - Heat I and pump switch

3 - northwest entrance valve
4 - southeast exit valve
6 - exit valve for cooling coil
7 - water-directing handle
8 - exit valve on heating generator



Operation: continual water flow system

Heating

1. Open entrance valve (1) located in northeast corner of table.
2. Open exit valve (2) located in southwest corner of table.
3. Turn water-directing handle (7) located under the table on east side to position: continual water flow.

Caution: valves (3), (4), (6), (8) must be closed (see Diagram II, page 13 for location of valves).

4. Set desired temperature on thermostat on wall faucet (A).
5. Open faucet (A) for water flow.

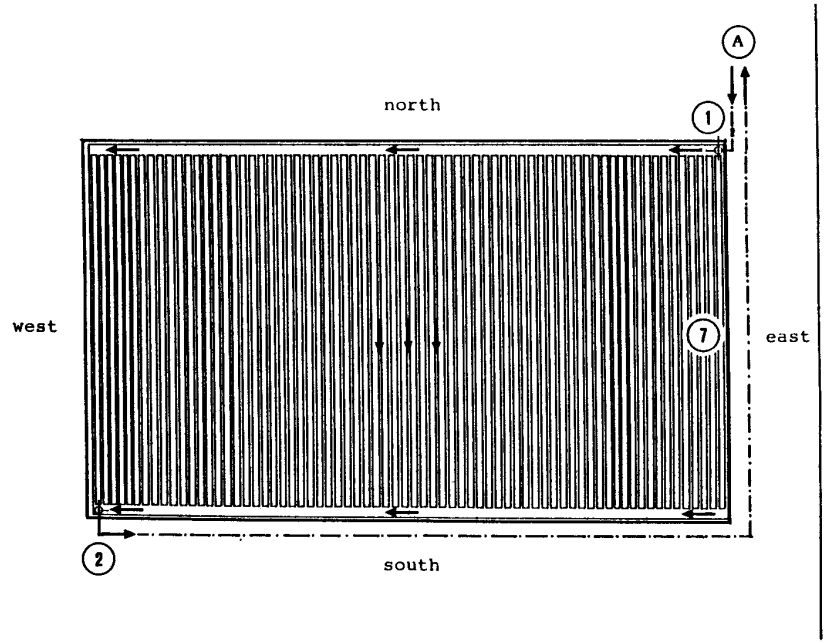
Cooling (cooling time approximetely two min.)

1. Set thermostat on wall faucet (A) to minimal temperature.
2. When operation is completed turn off wall faucet (A), close valves (1) and (2).

Diagram III - location of valves and switches employed in continual water flow system

A - water faucet with thermostat

1 - northeast entrance valve
2 - southwest exit valve
7 - water-directing handle



Operation: suction

Suction by vacuum cleaner

0. Starting position: valves (1 - 7) open, pipe openings (I - VIII) closed.
1. Connect vacuum cleaner hoses with orange valves (8) and (9) to pipe openings (I) and (IV) on east side of table.
2. Close orange pipe valves (3), (5), and (4), (6) located under the table.
3. Turn on vacuum cleaner switches (I - III) on east wall in order: (I), (II), (III). Turn off in order: (III), (II), (I).
4. Set motor revolution control located next to vacuum cleaner switches on east wall to desired level.
5. Turn on vacuum meter switches (4) and (G) (blue) located on main control panel. Pressure and air flow can also be read on meters on east wall next to vacuum cleaner switches (I), (II), (III).
6. Extra vacuum cleaner hoses with orange valve (10) can be connected either to pipe opening (VIII) or (V) on north or south side of table.
7. When operation is completed bring apparatus back to starting position 0.

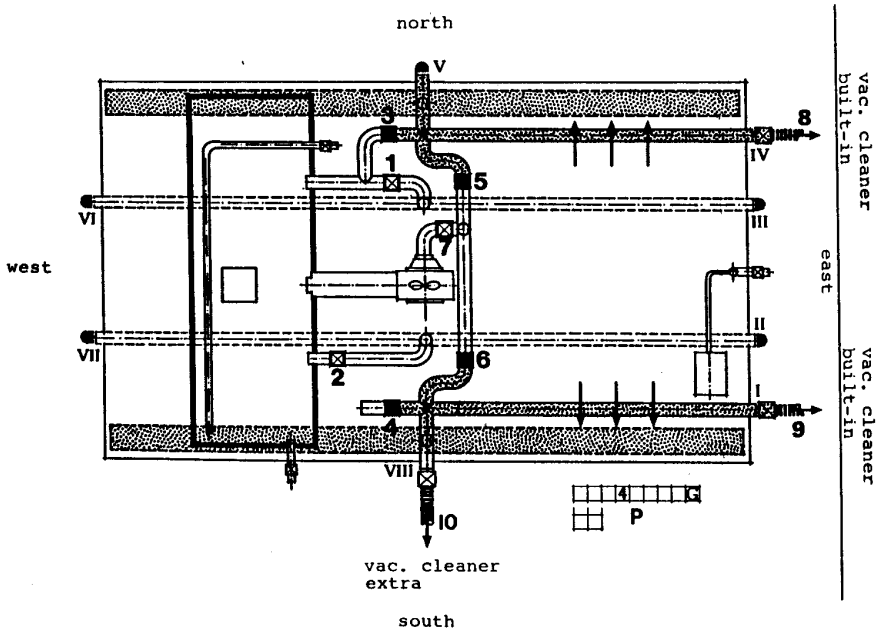
Diagram IV - location of valves and switches employed in suction by vacuum cleaner

(1 - 7) - orange colored air pipe valves

(I - VIII) - air pipe openings with caps

8 - hose to built-in vacuum cleaner
9 - hose to built in vacuum cleaner
10 - hose to extra vacuum cleaner

P - main control panel



Suction by ventilator

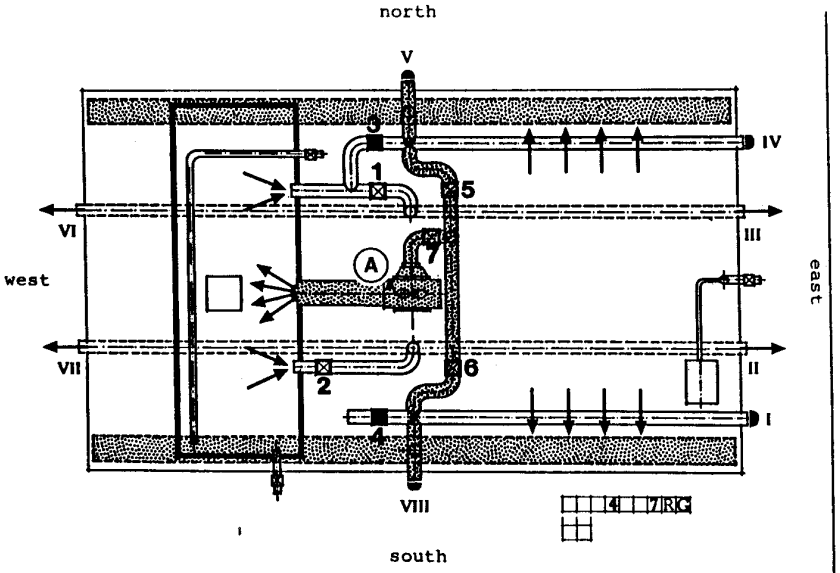
0. Starting position: valves (1 - 7) open, pipe openings (I - VIII) closed.
1. Remove caps from air pipe openings (II), (III), (VI), (VII).
2. Close valves (3), and (4).
3. Turn on main ventilator switch (7) (red) located on main control panel.
4. Regulate level of suction with regulator (R) located on main control panel.
5. Turn on vacuum meter switch (4) (blue) and display (G) (blue) located on main control panel.
6. When operation is completed bring apparatus back to starting position 0.

Diagram V - location of valves and switches employed in suction by ventilator

(1 - 7) - orange colored air pipe valves

(I - VIII) - air pipe openings with caps

P - main control panel



Suction by vacuum pump

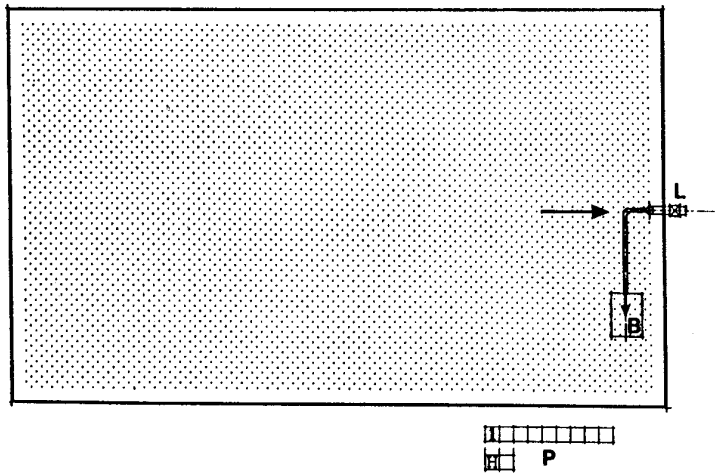
1. Open valve (L) located under table on east side.
2. Turn on vacuum pump switch (1) (green) located on main control panel.
3. Regulate pressure with valve (H) (green) located on main control panel. Monitor pressure on manometer.

Diagram VI - location of valves and switches employed in suction by vacuum pump

B - vacuum pump

L - valve from vacuum pump to above surface of table.

P - main control panel



Cooling table by air flow under perforated sheet

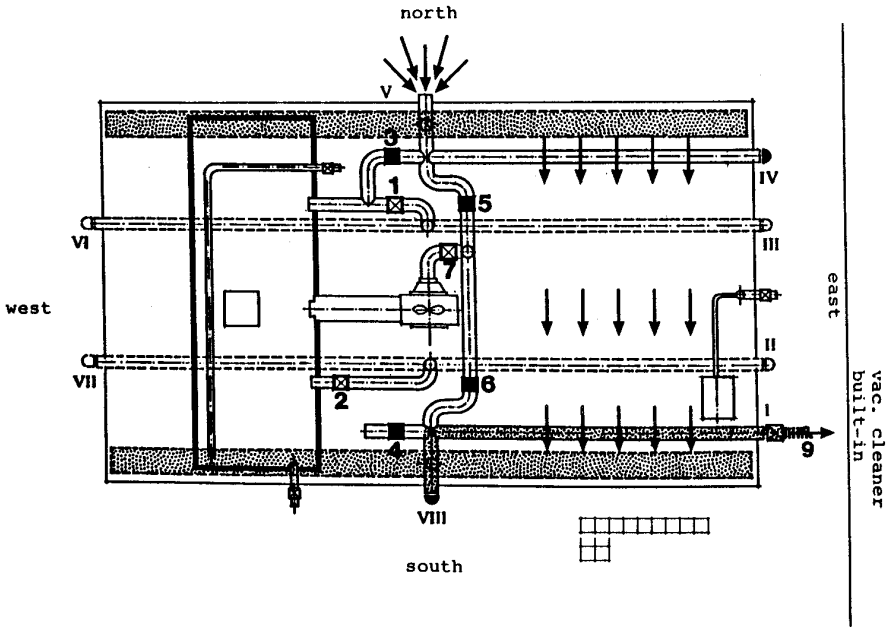
0. Starting position: valves (1 - 7) open, pipe openings (I - VIII) closed, vacuum cleaner hoses (8), (9), (10) closed.
1. Remove cap from pipe opening (V) on north side of table.
2. Connect vacuum cleaner hose with valve (9) (orange) to air pipe opening (I).
3. Open valve (9) (orange).
4. Close orange colored air pipe valves (3), (5) and (4), (6) located uder table.
5. Turn on vacuum cleaner switches (I - III), on east wall in order: (I), (II), (III). Turn off in order: (III), (II), (I).

Diagram VII - location of valves and switches employed in cooling table by air flow

(1 - 7) - orange colored air pipe valves

(I - VIII) - air pipe openings with caps

9 - hose with valve (built-in vacuum cleaner)



Operation: moisturing

Moisturing above perforated sheet with top cover in use, (vacuum by ventilator)

0. Starting position: valves (1 - 7) open, pipe openings (I - VIII) closed.
1. Check water level in moisturing chamber on west side below table.
2. Lower top cover with winding crank.
3. Connect openings on sides of top cover with openings (II), (III) and (VI), (VII) on east and west sides of table with four short pipes (stored in equipment drawer).
4. Close orange colored air pipe valve (3) and (4) located under table.
5. Turn on main ventilator switch (7) (red) located on main control panel.
6. Regulate ventilator with regulator (R) located on main control panel.
7. Turn on switch (4) (blue) located on main control panel to activate hygrometers.
8. Turn on moisture switch (2) (violet) located on main control panel.
9. Regulate level of moisture with regulator (K) (violet) on main control panel.
10. When operation is completed lift top cover with winding crank, and bring apparatus back to starting position 0.

Caution: remember to first disconnect top cover from table. Remove 4 connecting pipes.

Vacuum by ventilator can be also combined with vacuum by vacuum cleaner.

Caution: pressure from vacuum cleaners must not exceed -100 mb.

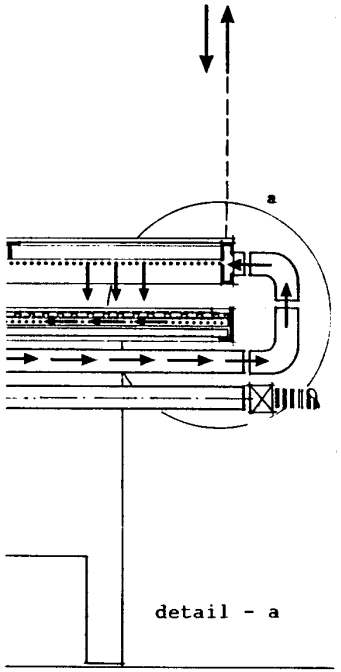
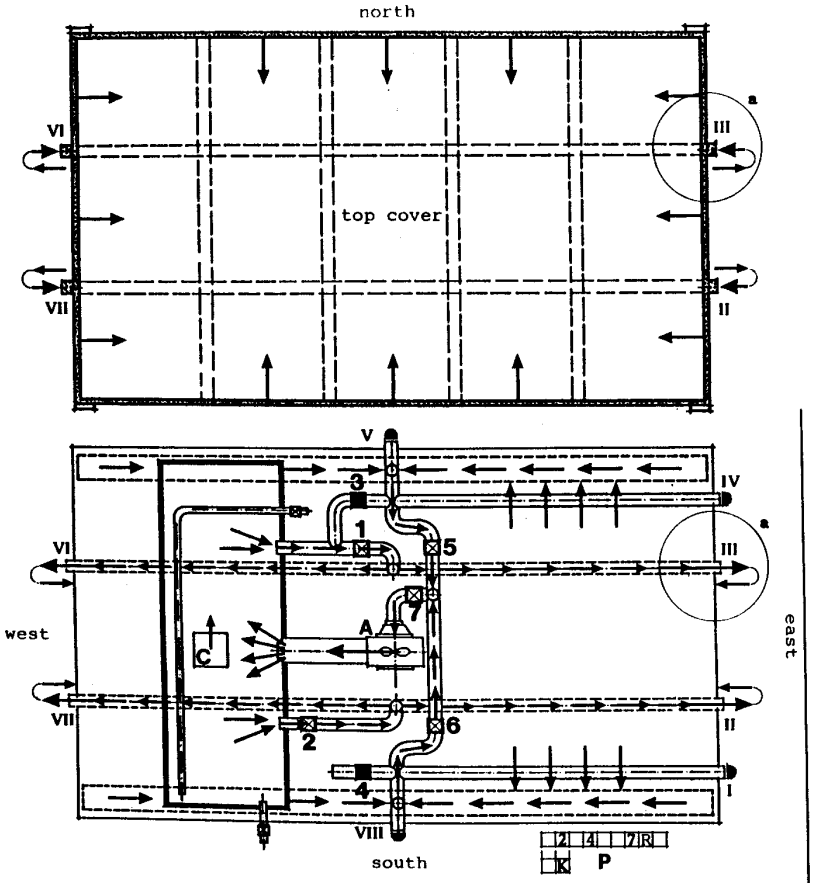


Diagram VIII -location of valves and switches employed in moisturing above perforated

(1 - 7) - orange colored air pipe valves
(I - VIII) - air pipe openings
A - ventilator
C - moisturing chamber
P - main control panel
a - detail, page 24



Moisturing below perforated sheet

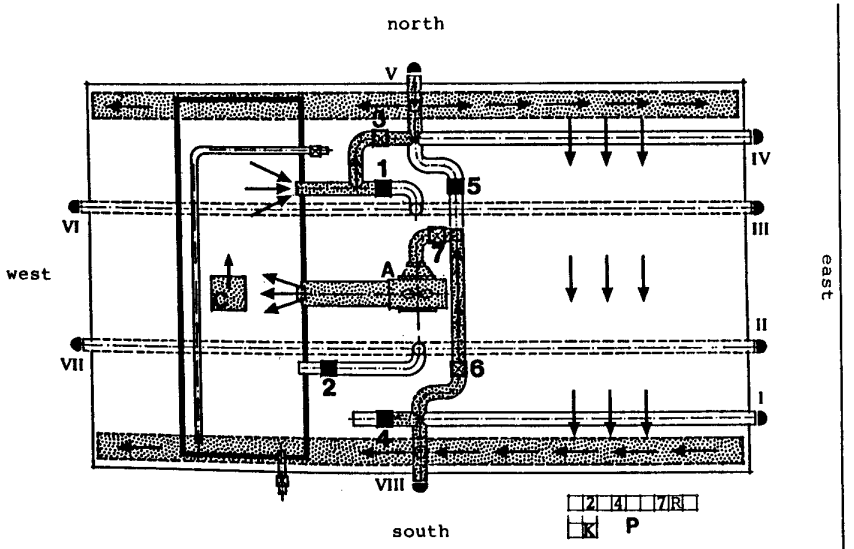
0. Starting position: valves (1 - 7) open, pipe openings (I - VIII) closed.
1. Check water level in container located in moisturing chamber, behind plexiglass window on west side below table (lift plastic stopper, fill using plastic container).
2. Close orange colored air valves (1), (5) and (2), (4) located under the table. 3. Turn on main vetilator switch (7) (red) located on main control panel.
4. Regulate ventilator with regulator (R) located on main control panel.
5. Turn on switch (4) (blue) located on main control panel to activate hygrometers.
6. Turn on moisture switch (2) (violet) located on main control panel.
7. Regulate level of moisture with regulator (K) (violet) on main control panel.
8. When operation is completed bring apparatus back to starting position 0.

Diagram IX - location of valves and switches employed in moisturing below perforated sheet

(1 - 7) - orange colored air pipe valves

(I - VIII) - air pipe openings

A - ventilator
C - moisturing chamber
P - main control panel



Data recorder

Registration of humidity

Humidity is registered by sensors:

1 - placed in the moisturing chamber
(violet on data recorder read-out sheet)

2 - placed under the perforated sheet
(red on data recorder read-out sheet)

3 - placed in top cover above the table
(black on data recorder read-out sheet)

Registration of pressure

Pressure is registered by sensor:

4 - placed in the middle of the table under perforated sheet
(green on data recorder read-out sheet)

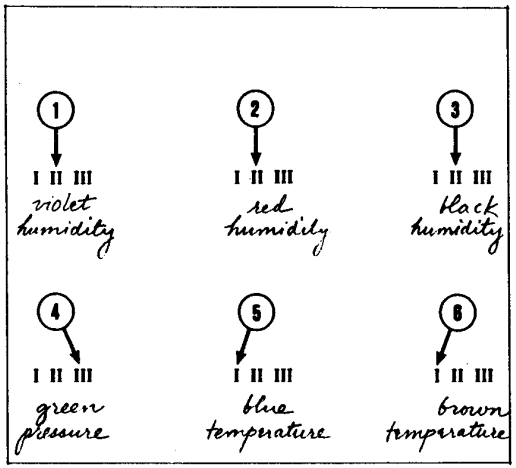
Registration of temperature

Temperature is registered by sensors:

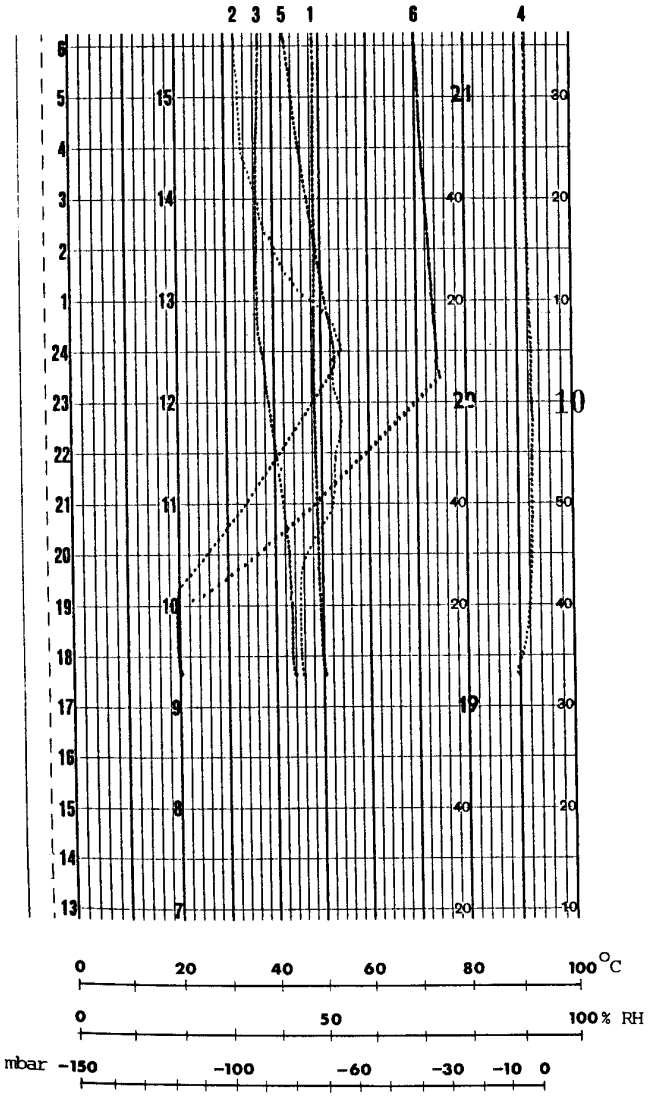
5 - in the heating generator water container
(blue on data recorder read-out sheet)

6 - non-stationary
(brown on data recorder read-out sheet)

Diagram X - back panel of data recorder



Sample of data recorder read-out sheet



De-aeration of the heating element

1. Lift up aluminium frame enclosing heating element from the south side of the table and insert wooden blocks (stored in equipment drawer) into aperture.
2. Follow directions for introducting water into heating element on page 10 (Heating, points 1 - 7) when closed circulatory system is to be used, page 14 (Heating, points 1 - 5) when continual water flow is to be used.
3. Increase water pressure in heating element by half-way closing exit valve for 1 second several times.
   Exit valve (4) on southeast corner of the table is manipulated when closed circulatory system is to be used.
   Exit valve (2) on southwest corner of the table is manipulated when continual water flow system is to be used.
4. When all air has been released, remove wooden blocks supporting frame and return it to its original position.

Caution: be sure not to damage any cables and wires under table when lowering frame.

5. A stethescope (stored in the equipment drawer) can be used for monitoring water flow sound. Ear plugs on stethescope must be cleaned with alcohol after use.

Decalcification (done at least once a year)

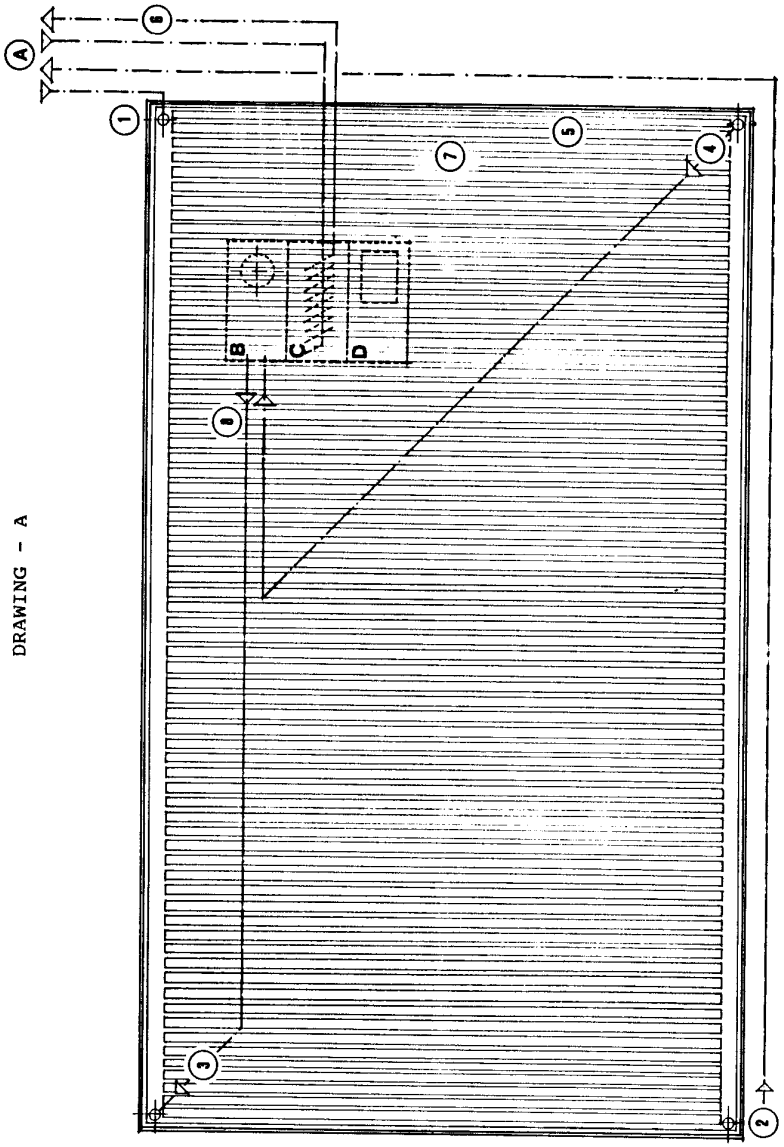
1. Follow directions on page 10 (Heating, points 1 - 7) for initiating of water flow through system.
2. Open exit valve (2) on southwest corner of table. Most of the water in the system will empty into water faucet (A) sink.
3. Empty remaining water by lifting aluminium frame enclosing heating element, from the north side of the table. Insert wooden blocks (stored in equipment drawer) into aperture.
4. Place buckets for the collection of water under exit valve (2) on southwest corner of table and entrance valve (4) (used here as an exit valve) on southeast corner of table.
5. Disconnect water pipes from valves (1) (3) and (2) (4).
6. Open valves (1) and (3).
7. Open valves (2) and (4). Remaining water will collect in buckets.
8. Empty water from heating generator under the table.
9. Re-connect water pipes to valves (1) (3) and (2) (4).
10. Fill water container in heating generator under table with decalcifying liquid.
11. Follow directions on page 10 (Heating, points 1 - 8) for initiation of circulation of decalcifying liquid through heating element, adding liquid when level in water container falls (a total of about 25 liters of decalcifying liquid is used in the operation).

12. Remove wooden blocks suppporting frame and lower it to its original position.

Caution: be sure not to damage any cables and wires under table when lowering frame.

13. Circulation of decalcifying liquid should continue for 4 - 5 hours.
14. When the decalcification process is completed, follow instructions on page 14 (Operation continual water flow, Heating, points 1 - 5) in order to exchange decalcifying liquid in heating element for water.
15. Replace decalcifying liquid in water container in heating generator with water. Scrub water container, cooling coil and circulation pump with brush before filling with water.
16. Before the table can be used heating eleelement must be de-aerated following instructions on page 30.

D R A W I N G S



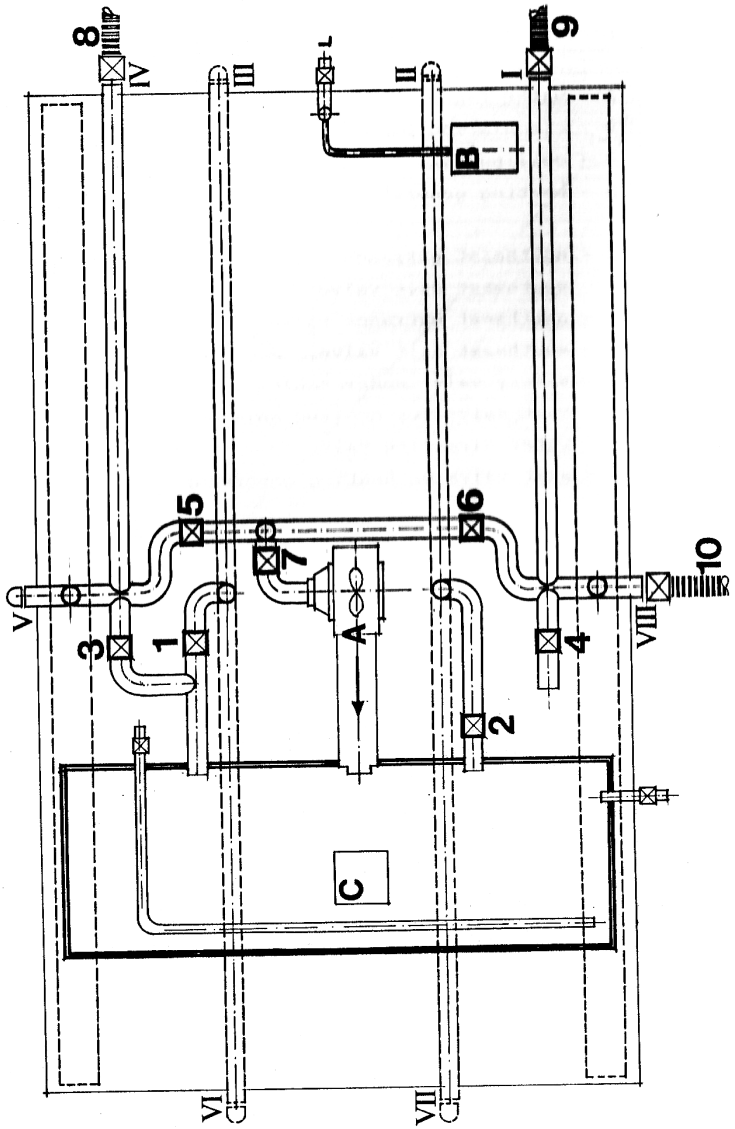
DRAWING - A

Drawing A - heating element

A - water faucet
B - circulating pump
C - cooling coil
D - heating generator

1 - northeast entrance valve
2 - southwest exit valve
3 - northwest entrance valve
4 - southeast exit valve
5 - safety valve under table
6 - exit valve for cooling coil
7 - water-directing valve
8 - exit valve on heating generator

DRAWING - B



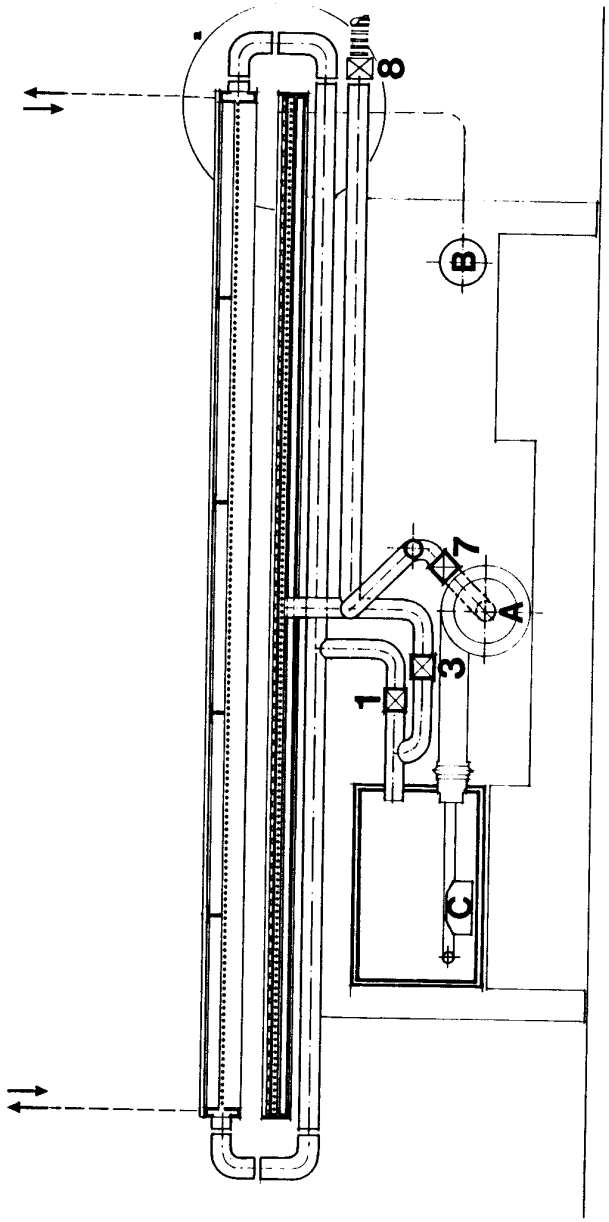
Drawing B - air pipe system

A - ventilator
B - vacuum pump
C - moisturing generator
L - valve on vacuum pump

1 - air pipe valve
2 - air pipe valve
3 - air pipe valve
4 - air pipe valve
5 - air pipe valve
6 - air pipe valve
7 - air pipe valve
8 - hose to vacuum cleaner
9 - hose to vacuum cleaner
10 - hose to vacuum cleaner

I - air pipe opening
II - air pipe opening
III - air pipe opening
IV - air pipe opening
V - air pipe opening
VI - air pipe opening
VII - air pipe opening
VIII - air pipe opening

DRAWING - C



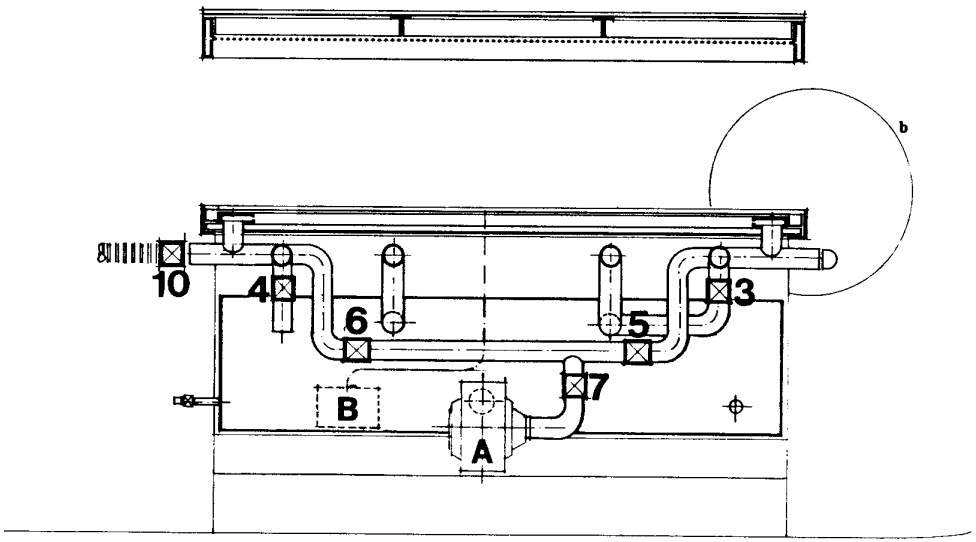
Drawing C - long section of the table

A - ventilator
B - vacuum pump
C - moisturing generator

1 - air pipe valve
3 - air pipe valve
7 - air pipe valve
8 - air pipe valve

a - detail (see drawing page 42)

DRAWING - D



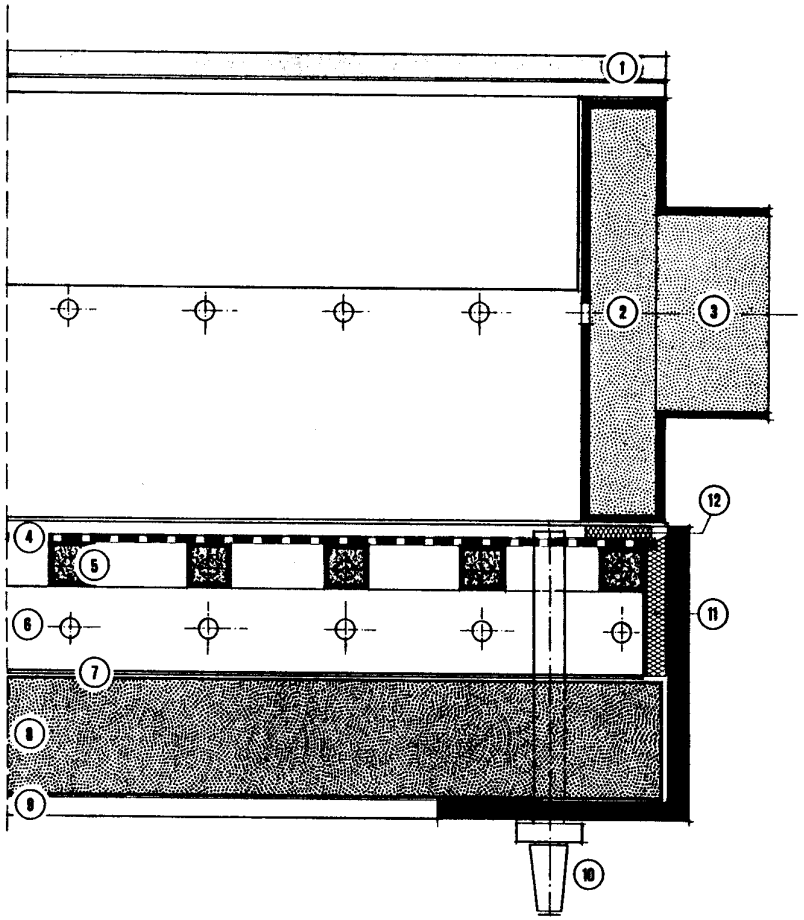
Drawing D - cross section of the table

A - ventilator
B - vacuum pump

3 - air pipe valve
4 - air pipe valve
5 - air pipe valve
6 - air pipe valve
7 - air pipe valve
10 - hose to vacuum cleaner

b - detail, (see drawing page 44)

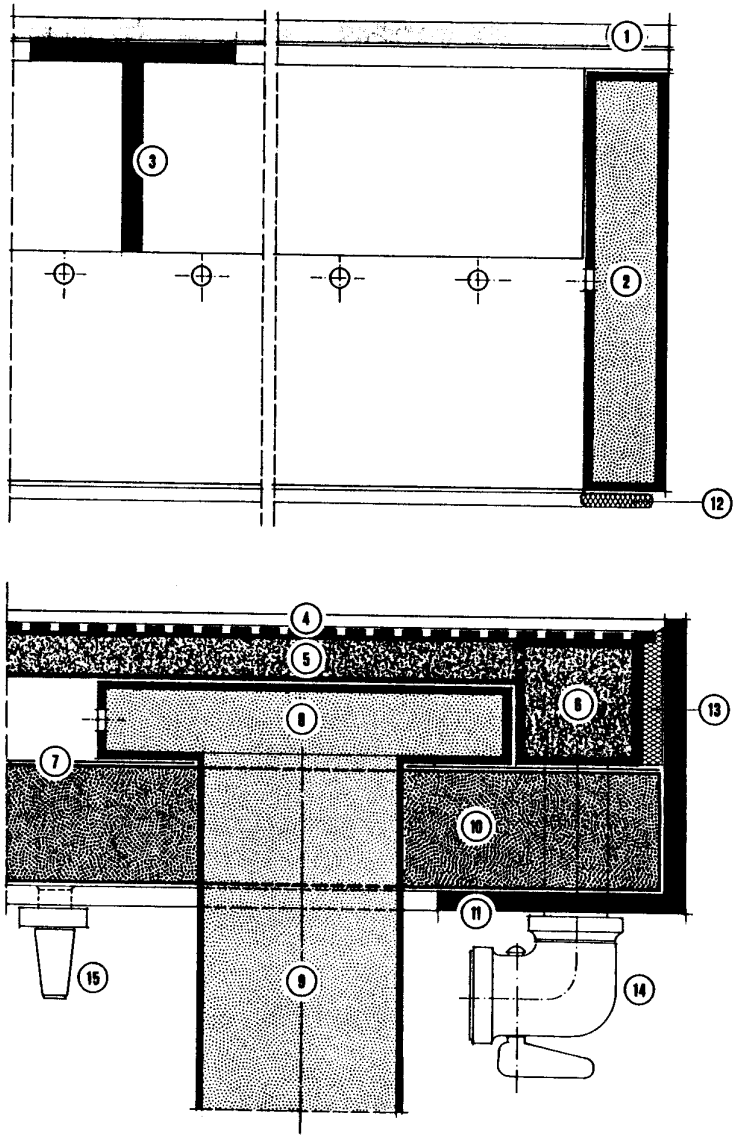
DRAWING - a



Drawing a - detail, construction of table

1 - plexiglass
2 - top cover aluminium frame
3 - connection to air pipe system
4 - perforated sheet
5 - heating element
6 - air manifold
7 - aluminium heat-reflecting foil
8 - forimica-laminated board
9 - aluminium L-profile frame
10 - connection to vacuum pump
11 - silicon isolation
12 - rubber isolation

DRAWING - b



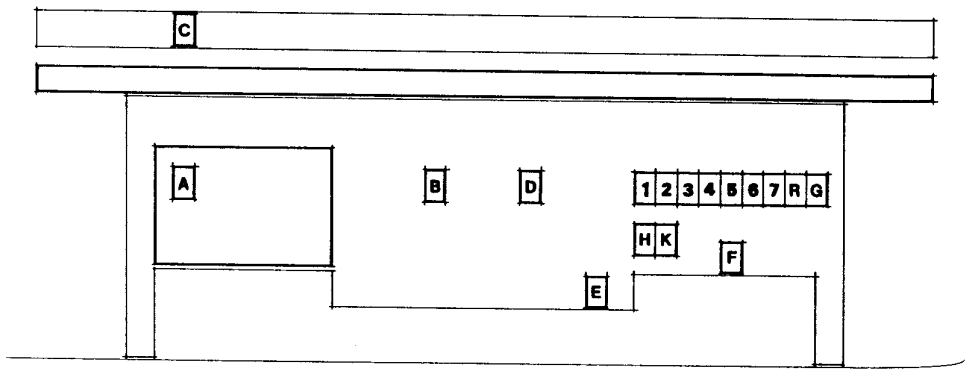
Drawing b - detail, construction of table

1 - plexiglass
2 - top cover aluminium frame
3 - aluminium T-profile (support for plexiglass)
4 - perforated sheet
5 - heating element
6 - heating element manifold
7 - aluminium heat-reflecting foil
8 - air manifold
9 - connection to air pipe system
10 - formica-laminated board
11 - aluminium L- profile
12 - rubber isolation
13 - silicon isolation
14 - valve to heating element
15 - drain for excess fluid

Diagram XI - instruments and switches

A - hygrometer and thermometer
B - hygrometer and thermometer
C - hygrometer and thermometer
D - vario-thermometer M-1, M-2, M-3
E - data recorder
F - vario-thermometer with 5 sensors
G - vacuum meter display (blue)
H - vacuum pump regulation valve (green)
K - moisture dosing regulator (violet)
R - regulator of ventilator (red)

1 - vacuum pump switch (green)
2 - moisture switch (violet)
3 - circulation pump switch (orange)
4 - vacuum meter switch (blue), also main switch for instruments (A, B, C, D)
5 - data recorder (E) switch (yellow)
6 - optional electrical outlet 220 v (white)
7 - ventilator main switch (red)

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