

Coating plants from "FERRI VATT" Ltd

A. A. Biktashev¹, O. V. Zhelonkin¹, V. A. Glinkin² A. P. Lyapin¹

¹"FERRI VATT" Ltd., Kazan, info@magnetron.ru

²Kazan technological University, department of vacuum technic. vacuum@kstu.ru

Overview of several batch coaters, developed and manufactured by Ferri Vatt Ltd in recent years. Plant for coating headlights reflectors, three-chambered plant for decorative metallization are presented and five types of vacuums coating plants that use arc discharge sputtering.

Historically, Kazan is one of the production centres of vacuum technological equipment in Russia. The Ferri Vatt Company had the leading position in development and production of diverse vacuum plants in the last decade. The many plants for deposition of decorative, protective, heat-insulating coatings on the glass, metal, plastic, ceramics etc. has been developed and manufactured. All presented plants are available with manual control or automated control, with computer and controller device. Chambers' internal equipment can be optimized to specific conditions of the customer. Technology elaboration, training of workers are obligatory part at equipment delivery. We are glad to cooperation with everyone, who has interest in development and use of vacuum technology and equipment

Reflectors coating plant

This plant is designed for coating various reflecting elements such as headlight reflectors. It can work both in manually and automatic mode.

VATT-1600-4TK" vacuum plant (Fig.1) is used for depositing combined reflective coatings consisting of aluminum layer and adhesion and protective organic-silicon layers. Coating can be applied to various reflectors made of metal or plastic.

Vacuum system, includes four high-vacuum diffusion pumps - AVDM -400,
Roots pump - DVN -500 and two fore-vacuum pumps - AVZ -125.

To maintain diffusion pumps functioning two 2NVR-5DM pumps (Fig. 2) are used, when AVZ-125 pump out the chamber. 1×10^{-4} mm Hg pressure achievement time is 20 min

Maximum power consumption is 50 kW.

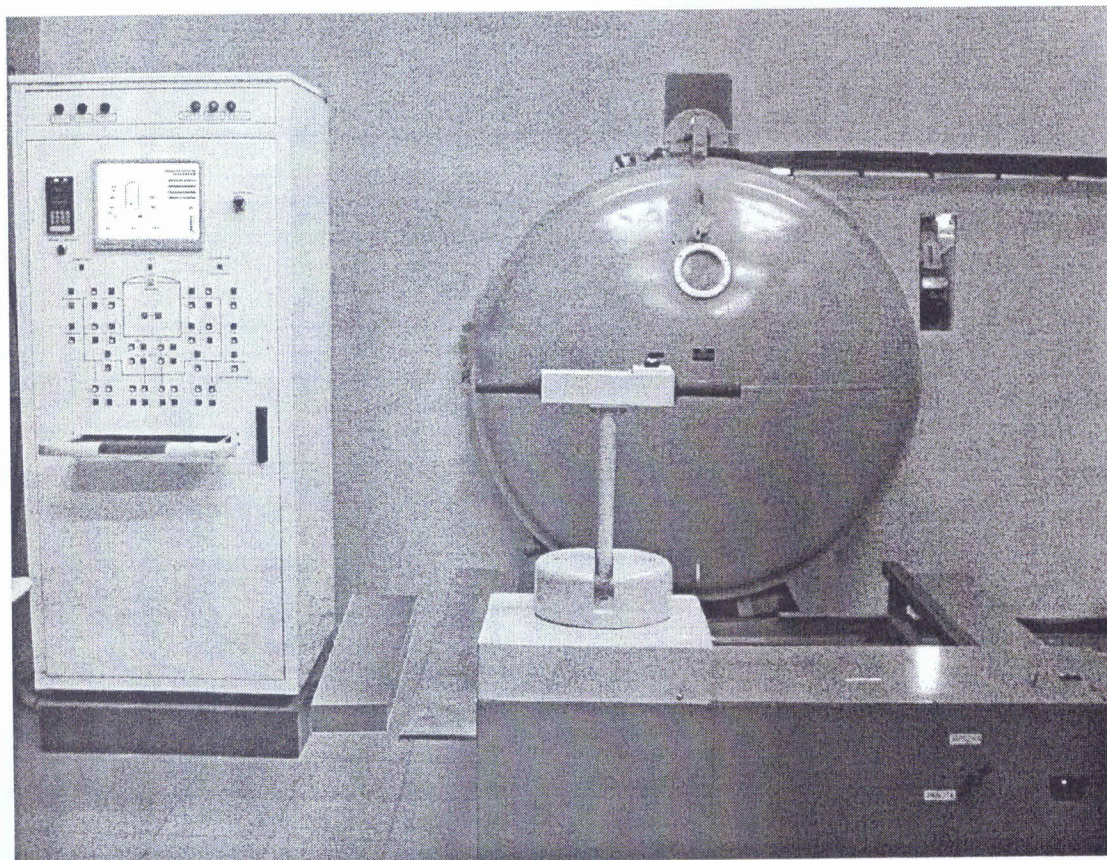


Fig.1. VATT-1600TK. Front view.

Drum has orbital motion mechanism with seven planets. Planet dimensions: $\varnothing=360\text{mm}$, length =1390mm (similar LH A1400). Planet capacity is e.g. 124 VAZ 2110's headlight reflectors. (Fig. 3)

In this modification thermal aluminum evaporation is used. Up to 20 tungsten spirals evaporators, are available for that. Organic-silicon layers deposition is carried out in RF plasma (13,56 MHz) and provides protection of aluminum layer from exterior action. Organic-silicon tank has temperature maintenance system and vapour supply regulation system.

Cycle may be conducted manually or completely automatically. In automatic mode control is realized by controller unit. Process parameters and sequence of the operations are shown on color display. Process parameters are recorded in computer memory, providing ability to analyze technology and make necessary changes in technologic process.

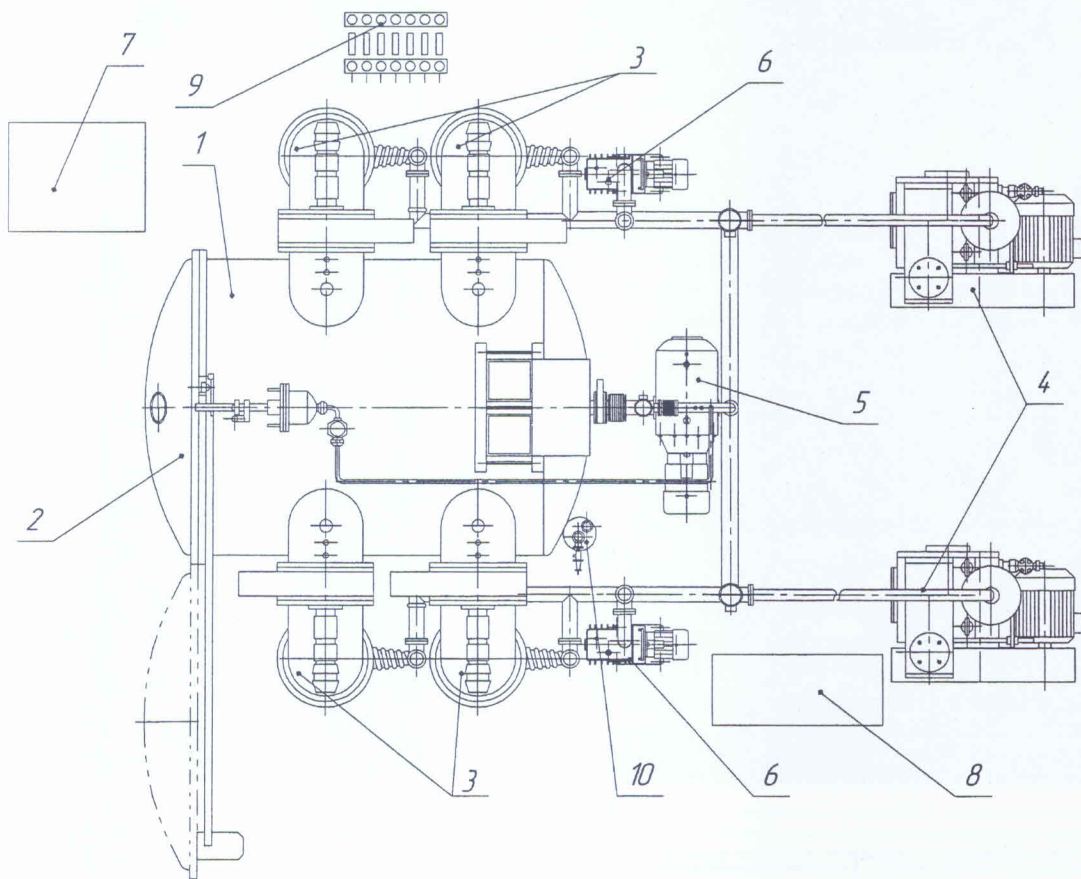


Fig 2. VATT-1600-TK.

1. Chamber; 2. Chamber lid; 3. Diffuzion pumps; 4. AVZ-125 pumps; 5. DVN-500 pump; 6. 2NVR-5DM pumps; 7. Control panel; 8. 13.56 MHz generator; 9. Rotameters; 10. Organic-silicon compound tank.

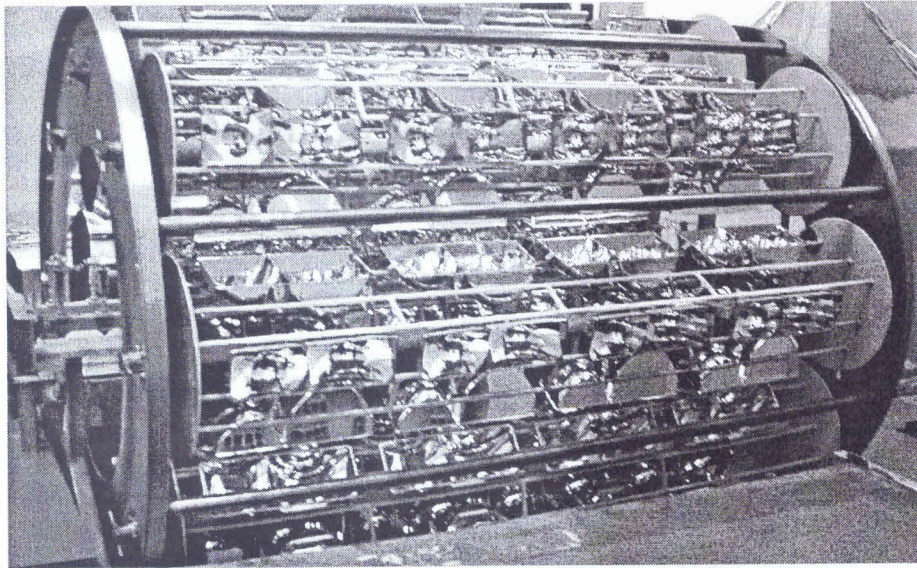


Fig.3. Drum with details

Unit has two drum sets on carriage. carriages have electric drive powered by accumulators. (Fig.4)

Vacuum system valves can have either electric or pneumatic drive unit. The last one increases plant reliability, especially when there are power supply irregularities.

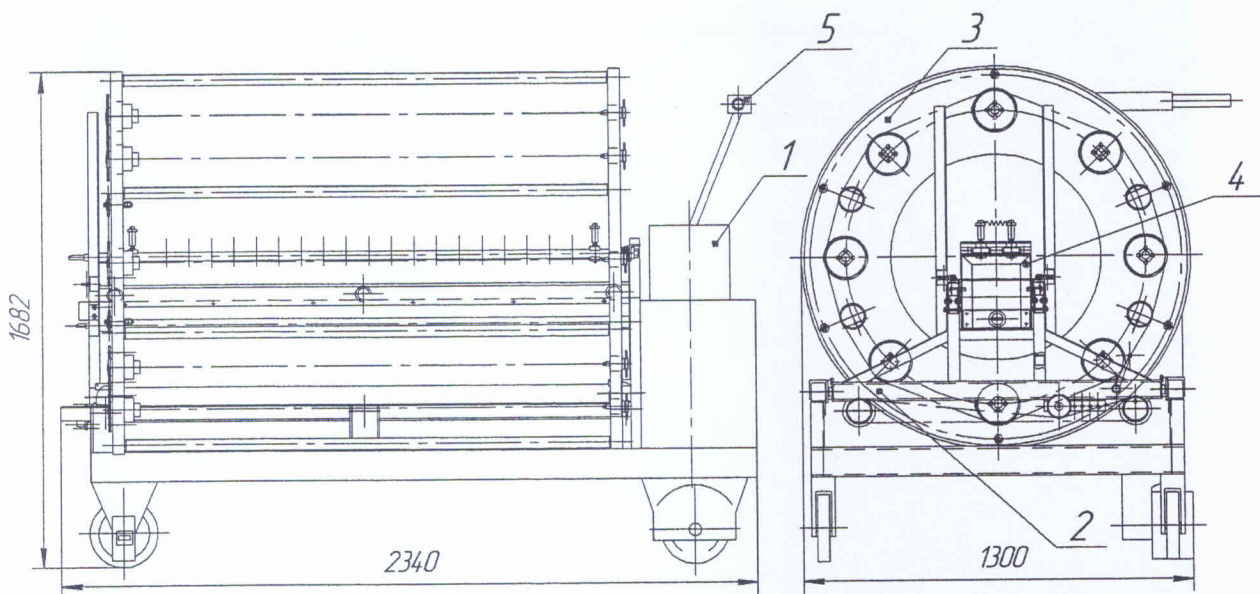


Fig. 4. Drum on the carriage

1.Carriage drive assembly; 2. Internal carriage; 3. Drum; 4. Evaporators assembly; 5. Carriage control knob.

Plants for decorative metallization

This plant is designed for applying pure metal and alloy coatings on small-sized decorative elements. Its advantages are small occupied area, high productivity and fine adjustability.

This plant is designed for applying pure metal and alloy coatings on small-sized decorative elements. Its advantages are small occupied area, high productivity and fine adjustability. VATT-500-M3 is designed for depositing pure metal and alloy layers in varnish-metal-varnish combination, employing magnetron sputtering method and ionic-plasmas activation of plastic articles.

Small occupied area is determined by vertical loading system (Fig.5, Fig.6). Plant dimensions in reloading position (without magnetron and fore-vacuum pumps) are (at most) 2900 mm in length, 2000 mm in width, 2400 mm in height.

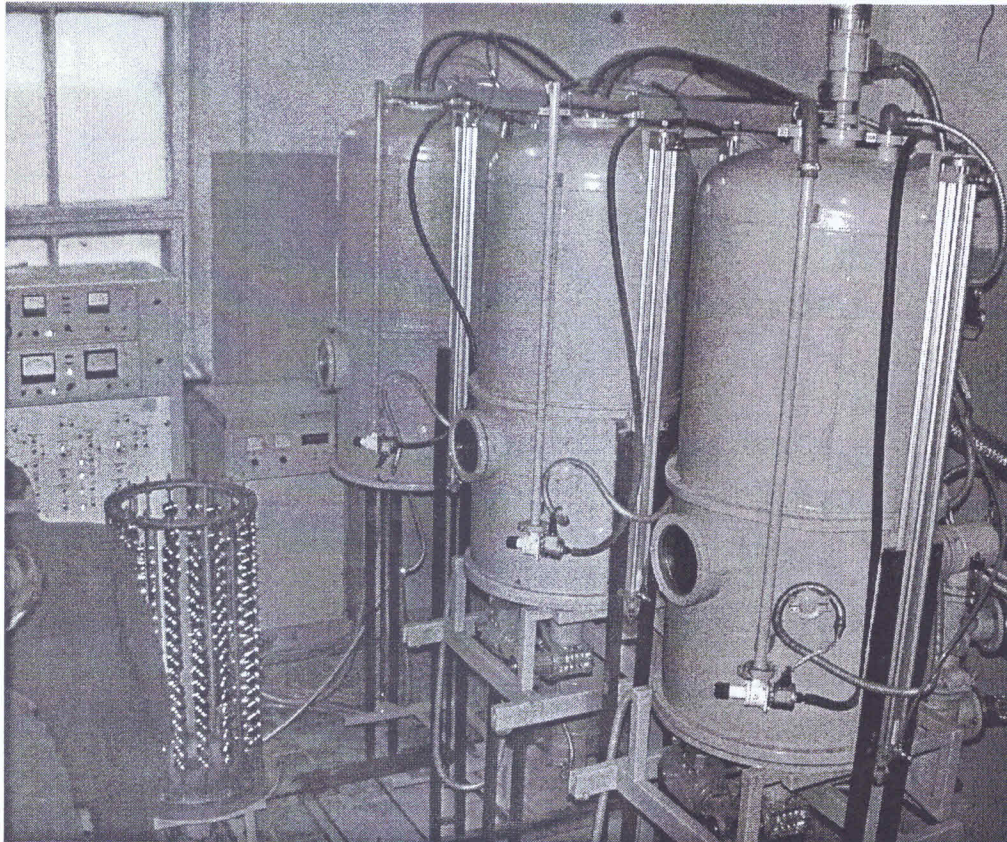


Fig. 5. VATT-500-3M

Use of three independent chambers provides fine adjustability. According to demanded output, one or two sputtering chambers can be used. It's also possible to apply different metal layers in two chambers separately. Coated articles must be smaller than 65x720 mm. Chamber capacity is 0.84 m² per cycle. Power consumption is (at most) 45 kW.

Components and details attachment system, drum and closing of a lid have common design in all three chambers. Holders are filled with articles and placed on the drum mounted on chamber flange. Drum is rotates under vacuum chamber; the lid is lifted together with the drum and pressing to the chamber by pneumatic cylinders.

Vacuum system consists of two AVDM-400 diffusion pumps and two AVZ-20 pumps. For fore-vacuum pumping-out AVZ-63 pump is used.

Chambers has removable heater for periodical chamber warming-up and internal elements degassing.

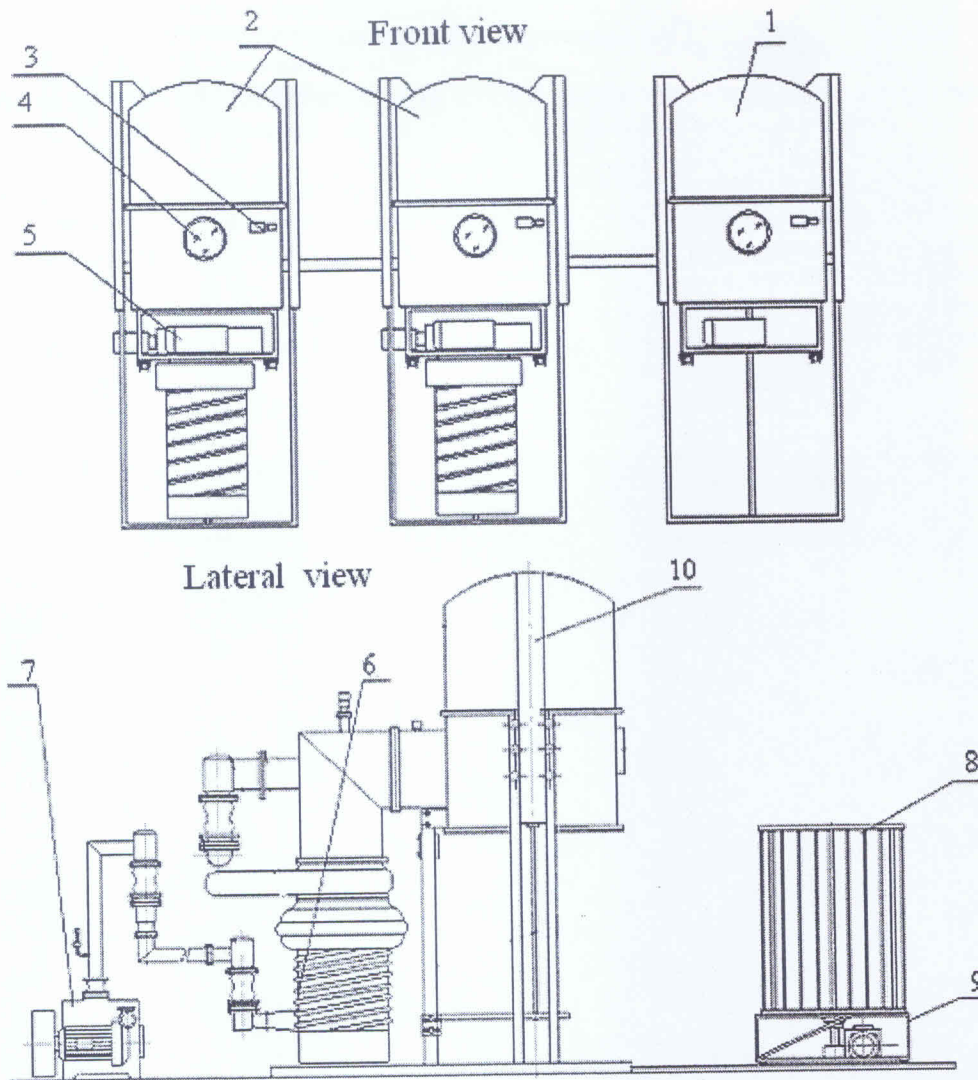


Fig.6. VATT-500-3M. Elements arrangement

1. Ionization chamber; 2. Coating chambers; 3. Inlet valve; 4. Sight hole; 5. Drum rotation mechanism; 6. AVDM-250 pump; AVZ-20 pump; 8. Drum; 9. Trolley with chamber lid; 10. Chamber lifting and pressing pneumatic ram.

Plants with linear arc cathodes

This series of plants provides deposition of various decorative and protective-decorative coatings on wide range of articles.

Arc discharge coating method has long been used in vacuum engineering for coatings depositing. High plasma ionization level, high average ion energy, and ability to easily direct this energy make it possible to get metal oxide and metal nitride coatings, as well as pure metal coatings of required quality without serious difficulties.

Use of linear cathodes that have simple design and relative cheap power sources makes this method applicable for Long industrial units. Besides, such cathodes are easily replaceable and have high metal recovery.

We have developed a series of plants for coating wide range of articles - from sheet glass to metal strips and small polished metal parts. Plants are provides warming up and bias potential on substrate, high productivity.

Figure 7 describes horizontal "VATT 1600-2ED" designed for depositing titanium and titanium nitride coatings on ceramic tiles. Plant has two cathodes moving up and down, and is capable of coating 11.5 m² of tiles per cycle. Use of moving cathodes provides coating uniformity all along the chamber's loaded volume.

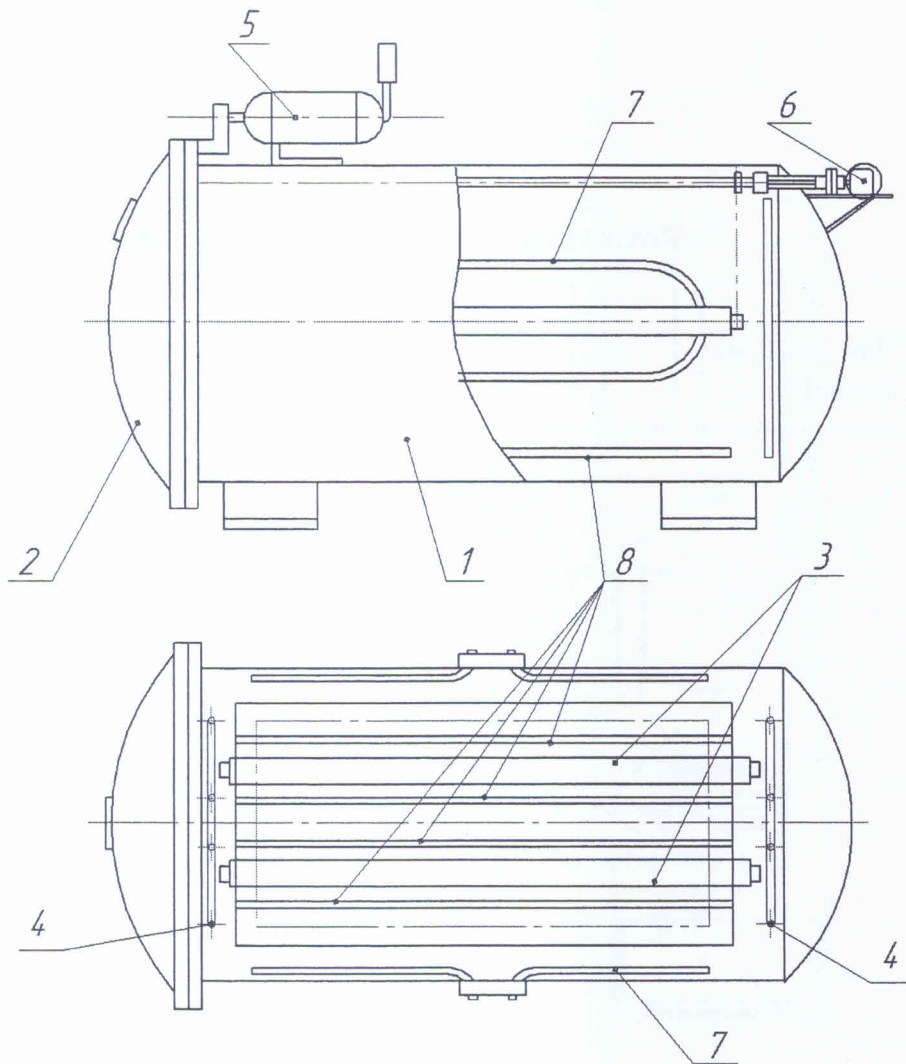


Fig. 7. VATT 1600-2ED:

1. Chamber, 2. Chamber lid, 3. Arc cathodes, 4. Discharge electrodes, 5. The pressing cylinder,
6. Electroarc cathode drive with rotary lead-in, 7. Heaters, 8. Slide guide

Figure 8 describes vertical "VATT1600-4ED" plant designed for deposited of protective coatings to steel strips up to 16 mm wide and 2010 mm long. There are 4 cathodes installed and articles suspended on a drum around them(512 details in a cycle). After coating is finished chamber lid with loaded drums is lifted and moves to reloading place by auxiliary mechanisms

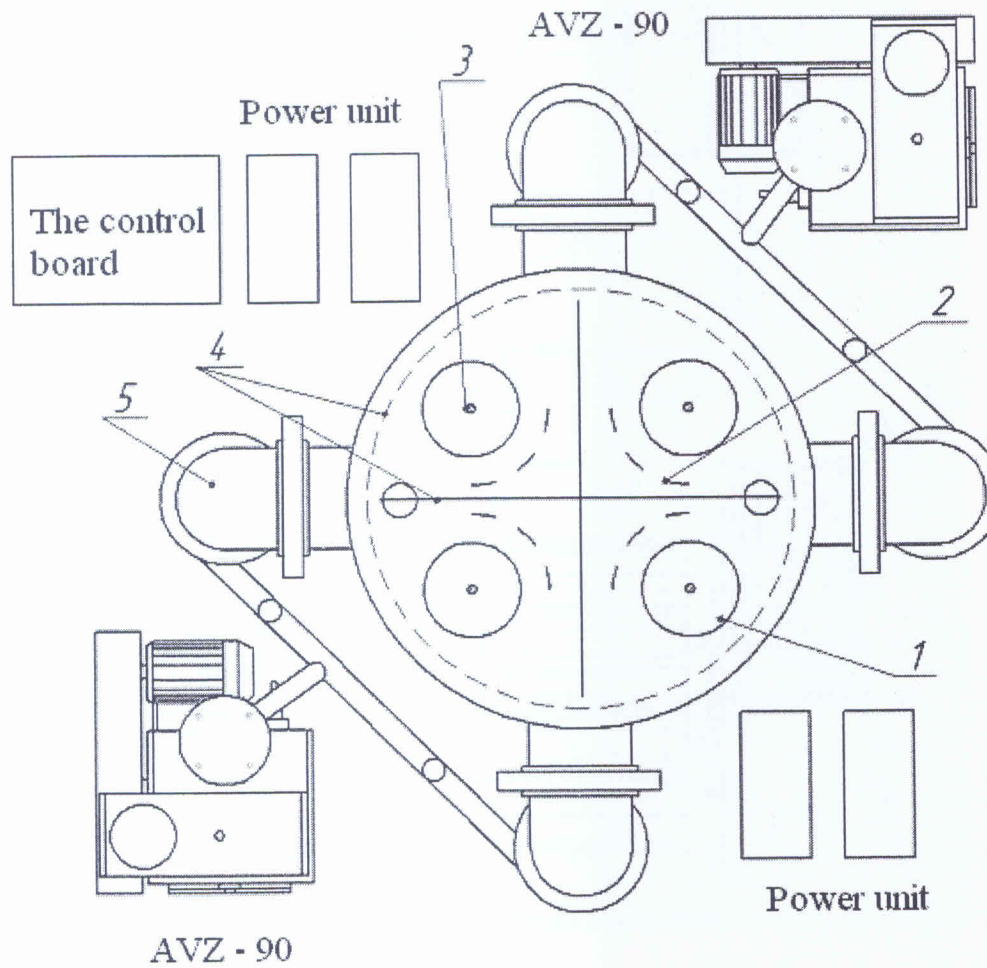


Fig. 8. VATT 1600-4ED. Vertical view.

1. Drums, 2. Heaters, 3. Arc cathodes, 4. Screens, 5. AVDM-400 high-vacuum pumps

Figure 9 describes vertical "VATT1600D" plant with central cathode designed for deposited of titanium and titanium oxide coatings on solids of revolution, e.g. vases (32 D250x450 mm articles in a cycle).

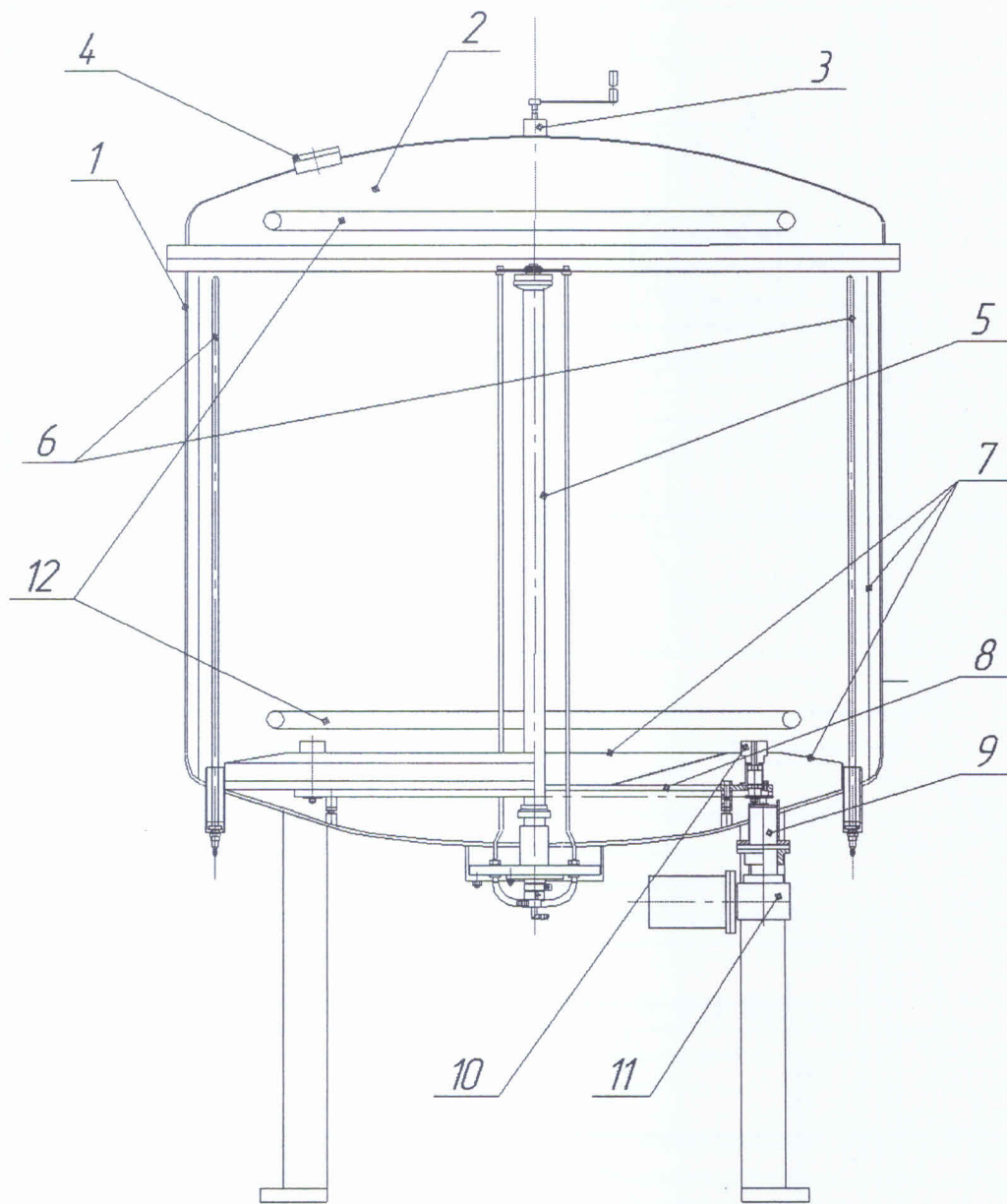


Fig. 9. VATT 1600D:

- 1. Chamber, 2. Chamber lid, 3. Lid lifting device, 4. Sight hole, 5. Arc cathode, 6. Heaters, 7. Screens, 8. Rotation device, 9 Rotary lead-in, 10. Rotary drive, 11. Rotary assembly, 12 Ion cleaning electrodes.

Figure 10 describes horizontal "VATT1600-ED" plant with vertical cathode designed for deposited of titanium and titanium nitride coatings on small-sized polished steel Details. Articles installed on holders move through heating and sputtering zones on chain conveyor.

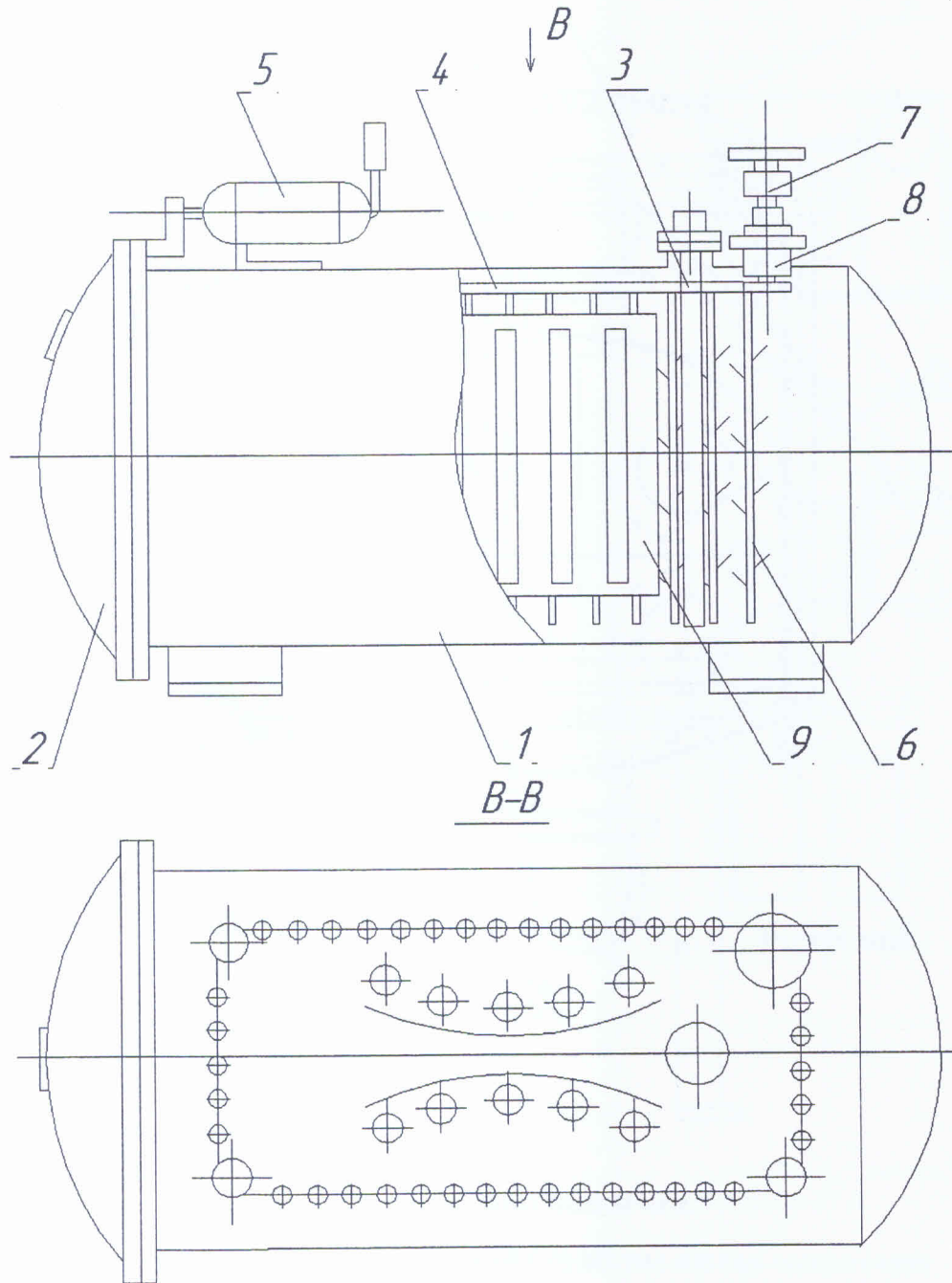


Fig. 10. VATT 1600-ED:

- 1. Chamber. 2. Chamber lid, 3. Arc cathode, 4. Substrate transportation mechanism, 5. Pressing cylinder, 6. Substrate transportation drive, 7. Rotary lead-in, 8. Heater, 9. Holder

Figure 11 describes horizontal "VATT 3000ED" plant for titanium and titanium oxide coatings depositing. It has one cathode moving up and down and is capable of coating two glass panes(2250x3210 mm) per cycle.

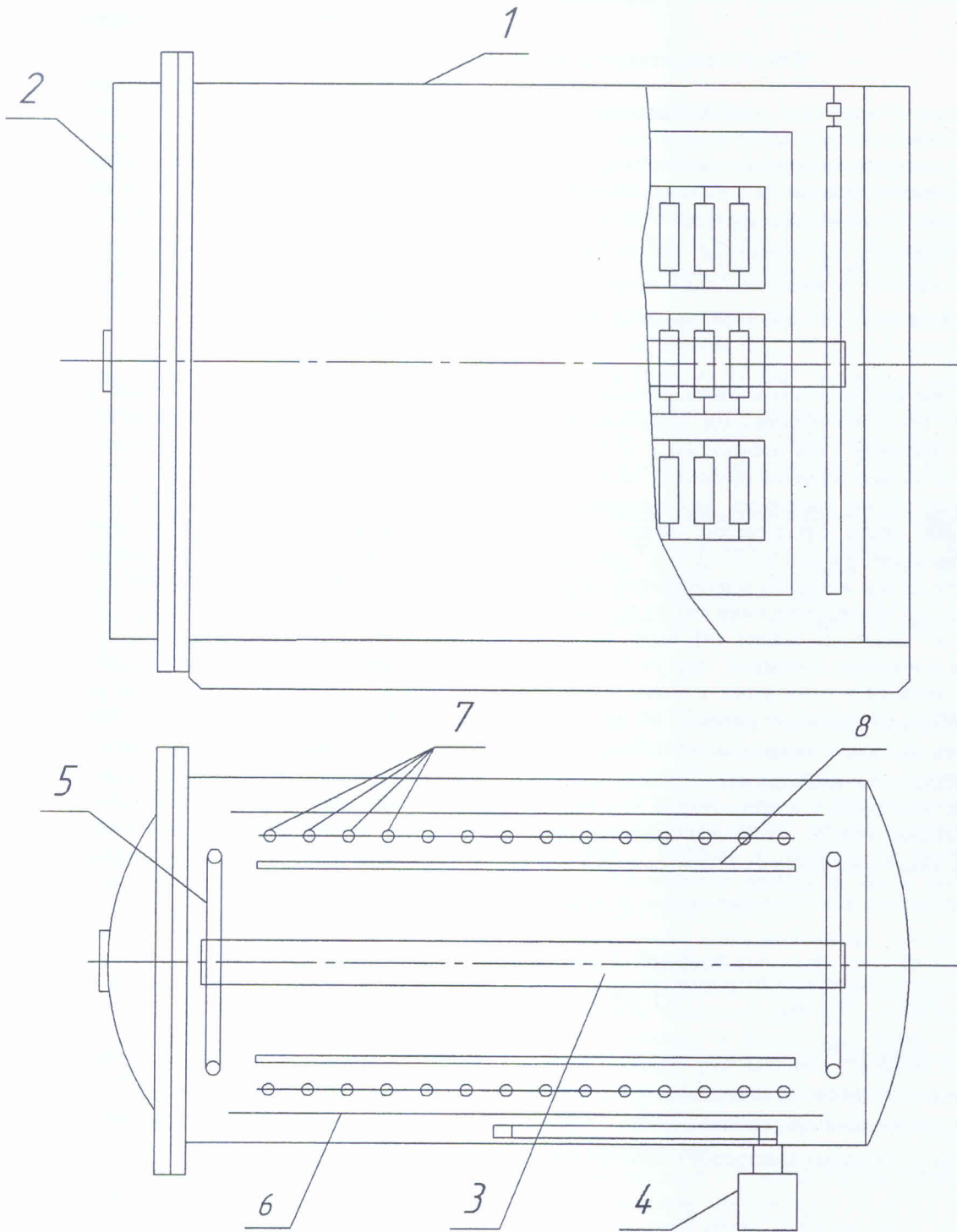


Fig. 11. VATT 3000ED:

- 1. Chamber, 2. Chamber lid, 3 Arc cathode, 4. Cathode transportation mechanism, 5. Ion cleaning electrode,
- 6 Screen, 7. Heaters, 8. Glass pane