MATRESHKA — HIGH INTENSITY ACCELERATOR OF CONTINUOUS PARTICLE BEAMS

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The schematic MATRESHKA arrangement is illustrated in Figure 1. The electron gun 1, vacuum pump, optical control and measuring systems are mounted with a feeding source in cylindrical metallic shield Seg (only a loading condenser C1 is shown). Around Seg the MATRESHKA's shields S25-S1 are mounted with high voltage sources (C25-C1) connected to these screens. Parts of the accelerating tube including the radial insulators 2, vacuum tubes 3, and focusing magnets 4, are mounted to them also. Screens are kept in a position needed by means of supporting insulators. The front doors 5 permit the operator to work with parts of the accelerating tube (without high voltage!).

Elements 6 (grouping device), 7 (UHF resonators), 8 (vacuum tube) and 9 (focusing winding) are parts of the UHF generator which is describing [1]. Parts 10, 11, and 12 are the MATRESHKA body. The bending magnet 10 analyses the MATRESHKA bunch and direct accelerated particles to corresponding lameles of energy analyser 11. Lameles 12 by means of the conductors 13 are connected to the screens S23-S1 and therefore have the corresponding potentials. Electrons catched by them without energy losses are directed in condensers C25-C1. This energy recuperation system makes MATRESHKA a very efficient source of relativistic electron beams for the UHF generator.

The MATRESHKA accelerator was developed for the UHF power excitation of many resonator systems [1] with moderate, for example 5 MW, level for each of them. If the number of resonators are 100, the complete power is 500 MW and with the efficiency 50%, MATRESHKA's beam power must be about 1000 MW. Electron beam can have such power with particle energy 5 MeV and current 200 A. If particles of the beam will have energy, for example, 10 MeV effects of the remainder radioactivity are dangerous. If higher currents are used, then losses of the particles will be higher.

Returning now to a MATRESHKA arrangement, we shall choose a number of the screens and voltage between them. If voltage is 200 kV, then number of the screens are 25, and distance between screens is 600 mm (for operator passage and power sources installation), and horizontal dimension will be 15 m. On the other side 200 mm gap will be sufficient, and the whole width will be about 22 m. Then the vertical dimension will be 12 m.

It is clear that creation of such a colossal installation can be realised only for an outstanding UHF generating system with continuous power gigawatt level. Our times is exactly time to solve like problem—the problem of gigawatt proton beams generation for nuclear transmutation and for nuclear energy stimulation [2,3]. The UHF feeding of the linear proton accelerators with power of the proton beam of gigawatt level is the problem of our days.

But with such power level the MATRESHKA efficiency must be near to 100%. Only with energy recuperator is it possible to have such a situation [4]. On our schematic representation, the recuperator 11 is fulfilled in ordinary form of energy analyser, but the beam power is used in a nonordinary manner: It is involved in accelerating tube elements. It is to be short to say that this recuperation system was not proved experimentally and therefore it is needed to fulfill a corresponding work. On our schema the return conductors 13, connected to screens in parallel to power sources C1-C25, are shown in coaxial form (they are placed in vacuum for electrical securing). In our early publication [5], and in experiments, we considered a cascadet rectifier system, but now we prefer more efficient electrical alternators driven from outside by means of ceramics rollers. If the electrical alternator is combined with the transformer and rectifier, then parallel conection of such sources with the recuperator conductors is no problem. Magnet 10 can be fulfilled with rotation to prevent a smelting the recuperatoa lameles.

In conclusion, the shield system, accelerating tube and return conductors 13 must be done individually in cyclindrical form with the ledges on their screens parts. After involving the tube in screen system and turning coupling of system is achieved. After this operation it can be possible to remove a montage bars.

References

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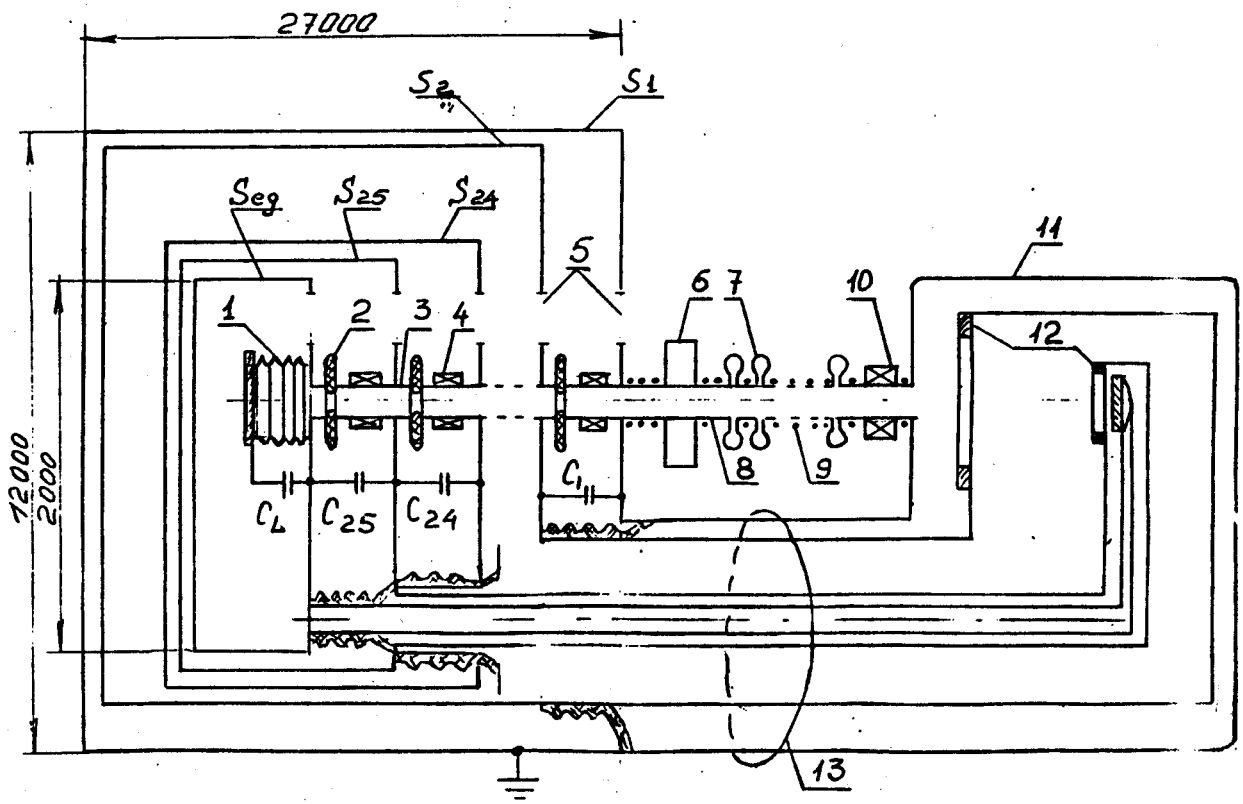

Figure 1. Schematic representation of MATRESHKA