

## COMPACT PULSE POWER GENERATOR AS A SOURCE OF ENERGY FOR A PLASMA GUN\*

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Ten years ago, at the Institute of High Current Electronics SB RAS in Tomsk a new method for the formation of a reusable point source of soft X-rays was proposed as an alternative to the X-pinch. This method was called PZ-pinch (Point Z-pinch) [1, 2]. In contrast to the X-pinch, the plasma of the PZ-pinch is preliminarily produced and then injected into the high voltage gap of pulse power generator during the operation of a high-current arc discharge.

The work is devoted to a new compact pulse generator designed as a source of power for a plasma gun. It was designed and created to replace the pulsed generator based on the IK-50-3 capacitor (3  $\mu$ F), which we used earlier. The IK-50-3 capacitor provided a current pulse with an amplitude of 70 kA and a current rise time of 1  $\mu$ s when operating on an arc. Its operating voltage was 20 kV [2]. However, this capacitor has impressive weight (120 kg) and size (31x31x67 cm<sup>3</sup>) parameters. In addition, the potential energy storage of the IK50-3 capacitor is excessive for plasma gun, which we use as part of a low-scale XPG-3 current generator to form PZ-pinch.

The new generator is based on a 1  $\mu$ F capacitor-switch assembly (Fig. 1a) of our own design [3, 4]. The dimensions of the pulse generator are  $\varnothing$ 30x30 cm, which is significantly smaller than its predecessor. The operating voltage of the new generator is 25 kV. It provides an arc current amplitude of 120 kA with a rise time of 500 ns. The external view of the generator is shown in fig. 1b. Experiments have shown that the power of the new generator is sufficient to form a bright point source of soft X-ray radiation based on the PZ-pinch in a wide range of linear pinch masses.

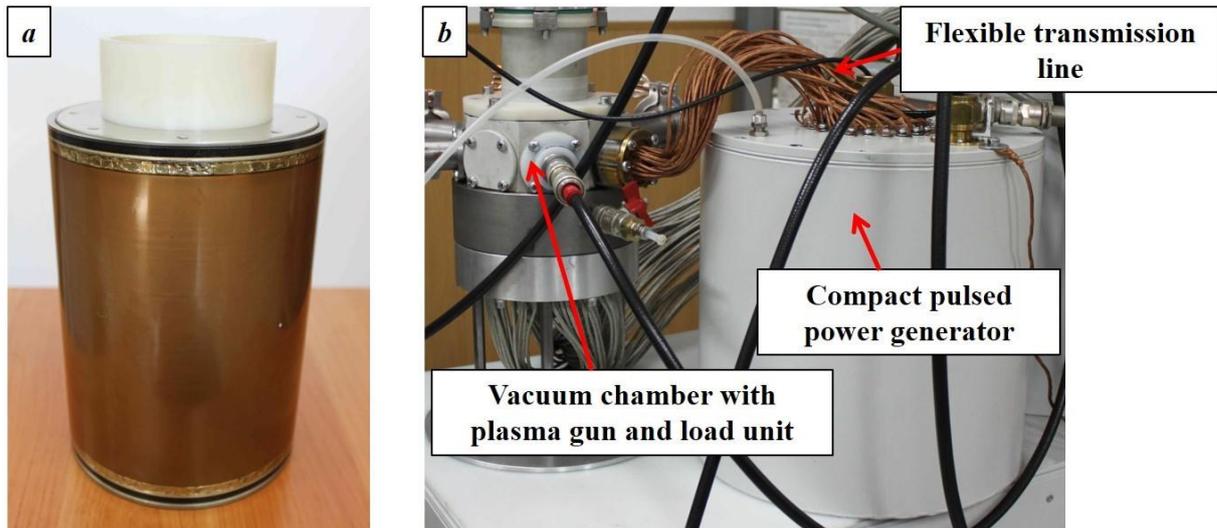


Fig. 1. External view of the capacitor-switch assembly (a) and the compact pulse power generator (b).

### REFERENCES

- [1] A.G. Rousskikh, A.V. Shishlov, A.S. Zhigalin, *et al*, "Small-sized vacuum-arc-discharge x-ray radiograph," *Plasma Sources Sci. Technol.*, vol. 20, 035011, 2011.
- [2] A.P. Artyomov, S.A. Chaikovsky, A.G. Rousskikh and A.V. Fedunin, "Soft x-ray source based on the point Z-pinch for pulse radiography", *Journ. of Phys.: Conf. Series*, vol. 1556, 012083, 2020.
- [3] S.A. Chaikovsky, A.P. Artyomov, N.V. Zharova *et al*, "Small-size high-current generators for x-ray backlighting", *Russ. Phys. Journ.*, vol. 60, pp. 1408-1412, 2017.
- [4] N.V. Zharova, N.A. Ratakhin, A.V. Saushkin, V.F. Fedushchak, and A.A. Erfort, "Fast energy output from a high-current pulsed capacitor by using a pseudospark gap", *Instrum. Exp. Tech.*, vol. 49, pp. 384-387, 2006.

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