Description
A multipurpose plasma torch has been developed for spraying powder materials, application of coatings and surface modification. The basic areas of application of the plasma torch with an interelectrode insert (IEI) and diffuse attachment of the anode arc are as follows:

- application of coatings of arbitrary powder materials, primarily, refractory materials;
- plasma processing of powders, including their spheroidizing, densification, etc.;
- thermal processing of material surfaces by a highly concentrated laminar plasma jet, including fusion of coatings, hardening and modification of surfaces, nitration of metal surfaces, etc.

Technical specifications
Multipurpose plasma torch:
- Nominal power – 50 kW (25 and 100 kW modifications are also possible);
- Thermal efficiency – up to 80%;
- Arc current – less than 200 A;
- Working gas – air, natural gas, argon, nitrogen, helium, and their mixtures;
- Test-gas (air) flow rate – 0.5–2.5 g/sec;
- Typical nozzle-exit diameter – 8–10 mm;
- Types of design – stationary and hand-held.

Technical appraisal and economic benefits
- Possibility of working with a turbulent and laminar plasma jets, which allows application of coatings from arbitrary powder materials (metallic, ceramic, composite, etc.);
- High power density of the heat flux from the laminar jet into the processed material, which allows one to use the plasma torch for melting coatings for obtaining better adhesion and lower porosity, surface hardening, plasma-mechanical processing, spheroidizing of refractory powders;
- The use of air in addition to all technically pure working gases (argon, nitrogen, helium, natural gas, and their mixtures), which significantly reduces the payback period;
• Possibility of using batch-production domestic power sources, such as APR-402 and APR-404.

**Application area**
The main users of the plasma torch can be machine-building enterprises with emphasis on power engineering and recovery, and also research teams and companies dealing with technologies for production of new materials, which include
– dimensional restoration and simultaneous hardening of worn units and elements of various machines and mechanisms;
– application of corrosion-resistant, abrasion-proof, anticavitation, and wear-proof coatings;
– thermoprotective, thermobarrier, heat-proof, and electric insulating coatings of ceramic high-adhesion materials applied by a laminar jet;
– coatings resistant to impact loads;
– biomedical coatings for implants.

**Development stage**
A pilot specimen of the plasma torch has been tested and used for several years; design documentation is available. In Russia, the plasma torch is used at several enterprises, including the shipyard (Yakutsk), Repair Plant of the “West-Siberian River Steamship Line” for recovery of propellers, and Pilot Plant of the State Academy of Water Transport (Novosibirsk).

**Patent situation**
Know-how.

**Commercial offers**
Delivery of plasma equipment.
Application of coatings of arbitrary powder materials.
Spheroidizing of metallic, ceramic, and composite powders.
Delivery of know-how.

**Estimated cost**
Depending on the set of equipment, the cost varies from 15,000 USD (reduced set of deliverables) to 70,000 USD (extended set of deliverables).

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