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EN 2502643 C2

(54)**MULTIFUNCTIONAL AIRCRAFT WITH REDUCED RADAR VISIBILITY**

(57) Abstract:
Invention applies to areas aircraft industry. Multifunctional aircraft contains a fuselage (1), wing consoles (2), all-moving vertical tail consoles (3), cantilever arm horizontal tail(four),lamp

cabins(five),horizontal edges air intakes engines (6) fine-meshed grids, shielding air intake and exhaust devices (7), lateral oblique edges air intakes engines (8), device (nine) decrease in effective scattering surfaces(EPR)power installations and sashes (10) rod compartment in-flight refueling. The optical sensors are made with the possibility of turning in the idle state with the back side, with the radar-absorbing coating deposited on it, in the direction of the irradiating radars. Antenna compartments are closed with shielding diaphragms. The planes of the antennas are deflected from the vertical plane. as antennas used designs of airframe units. The antenna-feeder system is based on low-reflective antennas in the radar wavelength range. The invention is aimed at reducing the magnitude of radar visibility.5 ill.

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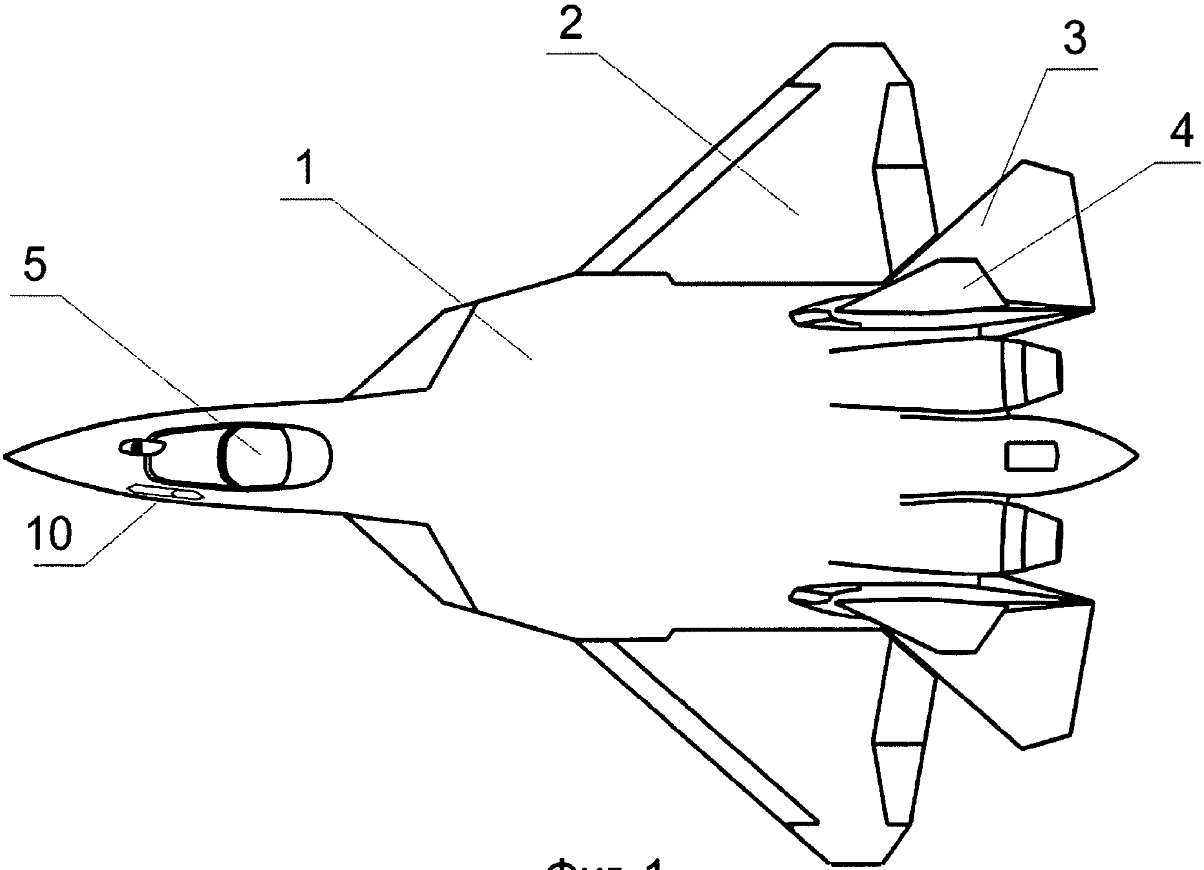

Фиг. 1

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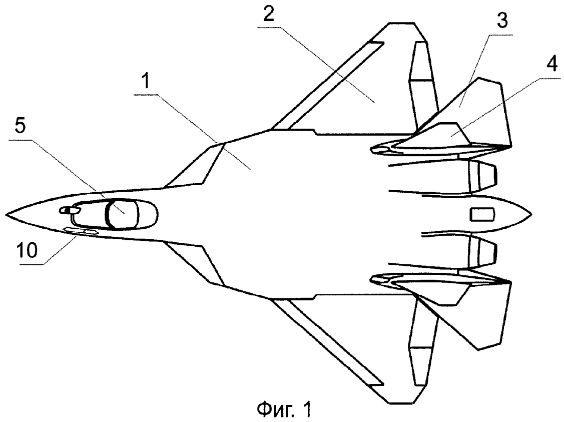
(54)MULTIFUNCTIONAL AIRCRAFT OF DECRASED RADAR SIGNATURE

(57) Abstract:

FIELD: transport.

SUBSTANCE: invention relates to aircraft engineering. Proposed aircraft comprises fuselage 1, outer wings 2, wings of all-moving vertical empennage 3, wings of all-moving horizontal empennage 4, cockpit canopy 5, horizontal edges of engine nacelles 6, close-meshed screen to shield air intake and discharge devices 7, lateral inclined edges of engine air intakes, device 9 to decrease engine absolute cross-section and flaps 10 of inflight refueling rod compartment. Optical transducers can turn in nonworking state by rear sides with radio absorption coating applied hereon in direction of illumination radars. Antenna compartments are closed by shielding membranes. Plates of antennas are deflected from vertical plane. Airframe structural elements are used as antennas. Antenna feeder system is built around low-radiation antennas in radar range of wavelengths.

EFFECT: decreased radar signature. 5 dwgs



Фиг. 1

C2 2502643 EN

The invention relates to the field of aircraft engineering, in particular to tactical aircraft, providing detection and destruction of air, surface and ground targets.

Known multifunctional aircraft (Fomin A.V. "Su-27. History fighter", Moscow, "RA Intervestnik",1999, pp. 208-251), containing a glider, power plant, general aircraft equipment, display and control system, a set of weapons, active and passive countermeasures, surveillance and sighting tools (radar sighting system, optoelectronic sighting system), a system for monitoring and recording parameters, a communication system between aircraft and with points control, flight and navigation system, countermeasures system, control system for weapons of destruction and passive countermeasures, providing navigation, piloting in manual and automatic control modes, built-in control of systems, inter-aircraft navigation and exchange of tactical information in a group, guidance from command control posts, radar an overview of the airspace and the underlying surface, the location of the airspace,detection and tracking of ground and air targets, target designation of weapons, setting active radar interference, the use of uncorrected weapons, as well as aviation weapons (ASP) with passive thermal, passive and active radar homing heads for ground, air and surface targets, the use of weapons passive opposition.

As disadvantages of the known technical solution, it should be noted the high value of the effective scattering surface (ESR), which determines the characteristics of the detection of an aircraft by enemy radar equipment. For the famous aircraft, the RCS value is about10-15 m^2(here considered average value for the selected angle).

The technical result, to which the invention is directed, is to reduce the value of the radar visibility of the aircraft to an average value order0.1-1 m^2.

The invention is illustrated by drawings, where in Fig.1 shows an integral plane aerodynamic layout - top view; in fig.2 - integrated plane aerodynamic layout - bottom view; in fig.3 - integrated plane aerodynamic layout - front view; in fig.4 - section A-A Fig.2.; figure 5 - section b-b fig.2.

In the presented drawings, positions are indicated: 1 - fuselage,
2 - wing consoles,
3 - consoles of the all-moving horizontal tail (TsPGO), 4 - consoles of the all-moving vertical tail (TsPVO), 5 - cockpit canopy,

6 - horizontal edges of the engine air intakes, 7 - fine-mesh nets covering air emissions, 8 - lateral inclined edges of the engine air intakes, 9 - a device that reduces the EPR of the power plant,
10 - flaps of the in-flight refueling boom compartment. The aircraft

onboard equipment complex includes: general aircraft equipment; indication system and controls; set of funds defeat, active and passive resistance; observation and sighting means (radar sighting system, optical-electronic sighting system); a system for monitoring and recording parameters, a communication system between aircraft and with control points; flight and navigation system; a system of countermeasures; a control system for means of destruction and passive countermeasures, providing navigation, piloting in manual and automatic control modes; built-in system control; inter-aircraft navigation and exchange of tactical information in a group, guidance from command and control posts, radar survey of airspace and the underlying surface, detection and tracking of air and ground targets, setting active radar jamming, uncorrectable weapons of destruction;

The EPR of the aircraft consists of the EPR of its following components: airframe; power plant; optical and antenna systems of the onboard equipment complex; outboard and retractable equipment in flight.

The value of the RCS of the airframe and the power plant is determined by three factors:

- the shape of the theoretical contours and the layout of the airframe, including air intake and air channel;

- design of airframe units, technological and operational joints skins, flaps, hatches and joints between the movable and fixed parts of the aircraft airframe;

- use of radio-absorbing and shielding materials and coatings. The shape of the

theoretical contours and the layout of the airframe made it possible to reduce the energy of reflected EM waves in certain angles due to the redistribution of the maxima of the backscatter pattern in the minimum number of directions and in the least dangerous sectors.

constructive measures

Cleaning the ASP inside the airframe made it possible to reduce the overall RCS by eliminating the reflection of electromagnetic waves of the irradiating radar from the ASP and their triggers.

Execution of the air intake ductS-shaped in combination with radio absorbing coatings (RPP) provides a decrease in EPR in paraxial directions. In other sectors of the front hemisphere (PPS) - due to the shielding of the input guide vane (VNA) of the engine, from the elements of which the electromagnetic (EM) waves of the irradiating radar are mainly reflected, which is a significant proportion (up to60%) in the EPR of the airframe - engine system in the PPS. The application of RPP on the walls of the air intake channel (AI) makes it possible to reduce the magnitude of the EM signals reflected from the VNA and re-reflected onto the channel walls, thereby the overall level of the RCS of the air intake in the ABL decreases.

Device9 in the air intake duct to reduce the EPR of the engine in the front hemisphere can be installed in a channel of any shape before the BHA, but is mainly installed in "straight" channels. Device9 plays a role a screen partially covering the VNA in the paraxial directions from the ingress of EM waves. In addition to shielding the device9 divides the VZ channel before the VNA into a number separate cavities formed by cylindrical (or concentric or non-concentric) or flat surfaces, while the flat surfaces may be parallel or intersecting. Each cavity has a smaller cross-sectional area than the air intake channel in this zone. Such segmentation with simultaneous coating of the walls of the RPP segments makes it possible to reduce the magnitude of the EM signals reflected from the VNA and re-reflected onto the walls of the device cavities9, thus the overall level of RCS of the EO in the PPP decreases.

Bringing the sweep angles of the leading and trailing edges of the bearing surfaces, air intakes, hatch doors to two or three directions other than the axial one, makes it possible to ensure that the global maxima of the backscatter diagram (BDR) are reduced to these directions. Such a DOR causes a decrease in the overall level of ESR in PPP.

Fuselage slope1 in cross section, slope vertical aerodynamic surfaces (vertical tail 4, side edges 8 vz) to one direction in the cross section allows you to reduce the EPR in the lateral hemisphere (BPS) due to the re-reflection of the EM wave incident on the inclined surface of the airframe, in a direction different from the direction of the irradiating radar.

Screening of air intake and exhaust devices with structural elements, as well as fine meshes, makes it possible to reduce or eliminate the RCS component from airframe "inhomogeneities" (such as a hole, slot, sinus) due to the fact that the linear size of the mesh cell covering the inhomogeneity is less than ¼ of the length of the EM waves that irradiate the aircraft. In such a situation, the fine mesh acts as a screen for the EM wave, which reduces the component of these inhomogeneities in the EPR.

Closing the in-flight refueling boom compartment with a flap10 excludes component of the niche and the rod in the total EPR of the aircraft.

The use of all-moving vertical tail4 allows you to reduce the total area of the AO and, as a result, reduce the level of the signal reflected from the AO, which, in turn, reduces the RCS value in the BPS.

The use of conductive sealants makes it possible to ensure electrical conductivity between individual structural and technological elements of the airframe, which, in turn, makes it possible to exclude the “inhomogeneities” component in the EPR of the aircraft (such as a slot, joint) due to the fact that in the absence of electrical inhomogeneities, there is no scattering of surface EM waves .

The use of RPP allows you to significantly reduce the level of global EPR maxima due to the fact that the principle of operation of RPP is to partially absorb the energy of an EM wave incident on the material, therefore, to ensure a decrease in the level of the reflected radar signal.

The implementation of the glazing of the lantern metallized provides EM impermeability in such a way that the glazing, in fact, is an impenetrable inclined wall that reflects the incident EM wave away from the irradiating radar.

The main measures to reduce the component of the onboard equipment complex in the EPR are as follows:

1. The use of frequency-selective structures in antenna radomes, allowing to transmit radiation in the operating frequency range of its own antenna and be impervious to radiation of other frequency ranges (irradiating radars). Thus, EM waves incident on antenna radomes from irradiating radars are re-reflected (due to the shape of the radomes formed by surfaces inclined to the vertical plane) away from the direction of irradiation.

2. Turning the optical part of the optical sensors in the idle state with applying RPP on the back side. Thus, in the non-working (passive) state of the sensors (minimum RCS state), the sensor faces the direction of the irradiating radars with the side with the RPP applied, which provides partial absorption of incident EM waves, thereby reducing the RCS.

3. The use of shielding diaphragms in antenna compartments to eliminate the effect of a wandering wave, when the irradiating wave, after repeated reflection in a closed compartment, is amplified and radiated into outer space. The shielding diaphragm is installed around the antenna post in such a way that it surrounds the post along the periphery. RPP is applied to the diaphragm wall facing the irradiating radar. When irradiated, the protective diaphragm prevents the EM wave from penetrating inside the antenna compartment, while simultaneously absorbing part of the energy of the incident wave and reducing the RCS.

4. Deviation of the plane of the antennas from the vertical and, consequently, the deviation the normals of the antennas from the horizontal plane provide a change in the direction of the reflected EM waves away from the irradiating radar, thereby reducing the EPR of the antennas.

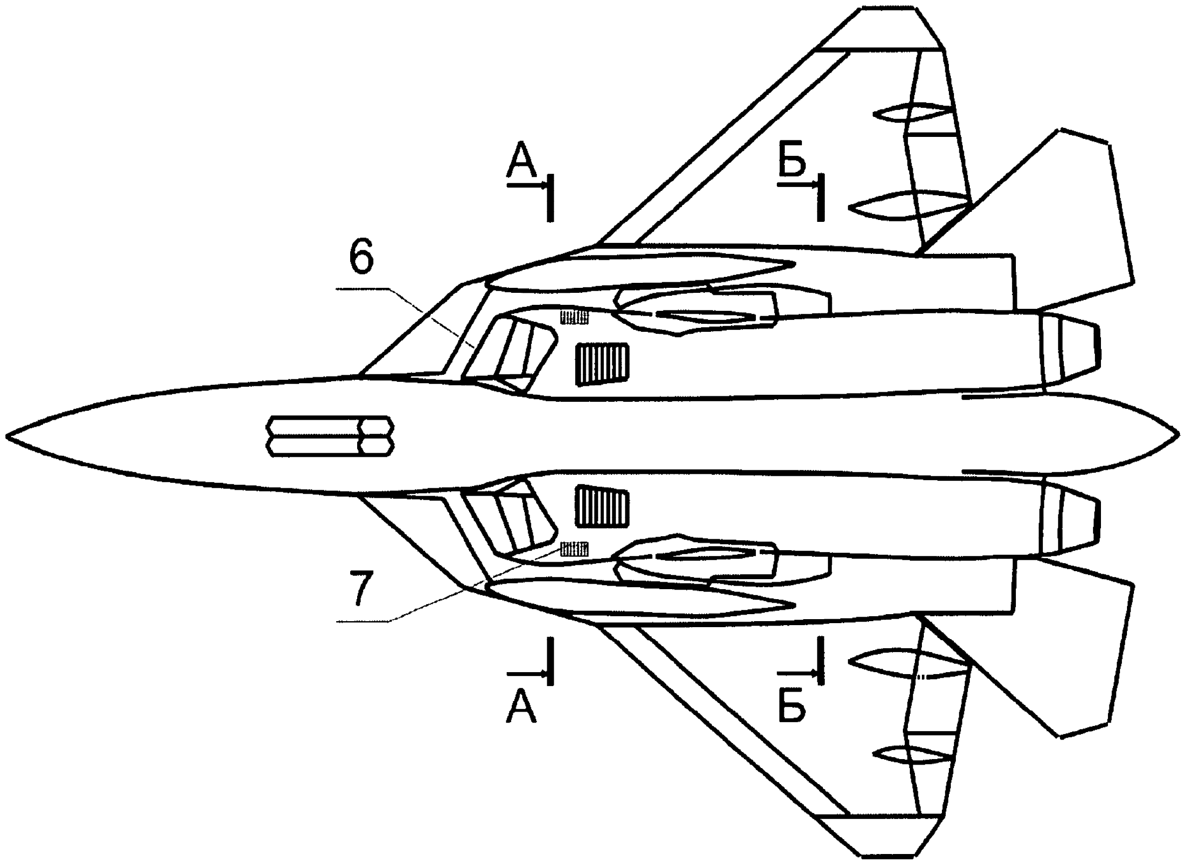
5. Reducing the total number of antennas and using the design of the units airframe as antennas (for example, vertical tail as a communication antenna). Reducing the total number of antennas reduces the overall RCS, tk. each antenna contributes a certain component to the EPR. The use of an existing airframe assembly (VO) as an antenna makes it possible not to use a separate antenna, which naturally reduces the RCS, compared with the option of a separate antenna.

6. Application of an antenna-feeder system based on low-reflective antennas Radar wavelength range. The low-reflective properties of the antennas are ensured due to the fact that they are not protruding beyond the outer contours of the aircraft and do not introduce a component into the EPR of the aircraft due to direct reflection of EM waves.

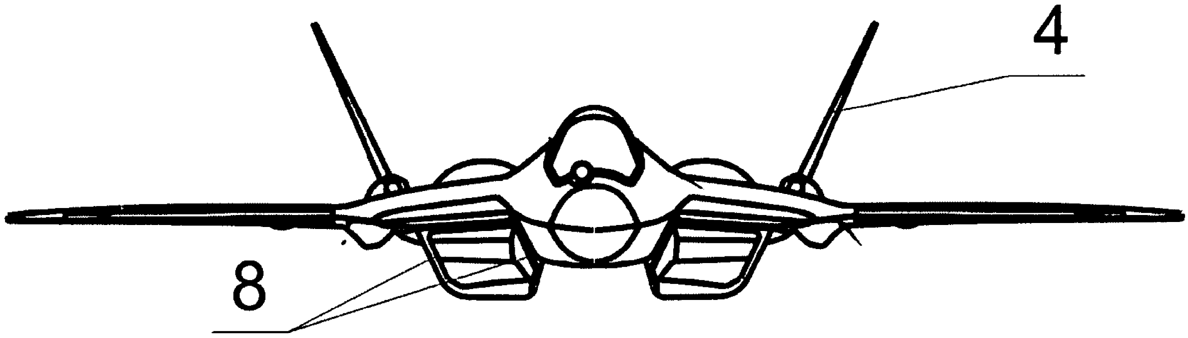
Comprehensive implementation of the set of these measures provides the maximum effect of reducing visibility with a minimum negative impact on the aerodynamic, weight, technological, operational and other characteristics of the aircraft.

Claim

A multifunctional aircraft containing a glider, a power plant, a complex of onboard equipment, characterized in that aviation weapons are placed inside the glider, the air intake channel is madeS- shaped, and radio-absorbing coatings are applied to the walls of the air intake channel, while a device is installed in the air intake channel that divides the air intake channel in front of the inlet guide vane into a number of separate cavities formed by cylindrical or flat surfaces, and the edges of the air intake inlet form a parallelogram, the sweep angles of the front and rear edges bearing surfaces, air intakes, hatch doors are brought to two or three directions, the sides of the fuselage in cross section, the all-moving vertical tail are made with an inclination from the vertical plane in one direction, the air intake and ejection devices are shielded, the compartment of the aircraft refueling rod in flight is closed by a flap , besides,the spaces between the individual structural and technological elements of the airframe are filled with conductive sealants, the glazing of the canopy is made of metallized, the antenna fairings are made of frequency-selective structures; optical sensors are made with the possibility of turning them in the idle state with the back side coated with a radar absorbing coating in the direction of the irradiating radar; antenna compartments are closed with shielding diaphragms; antenna planes deviated from the vertical plane; in this case, at least partially, the structures of the airframe units are used as antennas, and the antenna-feeder system is made on the basis of low-reflecting antennas in the radar wavelength range.

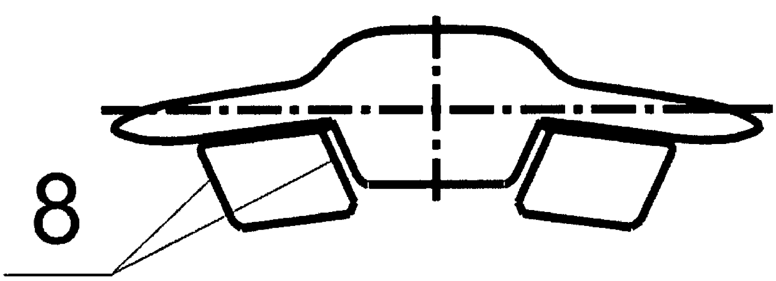


Фиг. 2



Фиг. 3

А-А



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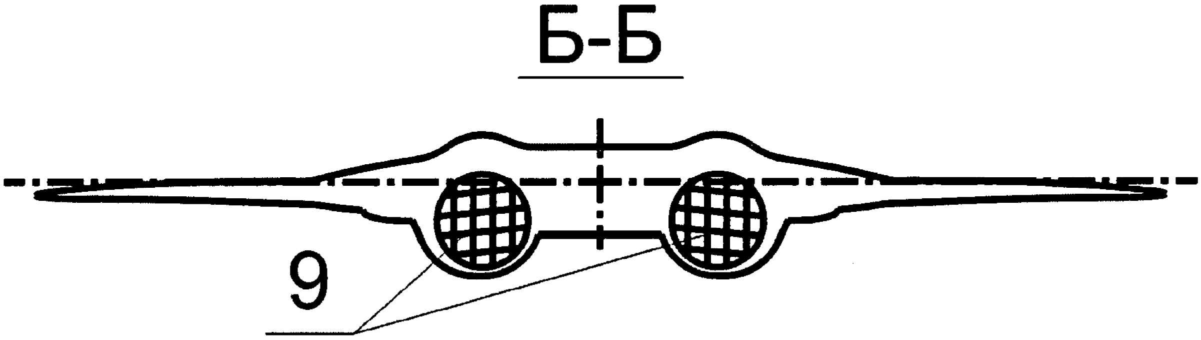

Фиг. 5