April 18, 1961 F. TAKACS 2,980,370

FLYING BODY FOR SUPERSONIC SPEED

Filed Oct. 18, 1957 2 Sheets-Sheet 1

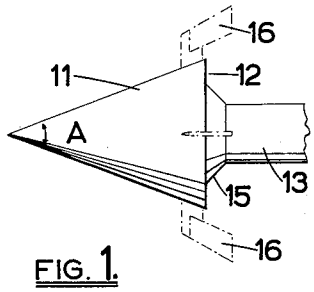


FIG. 1.

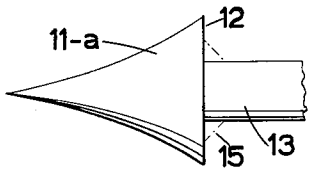


FIG. 2.

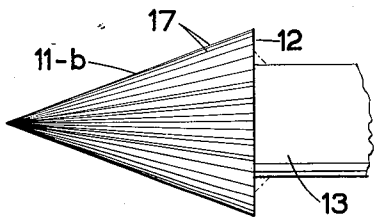


FIG. 3.

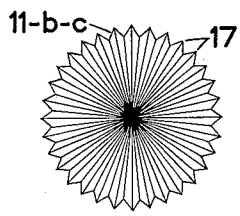


FIG. 4.

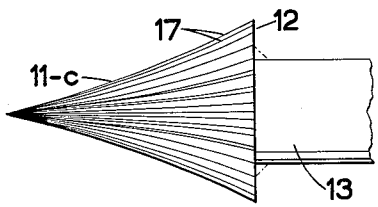


FIG. 5.

INVENTOR.

FRANCISCO TAKACS

BY Otto John Munn

HHV.

April 18, 1961 F. TAKACS 2,980,370

FLYING BODY FOR SUPERSONIC SPEED

Filed Oct. 18, 1957 2 Sheets-Sheet 2

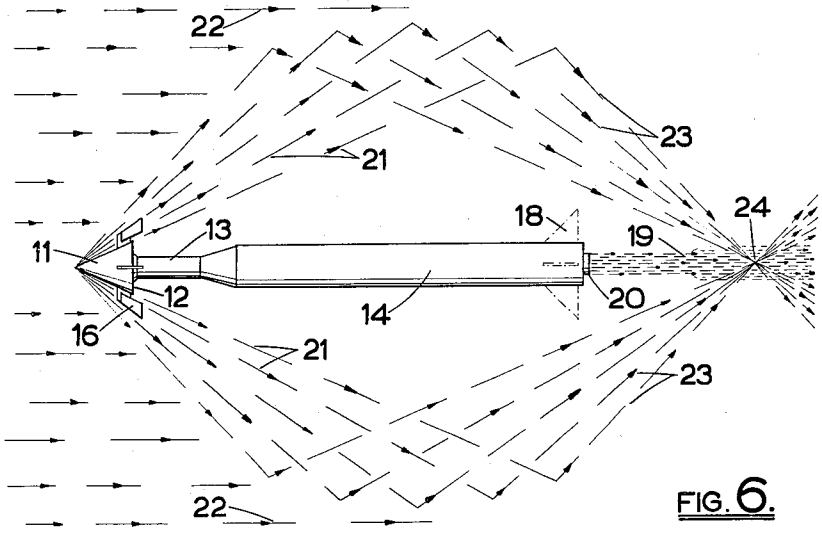


FIG. 6.

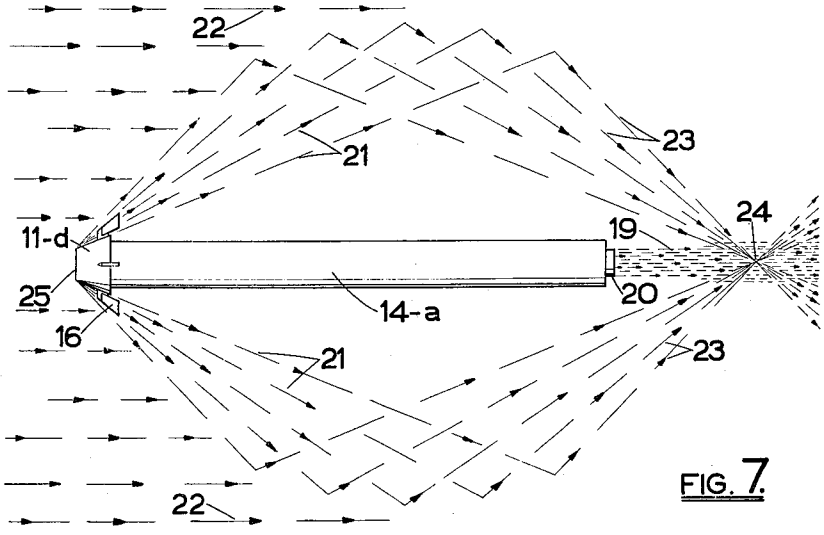


FIG. 7.

INVENTOR.

FRANCISCO TAKACS

BY Otto John Munz.

HHF

United States Patent Office 2,980,370 Patented Apr. 18, 1961

2,980,370

FLYING BODY FOR SUPERSONIC SPEED

Francisco Takacs, Apt. 5388-Este, Caracas, Venezuela

Filed Oct. 18, 1957, Ser. No. 691,009

Claims priority, application Switzerland July 9, 1957

1 Claim. (Cl. 244—130)

The present invention relates to a flying body for supersonic speed, for example a rocket, a remote-controlled missile, a jet airplane, etc.

The flying body according to the invention is principally characterized by a nose which is symmetrical with respect to its longitudinal axis, whose cross-sectional dimension steadily increases from front to rear, and that directly behind the nose the sectional dimension of the flying body is reduced step-like.

Other features of the invention will appear to those skilled in the art as the following detailed description proceeds, taken in conjunction with the accompanying drawing, wherein there are shown by way of example some forms of embodiment incorporating the invention.

In said annexed drawing:

Fig. 1 is a side view of the front part of a flying body with tapered nose;

Fig. 2 is the similar representation of the front part of the flying body, whose nose has concave surface lines;

Fig. 3 shows, also in side view, the front part of a flying body having a ribbed nose with straight surface lines;

Fig. 4 is the front view of the flying body according to Fig. 3;

Fig. 5 shows the side view of the front portion of a flying body having a ribbed nose with concave surface lines;

Fig. 6 shows the side view of a remote-controlled missile designed as rocket, and diagramatically the air currents forming round the same at supersonic speed;

Fig. 7 is the similar representation of a flying body with jet engine, the air currents forming at supersonic speed being likewise diagrammatically indicated.

With reference to Fig. 1, the portion of a flying body as shown includes a nose **11** which has the outline of a cone and is symmetrically disposed with respect to the longitudinal axis thereof. The sectional dimensions of the nose **11** thus steadily increase from front to rear. Directly behind the nose **11** there is a step **12**, behind which the sectional dimension of the flying body is considerably reduced. The step behind the nose **11** has adjacent to it a cylindrical neck **13** by means of which the nose **11** is connected to the trunk or body **14** of the flying body. At the transition between step **12** and neck **13** there is provided a conical part **15** which, however, could be easily omitted. The chain-dotted lines show how at the rear portion of the nose **11**, guide surfaces or vanes or control surfaces **16** could be arranged to stabilize the body during its flight and, if necessary, also to guide the flying body, provided the control surfaces are adjustable. If the described flying body is a weapon, the point of the nose **11** could be provided with a detonator. At least the nose **11** consists of a material resistant to heat and vibrations in order to withstand the stresses set up at supersonic speed. The nose has a polished smooth surface. The apex angle A of the nose **11** and the axial length thereof have in any case to be chosen according to diameter and length of the rest of the flying body. The advantages and the manner of behavior of the described flying body are disclosed below with reference to Fig. 6.

The form of embodiment according to Fig. 2 differs principally from the one described in that the nose **11*a*** has concave surface lines instead of straight ones, being however for the rest still conicall shaped. The surface

of the nose is likewise polished smooth. A further distinction consists in that the interposed conical part **15** shown in Figure 1 is omitted at the transition from the step **12** to the neck of the flying body. The interposed part **15** might, however, also be provided in this case as indicated in chain-dotted lines. For the action of the flying body the interposed part **15** has no significance; it may, however, often be desired for reasons of strength or otherwise.

The nose **11*b*** of the front part of the flying body, as shown in Figs. 3 and 4, has substantially also the outline of a cone which, however, in contrast to Fig. 1 has at its periphery preferably uniformly distributed ribs **17**, each extending in a plane which contains the longitudinal axis of the flying body. Toward the front end of the nose **11*b*** the cross-sectional dimensions of the ribs **17** steadily decrease. The outer surfaces of the ribs **17** are polished. The other design of the flying body is identical with that described with reference to Fig. 2. The ribs **17** give the flying body a greater stability during its flight and enlarge the surface of the nose **11*b***, thus making it possible to shorten the length of the nose with respect to the form according to Fig. 1, without thereby appreciably altering the flying properties of the flying body.

Obviously, the cross-sectional shape of the ribs **17** and the intermediate grooves may differ from the triangular form shown and be, say, trapezoidal.

In the form according to Fig. 5, the nose **11*c*** has the outline of a conical body with concave surface lines and ribs **17** distributed at its periphery, each of which extends in a plane containing the longitudinal axis of the flying body. Also in this case the cross-sectional dimensions of the ribs **17** steadily decrease towards the front end of the nose.

All forms as described hereinbefore will behave at supersonic speed substantially as disclosed in detail hereinafter for the flying body according to Fig. 6.

The front part of the flying body which is a remote-controlled missile, agrees with the design described with reference to Fig. 1. The neck **13** is in its longitudinal direction adjustably connected to the trunk **14** and coaxially arranged with the longitudinal axis thereof. The neck **13** is mounted relative to the trunk **14** to permit automatic adjustment of the length of the neck during the flight in response to varying pressures resulting from varying speeds of the flying body. The trunk **14** has at its rear end the usual steadying surfaces **18** and includes, in addition to an explosive charge, a rocket engine which produces a jet stream **19** and blows out of an exhaust nozzle **20** at the rear end of the flying body.

If the described flying body moves at a speed which is greater than the speed of sound or amounts to a multiple thereof, compressed waves **21** will be produced at the nose **11** in the gas, especially air, surrounding the flying body, which waves will diverge outwards in the direction of the generating surface of the nose and steeper, as diagrammatically indicated in Fig. 6 by broken lines. At the edge between the generating surface of the nose **11** and the step **12** the waves will leave the flying body owing to the step-like reduction of its diameter, to propagate further outwards in the same direction to which they were previously forced by the generating surface of the nose **11**. Due to the gradually decreasing intensity of the waves **21**, these will eventually be bent or reflected at the outer undisturbed or slightly disturbed air layers **22** and thrown back toward the axis of the flying body, as indicated in Fig. 6 by broken lines **23**. By properly choosing the apex angle A and the length of the nose **11** and neck **13**, it may be achieved that the deflected waves intersect the longitudinal axis of the flying body substantially at a point **24** which lies behind the flying body and so far away that the deflected waves **23** will

not touch the flying body. Since the waves upon passage of the point of intersection will again diverge, the described actions will repeat several times periodically, whereby, however, owing to decreasing intensity of the waves and the mixing process with the propulsion jet **19**, the phenomenon dies down soon. For the behavior of the flying body, however, only the first period as shown in Fig. 6 is of significance.

By the described and represented course of the compressed waves **21** and **23** in the first period, the following advantages will result:

The waves sweeping over the flying body only at the comparatively small surface of the nose **11**, at the remaining surface of the flying body neither frictional forces nor turbulences will set up which would produce a braking of the flying body together with heating and vibration of the material. The part of the flying body located behind the nose **11** is protected by the waves **21** and **23** against influences of the medium surrounding the flying body. Decisive for the resistance to flight is essentially only the shape of the nose **11** which, owing to its comparative smallness, may be suited to the requirements without economically unreasonable cost being thereby incurred.

As a further result of the compressed waves **21** and **23**, the flying body will be surrounded by an envelope of highly compressed gas which, because of its powerful dynamic impetus, is capable of protecting the flying body from external influences. Thus other bodies, such as missiles, will not be able to get close nor bring it down, because it will be warded off its course by the action of the potential current that continuously generates round the flying body. Since further the opposition offered by substances to the passage through it of rays is the greater, the denser the substance will be, the compressed shock waves **21** and **23** surrounding the flying body will moreover ensure an effective protection of the flying body against the influences of cosmic rays, X-rays, luminous, calorific and ultraviolet rays, waves sent out by radar, particles of mesons, mesotrons, micrometeorites, etc. Such waves or corpuscular rays will be either reflected on the shock waves **21** and **23** or be deprived of their energy.

Because of the shock waves **23** reflected toward the longitudinal axis of the flying body, impinging at an acute angle on the propulsion jet **19** near the point of intersection **24**, shortly after the same has left the exhaust nozzle **20**, as a result of the collision of said potential currents there will be a remarkable improvement of the static thrust on the flying body. Moreover, by the meeting together of two or several potential currents of different directions, the detonation otherwise usual when breaking through the sonic barrier will be diminished or practically eliminated.

If the flying body designed as rocket moves in the interstellar space, i.e. beyond the earth's atmosphere, in principle the same action and the same advantages will result, inasmuch as an absolute vacuum does not exist in nature, but only differences in the density of the gaseous medium.

The rudders **16** fitted on the nose **11** permit of guiding the flying body very effectively in its direction. It must however be observed that the rudders **16** act inversely as compared with the classic form of the rudders fitted on the tail of a flying body.

In a modified form, the rudders **16** could, however, be replaced by such rudders which are arranged in the region of the exhaust nozzle **20** of the propulsion jet, i.e. within the nozzle **20** or at a short distance behind it, to deviate the jet stream **19**. This design of the control system involves the advantage that ice cannot form on the control rudders and that the flying body can be kept with ease and great stability in the intended path of flight or be brought into another course.

Obviously, the energy of the waves **21** set up on the nose **11**, will depend on the speed of the flying body. If it is desired that the point of intersection, at different flying speeds, should lie at the same distance behind the flying body, the distance of the nose **11** from the rear end thereof has to be altered in dependence on the flying speed, which may be brought about by adjusting the length of the neck **13**, i.e. by pushing the neck **13** out of the trunk **14** to a greater or less extent. With decreasing speed the nose **11** must be pushed farther forward, while with increasing speed the nose can be retracted toward the trunk **14**. The cylindric body forming the neck **13** must therefore be adequately long and be guided well supported in the trunk **14**. The adjustment of the nose **11** may also be effected automatically by a servo-mechanism in dependence on the momentary flying speed.

The flying body as shown in Fig. 7 is distinguished from that according to Fig. 6 by a different outline of the trunk **14***a* which, without interposition of a thinner neck, joins direct to the step **12** behind the nose **11***d*. Instead of a rocket engine, the trunk **14***a* includes a jet reaction engine which compresses and heats the air sucked-in at the front end of the flying body and ejects it at high speed to the rear through the exhaust nozzle **20** so as to produce a jet stream **19** also in this case. The inlet **25** for the air sucked-in is positioned at the front of the nose **11***d* which has thus the outline of a truncated cone. Also in this case the nose **11***d* is fitted with rudders **16** as shown upon Figure 1, the edges of which extend in the direction of the waves **21** as in the form according to Fig. 6. The manner of behavior of the flying body at supersonic speed is the same as described hereinbefore with reference to Fig. 6. A distinction only exists in that the flying body according to Fig. 7, because of its propulsion engine, can practically only fly in the atmosphere.

In a modified form (not shown) the tip of the nose **11***a* (Fig. 2) of the flying body could be cut off and be provided with an air inlet for the jet reaction engine. The nose would then have the outline of a truncated cone-like body with concave surface lines.

Finally, as an alternative, it would be possible to cut off the tip of the noses **11***b* and **11***c* shown in Figs. 3 through 5 and to provide them with an air admission opening.

I wish to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to those skilled in the art.

In the claim, the term "radial section" means a cross section cut by any plane through the longitudinal axis of the missile.

What I claim is:

In a missile for flight at supersonic speeds, an elongated body having a longitudinal axis of symmetry and a nose cone fixed coaxially with the forward end of said body, the surface of said cone being ribbed along regularly-spaced elements of the cone, each rib decreasing in height from base to apex of the cone, said ribs being arcuately concave in radial section, and control vanes mounted on said cone at the base thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

1,065,506	Constantin	June 24, 1913
2,752,850	Warner et al.	July 3, 1956
2,816,721	Taylor	Dec. 17, 1957

FOREIGN PATENTS

718,498	Great Britain	Nov. 17, 1954
982,929	France	Feb. 7, 1951

OTHER REFERENCES

National Advisory Committee for Aeronautics, Technical Note 3287, September 1954 (Fig. 11 on page 26).

The Philosophical Magazine, Series 7, vol. 43, No. 342, July 1952, page 697.