TECHNICAL MEMORANDUMS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 651

WIND TUNNEL OF THE BUCHAREST POLYTECHNIC INSTITUTE

Washington
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WIND TUNNEL OF THE BUCHAREST POLYTECHNIC INSTITUTE*

The new wind tunnel of the Bucharest Polytechnic Institute, designed by Messrs. Carafoli and Stroesco, is of the closed-circuit type, the return being symmetrical with respect to the longitudinal axis of the tunnel. The tunnel is of the horizontal type (figs. 1, 2, 3 and 4), with a diameter of 3.2 m (10.5 ft.) at the beginning of the entrance cone (3), and 1.5 m (4.92 ft.) at the entrance to the test chamber (4). The latter, 2 m (6.56 ft.) long, may be either of the open-jet type (shown in picture) or enclosed in a cylindrical housing as shown by the dotted lines in Figure 1 and in section in Figure 3.

The tunnel section is circular from the entrance cone to the propeller and annular in the return passage. A honeycomb is mounted in the beginning of the entrance cone. The cross section of the exit cone (5), which is circular throughout its length, increases from 1.5 m (4.92 ft.) to 2.5 m (8.2 ft.) at the propeller. At this point the section becomes annular and the circuit makes a bend of 180°, the return being perfectly symmetrical with respect to the tunnel axis. Honeycombs are installed in the annulus (7 and 8) to keep the current parallel. The cross section of the annular return passage increases gradually from the bend to the entrance cone. The variation in areas is shown in Figure 5.

The tunnel is housed in a building which has, externally, the shape of an octagonal prism. (Figs. 6, 7 and 8.) Inside there is a cylinder of 5.72 m (18.77 ft.) maximum diameter. The return circuit is located between this cylinder and the outside walls of the tunnel.

Access to the test chamber (13) is had through the return passage, in the form of a streamlined passage. (Figs. 9 and 10.) In order to prevent this obstacle from disturbing the return flow, the tunnel section was widened at this point. Hence, the section of the return passage gradually increases toward the entrance cone, although its symmetry is disturbed by the test chamber.

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*Data received from Paris Office.

The fact that an obstacle, although streamlined, is placed in the return flow, would ordinarily lead to separation of the flow behind the obstacle, which, in the present case, is of symmetrical biconvex section. This difficulty is obviated by sucking off the flow behind the obstacle. (Fig. 4.)

The method by which this result is achieved is one of the outstanding features of the tunnel. It greatly reduces the turbulence and increases the efficiency of the tunnel. The suction is produced automatically by connecting the burbling area with the low-pressure region at the point of maximum air-flow velocity in the entrance cone. The connection is established by an annular metal collector (16) around the junction with the exit cone and a system of pipes (18) which lead through the test chamber to slots in the rear of the biconvex obstacle (20).

In addition to the above-mentioned advantages, this system also improves the flow in the test chamber, inasmuch as the powerful jet of air which enters the circular opening (15) carries off the air layer in the immediate neighborhood of the wall (boundary layer). This results in uniform velocity along the diameter of the test chamber and throughout its length.

Power is supplied by an electric motor (9) (fig. 1) developing 50 hp at 1460 r.p.m. The propeller (6) is mounted directly on the motor shaft, the whole being carried by a cantilever metal framework (17) supported by a concrete structure which is entirely independent of the body of the tunnel (12).

A speed of 41.7 m/s (136.8 ft./sec.) has been reached with only 32 hp, which corresponds to the extremely good efficiency factor $\rho = 3.35$. At speeds of less than 30 m/s (98.4 ft./sec.), the tunnel has proved very satisfactory as to uniformity of flow in the test chamber. Preliminary tests at higher velocities are being made.

The balance now in use is of the standard wire type.

The tunnel proper is built of wood and plywood, covered with waterproof fabric.

Translation by W. L. Koporindé,
National Advisory Committee
for Aeronautics.

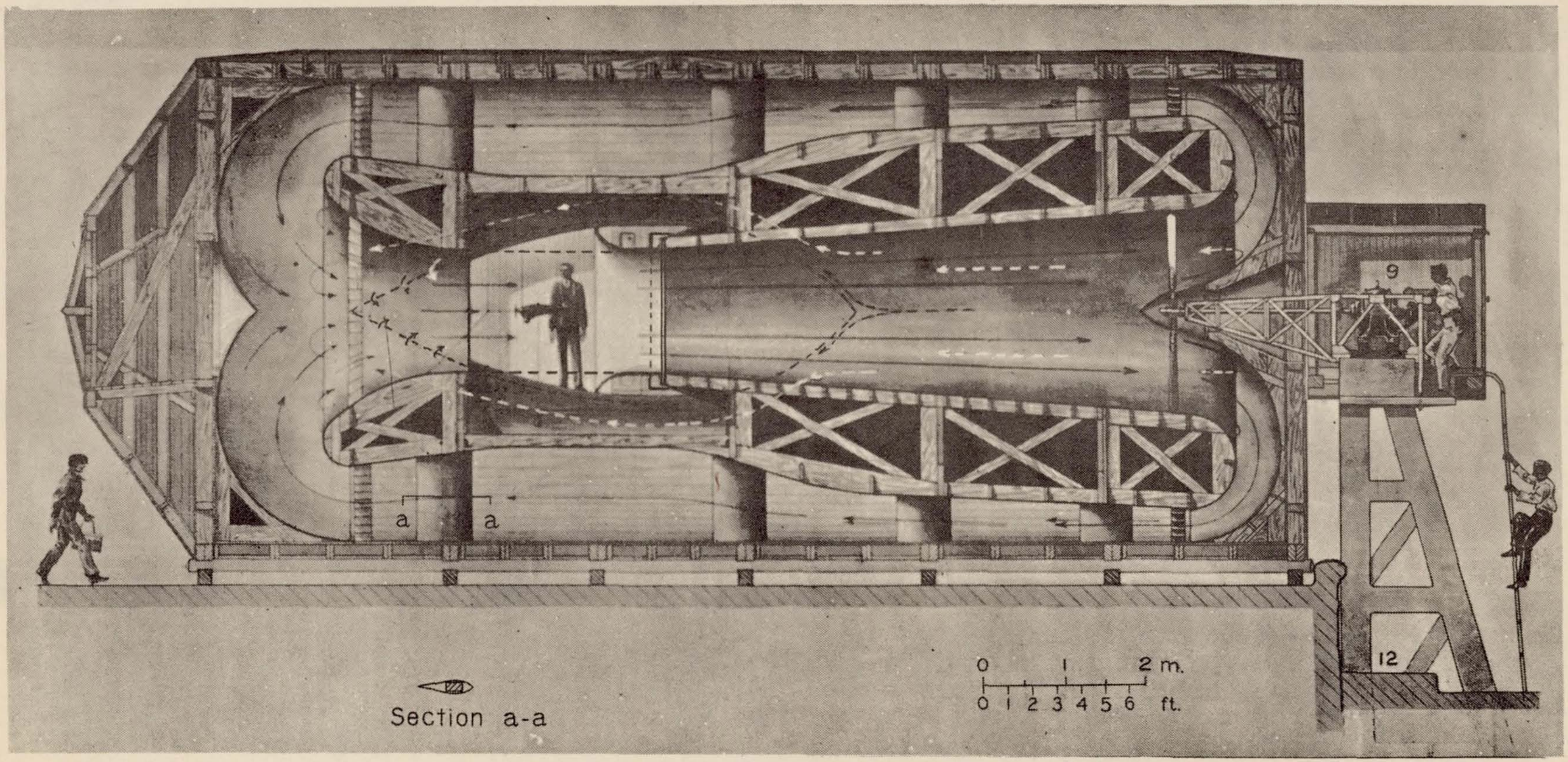

Fig. 1 Longitudinal sectional elevation of the Bucharest Polytechnic School wind tunnel

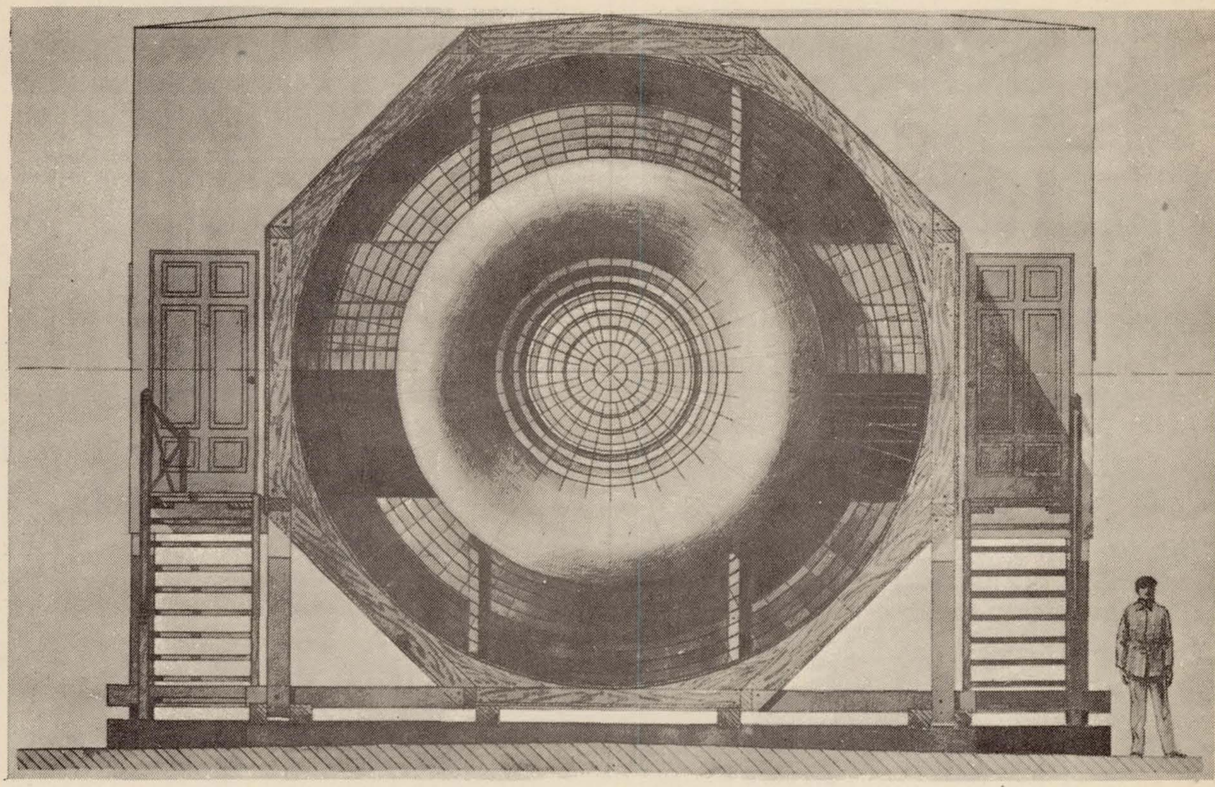

Fig. 2 Entrance cone.

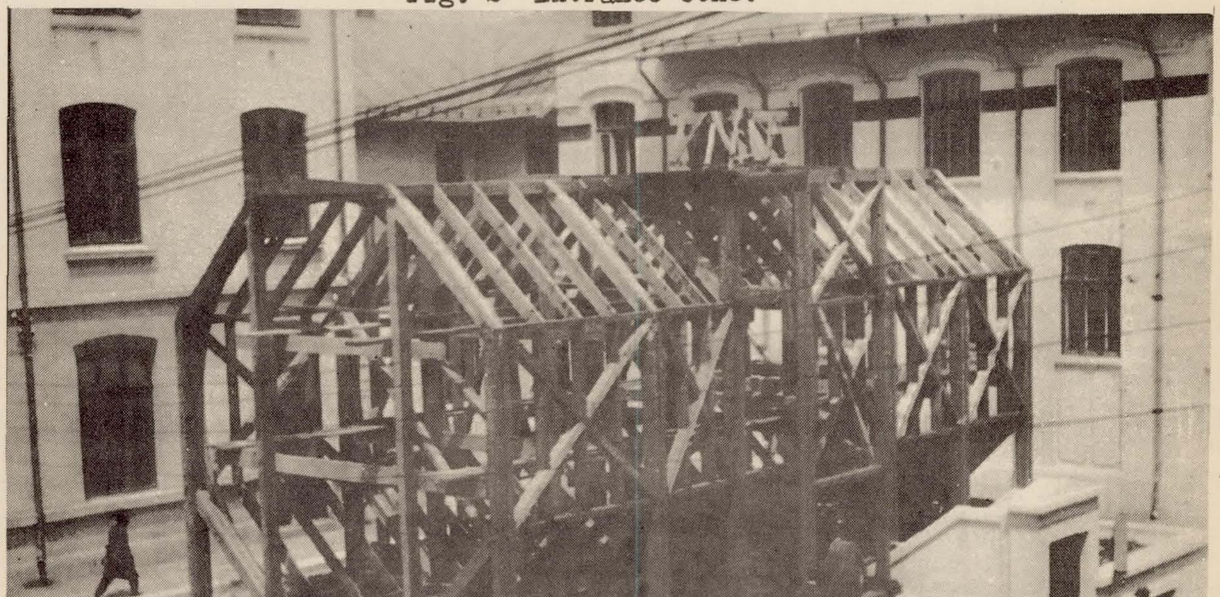

Fig 6 Wooden framework of tunnel.

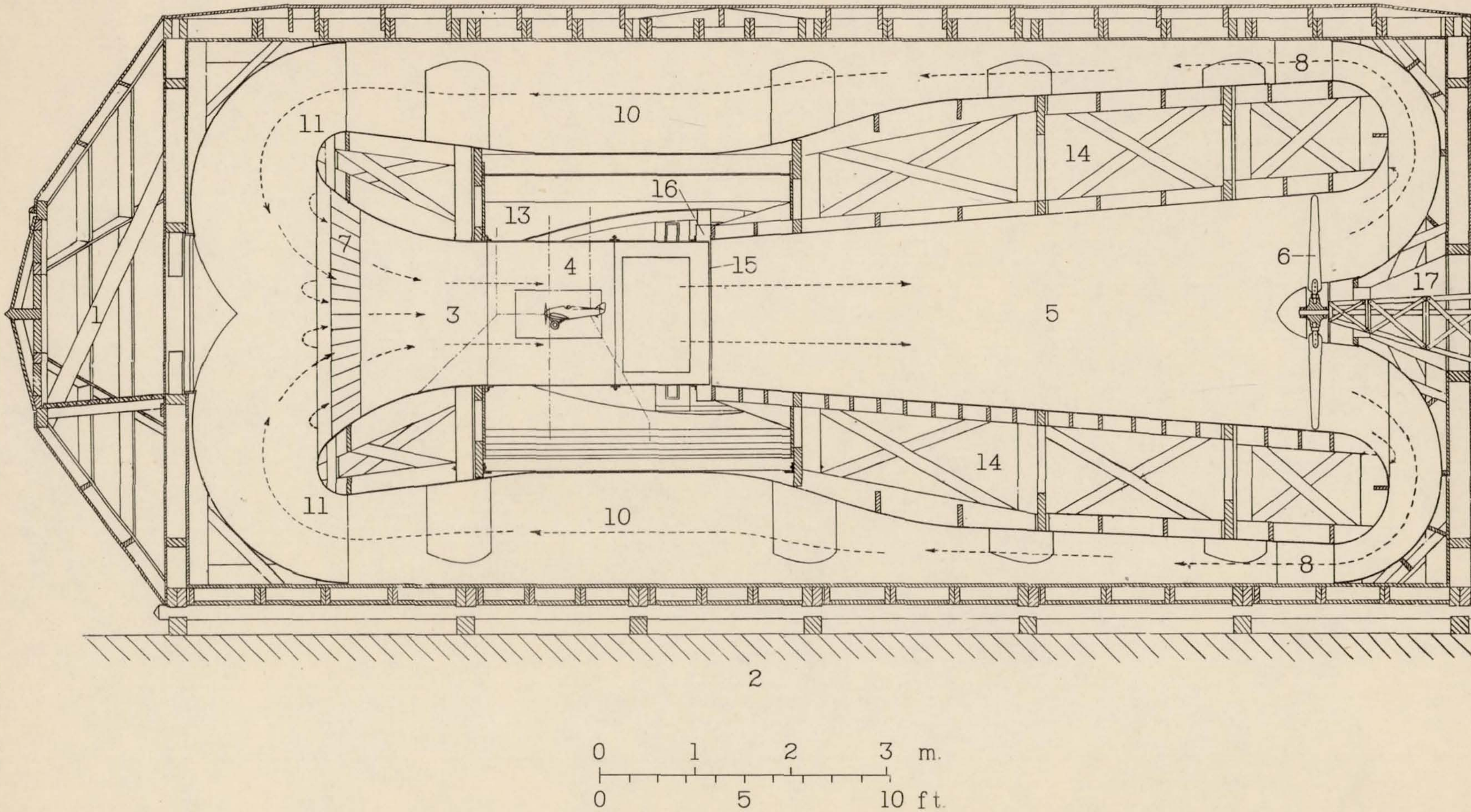

Fig. 3 Longitudinal-sectional elevation of the Bucharest Polytechnic School Wind Tunnel with enclosed experiment chamber.

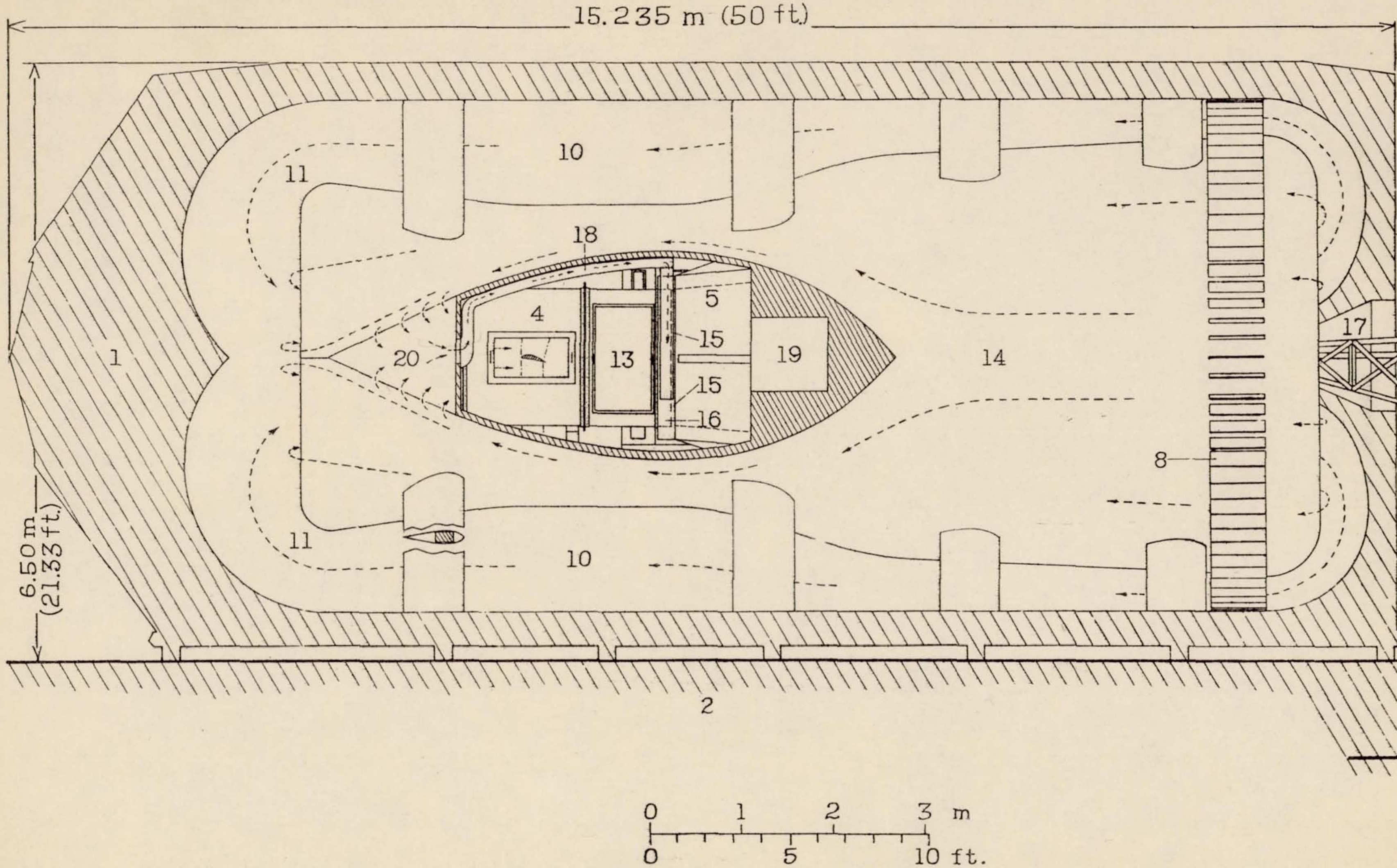

Fig.4 Longitudinal section and interior view of tunnel showing streamlined passage to experiment chamber. Tunnel of the Bucharest Polytechnic School.

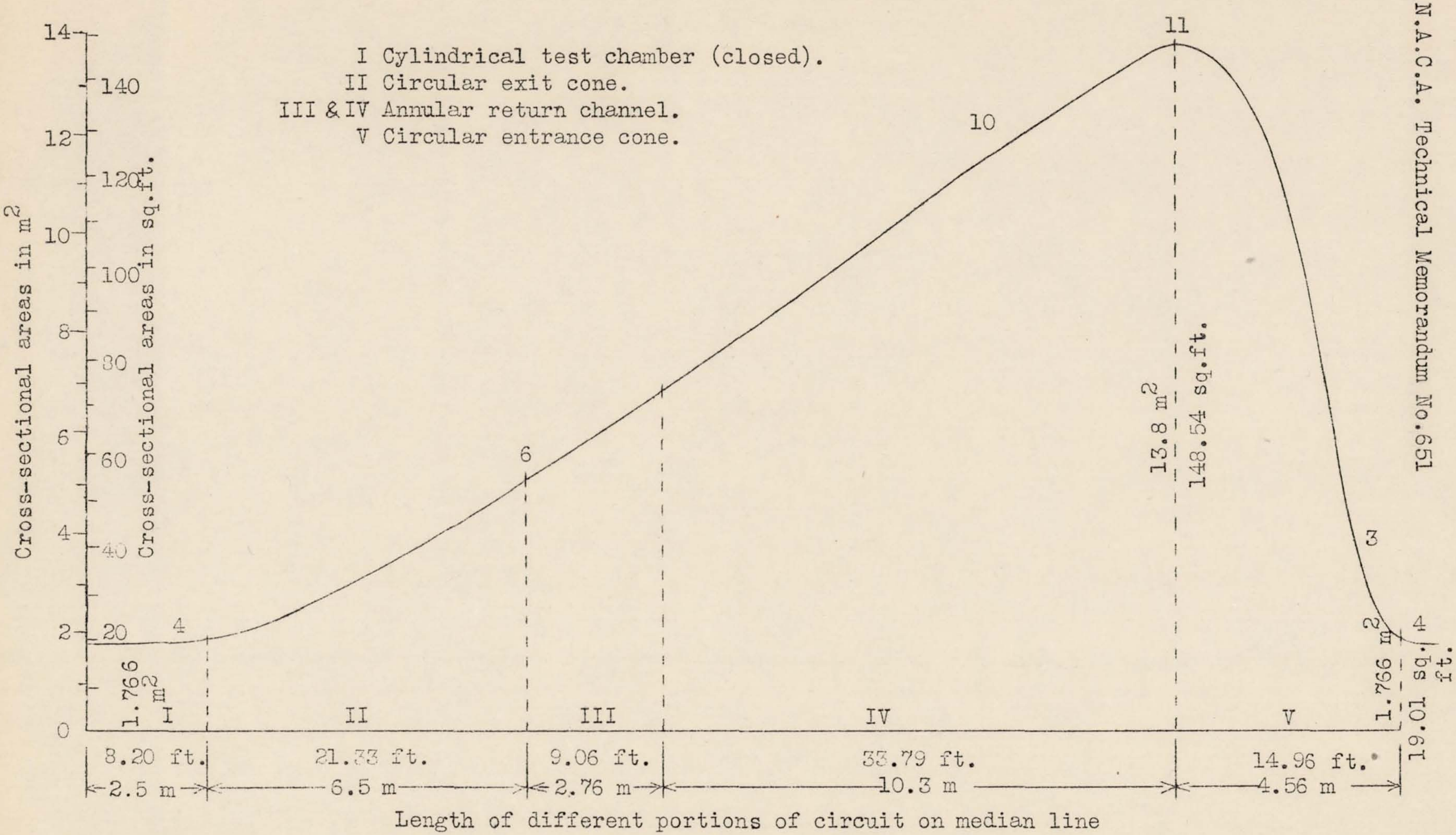

Fig. 5 Variation in cross-section of tunnel throughout closed circuit. Tunnel of the Bucharest Polytechnic School.

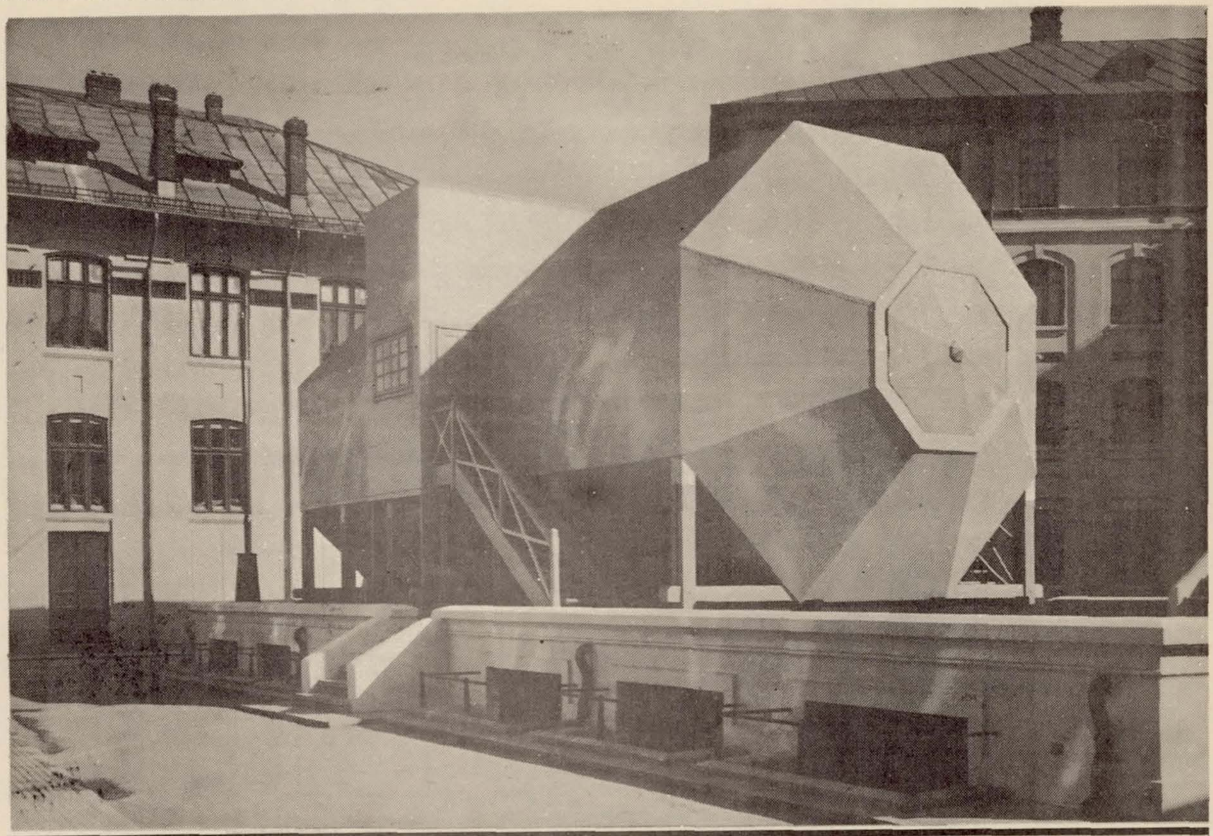

Fig. 7 Outside view of tunnel (Entrance cone end)

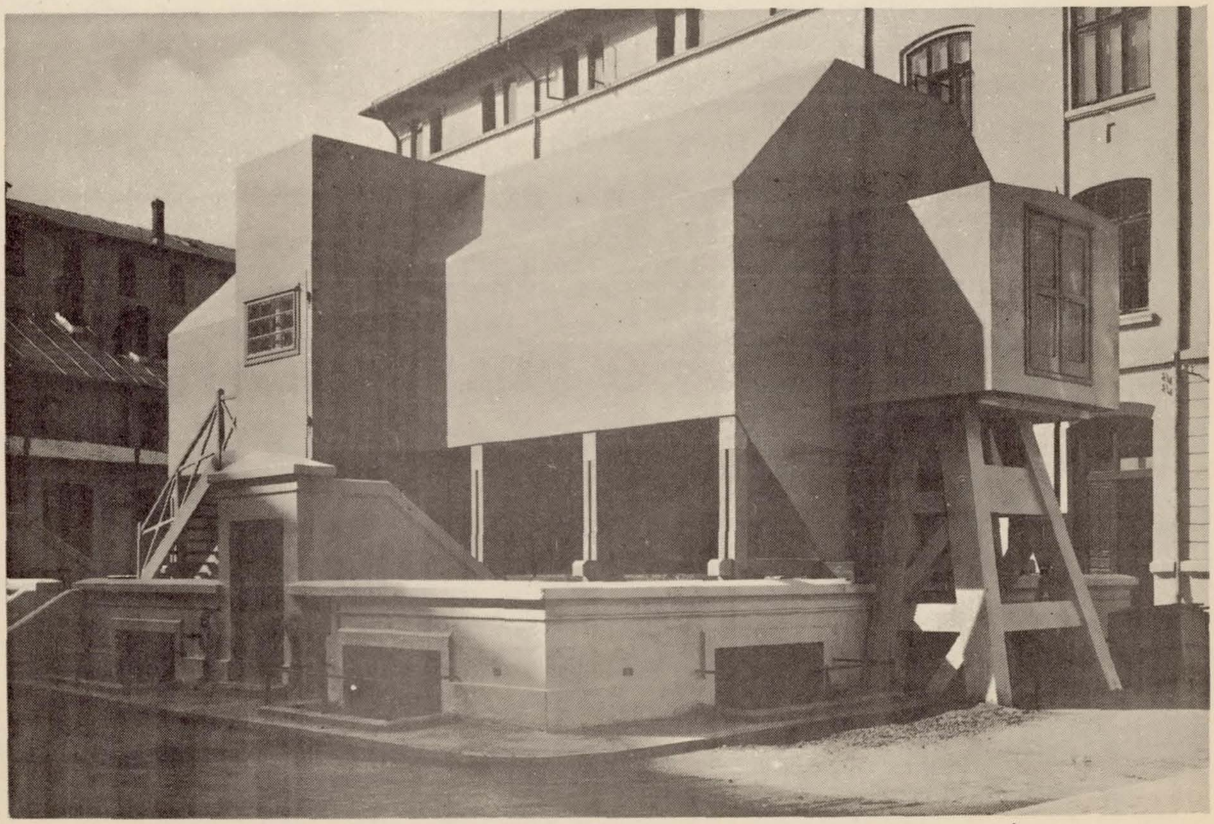

Fig. 8 Outside view of tunnel (Exit cone end and motor cabin)

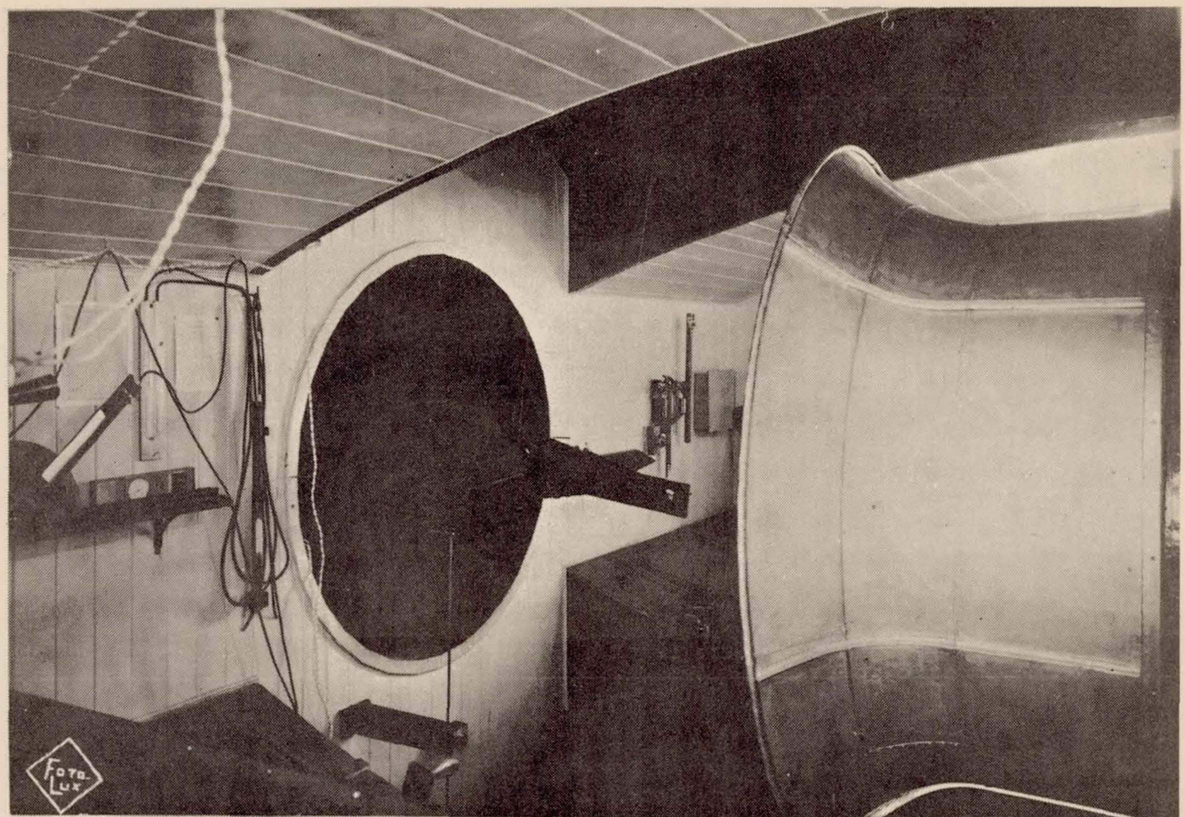

Fig. 9 Test chamber. Open jet arrangement. Entrance cone on left. Exit cone on right.

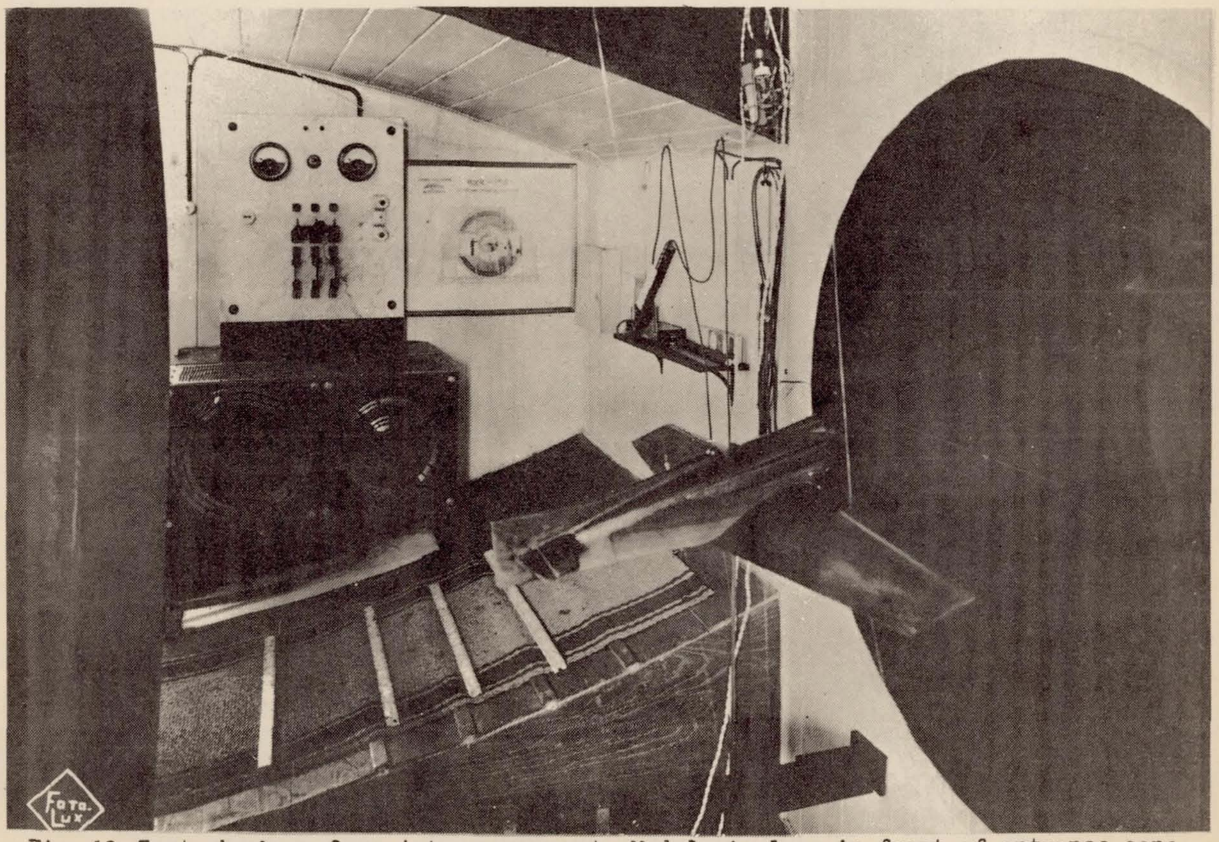

Fig. 10 Test chamber. Open jet arrangement. Model airplane in front of entrance cone.