*Robin Boyd*

# GERMANY

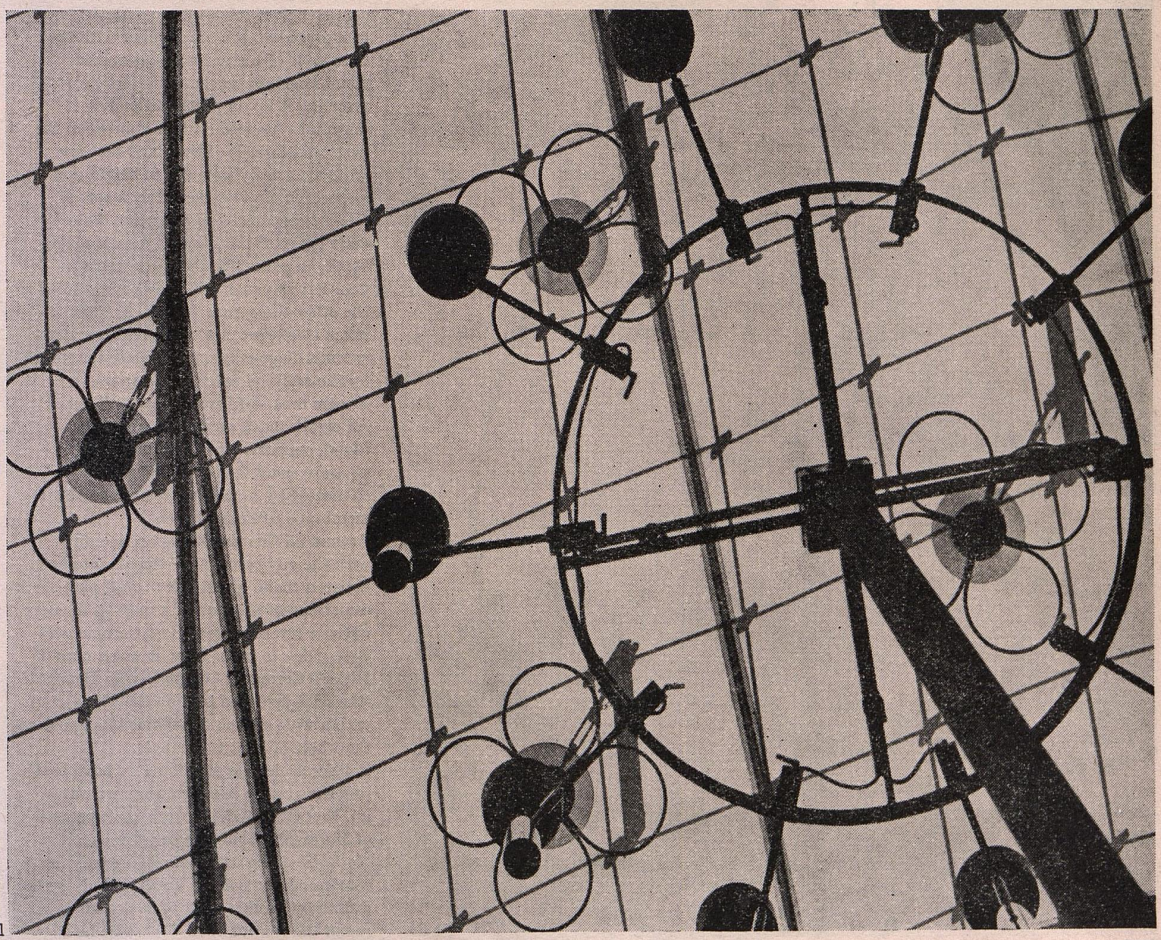
Because of the interest its tent-like roof-structure has aroused, the German pavilion at Expo has been made the subject of this critical appraisal by Mr. Robin Boyd.

Below, 1, is a close-up of a portion of the roof showing the quatrefoil rosettes that spread the load where hangers from the steel mesh support the plastic membrane.

Much the most invigorating form in this great garden of aesthetically-motivated shapes is Frei Otto's little man-made alps for West Germany. This can be said without forgetting or disparaging Buckminster Fuller's beautiful almost-sphere for the USA. The Otto tent looks keen, brave and potential while the Fuller sphere, some earlier difficulties with the welding now forgotten, looks sophisticated, final and suitably self-assured to represent American know-how.

The German pavilion will be the first magnet for most architecturally involved visitors. Long before Expo opened it was well known by illustrations of the model. It is the biggest demonstration yet of the extrardinarily personal relationship with tensile construction enjoyed by Dr. Otto. The pilgrims will approach the building through a forest of antic geometry (Germany is on the far bank of the farther island), with hopes justifiably maintained at a high level by the first glimpses from a distance. Yet as they suddenly come close by it at a turn in the road there may be for some of them a sense of being let down. The first impression is of a diminutive scale. The advance pictures of the model and some of the announced dimensions—for instance, the height of the highest mast: 130 feet—led to expectations of a much bigger visual treat. In the event one actually looks down from the approach road on to the lower edges of the tent and, because of the decline of the site away from the road, no craning is necessary to see the highest pinnacle.

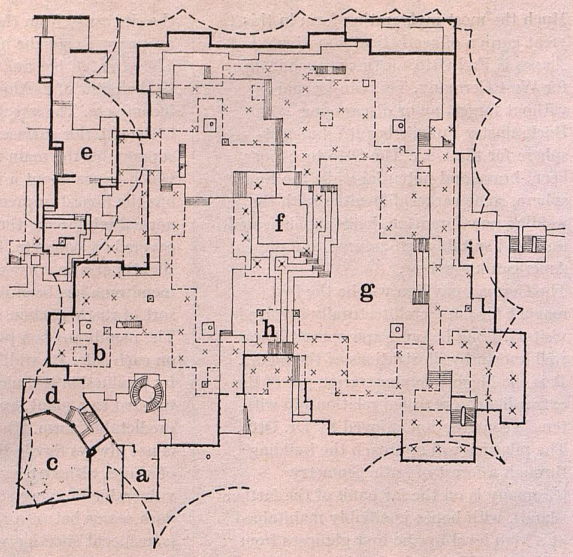
Then the finishes are sometimes unfussed to the point of looking tentative and incomplete. The sweeping steel mesh which is the exterior surface as well as the support for the main plastic membrane, which hangs about a foot below the steel, has the honest unprecision of any normal reinforcing that expects to be covered by concrete. It exhibits joints and slightly erratic curves. The plastic membrane has been made with a similar sort of rustic disdain for an elegant finish. The membrane is a polyester fabric coated on each side. Its width is strictly limited by production technique and it had to be tailored to a giant, and only semi-predictable, form. Understandably the fit is not always Savile Row, and the miles of seams, although separately coated, are vulnerable at every stitch-hole. These wide dark seams between the strips of the translucent sheeting were allowed to occur wherever they wanted to, and they bear no apparent relationship to the equally strong overlaid pattern formed by the hundreds of points where hangers from the steel mesh penetrate and support the membrane. Each of these points is marked by a load-spreading quatrefoil rosette about two feet across. In places also there are puckers in the plastic, so that all in all the surface of the great convoluted canopy has from below something of the look of a giant-size rose-pattern wallpaper stuck to



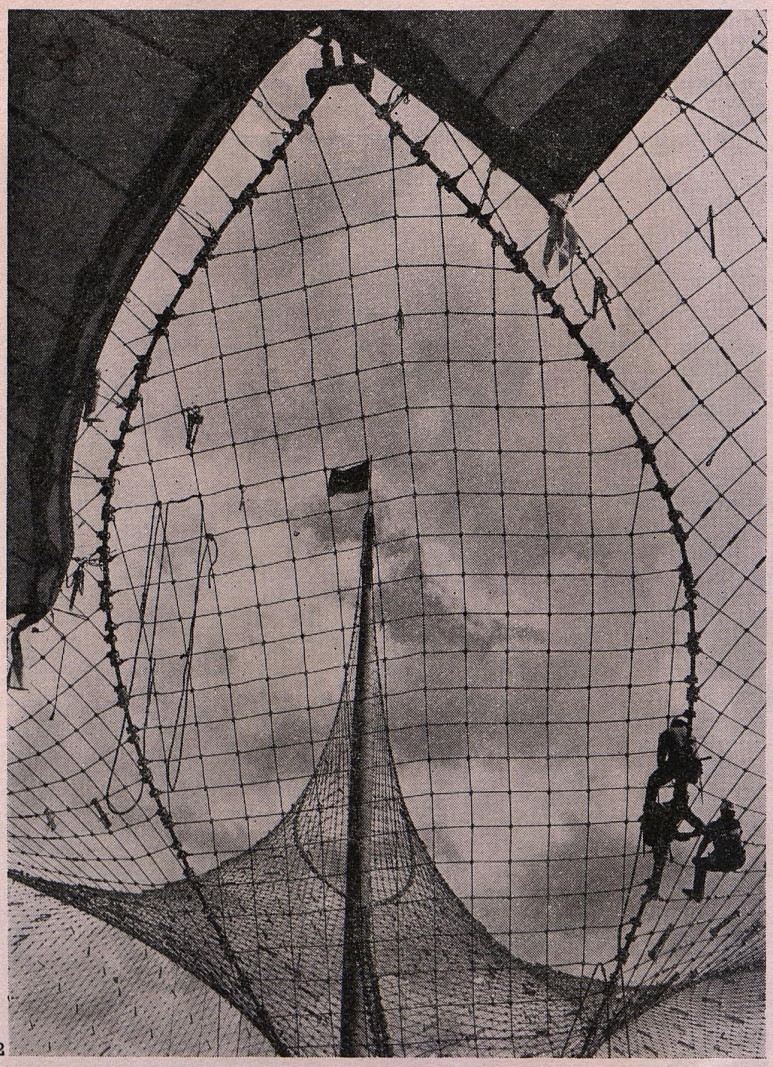
1

*Right, plan of German pavilion (the dotted line represents the spread of the roof-structure).*

*Key*
a, entrance
b, information
c, auditorium
d, gallery
e, sculpture court
f, pool
g, exhibition area
h, library
i, terrace




**2, the roof of the German pavilion under construction, with the steel mesh being attached to the main cables. At the top, the fabric already in place; in the distance, one of the steel masts.**



a ceiling in haste by Father.

At *Interbau* in Berlin just ten years ago a large part of the visual delight to be found in Frei Otto's twisted, bulging tents over the refreshment section came from the purity of form revealed by the surface of the white canvas membranes, sans steel mesh, trimly seamed like racing sails.

Was the scale of the Expo tent too big to permit a single membrane of canvas to do the job? The answer is that it was not too big for canvas in fair weather, but Montreal's snow might have loaded it to the ground. All the steel mesh and the rosettes are unquestionably needed.

Nevertheless, especially round the low perimeter where no great spans are encountered, they seem to be making a mountain out of a molehill of a problem, an unnecessary to-do in providing fairly minimal shelter against Montreal's often fearsome weather. There is just a suggestion that they are demonstrating a principle which is really more applicable to much bigger problems. It is also clear from a purely artistic standpoint that either the steel mesh or the membrane alone, or better still a seamless miracle fabric all in one piece, would do more justice to the magnificent form of the building.

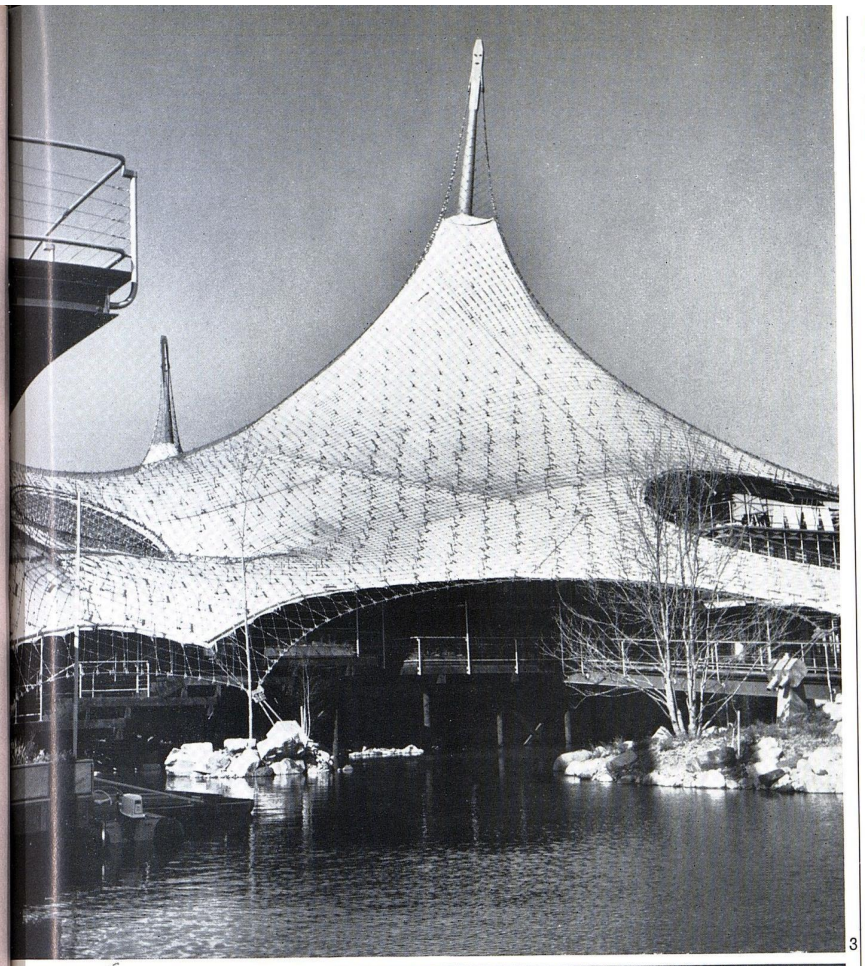
For it is a magnificent tent. The complaints above have been recorded largely to acknowledge lay criticism. When prejudiced eyes grow accustomed to Father's wall-papering job, the logic, orderliness and consistency of the always exciting design is appreciated. We are familiar with the Otto style of torturing a continuous membrane into tension by alternately propping it up on posts and pulling it down into funnels. At first impression the posts and funnels of the Expo tent are quite arbitrarily irregular in height and disposition. In fact they obey a sort of free-hand geometrical discipline. Four main outward-tilted masts form a rough square in plan. The shortest mast is on your left as you enter, and the heights of the other three grow by regular steps taken clockwise. A second smaller square extends diagonally out of one lower corner by the addition externally—around a theatre area—of three more small masts. An eighth mast, erected nearby on an island, supports what amounts to a separate small tent over a play area, connected by a narrow neck of the plastic membrane to the main tent.

Around all this the perimeter line dips with the guy cables and retreats into bays between them, giving the overall plan-shape something of the look of a map—a likeness which a few suspicious East German eyes were quick to note. Why, it was a map of Hitler's Germany! Complete with Denmark (the semi-detached tent on the island) and, with a wide stretch of inflamed imagination, the whole of East Germany!

Politics aside, the pavilion may have heat problems as the Montreal summer warms up. Frei Otto, judging from his experience of Montreal's 1966 summer, thinks not. He is providing artificial cooling only in comparatively isolated areas including the restaurant, and in a pit of cooled air round the central pool. Otherwise he is

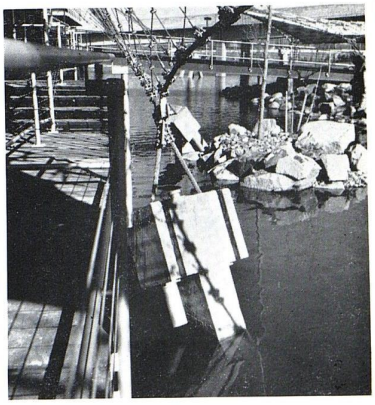
## GERMANY

Irregular tent-like roof suspended from eight steel masts. Steel cables and mesh carry a translucent plastic membrane. Exhibition areas disposed independently beneath the roof on steel and timber stages. 3, the roof spreading over a lake, with one cable attached to concrete base on island. 4, the edge of the roof membrane, again showing one of the concrete attachments (Expo Express and tower of British pavilion beyond). 5, attachment to foundation in the lake. 6, the roof-structure plunges down through the exhibition area to create an outlet for rainwater, which discharges into a pool below. The surrounding circular stair leads to offices. 7 (overleaf), the pavilion from the lakeside garden. Architects, Rolf Gutbrod and Frei Otto.



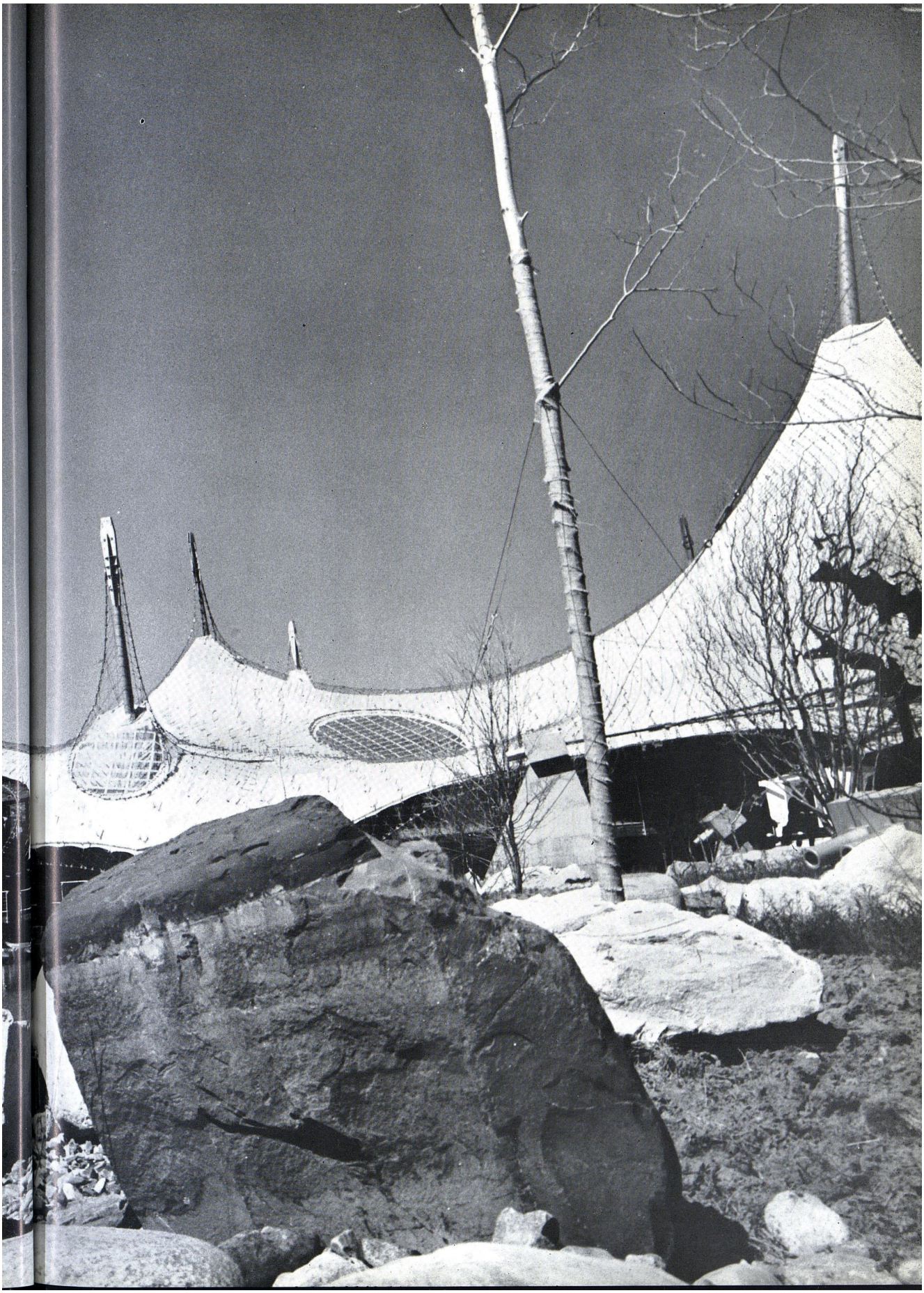
3

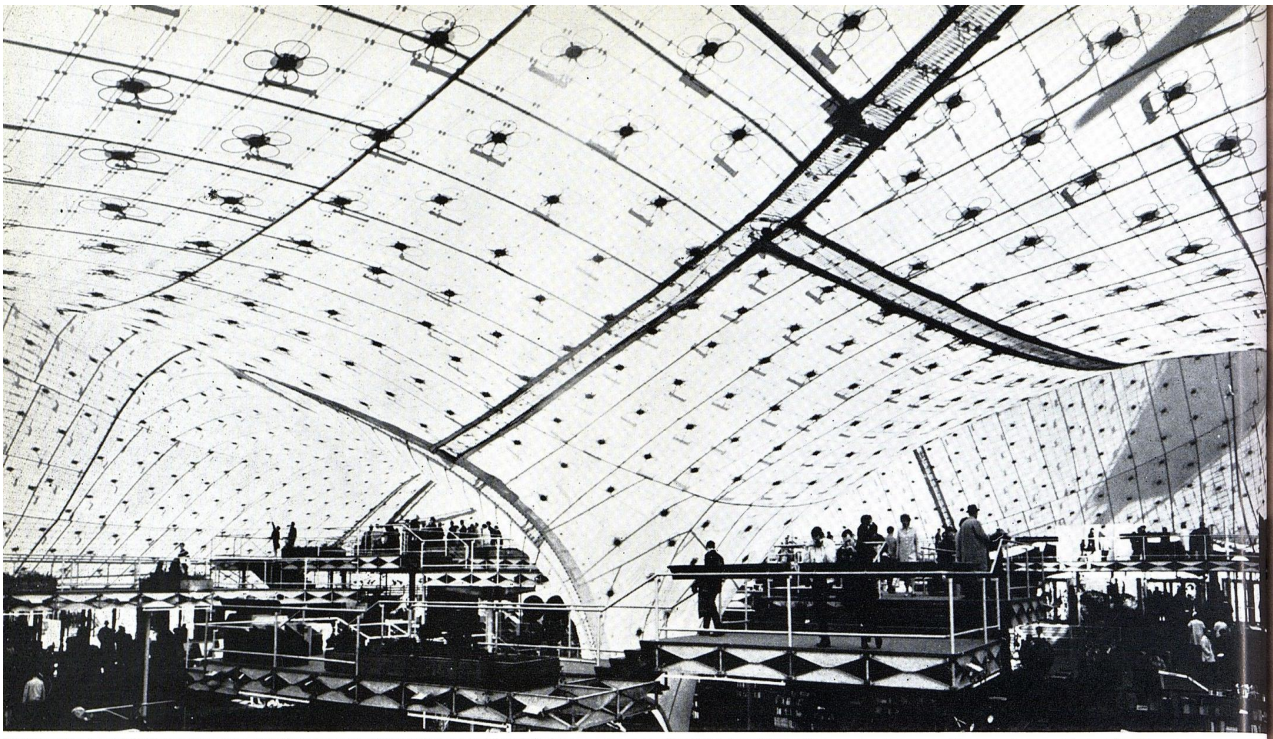
4

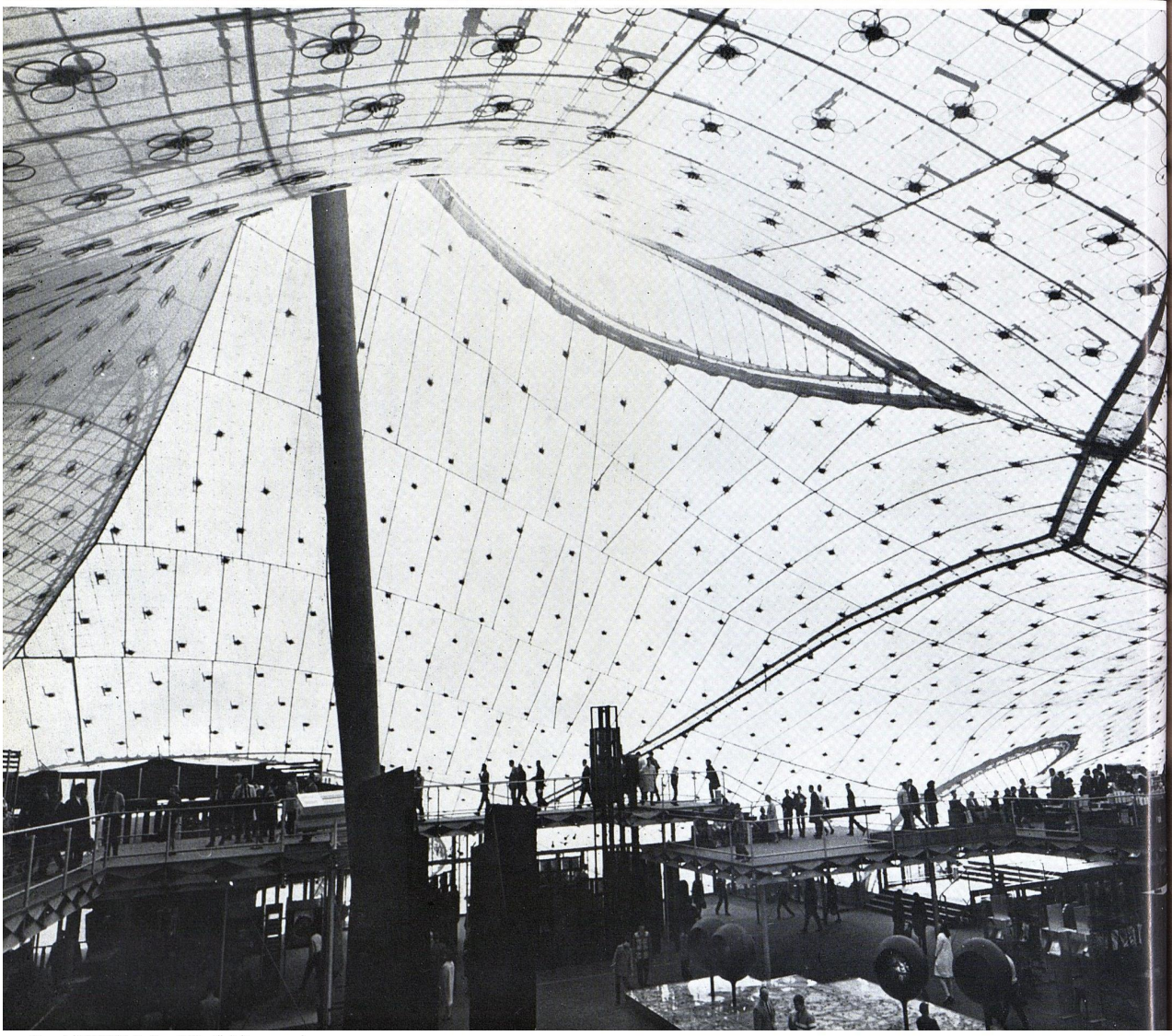


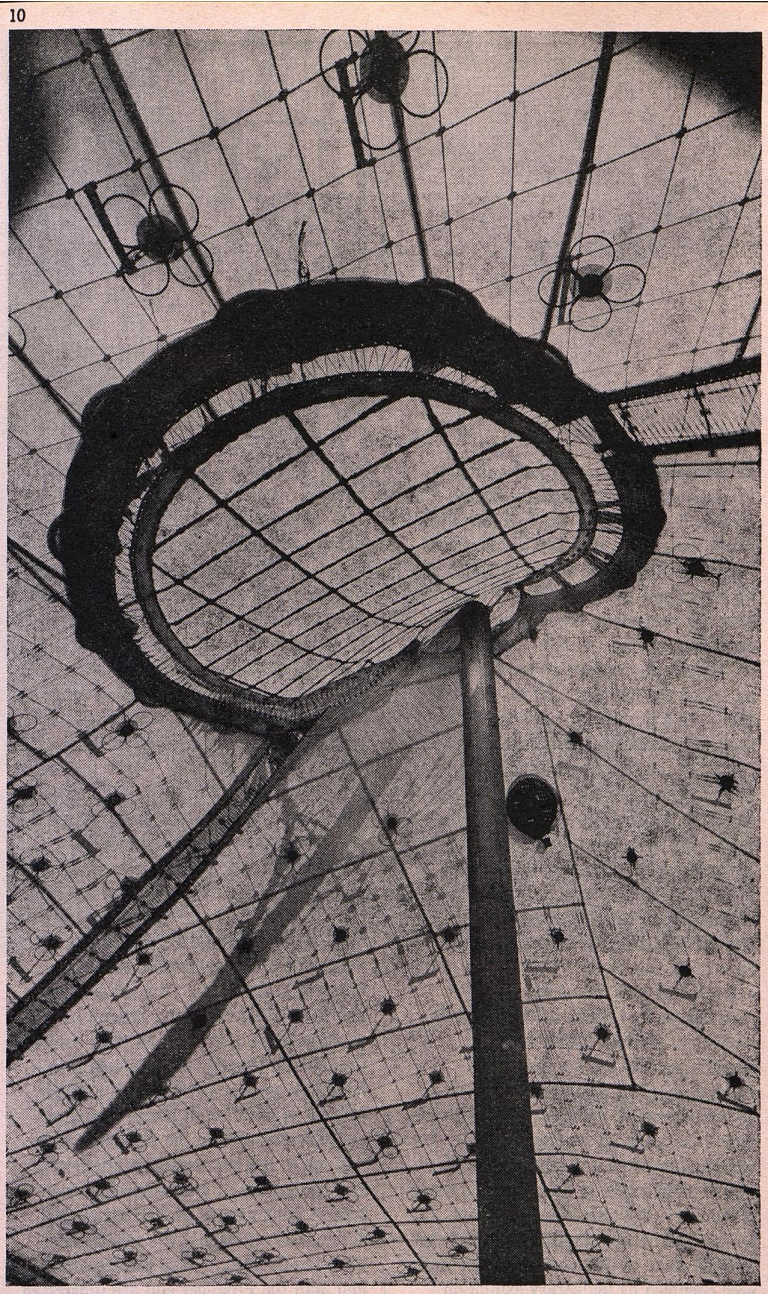
5

6









8 and 9 (facing page), inside the German pavilion showing the patterns made on the translucent plastic roof by the wire mesh from which it is suspended and the rosettes, formed out of bent steel rod, which spread the load from the hangers. In 8 can be seen another of the funnels that remove rainwater. Exhibition areas are independent concrete and timber platforms surrounding a pool, disposed at various levels and supported on modular steel columns and trusses. 10 (above), one of the windows set into the roof-membrane where it is suspended from the masts.

relying on cross-ventilation. Around the perimeter the plastic membrane hangs as a flap. It will be rolled up like a blind on hot days to let the breezes through. The cost of air-conditioning the whole of the enveloped space baulked even West Germany. Thus the design is, literally as well as figuratively, open-ended. It could be expanded to cover the whole Expo site, if requested, without losing its integrity, unity or composure.

The casualness of the mesh and membrane mixture, the tilt of the masts against the tension, and the open-endedness, all contribute to a fair-like character that is thoroughly appropriate, despite Expo's pretensions to seriousness. The authorities asked pavilion designers specifically for architecture of an unfamiliar mien. In many other pavilions they were presented with shapes much more unfamiliar than a tent. Yet these others, which are often quite frantic, still look more ordinary than an Otto tent. The obviously temporary quality is also very fitting for a show which will last only six months. All the pieces were made in Germany, including the steel mesh: in strips some twelve feet wide. When this pavilion has done its Expo job it can be dismantled, rolled up, and returned to Germany. There is something disturbing—actually aesthetically disturbing—about some other pavilions done in massive brick and concrete for only six months' life. Almost before their mortar had set, three months before they were seen by the public, tenders were being called for their demolition.

The pride of the German pavilion is of course the interior space. It is a big volume, lofty under the posts but sucked downwards where the big off-centre funnel dives into a decorative pool. It changes continuously and engagingly as the visitor walks among the exhibits on the many-stepped platforms. These are sometimes elevated on Meccano-like frames and sometimes drop to the ground, as by the central pool. Near the top of each mast a pair of guy-cables is pulled apart by the tension, and transparent sheeting replaces the translucent plastic in the eye-shape so created, allowing a blurry view of the sky. Then suddenly there comes a spatial surprise. Partly outdoors and partly under the extended corner tent are two domes, housing a small cinema and an upper-level viewing gallery respectively. These are deliberately complementary structures to the tent. Each dome is made of light timber battens pinned together like a pantograph's members and then distorted into a hump. The spacing of these compressive battens matches the spacing of the tensile cables in the tent. 'I am a student,' Frei Otto remarked when he pointed this out. 'I am learning. I wanted to see what happens when the two matched structures—tensile and compressive—come together in the one building.'

He has learnt and demonstrated quite a lot more about tension in this biggest of his works. The prehensile details at cable ends are especially noteworthy. But has Dr. Otto gone now as far as he can on this line pending the arrival of the miracle membrane? The German pavilion has been hailed in many places as something of an epoch-marking event. All levels of the press love it. To the intelligent Montreal magazine *Parallel* it demonstrated the immediate practicability of computer-calculated, adaptable, demountable shelters for a new urban order. To *Life* magazine it was thoroughly sensational: 'a major architectural innovation . . . a lasting influence on the planning of stadiums and exhibition halls of the future.' Yet while the structural components amply justify journalistic superlatives, the flappy, flimsy, impermanent reality of the sewn polyester membrane quite forcefully reminds the visitor to the pavilion that the new tensile epoch is not quite here yet. It is still waiting for the chemists.