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DOME WITH CYLINDER VAULTS

Authors deal with a double-layers grid structure. A double layer grid structure has an external layer which constitutes a triangular grid and an external layer which is a triangular grid as well but with a four times greater number of triangles. The both layers are connected with stiffenig rods in such a manner that six rods converge in every vertex of the internal grid. These rods are connected, in turn, with six vertices of the hexagon external mother grid. The mother grid /fig.2/ is created from the triangular grid reduced to triangles and hexagons, in such a way, that every side of a triangle constitutes a common side with a hexagon, but neither triangles nor hexagons of this grid have common sides. The external grid is made from the icosahedron closed with twenty equilateral triangles in such position that the axis connecting the polyhedron opposite vertices is vertical. Let us draw an equilateral triangle on each face of the icosahedron, by connecting the sides centres. Those céntres are the apices of a semi-regular 32-hedron closed with 20 equilateral triangles and 12 regular pentagons. Drawing on each pentagon a regular pyramid with apex lying on a sphere described on a 32-hedron, we obtain an 80-hedron /fig.1/.

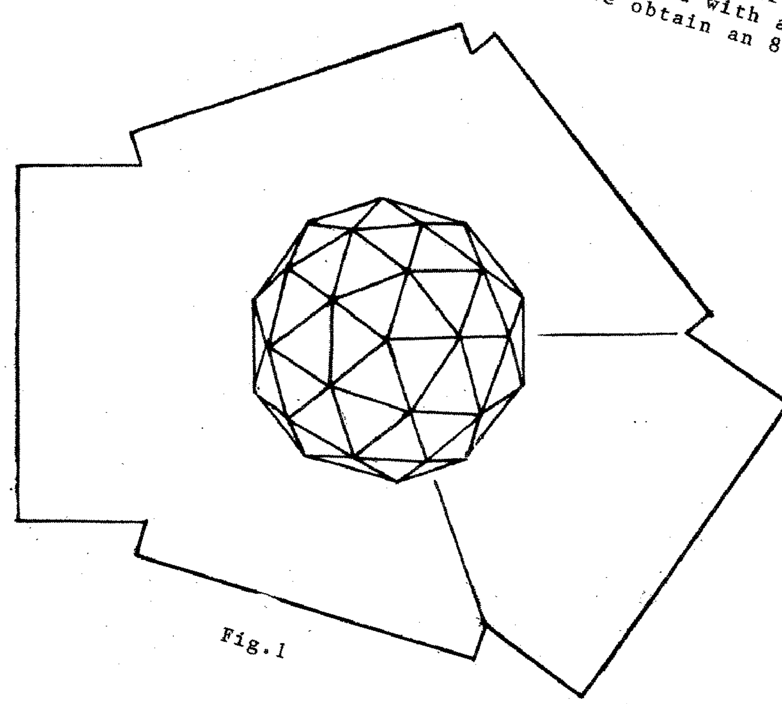

Fig.1

Let us consider a pyramid with a vertical height and pentagonal base, its five lateral faces constitute 1/16 part of an 80-hedron. The side of pyramid base measured in the angle between the radii of the 80-hedron sphere is 36°. The pyramid lateral side, measured in the same way, is equal to one half of the angle corresponding to icosahedron side i.e. $31^{\circ}43'03''$. So the dome will be formed from five isosceles spherical triangles with bases equal to 36° and sides $31^{\circ}43'03''$.

Let us now divide this spherical triangle into 400 spherical triangles. To do so we divide the triangle sides into 20 equal parts and we draw 19 big spherical circles, by corresponding points of division and by centre of the sphere. We divide these circles into 19, 18, 17, 16,... equal parts. So described grid apices are symmetrical collections of points with regards to the spherical triangle height. Thus, it is enough to take into consideration only one half of the spherical triangle. In this way we can fix position not only of the external spherical grid apices but also of the internal grid because every second apex will correspond to the internal grid apex and in this spherical triangle we obtain a four times smaller number of the internal grid triangles

At first let us designate angular coordinates of this collection of points. To calculate them we must find bases of the spherical grid triangles and their heights. Horizontal and vertical angular coordinates of the spherical grid apices are calculated on the respective tables. Having already angular coordinates, cartesian coordinates are calculated in tables for external and internal

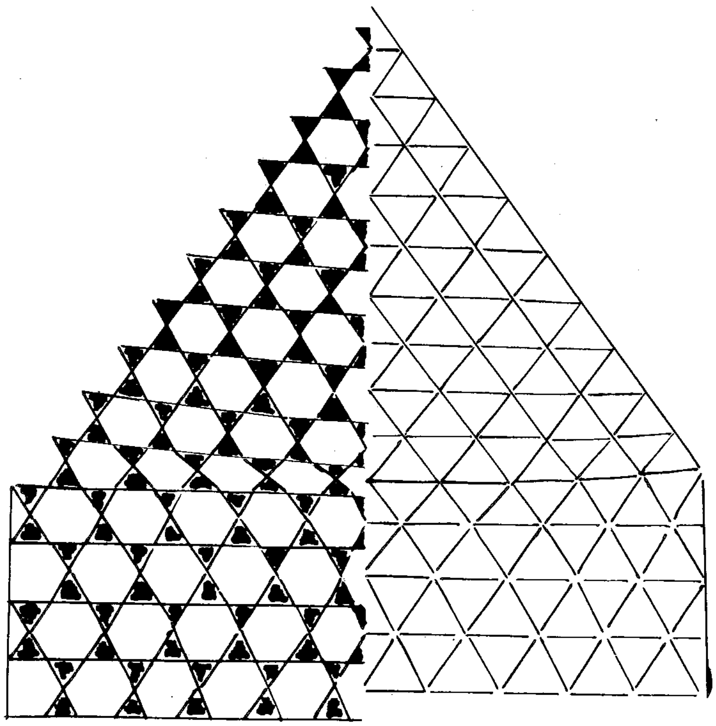

Fig.2

layer respectively. Thus we receive data to calculate length of the external and internal grid rods as well as rods connecting these two grids. These lengths are calculated on respective tables and are inscribed into the schemes of the 1/10 part of the dome. Grids on the cylinder vaults are designated in the following way. Let us consider one of the five arcs of the lowest circumference of the internal grid namely an isosceles triangle designated by points of support and the highest point of this arc. This triangle is leaned towards the level creating an acute angle. The base of this triangle is now the base of an isosceles vertical triangle with an apex having its ordinate equal to ordinate of the preceding triangle. Circumference circumscribed on this triangle is a cross section of the internal vault. The grid made of equilateral triangles is designed on the internal vault, taking as an example division of the lowest circumference of the spherical grid. Circumference having the same centre as the previous one but with radius longer respectively, being a cross section of the external vault depends also on the height of the highest apex of the external spherical grid lowest arc.
Analogically like in the equilateral grid, introducing additional meridians to the external vault we get an external isosceles grid with a four times greater number of triangles having a common axis with the internal grid. Then we calculate rectangular coordinates and lenghts of rods on the respective tables. Lenghts of rods are presented on schemes of 1/10 part of the structure.