412.00 **Closest Packing of Rods**

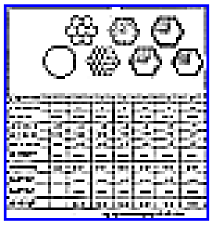


Fig. 412.01

412.01 Just as six balls may be closest packed around a nuclear ball in a plane, six rods or wires may be closest packed around a nuclear rod or wire in a cluster. When the seven wires are thus compacted in a parallel bunch, they may be twisted to form a cable of hexagonal cross section, with the nuclear wire surrounded by the other six. The hexagonal pattern of cross section persists as complete additional layers are symmetrically added to the cluster. These progressive symmetrical surroundments constitute circumferentially finite integrities in universal geometry.

412.02 **Surface Tension Capability:** We know by conclusive experiments and measuring that the progressive subdivision of a given metal fiber into a plurality of approximately parallel fibers provides tensile behavior capabilities of the smaller fibers at increased magnitudes up to hundreds- and thousandsfold that of the unit solid metal section. This is because of the increased surface-to-mass ratios and because all high tensile capability is provided by the work hardening of the surfaces. This is because the surface atoms are pressed into closer proximity to one another by the drawing tool through which the rod and wire are processed.

413.00 **Omnidirectional Closest Packing**

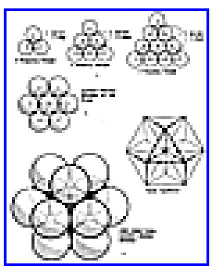
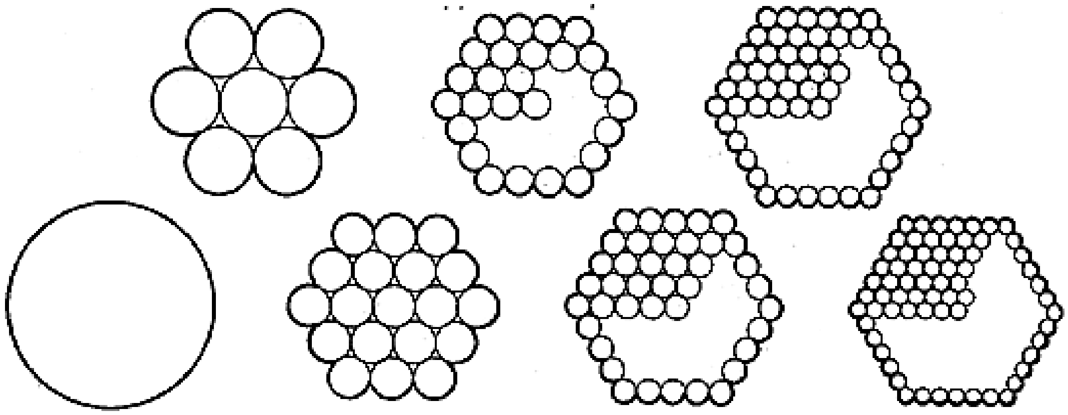


Fig. 413.01

413.01 In omnidirectional closest packing of equiradius spheres around a nuclear sphere, 12 spheres will always symmetrically and intertangentially surround one sphere with each sphere tangent to its immediate neighbors. We may then close-pack another symmetrical layer of identical spheres surrounding the original 13. The spheres of this outer layer are also tangent to all of their immediate neighbors. This second layer totals 42 spheres. If we apply a third layer of equiradius spheres, we find that they, too, compact symmetrically and tangentially. The number of spheres in the third layer is 92.

413.02 Equiradius spheres closest packed around a nuclear sphere do not form a supersphere, as might be expected. They form a symmetrical polyhedron of 14 faces: the vector equilibrium.



NO. RODS PER CLUSTER	1	7	19	37	61	91	127
NO. RODS OUTER LAYER		6	12	18	24	30	36
TOTAL ROD AREAS	314.159	314.159	314.159	314.159	314.159	314.159	314.159
DIAM. OF SINGLE ROD	20.000	7.556	4.588	3.288	2.561	2.099	1.775
AREA OF SINGLE ROD	314.159	44.880	16.535	8.491	5.150	3.452	2.474
PERIM. OF SINGLE ROD	62.832	23.748	14.415	10.330	8.045	6.594	5.575
TOTAL PERIMETER OF RODS IN BUNDLE	62.832	166.24	273.88	382.19	489.88	600.07	708.08
TOTAL PERIMETER OF RODS IN OUTER LAYER	62.832	142.49	172.98	185.93	193.08*	197.83*	205.39*
MIN. DIAMETER OF HEXAGONAL BUNDLE		20.649	20.483	20.373	20.302	20.277	20.218
MAX. DIAMETER OF HEXAGONAL BUNDLE		22.668	22.940	23.016	23.046	23.089	23.095
TOTAL AREA OF RODS OUTER LAYER ONLY		269.279	198.416	152.834	123.604	103.569	89.053

*NOTE THAT PERIMETERS OF OUTER LAYER RODS ALONE EXCEEDS THREE TIMES PERIMETER OF LARGE ROD.

Fig. 412.01 Closest Packing of Rods.

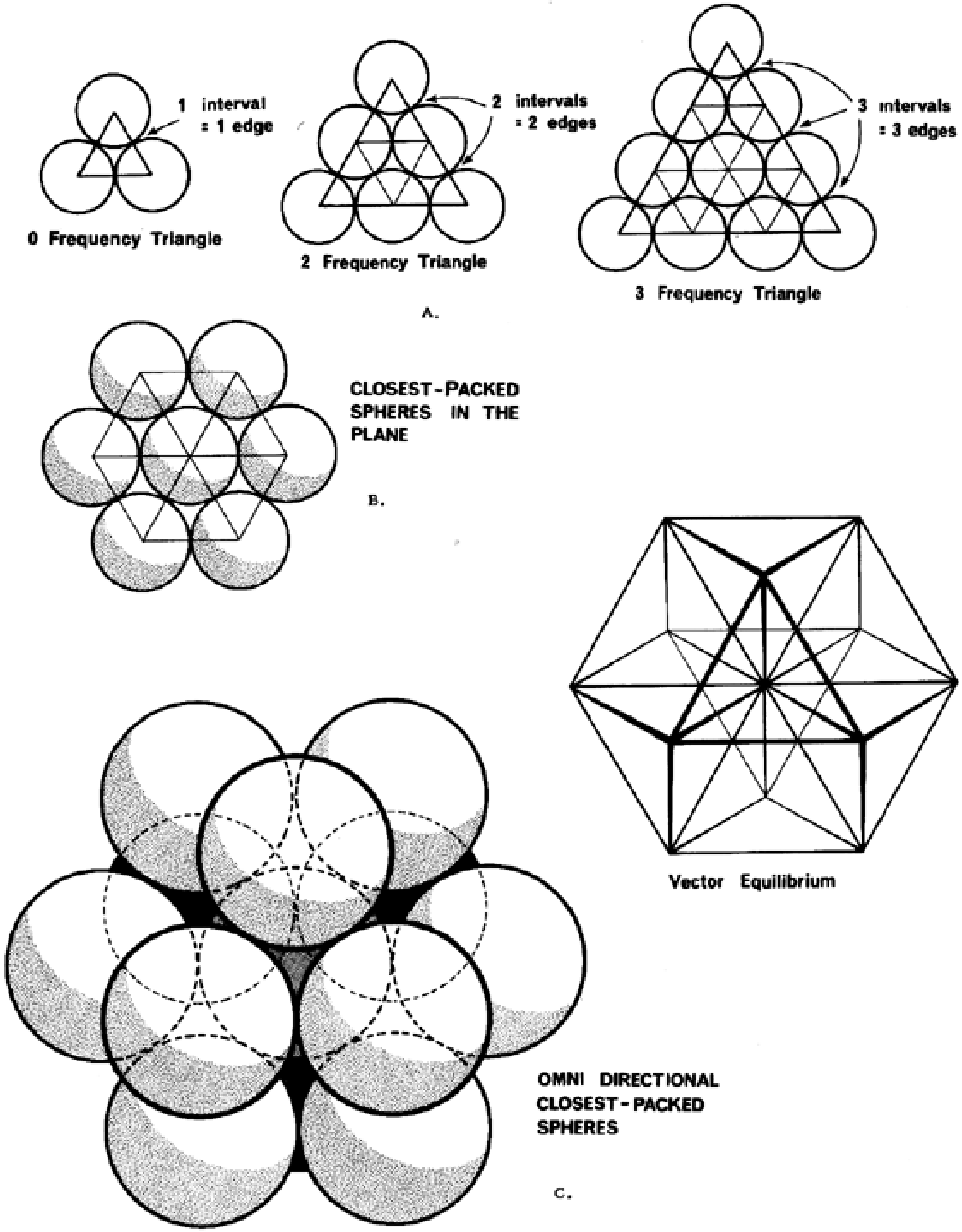


Fig. 413.01 Vector Equilibrium: Omnidirectional Closest Packing Around a Nucleus: Triangles can be subdivided into greater and greater numbers of similar units. The number of modular subdivisions along any edge can be referred to as the frequency of a given triangle. In triangular grid each vertex may be expanded to become a circle or sphere showing the inherent relationship between closest packed spheres and triangulation. The frequency of triangular arrays of spheres in the plane is determined by counting the number of intervals (A) rather than the number of spheres on a given edge. In the case of concentric packings or spheres around a nucleus the frequency of a given system can either be the edge subdivision or the number of concentric shells or layers. Concentric packings in the plane give rise to hexagonal arrays (B) and omnidirectional closest packing of equal spheres around a nucleus (C) gives rise to the vector equilibrium (D).

413.03 If we add on more layers of equiradius spheres to the symmetrical polyhedron of 14 faces close-packed around one sphere, we find that they always compact symmetrically and tangentially, and that this process of enclosure may seemingly be repeated indefinitely. Each layer, however, is in itself a finite or complete and symmetrical embracement of spheres. Each of these embracing layers of spheres constitutes a finite system. Each layer always takes the 14-face conformation and consists of eight triangular and six square faces. Together with the layers they enclose and the original sphere center, or *nucleus,* these symmetrically encompassing layers constitute a concentric finite system.

413.04 As additional layers are added, it is found that a symmetrical pattern of concentric systems repeats itself. That is, the system of three layers around one sphere, with 92 spheres in the outer layer, begins all over again and repeats itself indefinitely with successively enclosing layers in such a way that the successive layers outside of the 92- sphere layer begin to penetrate the adjacent new nuclear systems. We find then that only the concentric system of spheres within and including the layer of 92 are *unique* and individual systems. We will pursue this concept of a finite system in universal geometry still further (see Sec. 418, et seq.) in order to relate it to the significance of the 92 self- regenerative chemical elements.

414.00 **Nucleus**

414.01 In closest packing of equiradius spheres, a nucleus by definition must be tangentially and symmetrically surrounded. This means that there must be a ball in every possible tangential and optically direct angular relationship to the nucleus. This does not happen with the first layer of 12 balls or with the second layer of 42 balls. Not until the third layer of 92 balls is added are all the tangential spaces filled and all the optically direct angles of nuclear visibility intercepted. We then realize a nucleus.

414.02 It will also be discovered that the third layer of 92 spheres contains eight new potential nuclei; however, these do not become realized nuclei until each has two more layers enveloping it—one layer with the nucleus in it and two layers enclosing it. *Three layers are unique to each nucleus.* This tells us that the nuclear group with 92 spheres in its outer, or third, layer is the limit of unique, closest-packed symmetrical assemblages of unit wavelength and frequency. These are nuclear symmetry systems.

414.03 It is characteristic of a nucleus that it has at least two surrounding layers in which there is no nucleus showing, i.e., no potential. In the third layer, however, eight potential nuclei show up, but they do not have their own three unique layers to realize them. So the new nuclei are not yet realized, they are only potential.

414.04 The nucleus ball is always two balls, one concave and one convex. The two balls have a common center. Hydrogen's one convex proton contains its own concave nucleus.

Next Section: 415.00
