751.00 **Pneumatic Model**

751.01 If the frequency is high enough, the size of the interstices of the tensegrity net may become so relatively small as to arrest the passage of any phenomena larger than the holes. If the frequency is high enough, neither water nor air molecules can pass through. The geodesic tensegrity may be designed to keep out the weather complex while admitting radar's microwaves and light from the Sun.

751.02 If we raise the structural-system frequency sufficiently, we will decrease the residual compression islands to the microcosmic magnitude of atoms, which only serves to disclose that the atoms and their nuclei are themselves geodesic tensegrity structures, ergo, compatible with this ultimate frequency limit—a fact that is now, in the 1960s and `70s, swiftly looming into the nuclear physicist's ken.

751.03 We now comprehend that geodesic tensegrity structuring provides the first true and visualizable model of pneumatic structures in which the relative thickness of the enclosing films, in proportion to diameter, rapidly decreases with the increasing size of the balloons or spheric networks.

751.04 In the case of geodesic tensegrity structures, no overcrowding of interior gas molecules, imprisoned within a submolecular mesh net, is necessary to thrust the net's structure outward from its spherical geometric center, because the compressional struts, locally islanded, as outward-thrusting struts at both their ends, push the spherical net outwardly at every vertexial advantage of network convergence. Geodesic tensegrities are the "hollowed-out" balloons discarding their redundantly "solid" air core.

751.05 The geodesic tensegrity is a hollowed-out balloon in which those specific molecules of gas that happen to be impinging from within against the skin at any one moment (thus pushing it outwardly) are replaced by the islanded geodesic struts, and all other redundant molecules are discarded. It is possible to sew pockets on the inside surface of a balloon skin corresponding in pattern to the islanded tensegrity geodesic strut- end positions and to insert into those pockets stiff battens that cause the otherwise limp balloon bag to take spherical shape, as it would if filled with a pressured-in gas.

751.06 Local stiffeners of skin suitable to preferred activities, at any structural focus, can be had by increasing the inward-outward angular strut depths and the local- surface-frequency patternings-thus thickening the truss depth without weight penalties. Here we have nature's own trick of local stiffening as accomplished by the higher- frequency, closest-packing pattern of isotropically moduled local cartilages, and even higher-frequency local bone structuring, as ratioed to the frequency of tissue cells of animal flesh.

751.07 If we employ hydraulic pressure within the local islands of compression for dimensional stability, and if we employ gas molecules between the liquid molecules for local shock-load compressibility (ergo, flexibility), we will find that our geodesic tensegrity structures will in every way have taken advantage of the same structural- strategy principles employed by nature in all her sizes of biological formulations.

751.08 Geodesic tensegrities are true pneumatic structures in purest design frequency principle. They obviate the randomness and redundance characterizing the work of designers dealing only with pneumatics who happen to be successful in blowing air into a bladder while being utterly dependent upon the subvisible behaviors of chemical phenomena. Geodesic tensegrity engineering enables discrete separation of all the structural events into two diametrically opposed magnitude classes: all the outward-bound phenomena which are too large to pass through all the interstices of all the inward-bound events in the too-small class. This is the same kind of redundancy that occurs in reinforced concrete which, if drilled out wherever redundant components exist, would disclose an orderly four-prime-magnitude complex octahedron-tetrahedron truss network, disencumbered of more than 50 percent of its weight.

751.09 Tensegrity geodesic spheroids have none of the portal pressure-lock problems of "solid-oozing" pneumatic balloons. The pressure is discretely localized and locked in place by the tension net, and therefore it cannot escape.

751.10 Tensegrity geodesic spheroids may have several frequencies simultaneously—a low-frequency major web and a high-frequency minor local web. If they are of sufficiently high frequency of secondary or minor webbing to exclude atmospheric molecules, they may be partially vacuumized; that is, they may be made air- floatable.

760.00 Balloons

761.00 **Net**

761.01 People think spontaneously of a balloon as a continuous skin or solidly impervious unitary and spherically enclosed membrane holding the gas. They say that because the gas cannot get out and because it is under pressure, the pressure makes the balloon spheroidal. This means that the gas is pushing the skin outwardly in all directions. People think of a solid mass of air jammed into a pneumatic bag. But if we look at this skin with a microscope, we find that it is not a continuous film at all; it is full of holes. It is made up of molecules that are fairly remote from one another. It is in reality a great energy aggregate of Milky Way-like atomic constellations cohering only gravitationally to act as the invisible, tensional integrities of the fibers with which the webbing of the pneumatic balloon's net is woven.

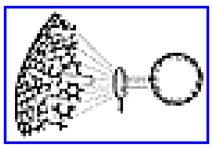

Fig. 761.02

761.02 In a gas balloon, we do not have a continuous membrane of film. There is no such thing as a continuous "solid" skin or a "solid" or a "continuous" anything in Universe. What we do have is a network pattern, a network of energy actions interspersed with vast spaces or lack of energy events. The mass-interattracted atomic components not only are not touching each other, but they are as remote from one another as are Sun and its planets in the relative terms of respective diameters of each of the phenomena involved.

761.03 The spaces between the energy-action-net components are smaller, however, than are the internally captivated and mutually interrepelled gas molecules; wherefore the gas molecules, which are complex low-frequency energy events, interfere with the higher- frequency, omnienclosing net-webbing energy events. The pattern is similar to that of fish crowded in a spherical net and therefore running tangentially outward into the net in approximately all directions. Fish caught in nets produce an enclosure-frustrated, would- be escape pattern. In the tensegrities, you have gravity or electromagnetism producing the ultimate tension forces, but you don't have any strings or ultimately smallest solid threads. The more we think about it and the more we experiment, the less reliable becomes our concept "solid." The balloon is indeed not only full of holes, but it is in fact utterly discontinuous. It is a net and not a bag. In fact, it is a spherical galaxy of critically neighboring energy events.

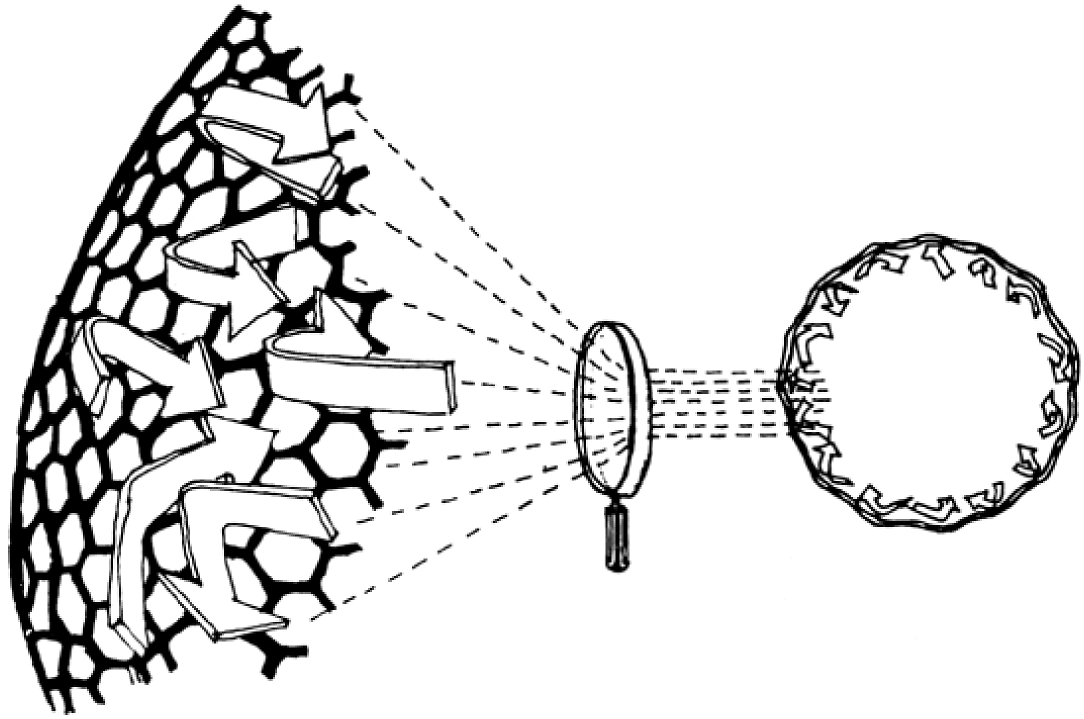

Fig. 761.02 Function of a Balloon as a Porous Network.

761.04 The balloon is a net in which the holes are so small that the molecules are larger than the holes and therefore cannot get out. The molecules are gas, but they have a minimum dimension, and they cannot get out of the holes. The next thing that we discover is the pressure of the gases explained by their kinetics. That is, the molecules are in motion; they are not rigid. There is nothing static at all pushing against the net. They are hitting it like projectiles. All of the molecules of gas are trying to get out of the system: this is what gives it the high pressure. The middle of the chord of an arc is always nearer to the center of the sphere than the ends of the chord. Chord ends are always pushing the net outwardly from the system's spherical center. The molecules are stretching the net outwardly until the skin acts to resist the outward motion and relaxes inwardly. The skin is finite and closes back upon itself in apparently all circumferential directions. The net represents a tensional force with the arrows bound inwardly, balancing all the molecules, hitting them, caroming around, with every molecular action having its chordal reaction. But the molecules do not huddle together at the center and then simultaneously explode outward to hit the balloon skin in one omnidirectionally outbound wave. Not only are there critical proximities that show up physically, but there are critical proximities tensionally and critical proximities compressionally—that is, there are repellings.

761.05 What makes the net take the shape that it does is simply the molecules that happen to hit it. The molecules that are not hitting it have nothing to do with its shape. There is potential that other molecules might hit the network, but that is not what we are talking about. The shape it has is by virtue of the ones that happen to hit it.

761.06 When we crowd the gassy molecules into a container, they manifest action, reaction, and resultant. When one molecule goes out to hit the net, it is also pushing another molecule inwardly or in some other direction. We discover mathematically that it would be impossible to get all of them to go to an absolute common center because that would require a lot more pressure. It would have to be a smaller space so the patterns are not all from the center outwardly against the bag. Each one of the patterns is ricocheting around the bag; some are hitting the net and some are only interfering with and precessing each other and changing angles without hitting the net.

762.00 **Paired Swimmers**

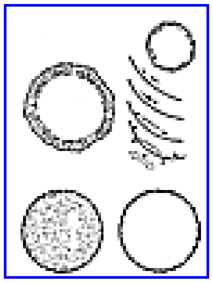
Fig. 762.01

762.01 The molecules near the surface of the net are coursing in chordally ricocheting great-circle patterns around the net's inner surface. Because every action has its reaction, it would be possible to pair all the molecules so that they would behave as, for instance, two swimmers who dive into a swimming tank from opposite ends, meet in the middle, and then, employing each other's inertia, shove off from each other's feet in opposite directions. We have an acceleration effectiveness equal to what they experience when shoving off from the tank's "solid" wall. When you are swimming, you dive from one end of the tank, which gives you a little acceleration into the water. When you get to the end of the tank, you can put up your feet, double up your body, and shove off from the wall again. Likewise, two swimmers can meet in the middle of the tank, double up their bodies, put the soles of their feet together, and thrust out in opposite directions. The phenomenon is similar to the discontinuous compression and continuous tension of geodesics. The molecules are in motion and have to have some kind of a reaction set; each molecule caroming around, great-circularly hitting glancing blows, then making a chord and then another glancing blow, has to have another molecule to shove off from. They are the ones that are accounting for all the work. Each one would have to be balanced as a balanced pair of forces. We discover that all we are accounting for can be paired. So there is a net of arrows outwardly in the middle of the chord pulling against the net of arrows pointing inwardly.

762.02 The pattern indicates that we could have each and all of the paired molecules bounce off their partners and dart away in opposite directions, with each finally hitting the balloon net and pushing it outwardly as they each angled in glancing blows in new directions, but always toward the net at another point where, in critical repelling proximities, they would all pair off nonsimultaneously but at high frequency of re- repellment shove-offs to ricochet off the net at such a high frequency of events as to keep the net stretched outwardly in all directions. This represents what the molecules of balloon confined gases are doing. With discontinuous compression and continuous tension, we can make geodesic structures function in the same way.

763.00 **Speed and Concentration of Airplanes**

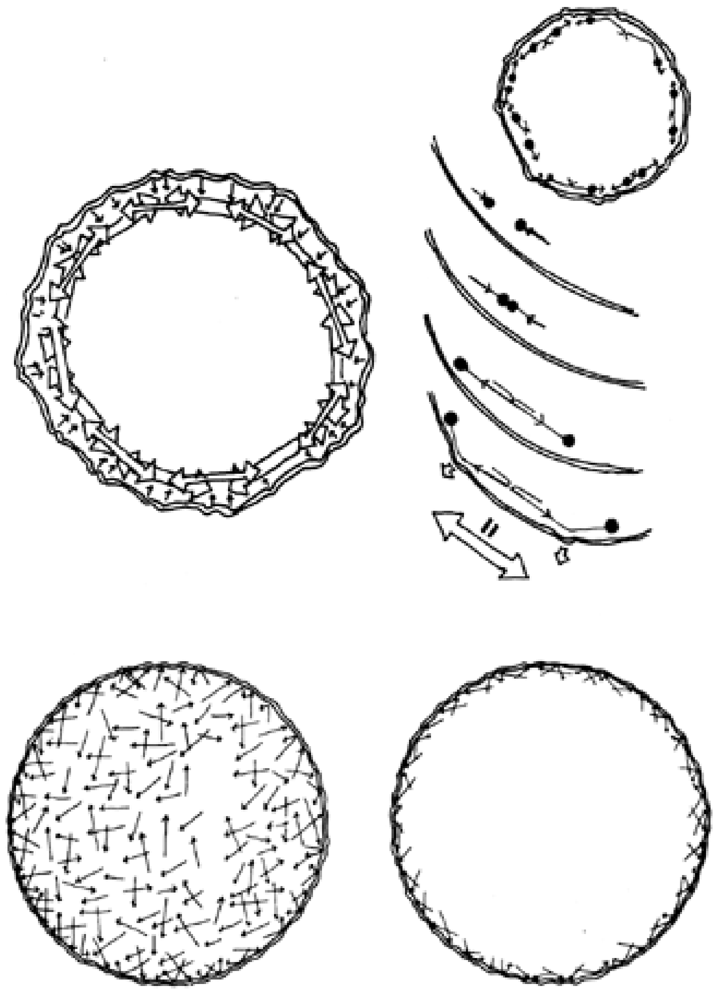

Fig. 762.01 Chordal Ricochet Pattern in Stretch Action of a Balloon Net: A gas balloon's exterior tension "net" has the shape that it has because some of the molecules are too large to escape and, crowed by the other molecules, are hitting the balloon. But the molecules do not huddle together at the center and then simultaneously explode outwardly to hit the balloon skin in one omnidirectionally outbound wave. The molecules near the surface are coursing in chordally ricocheting patterns all around the inner net's surface. I therefore saw that—because every action has its reaction—it would be possible to pair all the molecules so that they would behave as can two swimmers who dive into a swimming tank from opposite ends, meet in the middle and then, employing each other's inertia, shove off from each other's feet in opposite directions.

763.01 As we find out in electromagnetics where there are repellings and domains of actions, the kinetic actions of these gas molecules seem to require certain turning-radius magnitudes. When you pressure too many of these patterns into the same area, there is not enough room to avoid interferences, and they develop a very high speed. Increased speed decreases interference probability caused by increased crowding.

763.02 Airplanes in the sky seem to be great distances apart. But the minute they come in for a landing, they are slowed down and are very much closer to each other. If you have phenomena at very high speeds, their amount of time at any one point is a very short time: the amount of time there would be at a given point for something to hit it would be very much lessened by the speed. The higher the velocity, the lesser the possibility of interference at any one point. So we have the motion patterns of the molecules making themselves more comfortable inside the balloon by increasing their velocity, thereby reducing the interferences that are developing. The velocity then gives us what we call pressure or heat: it can be read either way. If you feel the pneumatic bag, you may find it getting hotter. You can feel an automobile tire getting hotter as it is pumped full.

Next Section: 764.00
