Reprinted with permission from Games & Puzzles magazine, Sep 1975 N 40, p37, Author David Wells a friend of mine. This is a different way of making the cube flexahedron without long bands so not a flexahedron is the same sense but very similar in other respects, also might be easier to manufacture. This method of connection could produce some very interesting puzzles as David suggests, like 64 cubes connected to fold into 4x4x4 cube. He does not suggest trying 26 c's. then fold into a cube with void in center. Might be challenging to solve.

TWO PUZZLING MODELS

G+P #40 Sep 75

MODERN teaching methods are notorious for the freedom, or licence, depending on one's point of view, which they offer to the pupil. The freedom, or licence, which they offer the teacher is not appreciated in the same way. It was, for example, while showing a class how cardboard models of Platonic solids could be hinged together to create more complicated structures, not a topic on any syllabus, that I accidentally discovered the two models described here.

The models are a ring of six cubes and a ring of eight cubes. The hinges, however, are not your usual kind, which would join one edge each from two cubes and allow one cube to rotate a mere 180° about the other. Such ordinary hinges can be used but the models are then, as it were, crippled, and lose much of their freedom of movement. Our hinge is taken from the well-known wallet trick (Fig. 1). The strip from AA to BB is attached to the back of the LH card at AA and to the back of the RH card at BB. The other strips are similarly glued. A £1 note is placed between the two cards, on top of the two strips, and the wallet is closed at the top and then opened *from the bottom.* The £1 note is now underneath the two strips! A wallet is easily made from two postcards. [illegible] a very little sleight of hand to disguise [illegible] fact that the wallet is not opened exactly as it was closed the effect is quite mystifying.

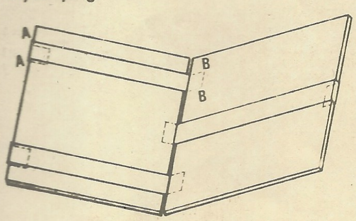
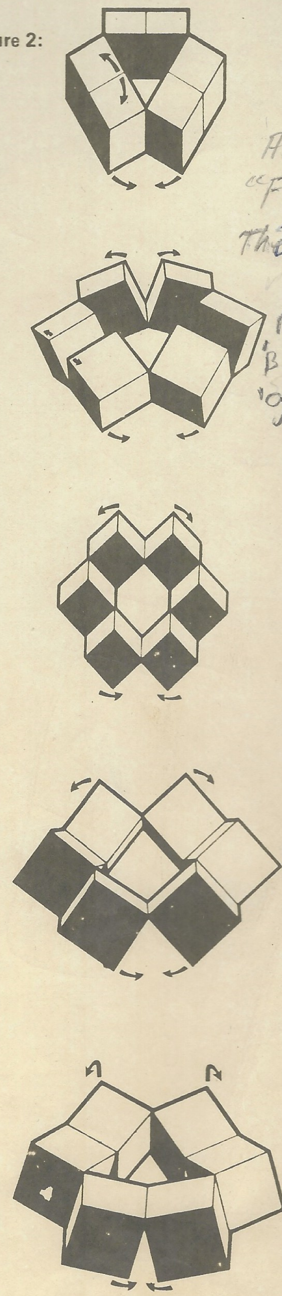


Figure 1:

To make the 6-cube ring place six cubes in a line face to face, and join 1 and 2 with a wallet hinge on their adjacent faces. Next join 2 and 3 also with a wallet hinge, but at right-angles to the first hinge. If the first was, say, vertical, make this one horizontal. Continue to the end of the line and finish by joining cube 6 to cube 1. The result is a ring with a surprising property: it will rotate so that it is continually turning itself inside out. Fig. 2 shows a sequence of five positions. Initially it is flat, a triangle with base North. Pairs of faces sandwiched between adjacent cubes separate at the top and continue to rotate away from each [illegible] while the two faces nearest us are coming together, until the triangle of cubes is reversed, with its base towards the viewer. The rotation need not stop here; it can continue indefinitely. Unfortunately, this model will do nothing but rotate, because it has only one degree of freedom.

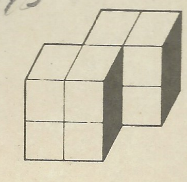
Figure 2:



See my Article "Flexahedrons" This six cube cannot rotate like 'Belts' around 'gears'

To obtain greater freedom, eight cubes are needed. Join the cubes as before with wallet hinges, alternately vertical and horizontal, and the ring will indeed rotate, but will also do more. Figs. 3 and 4 show two of the shapes it will make. The simplest is a 2x2x2 cube. Fig. 5 shows how it is folded into a cube. Easy? Well, yes, but this easy operation can result in any of sixteen different large cubes.

Figure 3:



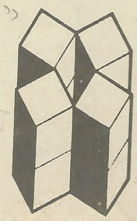
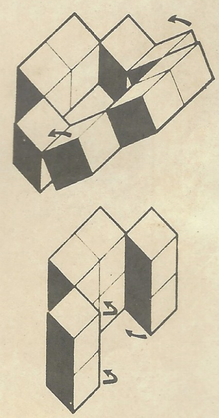


Figure 4:

Figure 5:



To enumerate all sixteen cubes is a puzzle in itself, but the variety of possibilities can be shown by colouring the faces of just one large cube. Because the surface area of a large cube is exactly one half of the total surface area of the eight small cubes, the area of the internal faces equals the area of the coloured faces. Is there another large cube in which all the coloured faces are internal and the uncoloured faces appear on the outside? Yes, there is, but it is not easy to find without practice.

Six and eight are not the only numbers of cubes which will make a ring. Going down, there is a ring of four cubes, but the inside of the ring is a single point! Going up, any even number of cubes will do. A problem I would dearly like to know the answer to is this one, naturally: In how many ways can a ring of 64 cubes be folded to make a 4x4x4 cube? Is there a spare computer in the house?