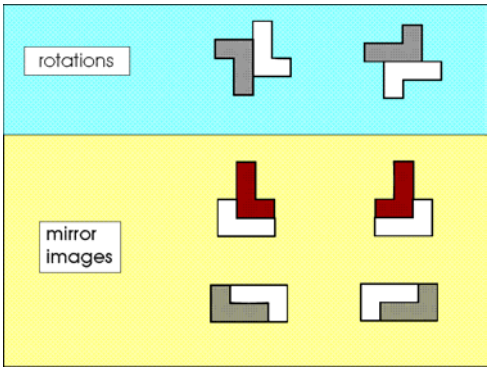
A Structure of Diagrams
Paper II
Hierarchies and Lateral Structures in Technical Diagram
(Continued from a previous issue)



Now everyone will immediately suggest simple diagrams, with content determined on a ***need-to-know*** (and ***what-does-he-know-already***) basis. Each diagram is then designed to have a specific purpose with NO redundant information – You can see that in this case "redundant" means superfluous – and there is definitely a place for simple, clear, directed diagrams of this sort.

The trouble is - how do you explain your complex areas of knowledge? What is the relationship between diagrams of the same thing, but for different purposes? And, how do we lead from one level of explanation to another?

B **Comparing two diagrams of the same thing**

We have two quite different diagrams of the same thing – an **Envelope Shaper and combined Voltage Controlled Amplifier** from a simple synthesizer. For the purposes that we are interested in at this point, you don't need to know about synthesizers at all. I am going to show how diagrams RE-STRUCTURE the same information for different (and even complementary) purposes. Let me just confirm for you that these two diagrams contain the ***same*** information. The first diagram, let us call it Type 1, and the second – Type 2, are on the next two facing pages of this paper. This is obviously to make it easy for direct comparisons between the two..

Let us start with the integrated circuits. They are quite easy to recognise. First, the operational amplifiers: these ate shown as **triangles** on Type 1, and as **rectangles** on Type 2. There are 4 **741** op amps, and a single **4016** – a quad switch chip. This latter integrated circuit is easy to pick out on Type 2, but appears as a set of dispersed individual switches on Type 1. The dispersed switches are shown as white rectangles enclosing an obvious switch at various points in Type 1. Similarly for the 74C00 – quad NAND gates chip: once again , a single rectangle is the symbol for it on Type 2, but yet another dispersed set of white D-shaped gates have to be found on Type 1.

I think that's about enough.

The two diagrams are of the SAME electronic circuit. Now, *WHY* are they so different?

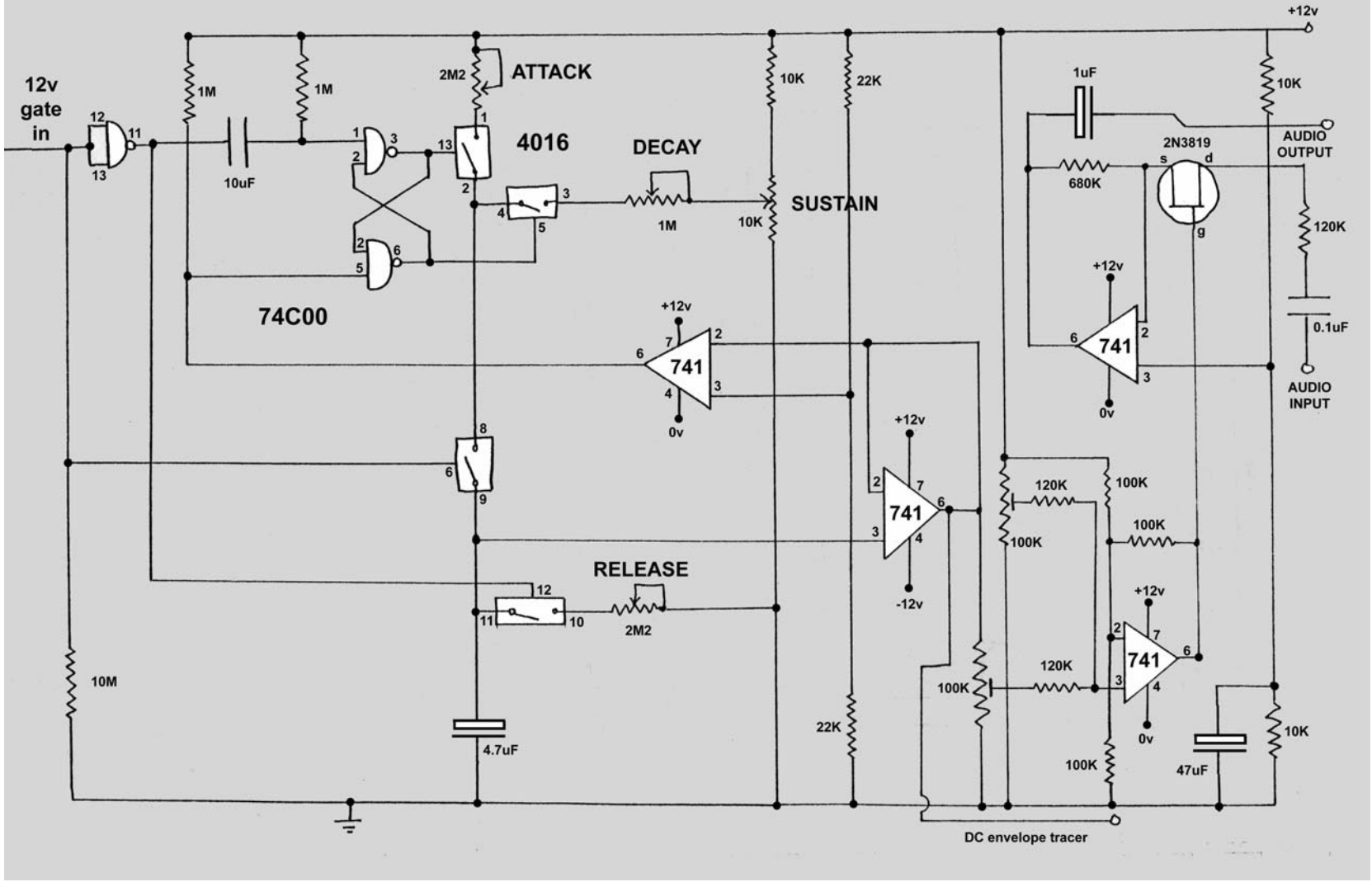
The first diagram (Type 1) is a classic **logical, conceptual** representation of all the elements : how they are connected, and relate to one another. They are laid out in such a way, and with such SYMBOLS for the functional units, as to facilitate understanding. In effect, this diagram is written in the **language** of electronic circuits that was developed for this precise purpose. We will call it the **LOGIC** diagram.

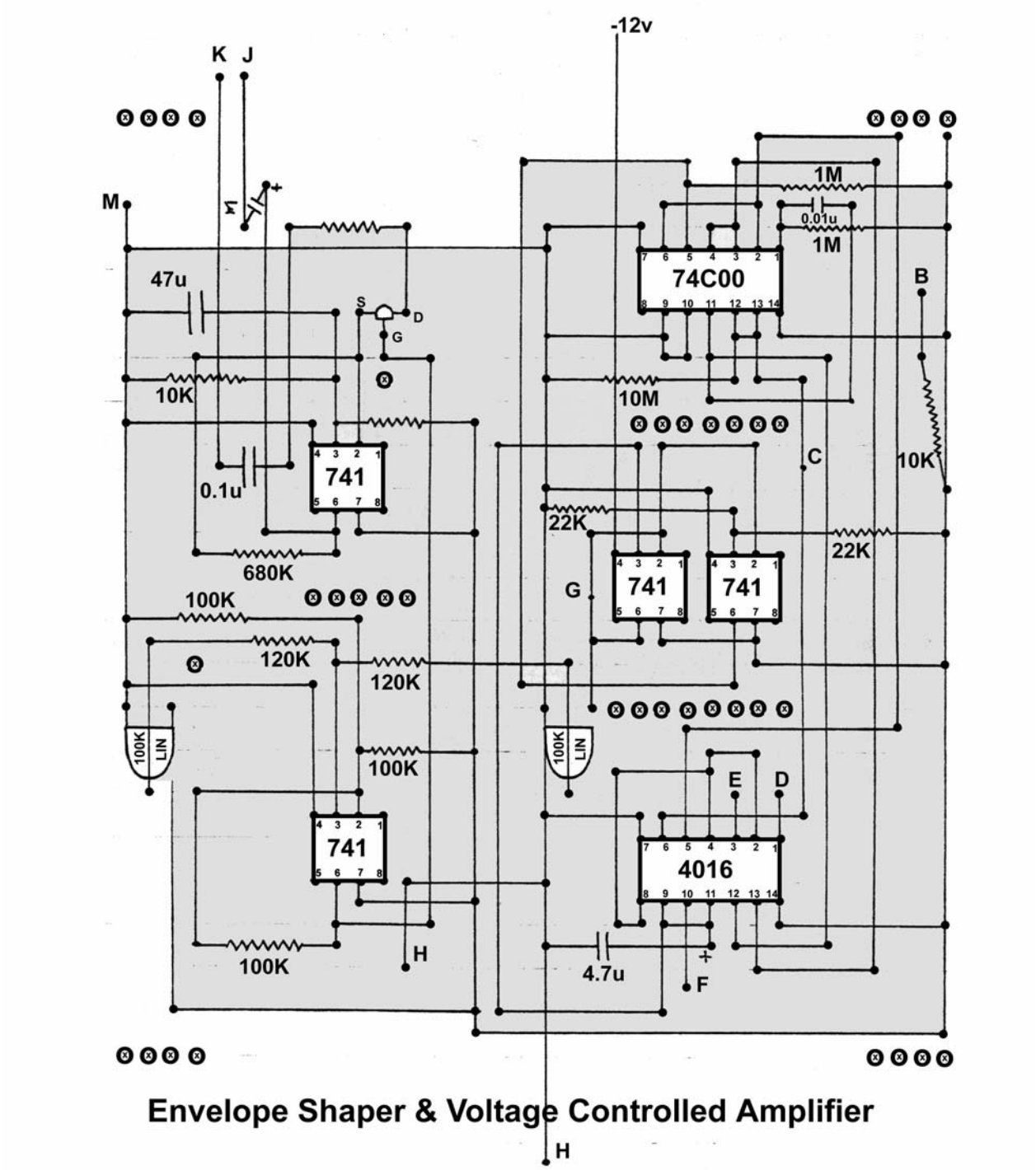
The second diagram (Type 2) is the physical implementation of the circuit on a piece of strip board (Vero board) , a standard, general purpose board designed for wide use with both integrated circuits, and ordinary, individual electronic components. It is made out of a piece of insulating board, completely covered on one side with a series of parallel, copper strips in the form of straight lines, with gaps between them. These are effectively COPPER WIRES fixed to a board! All strips are drilled with small holes at a standard spacing (pitch) throughout. This enables them to easily take both the FEET of integrated circuits (ICs), and any other components, which are usually mounted on the REVERSE side of the board (which, remember, has no strips, and is totally insulating), and their LEGS (or wire connections) are pushed through to the copper strip side, where they can be soldered to the pierced strip at that point. Cutting the strip at certain points enables them to

be ISOLATED into SEPARATE “wires” and, VERY IMPORTANT, followed and understood, after the event.

If, as an alternative, you tried to simply wire up the circuit from diagram 1 (the LOGIC diagram) on a point to point basis, without the benefit of a structure-matrix given by the Vero board, you would end up with a right ***rat’s nest*** of a mess – incoherent and almost impossible to follow.
So, I think you now see the point of this diagram. We will call it the **IMPLEMENTATION** diagram.
Design, and conceptual work, is generally done using LOGIC representations of the electronic circuits, whereas BUILDING the actual physical circuit is BEST done with an IMPLEMENTATION diagram. Both types of diagram are essential. Also it must be clear that Implementation charts are DERIVED from LOGIC circuit diagrams, for the purpose of aiding construction.

Envelope Shaper & Voltage Controlled Amplifier





A **solderer** will generally ONLY work with diagrams of the Implementation type, as it is considered NO part of his job to wonder about the principles involved and the design of NEW circuits. On the other hand, it is quite possible that they will see possible ALTERNATIVE arrangements, that could be MORE EFFICIENT, or SIMPLER, than the arrangement on the implementation chart that they have been given, and if such suggestions then proved to be better, they could well be included in future implementation layouts.

Designers, on the other hand, will be more concerned with the bringing together of components to achieve varying, or even quite different effects, and will almost certainly do all their work with the Logical circuit diagrams.

To be continued
(878 words)