

A magnet with just one pole?

There is a common, everyday magnet, which sticks on to iron things, but still cannot point to the North, says S.Ananthanarayanan.

What we are talking about, of course, are the little strips of magnet that we use to stick notes or decorations on the refrigerator door. Strips of plastic, or sometimes of flexible tape, that hold on to iron on one side, but show no magnetism on the other.

How are magnets born?

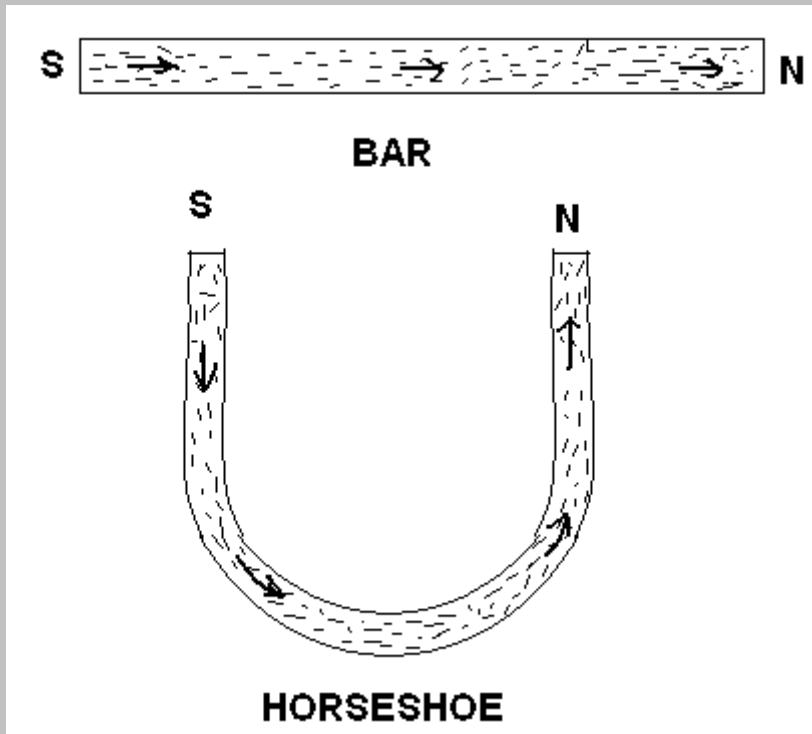
We are familiar with the common bar magnet, which grabs hold of iron nails, paper clips and also sticks firmly to iron things. Usually made of iron, magnets depend on tiny electric currents in the atoms of which they are made. As we may know, atoms consist of a heavy, positively charge core, with several, tiny, negatively charged particles called electrons in orbit around the core. And apart from being in orbit, the electrons themselves have electric properties, as if they were themselves spinning around. In most materials, the effect of electric charges in motion cancel out. But in atoms of *magnetic* materials, things are not so well balanced and the atom behaves like a little coil with current flowing. The result is that the atom is a little magnet!

When pieces of such material form, from solution or from the melt, the random motion of the atoms jumbles up directions in which the atoms point. The result is that though each atom is a magnet by itself, the atomic magnets cancel each other out when they are together in a piece of the metal. But if a bar of the material should form in the presence of a strong magnetic field, then, the atoms would all get lined up, along the field, and most of them would be set like that, lined up in one direction. Their magnetic effect would then not cancel but add, and the bar itself be a strong magnet, like the ones we have seen.

Another way to create magnets is to coax each atom to reorient, by stroking a piece of iron with another magnet. Or to put a rod of iron inside a coiled wire and to pass a heavy current through the coil. The strong magnetic field that is created in the coil has the same effect as the stroking by a magnet.

Can we have monopole?

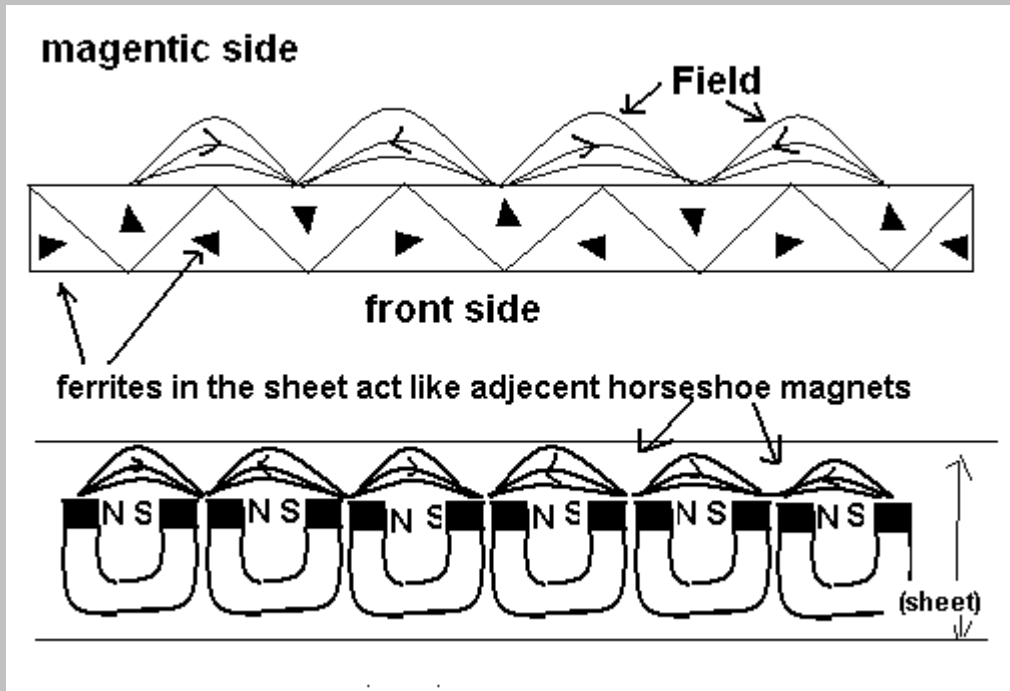
As we see, magnets are actually millions of loops of electric current stood end to end. Each loop of current has a N pole on one side and a S pole on the other. Which means that if there is a N pole, there has to be a S pole too. There can be no such thing as an isolated magnetic pole.



But there is a kind of magnet that has both poles on the *same side*. Mind you, this is same side, not at the *same end*. We are talking about the horseshoe magnet, which is just a bar magnet bent around like a horseshoe, with both poles pointing the same way. Horseshoe magnets create a very strong field in the cap between the poles!

The magnetic strip

The plastic sheet that sticks to refrigerator doors also shows magnetic effects only on one side. Could it be that it consists in fact of many tiny horseshoe magnets lined up, side by side, inside the sheet?



Well, that is exactly the case. Flexible magnetic sheet is made from rubber or plastic that is mixed with powdered magnetic material, usually iron-based, called ferrite. When the mixture sets, it is passed through rollers to give it the shape of a sheet and also by a matrix of strong magnets, to align the ferrites as the plastic sets. The alternate poles in the matrix orient the ferrites into little 'U's and there, the sheet is magnetic on one side but not on the other!
