




From
Cheniere Press:

The Secret World of Magnets

By the father of spintronics,
Howard Johnson

DEDICATION

This book is lovingly dedicated in memory of Dr. Gerhard H. Beyer, Distinguished University Professor at Virginia Polytechnic Institute and State University, Blacksburg, Virginia. He was former Head of Department of Chemical Engineering; Fellow in the Chemical Engineering Society and Active in the Nuclear Engineering Society and the Society of Professional Engineers. He enjoyed teaching and advanced research, including the discoveries and development of this book.

Howard Johnson first became interested in magnetics while doing some graduate work at Vanderbilt University. Several patents later he was joined by Jerry Beyer, a senior scientist in Chemical Engineering at V.P.I., and Steve Davis, an electrical engineer and leading computer man. Together they broke some of the magnetic code which they present here just as they found it.

"There is a God in heaven that revealeth secrets, and maketh known to the king Nebuchadnezzar what shall be in the latter days."

Daniel 2:1-28

"Hast thou entered into the treasures of the snow?". . .

"Which I have reserved against the time of trouble, against the day of battle and war? "

Job 38:22,23

CONTENTS

WHO DISCOVERED MAGNETS? BY DR. GERHARD H. BEYER

We'll never really know — it happened such a long time ago . ..

Maybe someone picked up a piece of "magnesian" rock on an Aegean coast and noticed the piece of lodestonc was peculiar. It attracted a piece of iron, and could change the properties of the iron when the iron was rubbed with the rock.

Thales — who lived in Greece about 600 B.C. — studied attractive forces associated with magnets, and a resin called "amber." That started the long history of magnetism and electricity that is still being added to today.

It may have been that some Chinese used magnetic stones which pointed northward to find their way through the Gobi Desert many centuries ago.

The use of a magnetized needle floated on a cork, that has developed into the compass we know today, was a great boon to explorers and markedly changed our world.

More recently, the discoveries of new materials — such as ferrites and rare earth magnets — are likely to change our world again.

Have you ever wondered about:

How magnets work?

Why some elements are magnetic and others aren't?

How a magnet manages to change things without touching them?

This book may suggest at least partial answers to some of these questions. But most likely there will still be more questions than answers, for there are many things still to be discovered about magnets.

More work needs to be done. Maybe YOU will do it if you get inerested in magnets. That's one of the reasons for this book.

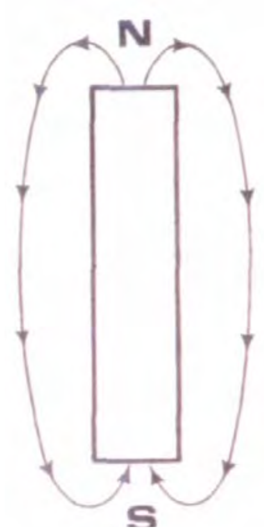
Way back in 1734, a Swedish scientist named Swedenborg showed the difference between magnetized iron and unmagnetized iron. And since then, we've discovered a lot of new materials and new techniques. Today there are better sensors for making measurements, and there are computers to help in recording, analyzing, and displaying them.

Another reason for this book is to tell you about these new materials and techniques and to show you some magnetic patterns no one else has ever seen.

The Direction of Magnetic Fields

For generations, physics students and others have been taught about magnets with iron filings.

It has been the popular belief of almost anyone with a common knowledge of magnetics that the pattern made by the filings represents the form and the movement of the magnetic fields. The following is an illustration of the popular view, using a simple bar magnet:



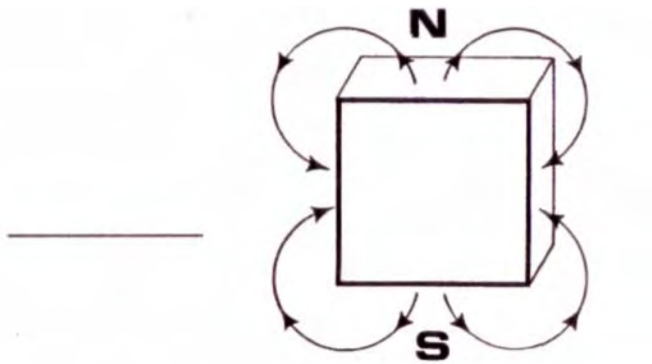
The over simplification of magnetic field, showing its movement from the north pole of the magnet to the south pole.

Today, however, it is quite evident that filings do not show magnetic fields as they are, but that they show what little pieces of magnets do in magnetic fields. The two are about as much alike as a Venetian blind and a blind Venetian.

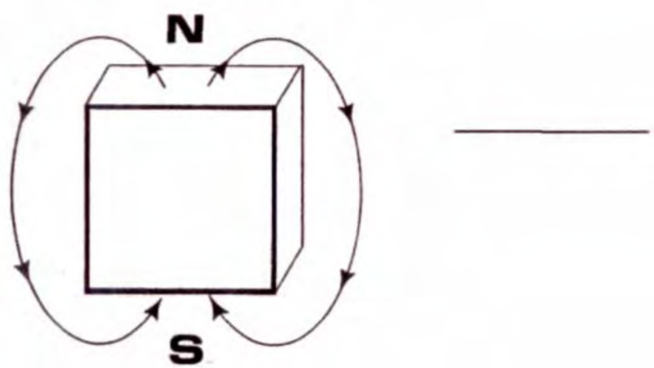
The pieces of iron become little magnets that attract to each other, and are not free moving particles in the magnetic field, and cannot act as a dye to show where the fields are and what they look like.

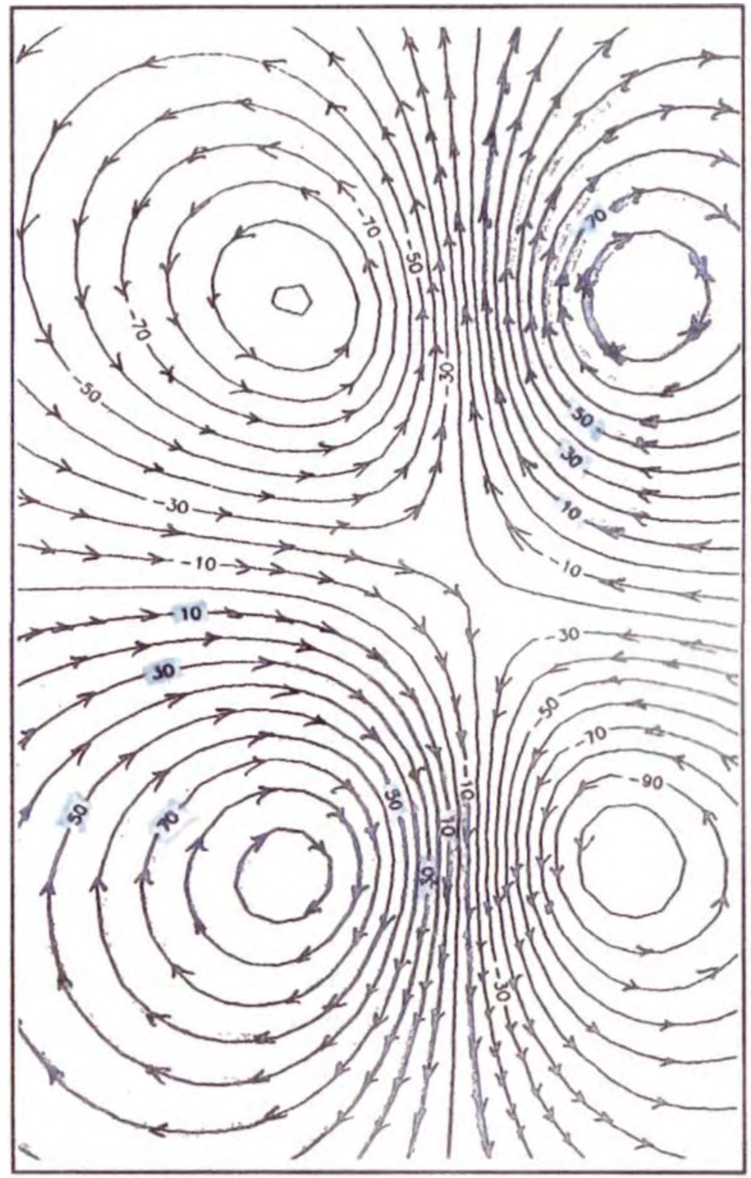
These lines of force, that is, the magnetic fields, are much more complex than most minds would ever conceive. The concept that is about to be introduced here has been verified through much research, and will be demonstrated by experiments throughout the book.

This is what the direction of the lines of force really looks like, demonstrated with a cubical magnet having the top face for the north pole and the bottom face for the south pole:



As opposed to this:





This actual graphic mapping of a magnet shows its lines of force by measuring the intensity of the magnetic field every 1/16" at each point on a grid, covering the entire magnet, as well as some of the field in the area around the magnet. (Sec page # 29 for description of method.) This measurement of the strength of the magnetic field is rated in gauss.

Upon careful examination of the illustration on page 3, you will notice that the lines of force leaving either pole are going in opposite directions.

For this to be possible, you must have two completely different lines of force which distinguish the north pole from the south pole, the difference being the direction of the lines of force. This brings us to the theory in which this work is based:

The lines of force of which a magnetic field consists are the track of a particle.

But, reason tells us, that if the illustration be true, and the lines of force are the track of a particle, then since there arc two lines of force, then there must be two different particles.

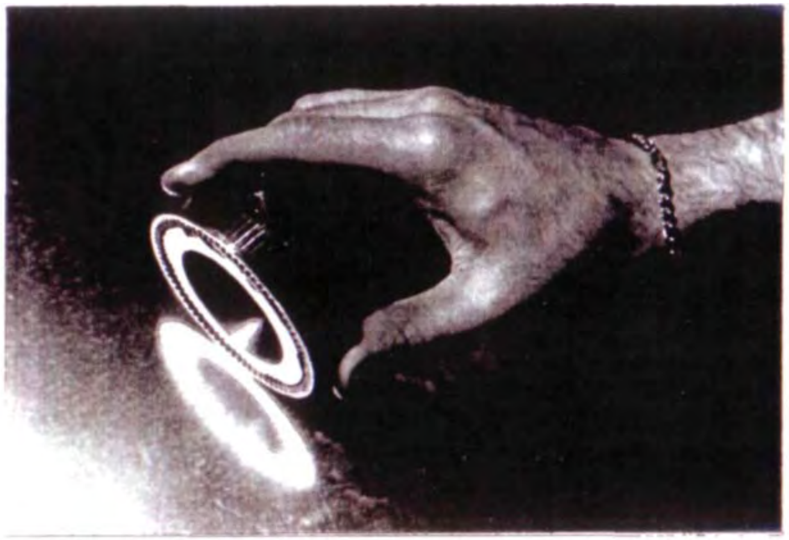
The knowledge of the existence of two particles came about by the design of a generator. As a result of DC. current being sent in one direction through a magnetizer around the rotor to be magnetized, alternating north/south poles are laid down. In illustrations:

The magnetizer, designed by George Eyerly, is assembled.

MAGNETIZING
A 92 POLE PERMANENT
MAGNET GENERATOR ROTOR

92 alternating north/south poles appear on the rotor. It is now ready to generate.

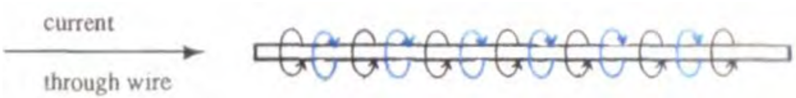
The preceding process uses the two particle principle, laying down lines going in opposite directions around a current carrying wire.

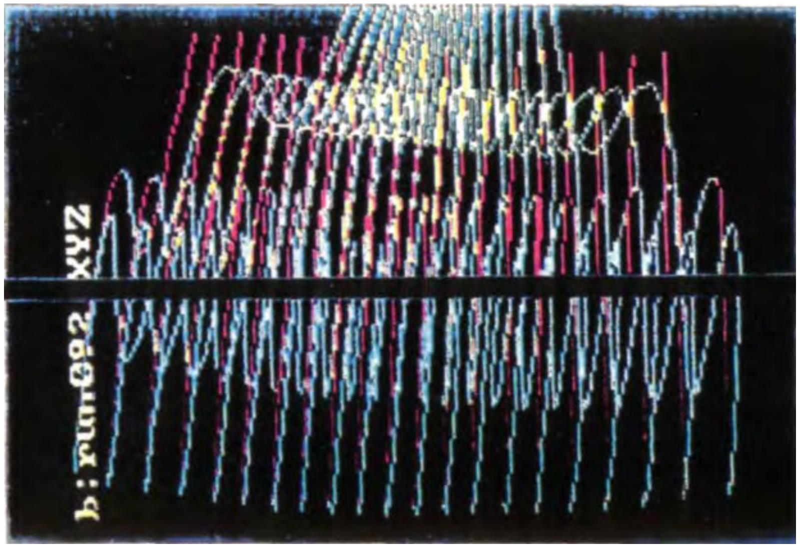


The rotor is put inside and a single wrap of conductor is placed around it.

A magnetizing current is released through the copper and . . .

This is made possible in keeping with the principle that, around the wire conducting current, these two opposing particles orbit in opposite directions. Illustration:





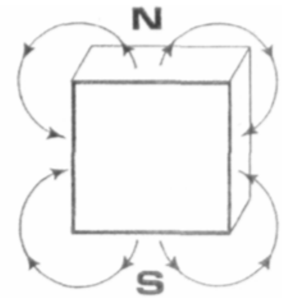
Computer color illustration.

In the permanent magnet, we have the same two spins in opposite directions. We do not know what makes them behave that way, but we do believe the record of our excellent monitoring and recording equipment.

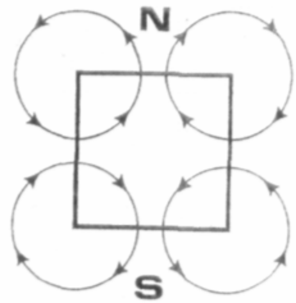
Lines of Force are Spins forming Vortices

One of the most most amazingly illustrative and thoroughly innovative concepts in the area of magnetic field structure has been the discovery of vortices caused by the path of the particles which make up the lines of force. Notice the previously used illustration:

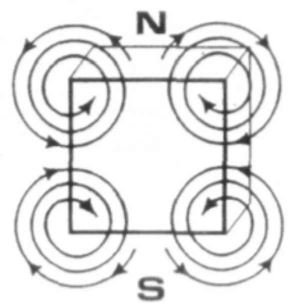
Increased detail:



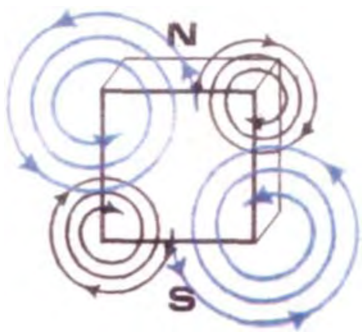
This gives us four complete spins, one in each corner.



More details:



THE DOUBLE VORTEX
WITH THE SPINS ALONGSIDE



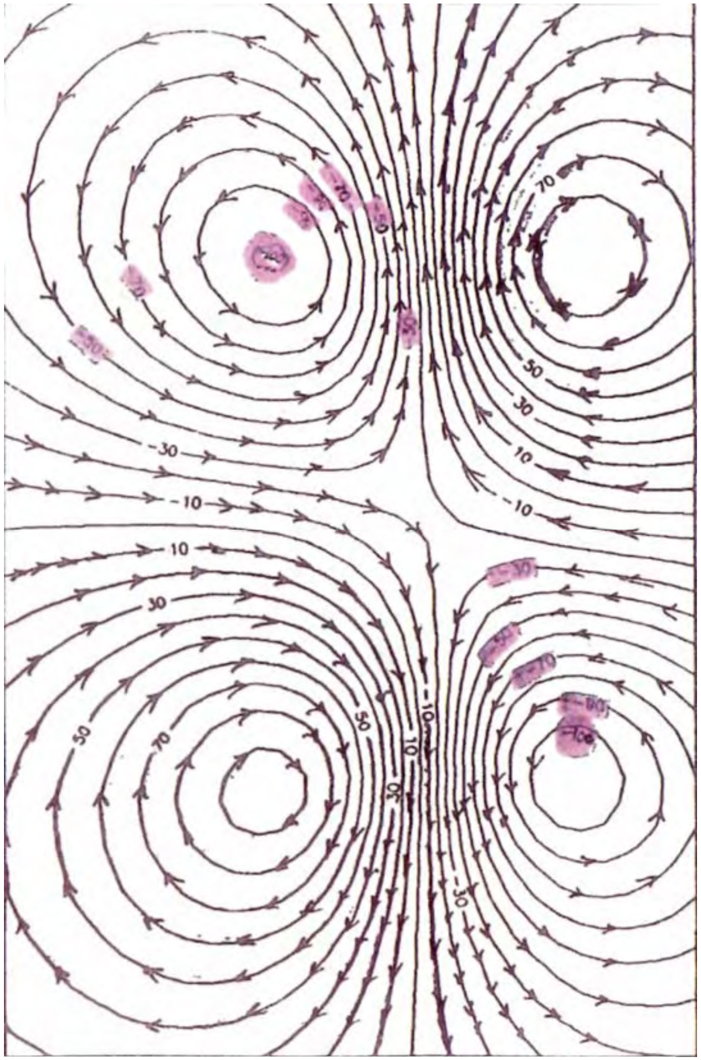
Here is the picture which recorded the discovery of the Double-Vortex

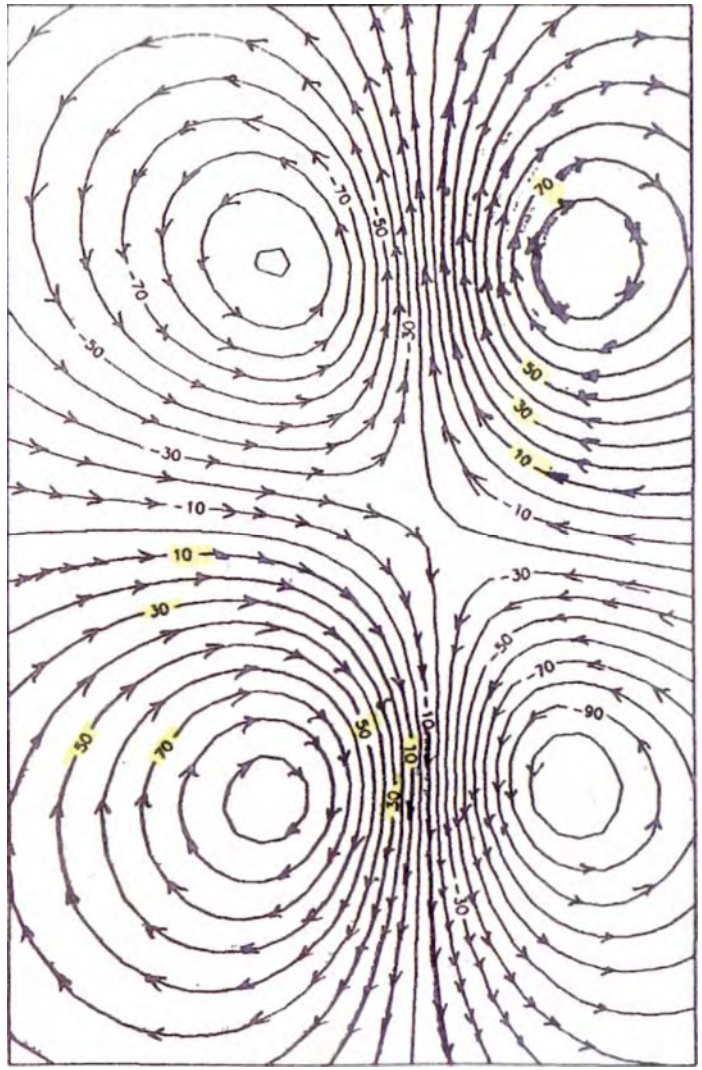
Noticing the last illustration, it is evident that the "whirlwind" or "tornado" effect is present and that there are two vortices present at each "pole".

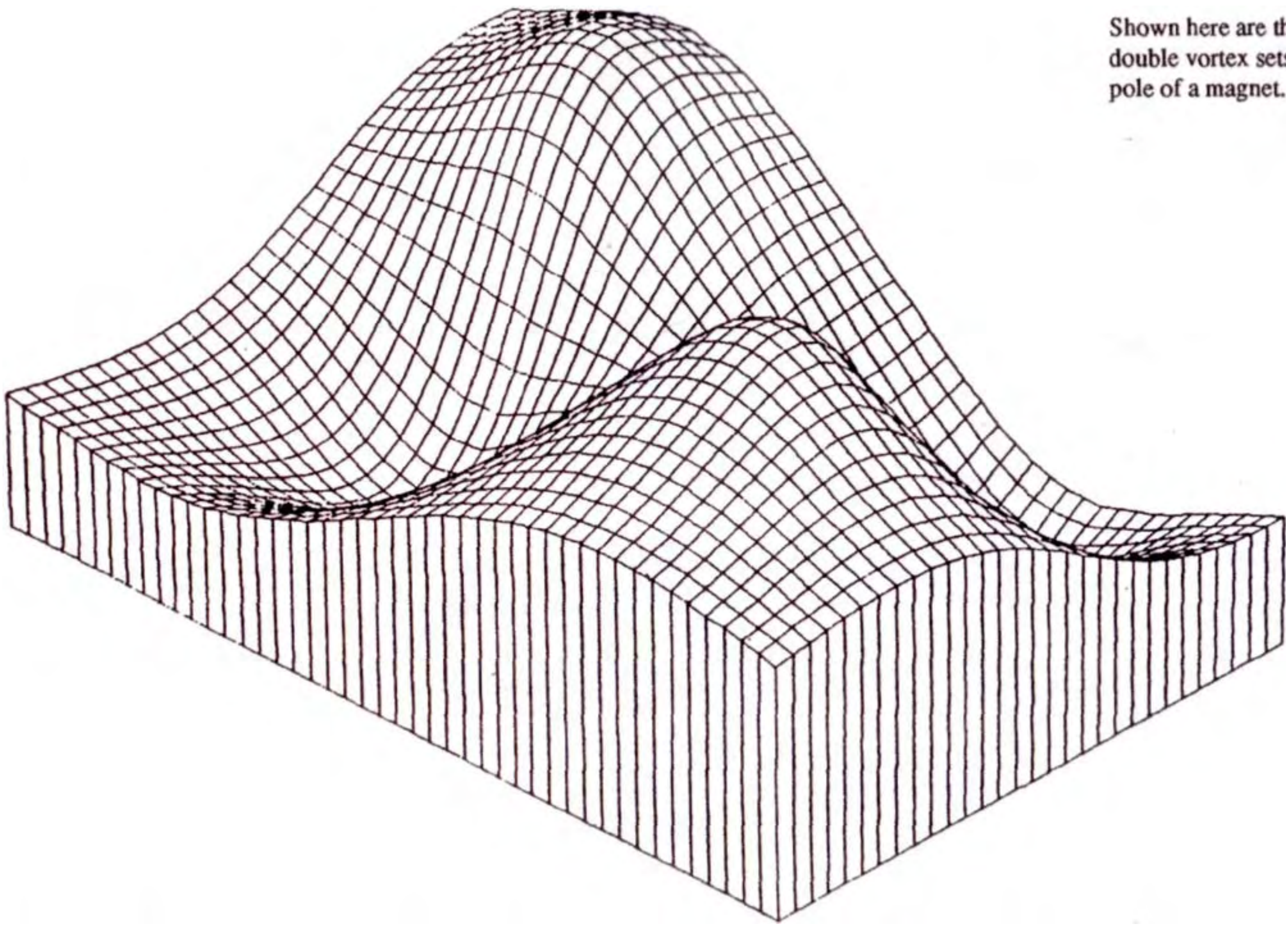
An interesting and important piece of information, though, is that these vortices are not all the same, as is shown in previous illustration for clarity. Notice the distribution of the spins:

The Double-Vortex is highly significant in many ways, but the point to be reckoned with here is that both particles exist at both poles. Therefore, there is an element of both the "north" and the "south" in each pole. The north element (vortex) is dominant, and has proven to be the stronger vortex with higher gauss ratings.

Since the stronger north element (vortex) exists in both poles, you are sure to ask what the deciding factor is that distinguishes the north pole from the south pole. The same illustration just used shows that the north pole is the one with the weakest south element (vortex). This means the other pole must be south.

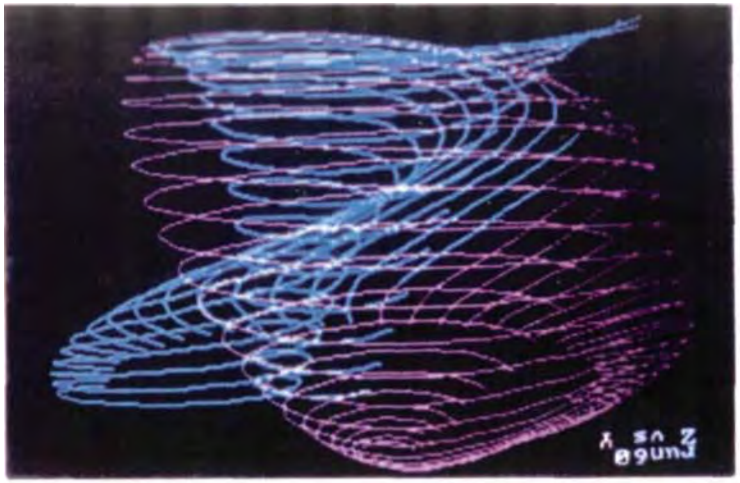




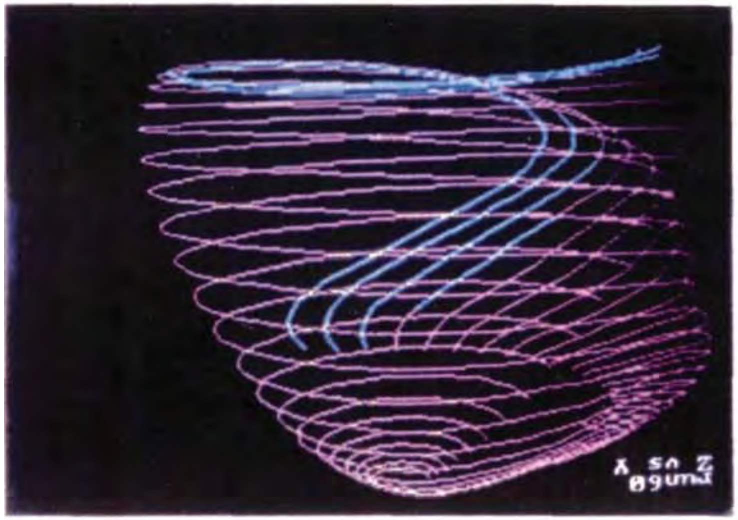


Shown here are the double vortex sets at each pole of a magnet.

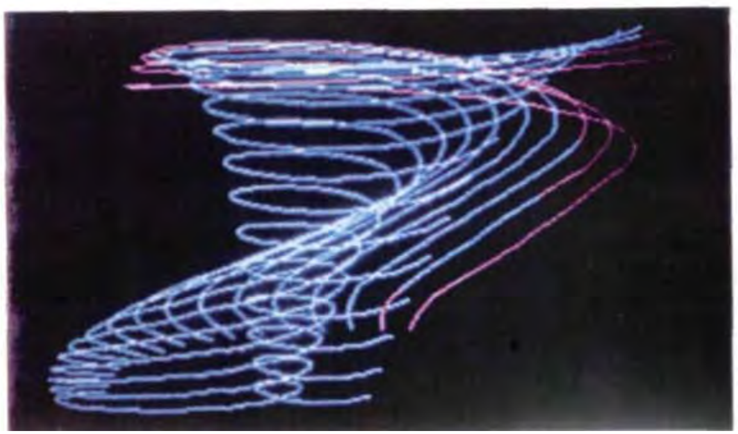
This is a topographical map of the fields at the end of a square ceramic bar magnet magnitized through its thickness.



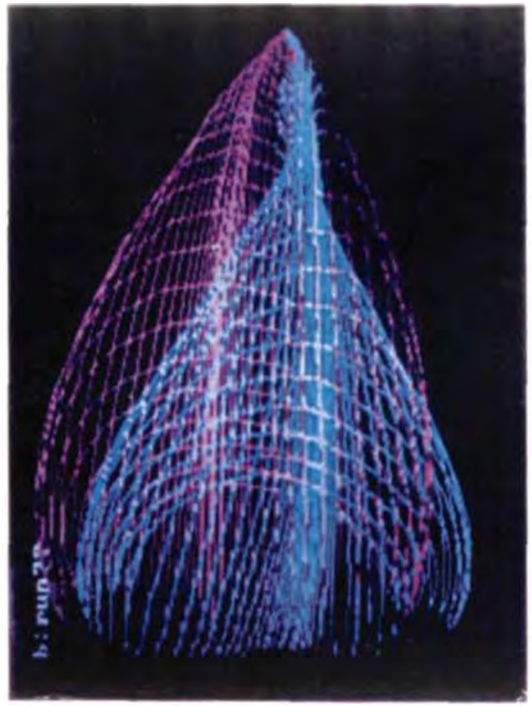
The Double Vortex:



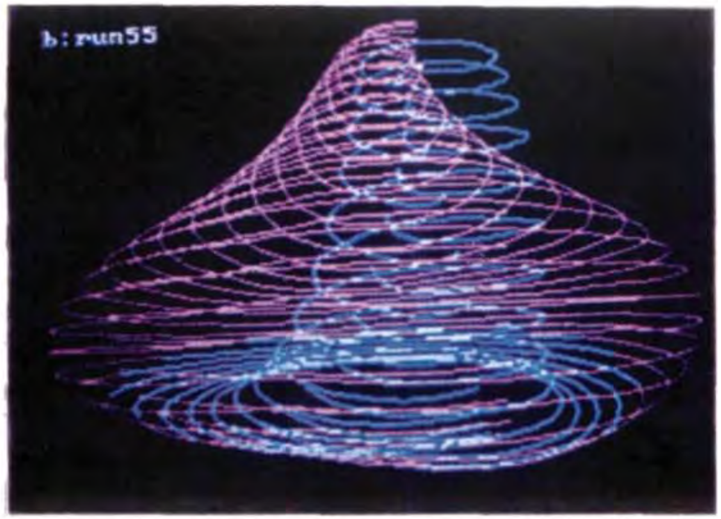
This vortex is the north element.



This vortex is the south element.



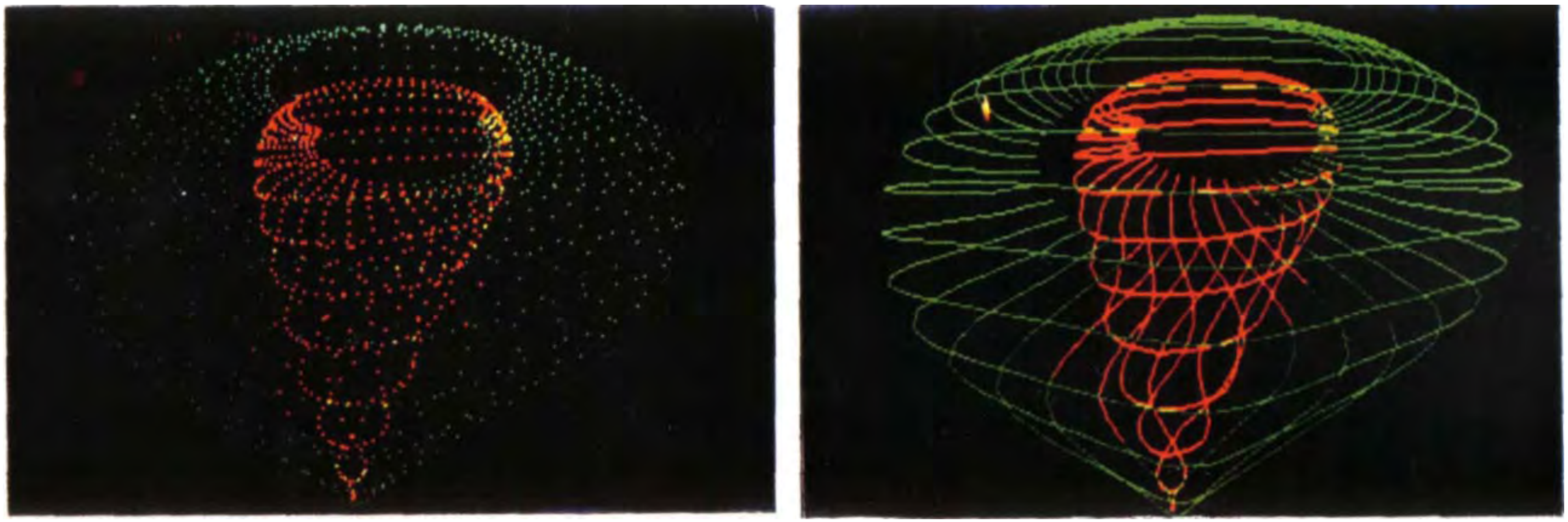
The Double Vortex of a different magnet mapped at a slightly different angle.



Slightly different materials result in different formations of the fields.

When dealing with Double Vortices, different arrangements of magnets can be used to manipulate the form in which a Double Vortex shows up.

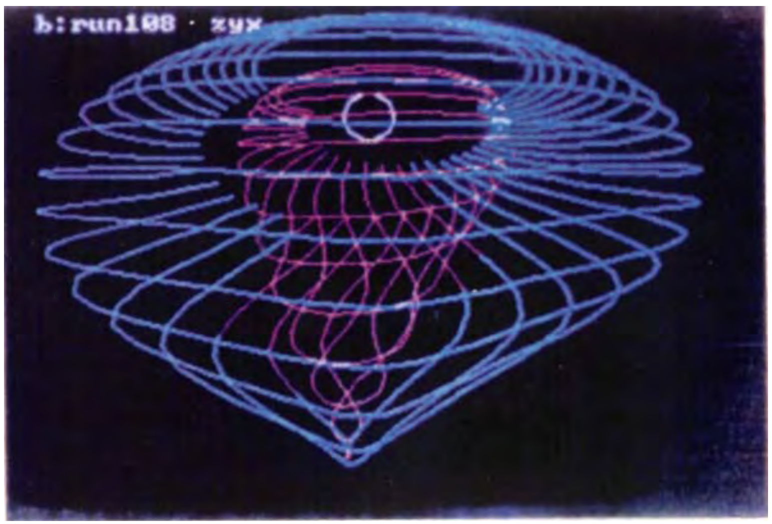
In a different experiment, in which layers of different kinds of magnets are used, the manipulation of the strengths of the different layers produced the formation of a vortex within a vortex. Notice illustrations and descriptions:



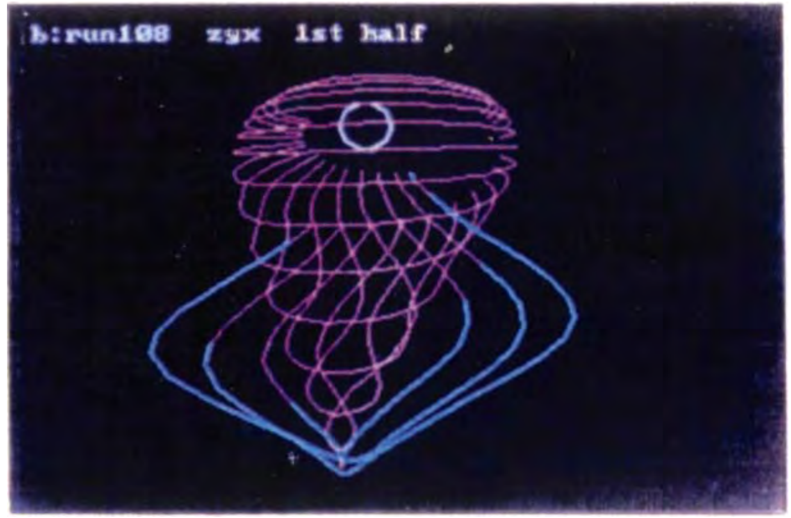
The 3-D mapping showing the tracks of the particles in a particular "vortex in a vortex"

The following three pictures show the vortex in a vortex (a), the "south" vortex (b), and the "north" vortex (c).

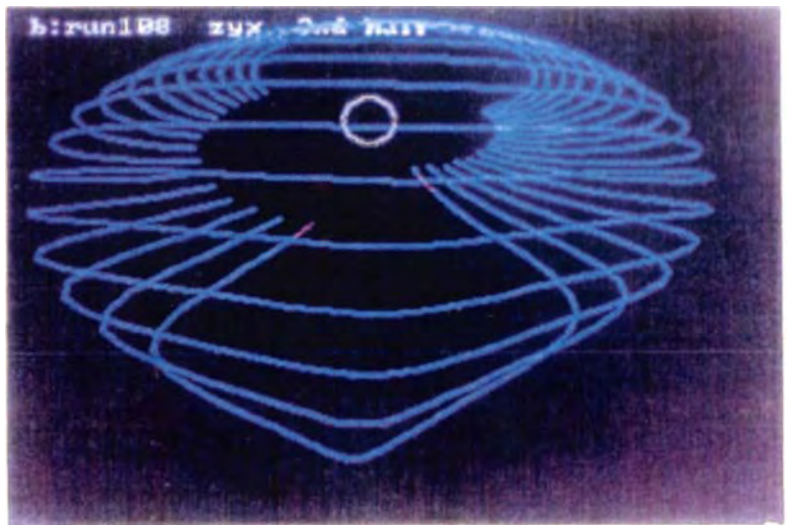
(a)

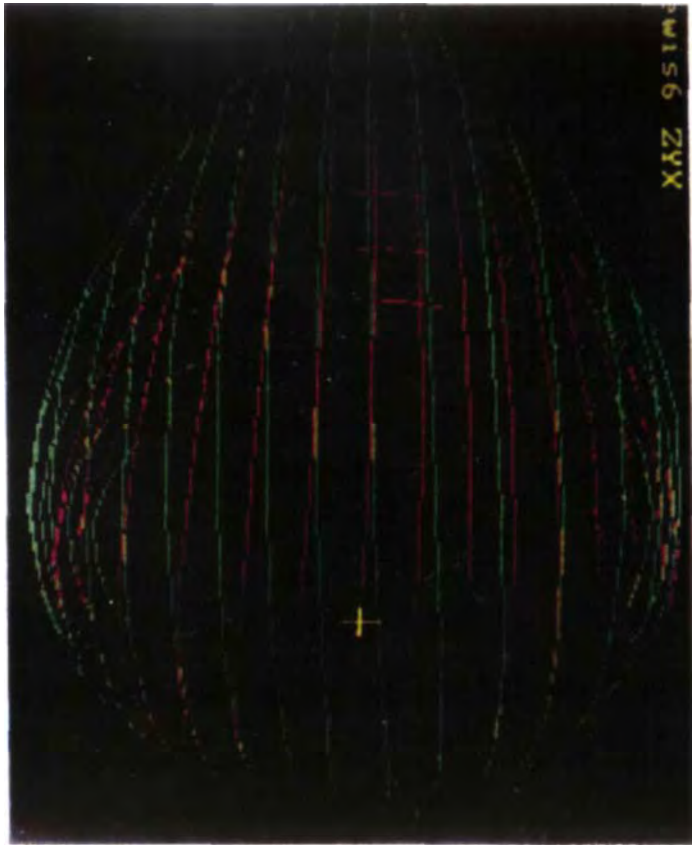


(b)



(c)

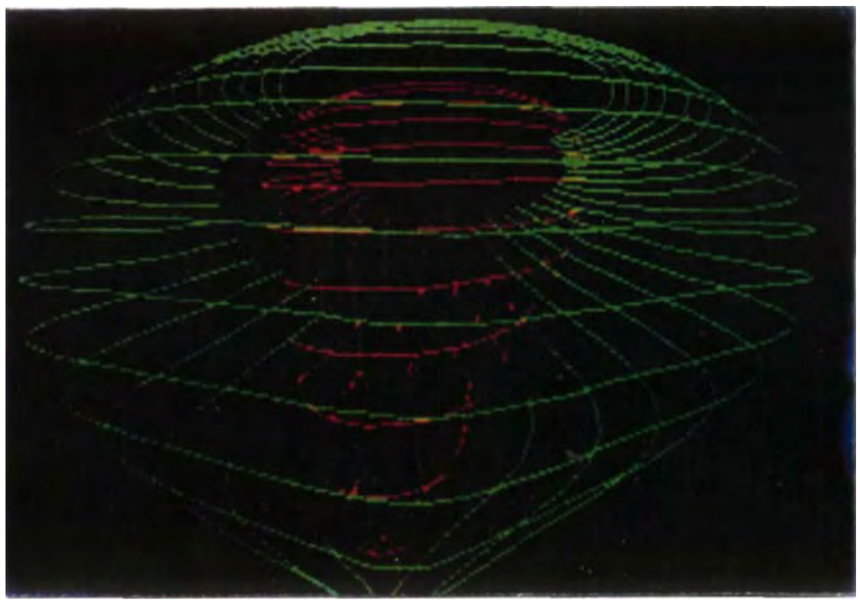




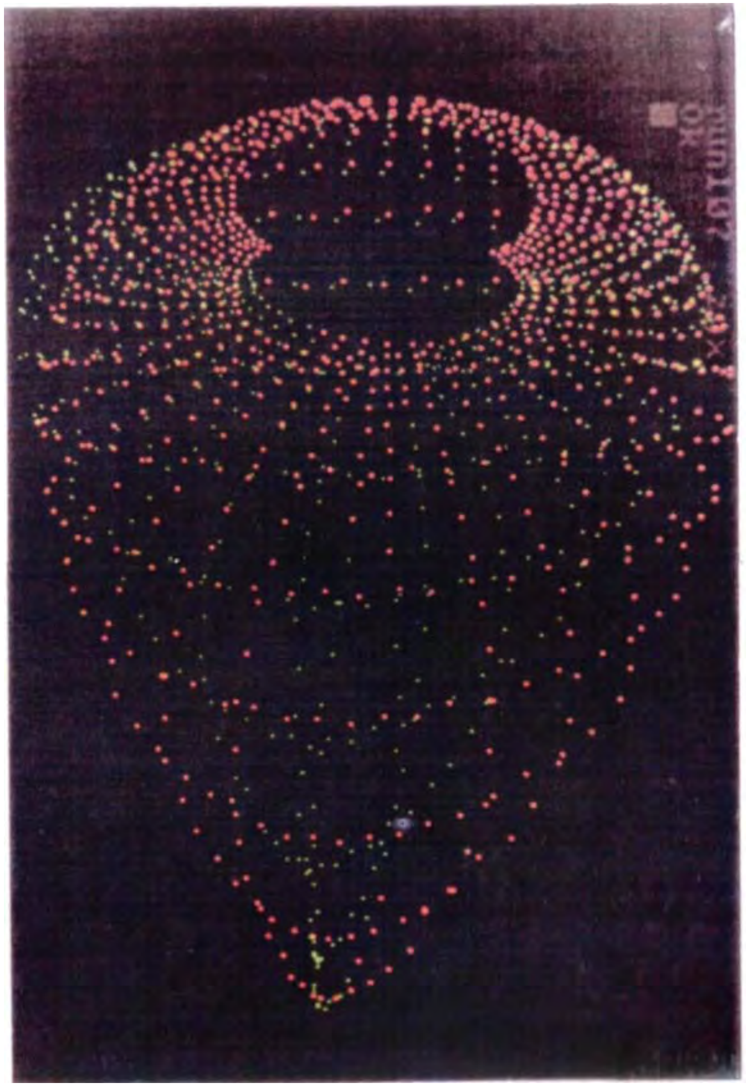
Notice the 3-D effect that the mapping produces.

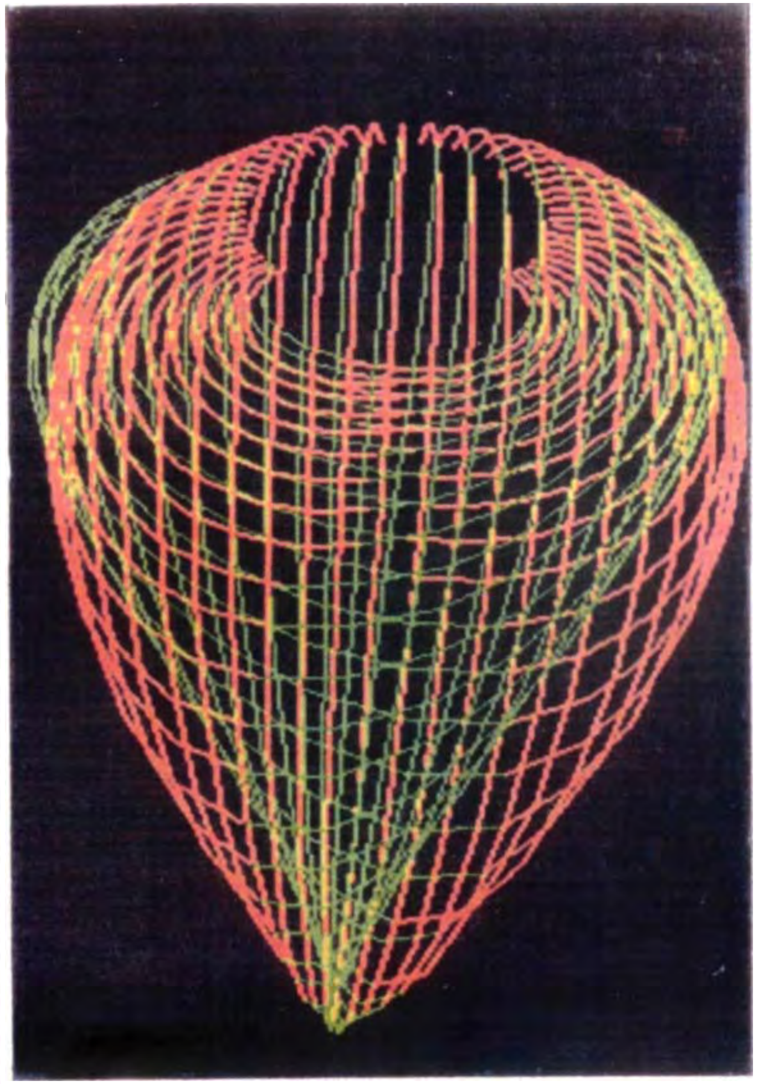
The vortex within another vortex is formed by the combination of three different magnets. The fields shown exist immediately above them when they arc layered like a sandwich and standing on edge. This magnetic sandwich is composed of a ceramic magnet, neodymium magnets, and magnetic rubber or vinyl (similar to that on the door of your refrigerator).

The computer is also used to register the percentages of the two particles that make up the two vortices. (See "Mapping of Magnetic Fields" on page 29.) These percentages are important in determining the momentum of the magnetic field. These two populations are distinguishable in the recording process because the different particles are going in opposite directions.



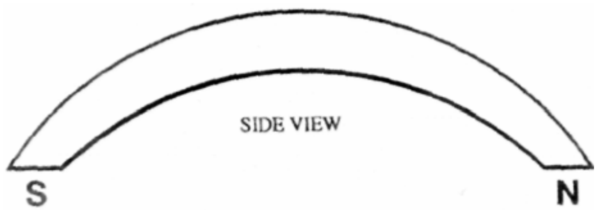
The Double Vortex in a different magnet has a different form, as is shown here.



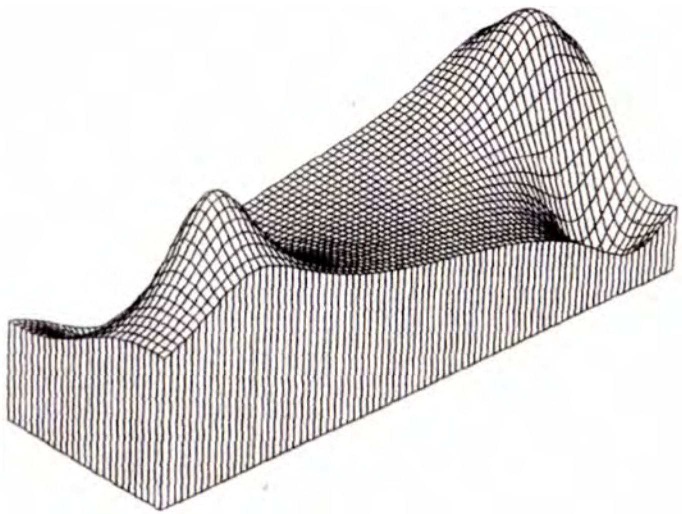


The following is a theory that may help to explain the various conditions of the Double Vortices:

Since the Double Vortices can be arranged so that they are in different relationships to each other (i.e., alongside or within each other) their relationship to each other determines, or may determine the momentum of the field.



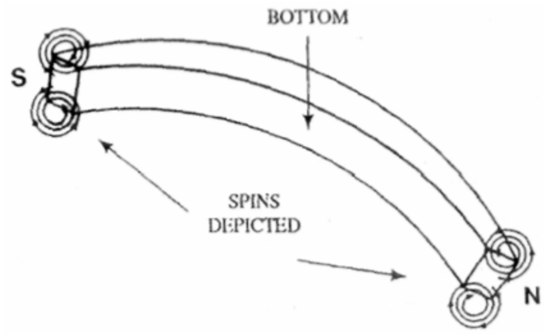
Here is a graphic computer printout of the plotting picturing the above.

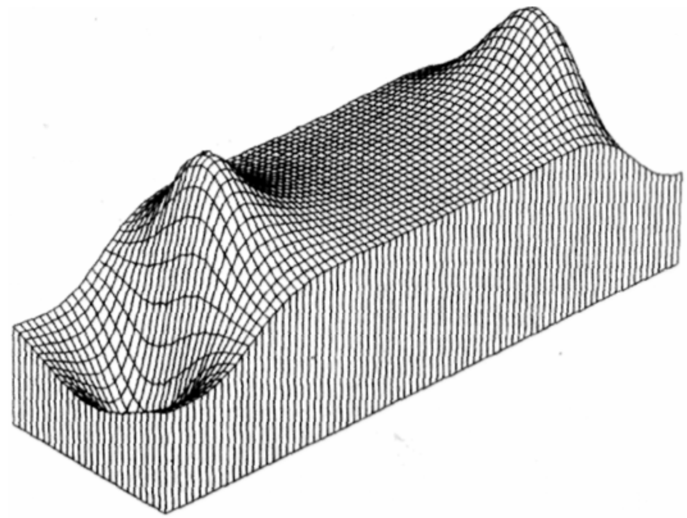


The different axes show the Double Vortices at either pole.

Case in point: Maybe the vortex in a vortex demonstrates the apex of unity and concentration of the field, giving a single pole the most direct thrust possible.

A magnet that clearly depicts the two vortices at each pole is the "banana" shaped curved magnet. The magnet:





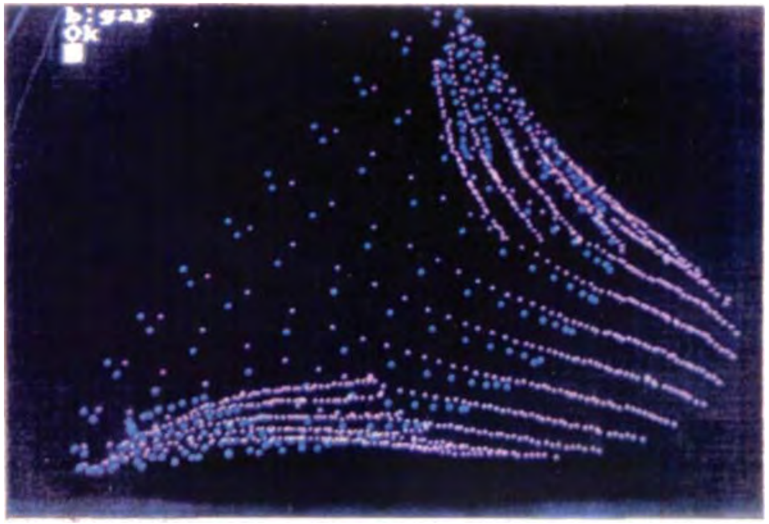
ATTRACTION AND REPULSION

To this point, the discussions and descriptions have dealt with single magnets, or single magnet arrangements and their fields. Now, we will present interactions between magnets, and show what really happens in attraction and repulsion.

Taking a ceramic magnet magnetized through the thickness we mount a curved metallic magnet over it and monitor the reacting fields in a one-half inch air gap. Study it carefully - the result may not be what you were expecting. Notice first what happens in attraction;

We are all familiar with the pull of one magnet toward another. But, the mechanism is not visible, even if we use iron filings. What wc need to see is the activity of atomic particles that constitute the magnetic fields.

Our mapping operation shows these particles pairing off as the unlike fields merge. Examine the illustration:

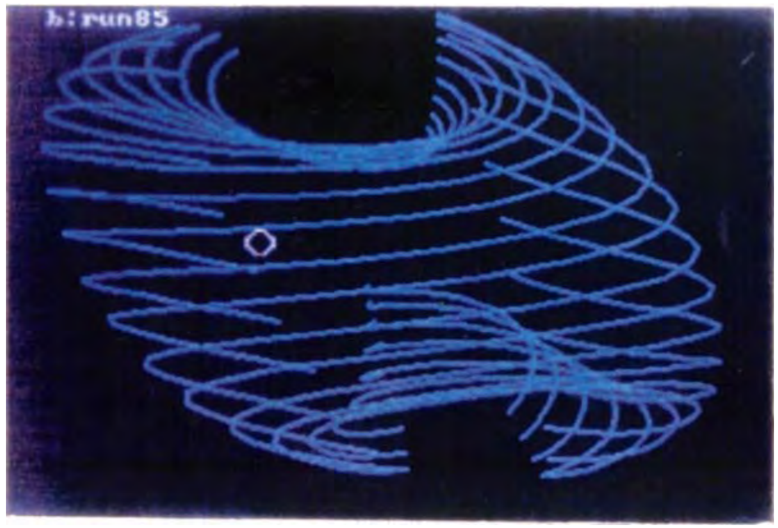


Then, our topographical program snows that the gauss count (the strength of the lines of force) at the attracting end has been reduced, because the pairing of a large part of the particle populations.

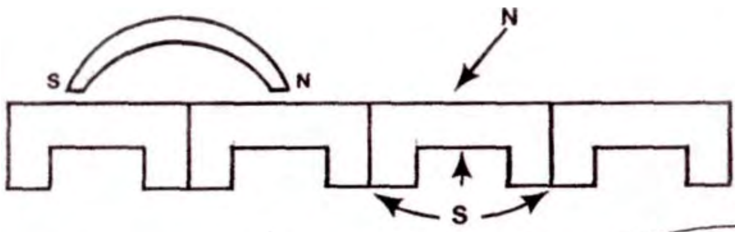
The repulsion of like poles represents particle activity which is quite different from attraction.

The particles react with each other as they form two vortices that spin in the same direction. There is no reduction in the gauss count, which registers about three times as high as it does at the attracting end.

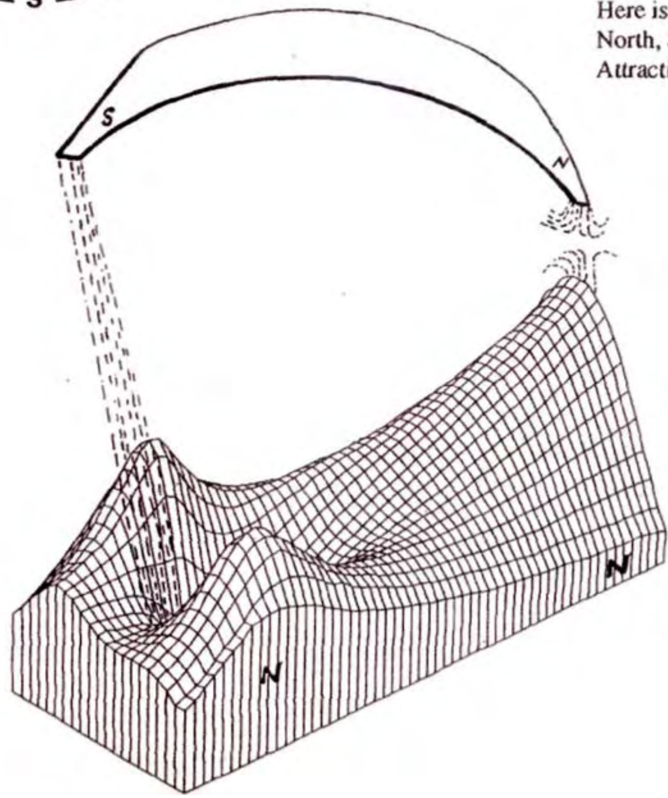
Illustration:



The magnets used in the previous two illustrations, and the one that will follow, appear like this:



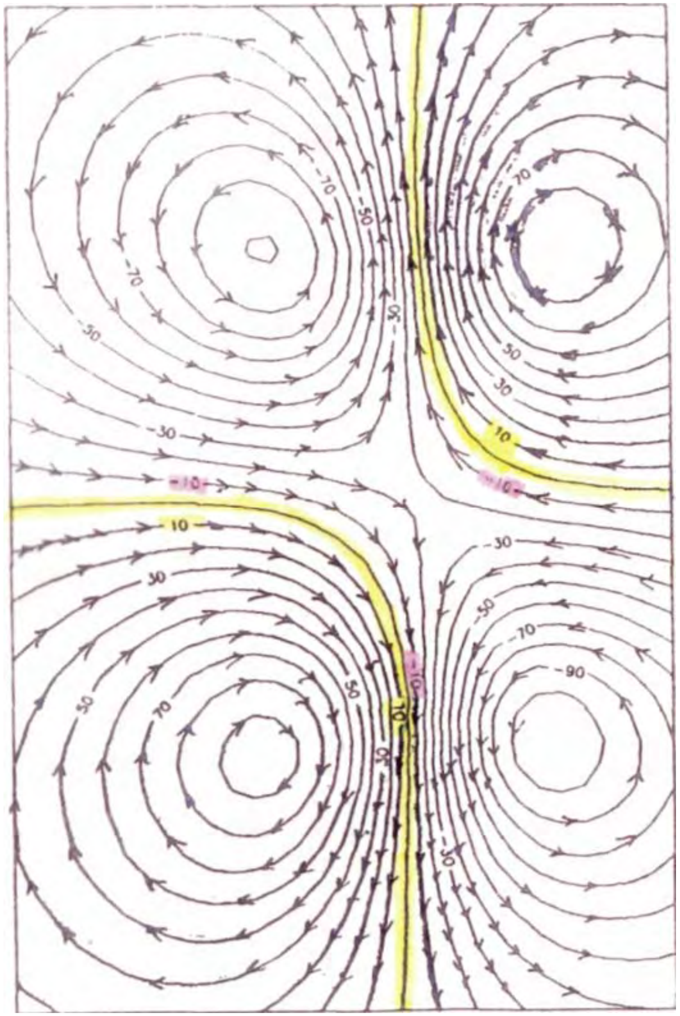
Here is a computer printout:
North, South Pole Differences
Attraction (L) Repulsion (R)



Notice how that (in the previous illustration) the south pole of the curved magnet bores a hole in the field below it. This beautifully illustrates the principles just started on attraction. Also, notice the repulsion, as it does not diminish the strength of the magnet mapped.

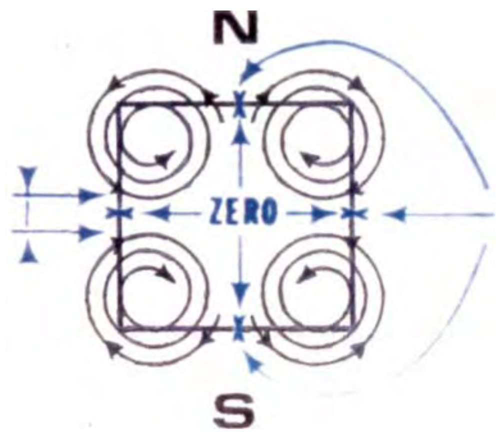
ATTRACTION and REPULSION of VORTICES WITHIN A MAGNET

This is a very unique area of interest. Notice the following topographical printout:



II you look carefully, you will seec that the vortices are separated by zerolines or dead space. The reason is the direction that the vortices spin. Illustration:

Lines of force going in the same direction REPEL



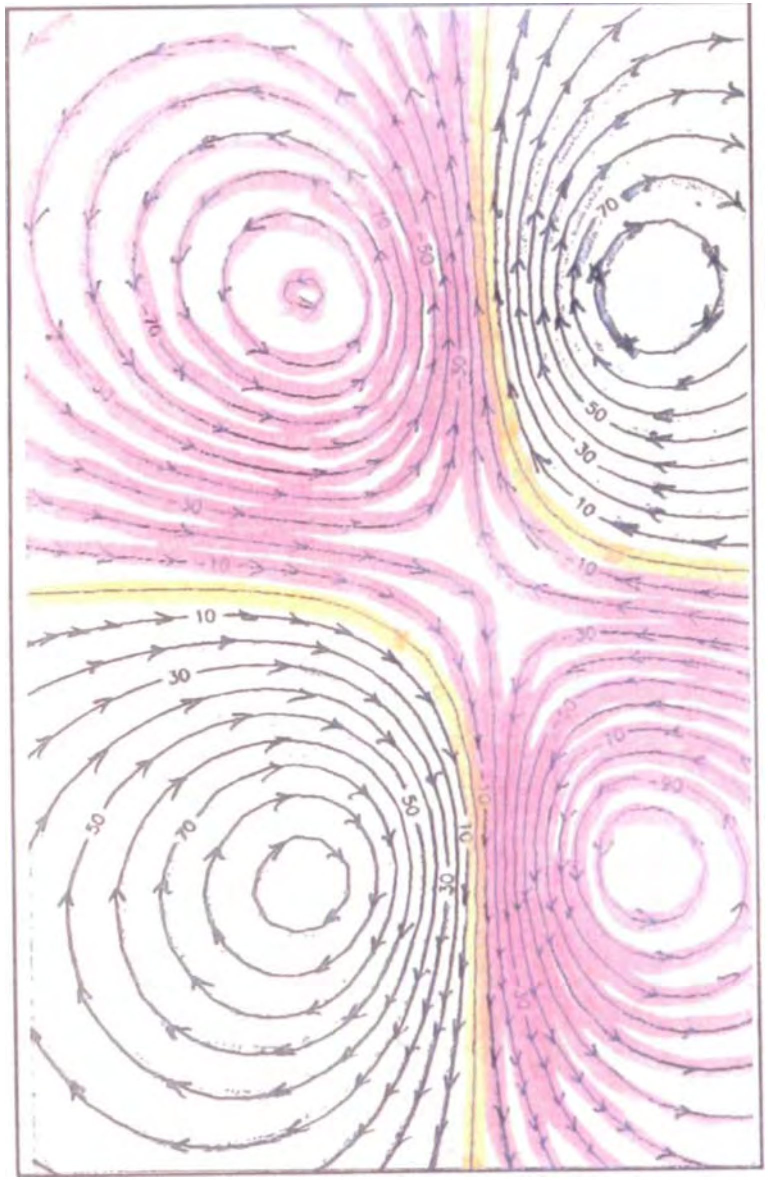
The vortices repulsion of each other causes spaces void of lines of force

Each vortex repels those next to it. Why? Magnetic lines of force going in the same direction repel. Notice that as the lines leave the poles, they are going the same direction, and therefore repel. And also, as they enter the sides, they enter going the same direction and repel each other. This leaves you a fine line in between vortices on the center of the magnet with no lines of force.

Another thing that is very interesting, though, is the fact that vortex spins in opposite corners (in the case of the stronger north element) attract each other. They can form a bond of continuous spins from corner to corner.

Notice the following illustration:

The evident bond of continuous spins from corner to comer that shows the linkage of the two north elements.



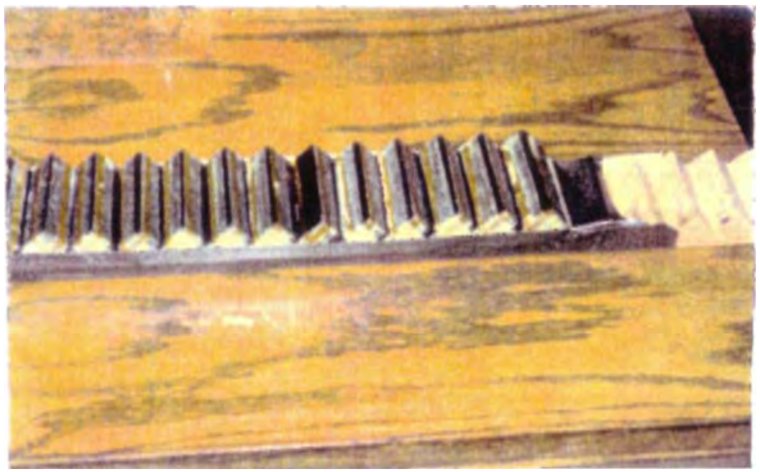
CORNER SPINS

Using the spins (vortex) of an individual corner of a magnet.

We now begin to discuss the arrangements of magnets designed for the purpose of doing work. The work is achieved by interactions between magnetic structures that cause one to drive the other.

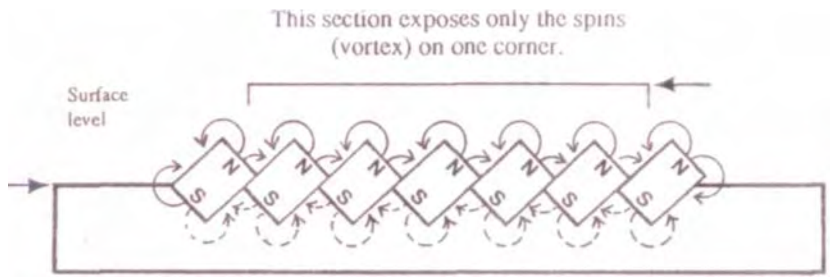
The following structure uses a series of magnets with only one comer exposed so that the spins (vortex) of that corner only are (is) used to interact with the spins of a curved magnet, which is to be driven. Illustration:

Actual photographs:



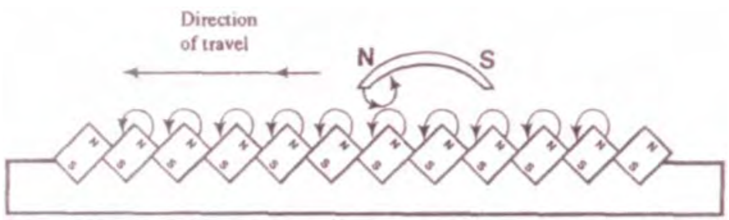
This picture shows the magnets in discussion in the foreground, and the mapping device in the background. (The 3-axis probe can be seen extended into the mapping area.)

HERE IS A LARGER DEPICTION, SHOWING SPIN DETAIL.

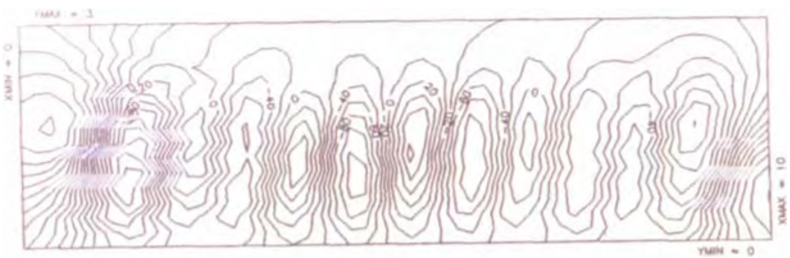


Notice that, within the structure, the only spin (or vortex) that is exposed, and affects anything above the magnets, is the one at the uppermost corner, the other north pole vortex is "shorted out", and the south pole vortices are below the structure.

Therefore, with this structure, and a curved magnet placed above it —



JAWS1 TRACK — RUN149 x axis

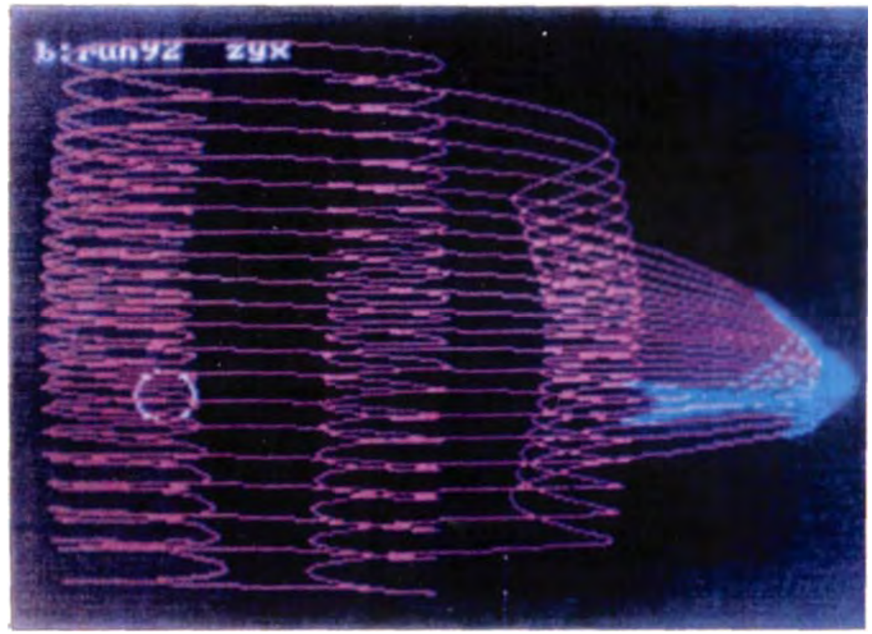


JAWS1 TRACK — RUN149 z axis

... the interacting spins, going in opposite directions, drive the curved magnet forward. This arrangement of the magnets greatly enhances the driving movement normally due to the right pulsing caused by simultaneous repulsion and attraction.

The pictures made by computer mapping show us that these comer spins tie knots in the lines of force, or make loops.

Here is how these spins register in this formation:



This is just one of the many ways that the magnetic field can be appropriated and used.

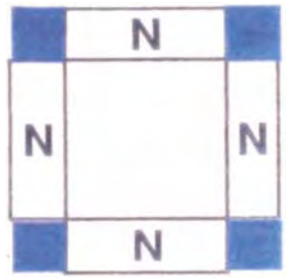
THE MAGNETIC GATE

One of the most radical new concepts due to the knowledge of the four spins (vortices) is the magnetic gate. (This is also an application designed for the use of doing work.)

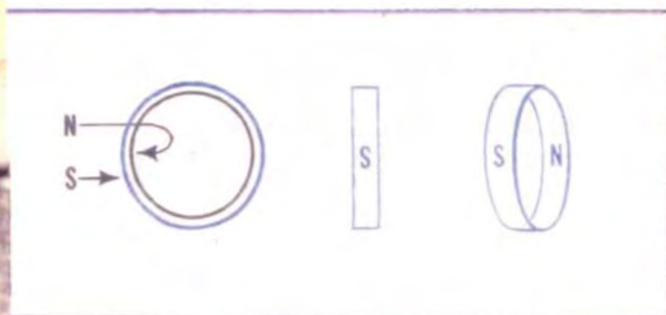
To anyone with a knowledge of physics, the thing about a "gate" that is fully radical is the fact that, in this case, a north magnetic field attracts a north pole. It will reject an approaching south pole.

This result, not anticipated by the physics books, shows how the spins in a magnet and the fields outside can be controlled. In this case, one set of spins and its field is shorted out and the other set takes over. The second set is going in a direction that will provide attraction despite the fact that the compass will register it as an opposing field.

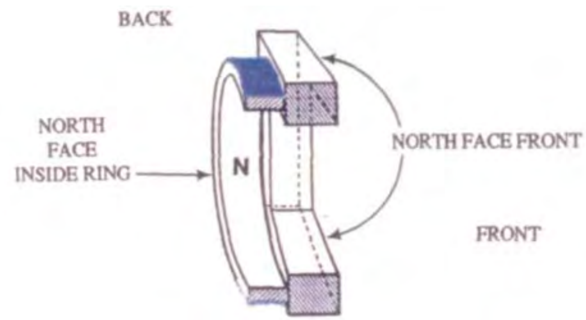
The gate is a complex arrangement of magnets. Its face is a square of four ceramic magnets magnetized through the thickness, with the north pole being the face for the whole square.



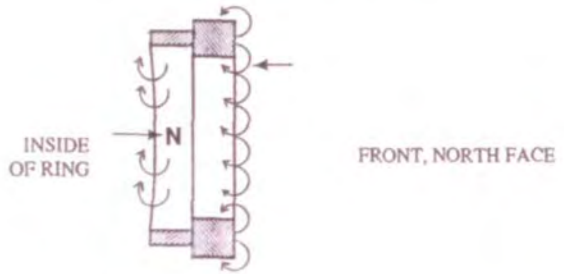
The back side of the gate is a ring of rubber magnet with the north pole on the inside face. This ring attracts to the back of the square. Illustration:



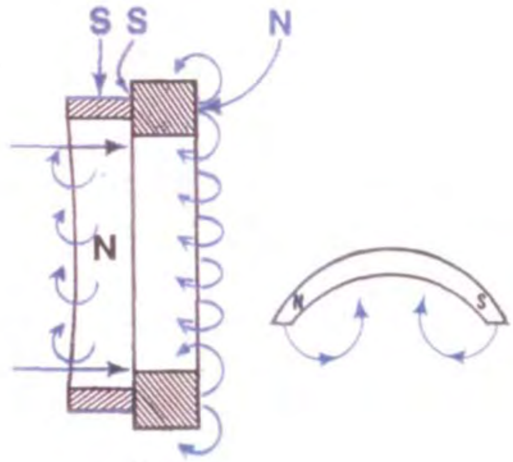
Here is a cross-section of the gate:



Another cross-section, to show the spins"



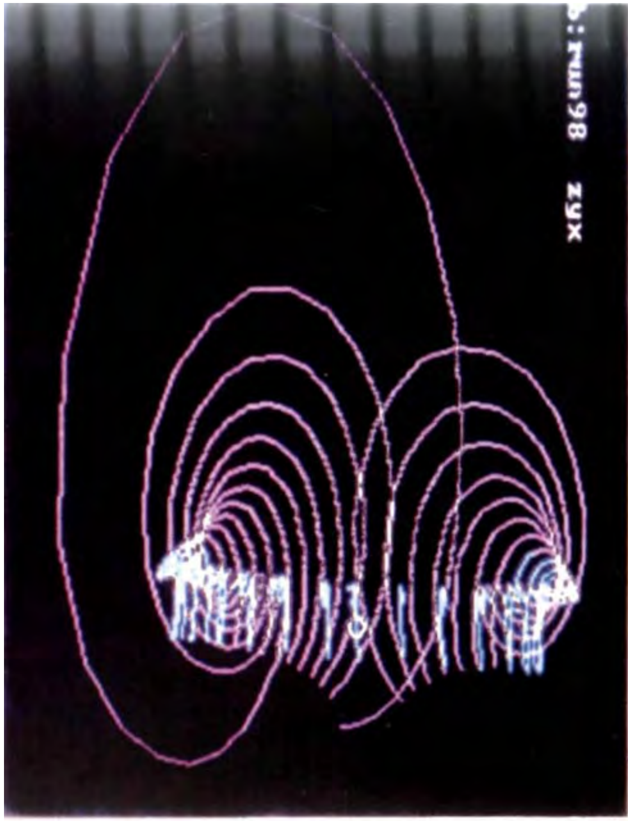
Only the front spins operate on the square; the spins on the back of the square, and the front of the ring, are shorted out.

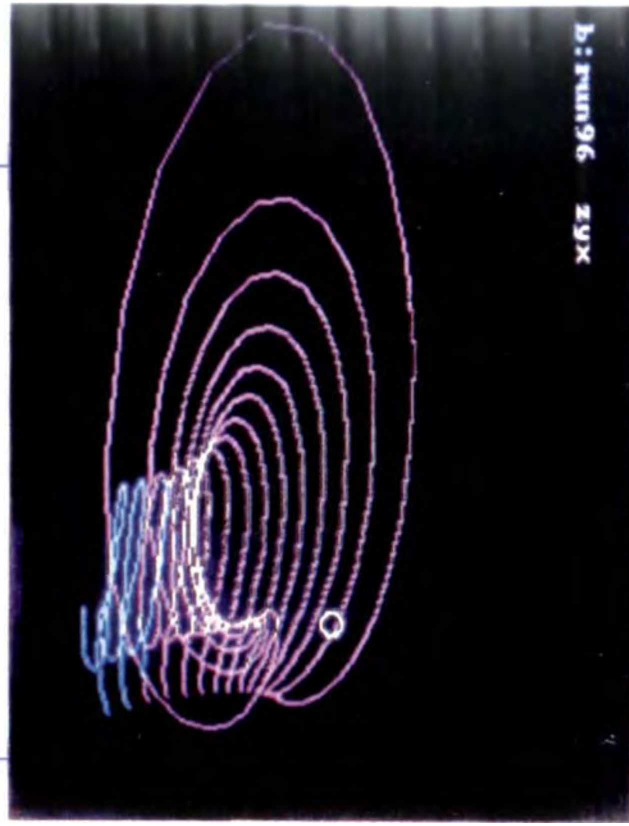


The south spin on the back of the square goes directly into the north face inside the ring behind.

The other spin of the ring's north inside is shorted out into the south back of the square.

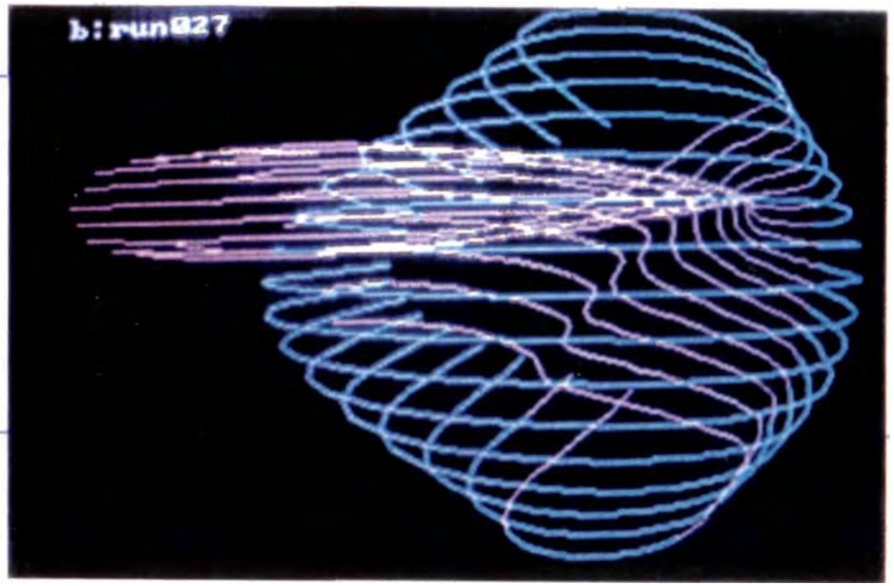
Since there are no back spins going the same direction as the leading north spin of the curved magnet, there is no repulsion. Because the spins of the gate are in the **opposite** direction of the lead north spin, there is **ATTRACTION of two north poles**, and therefore, the spins drive the curved magnet through the gate.





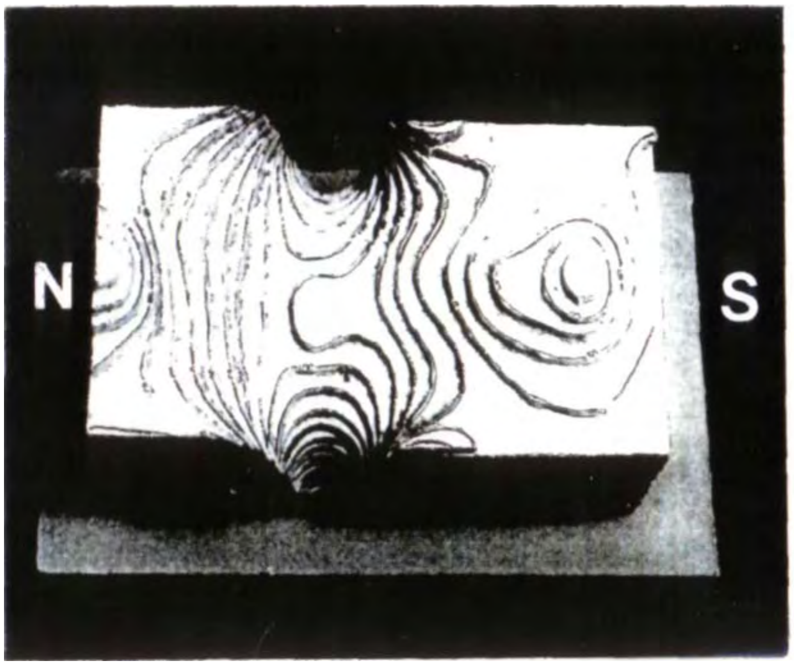
The computer beautifully pictures the spins in the sides of the gate that propel the curved metallic magnet through:

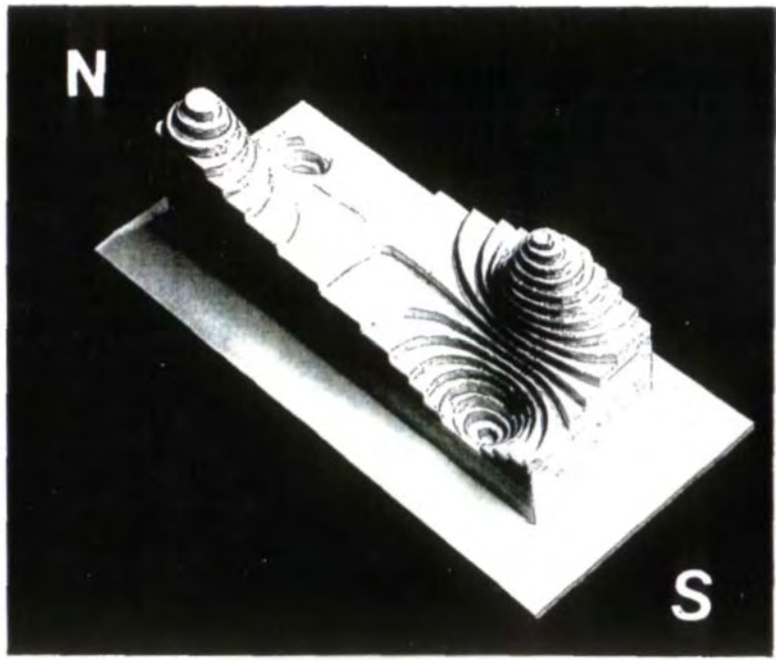
This picture is the interaction of the curved metallic magnet as it enters into the gate:

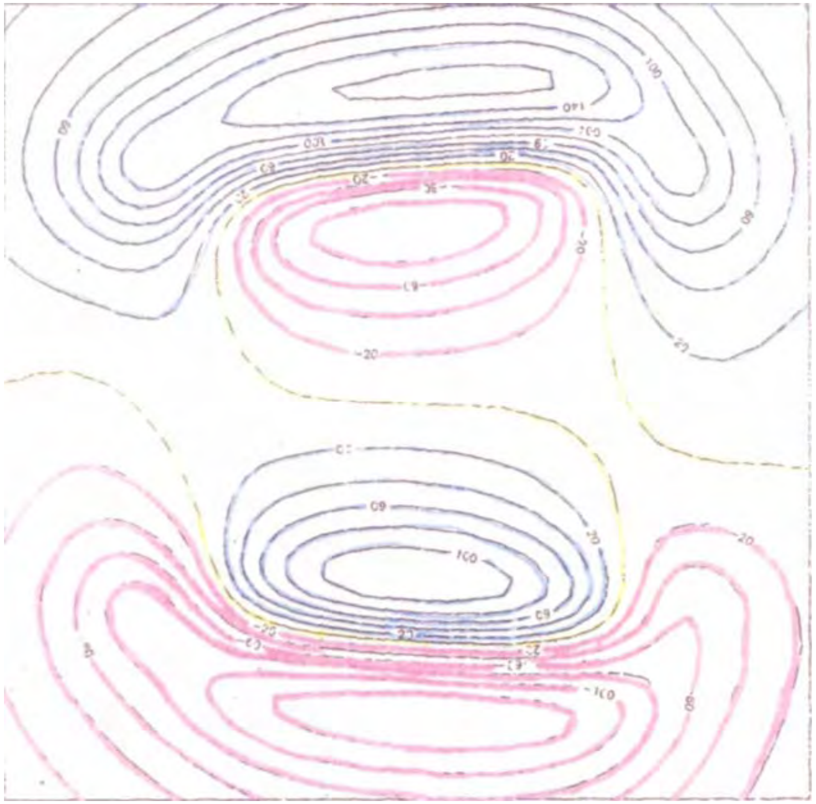


MORE ABOUT THE MAGNETIC GATE

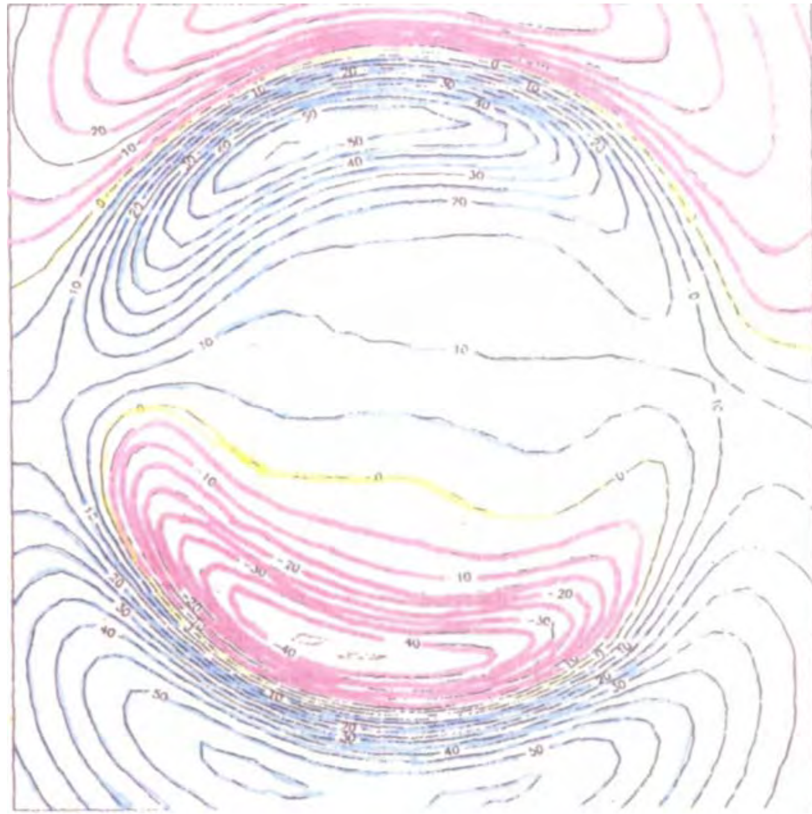
This is a picture of a topographical model of the magnetic gate. The vortices on the sides, which enable the north magnet field to attract another north pole, arc the result of shorting out one set of spins in order to use the other set. The second set is going in a direction that will provide attraction despite the fact that the compass will register it as an opposing field. (Note: The gate's north magnetic field will reject an approaching south pole.)







FRONT GATE FACE (north)



REAR GATE FACE (south)

MAKING USE of the TIME-ASYMMETRIC QUALITIES of PERMANENT MAGNETS

The following excerpts are from a paper by H. Zocher and C. Torok which concerns research done by these two men. The location where this work look place was Laboratorio da Producao Mineral, Ministerio da Agricultura, Rio de Janeiro, Brasil. E. P. Wigner communicated this Brazilian work to the Proceedings of the national Academy of Science on April 15, 1953.[1]

According to Zocher and Torok, the circularity of conductivity is a time-asymmetric property. Processes of conduction are not only lime-asymmetric, they are irreversible. One direction of time corresponds to the probable course, the other is improbable according to the second law of thermodynamics. Potential differences are time-symmetric. The circular asymmetry consists in the difference of resistance against the clockwise and counterclock-wise currents, being probable or not. These currents are naturally time-asymmetric. Hence, a crystal structure, which is time-symmetric, cannot cause acircularly asymmetric conductivity. Such a property can be found only in a system with time-asymmetric circularity, with a mechanical or electrical rotation, with Coriolis forces or magnetic fields. The Hall effect corresponds indeed to circular electric conductivity, the RighiLeduc effect to a circular thermal conductivity, both produced by a magnetic field.[2]

The consideration of space-time asymmetry may prove to be useful outside the realm of crystal physics. The process of splitting a magnetic dipole into two free magnetic charges is seen to be impossible if one considers the space-time asymmetry involved in this process. Present-day literature is ambiguous concerning this point. Thus Dirac[3] discusses the reason why the separation of electric charges is so much easier than that of magnetic charges and Ehrenhaft believes to have succeeded in obtaining free magnetic charges.[4]

According to the given concept, a magnetic moment, and therefore a spin as well, always corresponds to a real circulating movement and cannot be considered as an intrinsic property without the character of movement. This reemphasizes the fact that static structures in three-dimensional space arc not adequate to represent the physical bodies and that the space-time relations are inevitable necessities.[5]

We shall speak of time symmetry if the time inversion has no influence upon the sign of the quality to be reversed.[6]

Asymmetry is much more than the counterpart of symmetry. Asymmetry indicates the existence of characteristic differences, whereas symmetry discards characteristic features. Certain physical phenomena are intrinsically related to certain types of asymmetry, whereas certain symmetry elements may exist without necessarily being related to those effects.[7] "C'est la dissimetric, qui cree le phenomene," stated P. Curie.[8]

THE MAPPING OF MAGNETIC FIELDS

To map a magnet's field the sensor must be moved between readings in a regular pattern. Two servomotors advance the Hall Effect sensor after each reading is taken to collect the 6000 needed data points.

To map a 3" X 7" area, taking readings every 0.1", requires over 2000 readings. This must be done three times to measure the X, Y, and Z components of the magnet's fields.

Each component is unique. X, Y, and Z can be looked at seperately, or combined as "magnitude," the square root of the sum of the squares of X, Y, and Z.

Topographic maps can be made of these magnetic fields, just as they can be made to show land contours.

Of particular interest arc the null lines where the field changes sign or direction.

Complex assemblies of magnets can be designed to shield, focus, and distort magnetic fields for various purposes.

BIBLIOGRAPHY

[1]National Academy of Science. Proceedings of National Academy of Science, vol. 39 (n. p., 15 April 1953), p. 681.

[2]lbid., p. 684.

[3]P. A. M. Dirac, Proc. Roy Soc., A133,60 (1931); Phys. Rev., 74,817 (1948), cited by National Academy of Science, Proceedings of National Academy of Science, vol. 39 (n. p., 15 April 1953), p. 685.

[4]National Academy of Science, p. 685.

[5]Ibid., p. 686.

[6]Ibid., p. 681.

[7]Ibid., p. 682.

[8]P. Curie, "Oeuvres," Paris, 1908, p. 127, cited by Nauonal Academy of Science, Proceedings of National Academy of Science, vol. 39 (n. p., 15 April 1953), p. 682.

Literature Cited

Curie, P. "Oeuvres." Paris, 1908. Cited by National Academy of Science. Proceedings of National Academy of Science. Vol. 39: n.p., 15 April 1953.

Dirac, P. A.M. Proc. Roy. Soc., A133,60: 1931; Phys. Rev., 74,817: 1948. Cited by Nauonal Academy of Science. Proceedings of Nauonal Academy of Science. Vol.39: n. p., 15 April 1953.

Nauonal Academy of Science. Proceedings of Nauonal Academy of Science. Vol.39: n. p., 15 April 1953.

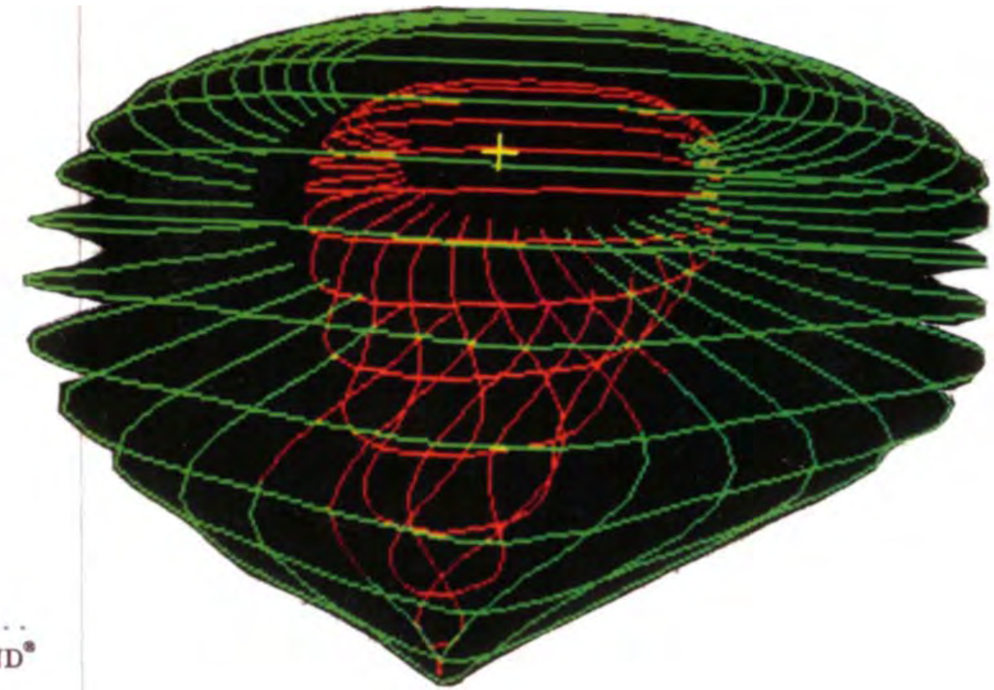
References

Richard P. Feynman, Robert B. Leighton, and Matthew Sands, "A Fields," The Feynman Lectures on Physics. Addison-Wesley, 1963, Vol. 2.

"Seeing is Believing," Elektro-Elektroteknisk Tidsskrift Bd. 95, nr. 12,24 Juni 1982: 20-55.

U.S. Patent, 4151431,24 April 1979, H. R. Johnson.

Nauonal Research Laboratory. Annual Report 1985. pp. 166-7.



INTRODUCING . . .
WHIRLWIND®
Logo

The Discovery of the Double Vortex

After predicting for years the presence of a vortex in the fields of permanent magnets, Steve Davis and I were working late one night with our three axis gauss meters and a new computer, mapping magnetic fields. I was starting to go home when he announced, "I don't know what I am doing, but I have something here that looks pretty linear."

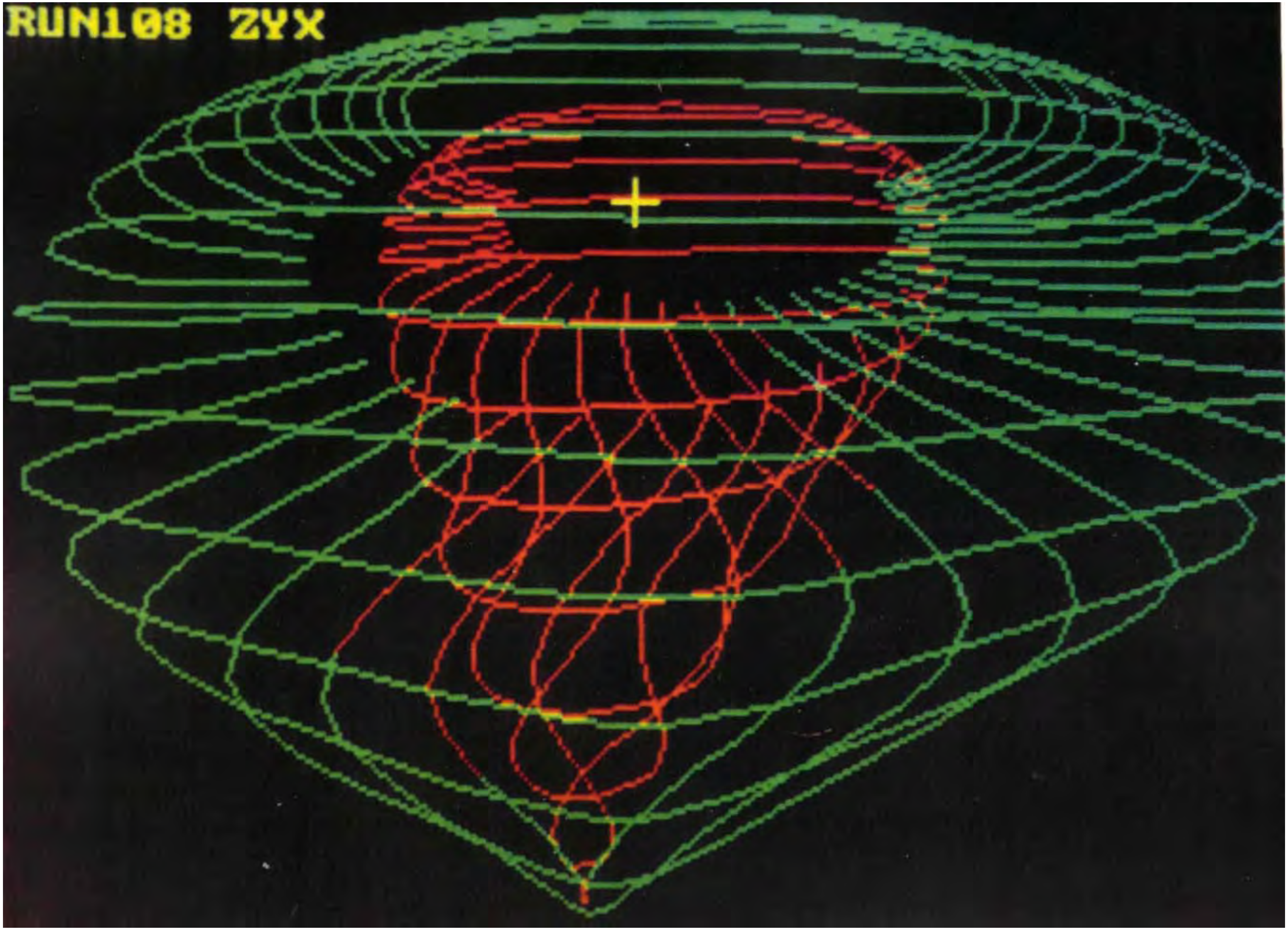
He proceeded to bring up on the screen, in living color, the forming of a double vortex. Not only was the double vortex there, but we could see as it formed, the opposite spins in such a perfect way. We knew that this had to be the beginning of something new and mighty important. The question now was, "How do we use it to the greatest advantage? How do we explain its importance to the patent structure that we have been developing for many years?"

We resorted to the libraries and studied many months to see what others had done. The results showed a great desert in this area.

Researchers, it seemed, had been content with the ancient iron filings as a mapping tool and had not used twentieth century methods to see what could be seen. The field had simply been ignored.

We ran a picture on the cover of National Laboratory but only the magazine seemed to sense the importance of it.

We have used our mapping methods to show the fields around a conductor, to show how a new generator works, to describe the thrust of permanent magnet units, and to explain our versatile gate discovery.


RUN108 ZYX

Amperian Currents

in Permanent Magnets

We are familiar with AC & DC electricity but we are not so familiar with Amperian currents in magnetic material. Yet, Ampere told us much about them over 150 years ago.

Today our magnetic materials are much better due to the rare earth usage. Fields of 35,000,000 Gauss Oersteds are available.

These Amperian currents are tightly wound in the material. They are firmly anchored so that they can not ordinarily be reversed. Thus, they should be available for many years of usage.

Three kinds of Amperian currents we have observed are:

1. The double vortex where opposite spins are found along side each other.
2. The double vortex where one vortex is inside the other.
3. The third form is the flat vortex.

Dr. Feynman recorded finding some of these in his Vol. 2 Physics lectures 37 - (12 - 13).

The interaction of the momentum of these currents is the basis of our patent work for the last number of years.

"Ampere was the first investigator to propose that the magnetism observed in permanent magnets is caused by tiny electric currents circulating within the molecules of magnetic material." Scientific American Jan. 89.

"Magnetism - more specifically ferromagnetism - in a material is associated with cooperative interactions between individual atoms tending to align the magnetic moments of those atoms parallel. The magnetic moment of an atom arises from the orbital and spin angular moments of its electrons. Only some elements have unpaired electrons - hence magnetic moments - and even fewer show the cooperative interaction necessary for ferromagnetism.

"A permanent magnet (PM) is a piece of a material that has stored within it magnetic energy - by alignment of magnetic moments - supplied by an electric field during the initial process of magnetization. The magnet retains this energy indefinitely - it is permanent. The material can be a metallic element, a metallic alloy, or even an oxide.

"There is a growing tendency to replace electromagnets by PMs because of major improvements in PM properties. The increasing cost of energy and the trend towards miniaturization are other reasons. The samarium-cobalt series of magnetic materials until recently provided the strongest PMs known. However, recent discoveries with alloy systems based on iron and neodymium promise even better performance.

"The two basic parameters used to define properties are the remanence, Br, and the coercivity, Hc, the vertical and horizontal axes respectively on the Lanthology diagram. The remanence arises from the cooperative alignment of magnetic moments. The coercivity measures the resistance to demagnetization of the material; a high value is essential in devices where the magnet will be subject to strong demagnetizing fields such as in motors.

"The coercivity depends not only on the underlying crystal structure but also on the microstructure of the material, on the domain morphology within the bulk magnet.

"Demagnetization is resisted when a large energy is needed to reverse the aligned magnetic moments within a crystallite. In some crystal structures certain directions - determined by the orbital moment of the minor component together with crystal-field effects and exchange interactions - provide an exceptional resistance. A great deal of energy will be required to reorient the magnetic moments from one easy direction to another. The crystal is said to have a high magnet-crystalline anisotropy.

"The role microstructure plays in giving high coercivity is related to the existence of domains - regions of common direction of magnetization - within a practical PM material. The movement of domain walls - separating domains - must be inhibited. This is often done by incorporation of another phase within the material. Much of the art of producing PMs lies in this microstructure control.

"The Neodymium-Iron systems, the latest and most powerful permanent magnets, seemingly provide the best yet approaches to the two mechanisms outlined above for high coercivity. They are being intensively studied by many research groups." "Neodymium, Iron, a Pinch of Boron and Permanent Magnets" Union Molycorp.

Visualizing Magnetic Fields

by

H.R. Johnson, S.M. Davis, and G.H. Beyer
Virginia Polytechnic Institute and State University
Blacksburg, VA 24061

ABSTRACT

In unrestricted 3-space, what patterns would be seen if iron filings were not constrained by gravity to lie in a single plane? We have recorded magnetic field patterns and displayed them in a variety of ways: as 3-D surfaces; as contour maps; and as plots of two of the field components, with the third component's sign conferring color to the tip of the field vector. Our hope is that others may also find such patterns helpful in understanding magnetic phenomena.

One of Faraday's many contributions was his concept of force as traced by iron filings aligned on a glass plate above the poles of a magnet. However, the pattern is perhaps somewhat misleading since the iron filings can move only in the plane of the plate. In unrestricted 3-space, what patterns would be seen if the filings were not constrained by gravity to lie in a single plane, but could show the true direction of the magnetic vectors?

We measure the components of our magnetic field using three mutually-perpendicular indium arsenide semiconductors. Their Hall effect voltages are amplified, digitized, and recorded on a disk by an IBM personal computer. The probe containing the three semiconductors is accurately positioned by two servo motors which progressively scan the area above the poles in a series of small steps. The thousands of data points are then displayed in various ways.

What are the typical data and displays for a 6-inch Alnico magnet, shaped like a banana, having Nd-Fe-B pole pieces, each 1/8 x 5/16 x 1 inches?

The menu shown in Figure A summarizes such data. The area surveyed, 1/2 inch above the pole pieces, was 8.0 inches long by 2.0 inches wide. The sensor was moved in 1/10 inch steps to obtain 1701 data points for each component of the magnetic field. A Bell 620 gaussmeter amplified the voltages from the Hall effect sensors.
The signals were digitized by a Metrabyte interface board and recorded on a floppy disk. These data then served as input to our display programs.

Three-dimensional surface plots for the X (vertical), Y (horizontal), and Z (longitudinal) directions are shown in Figures B, C, and D, respectively. A typical contour, or topographic map, is shown in Figure E.

What good are these magnetic data? Are the 90 minutes necessary to obtain 5103 measurements well spent? We think that three distinct accomplishments are represented here.

First, we have learned to cope with the complexity of data acquisition using a personal computer, independent of dedicated, expensive mainframe time on a larger computer. The personal computer has made such activity affordable and efficient.

Second, we have learned to make contour plots and models which show the location of zero lines, where the field changes sign, or direction. Contour plots show also precipitous field changes where they occur, where the lines are closely spaced. Such data should prove helpful in the design of magnetic assemblies that can do unique tasks. By shading poles so they present an unsymmetrical structure when viewed relative to other magnetic components, unbalanced forces can be generated, causing motion in a preferred direction. Magnetic gates can be designed, and the optimum orientation of interacting magnets can be studied.

Third, we have made magnetic measurements that are accurate, reproducible, and easily stored for further review using a wide variety of display programs.

Using this method we have secured the following pictures:

1. The north and south poles of a curved magnet.
2. The picture of the fields around a current carrying wire.
3. The magnetic bullet formed in a permanent magnet railgun operation.

H. R. Johnson, Director of the Permanent Magnet Research Institute,
Box 199, Blacksburg, VA 24060.

S. M. Davis, Electrical Engineer and Consultant.

Dr. G. H. Beyer, Distinguished University Professor of Chemical Engineering, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061. *Recently deceased.

Address all inquiries to H. R. Johnson at the above address.

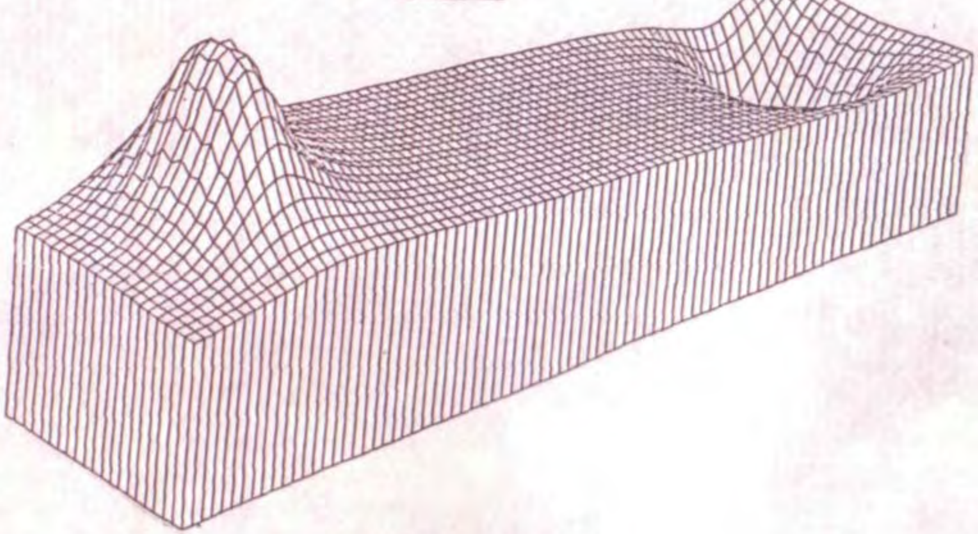
FIGURE A

DOT/LINE ⲙ
Magnetic Field Plotter

File Name: bnew	Scan Length - X: 8.000
Begin Plot: NO	Scan Length - Y: 2.000
Orientation: XYZ	Steps/Inch: 10
Beginning Col: 0	
Ending Col: 21	Data Points/Axis: 1701
DOT or LINE: DOT	
Label:	
Color: 0 (GRN/RED/BRN)	
Mark Center: YES	
Return to DOS: NO	

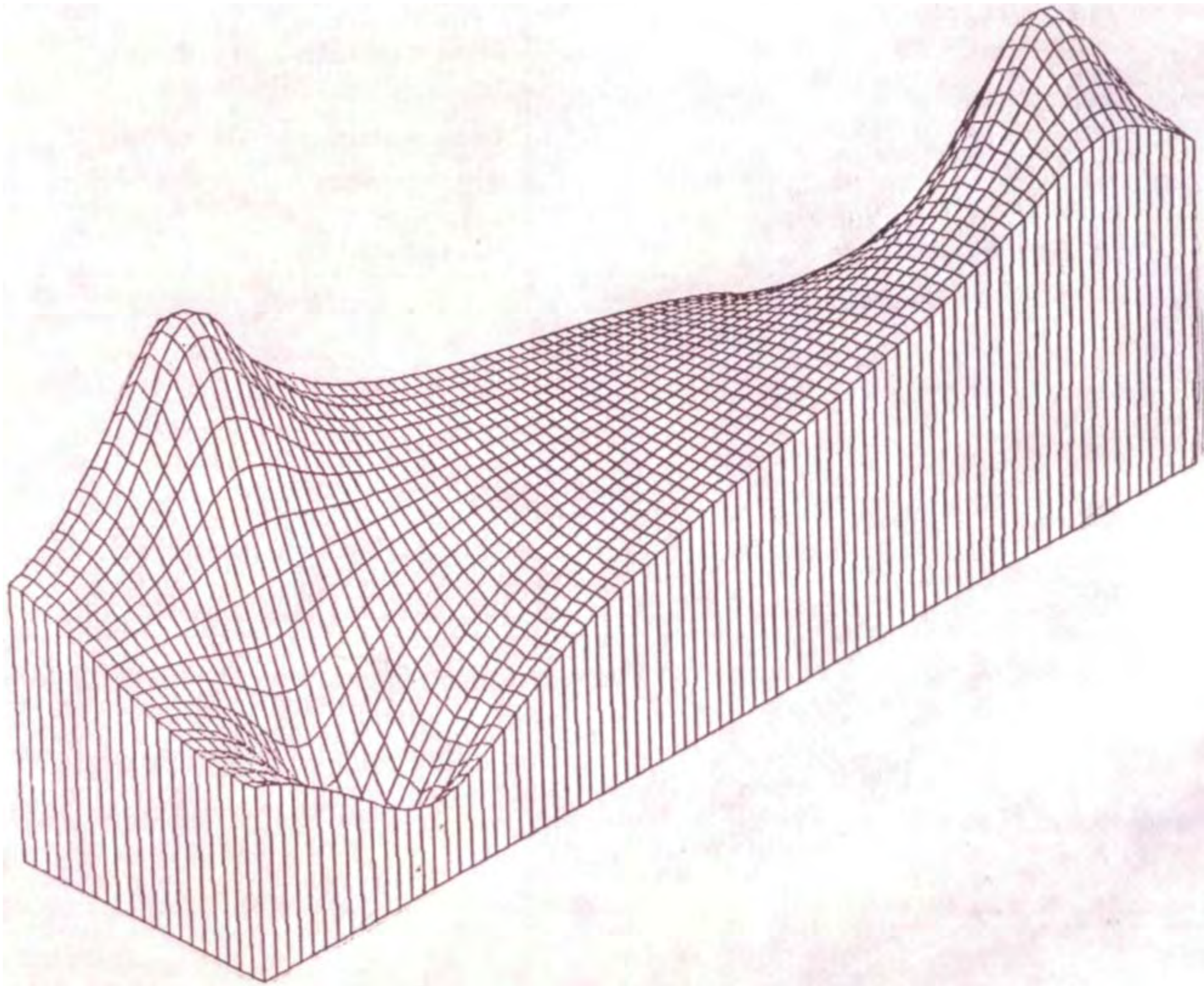
	X	Y	Z
Minimum:	-1327.50	-487.00	-457.00
Maximum:	1385.50	458.50	629.00

FIGURE B

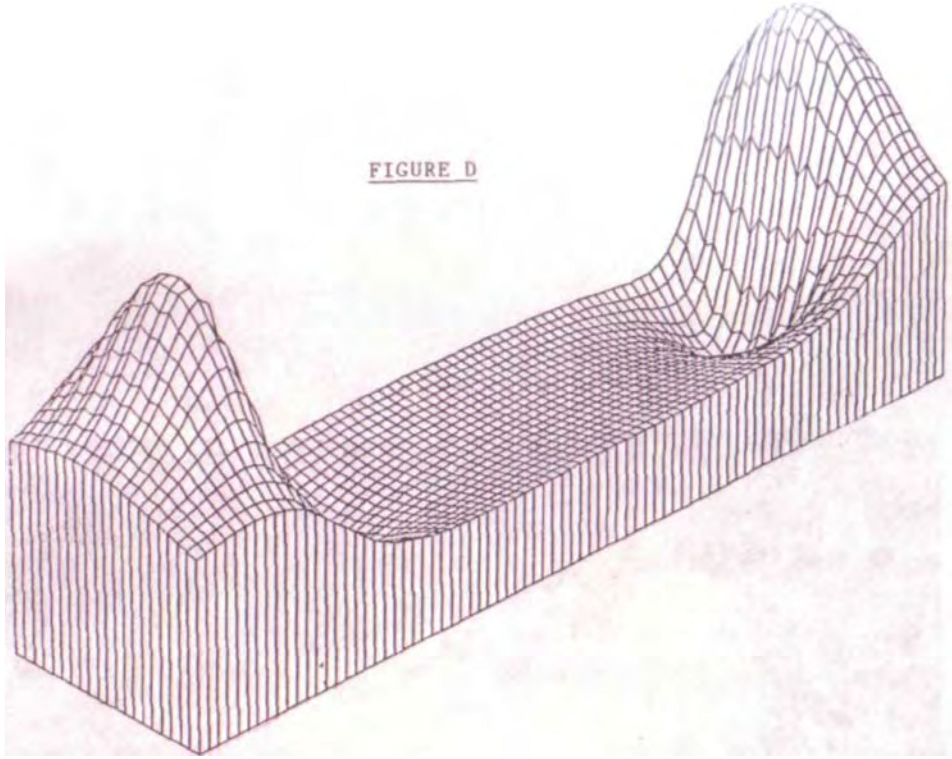


BNEW x axis

FIGURE C

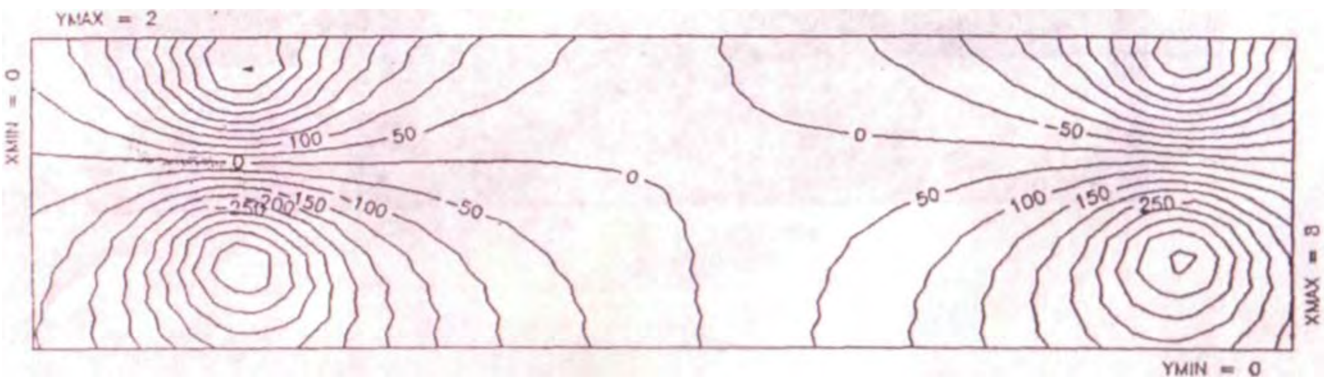


BNEW y axis



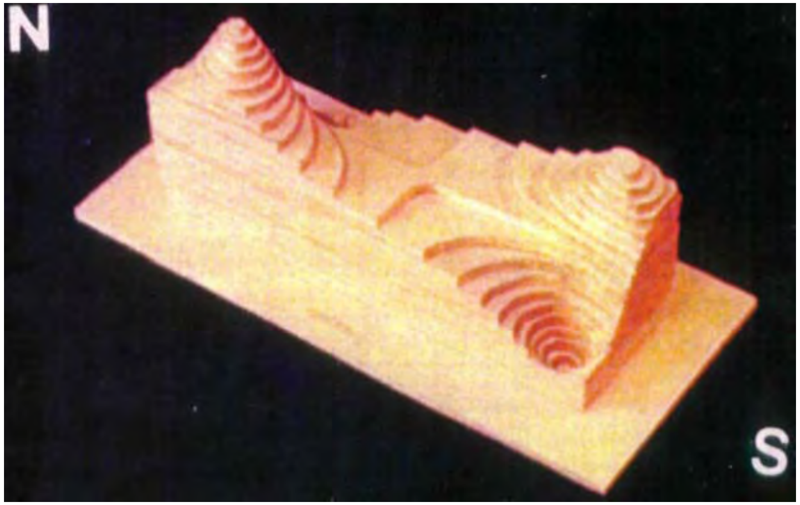
- BNEW z axis

FIGURE E



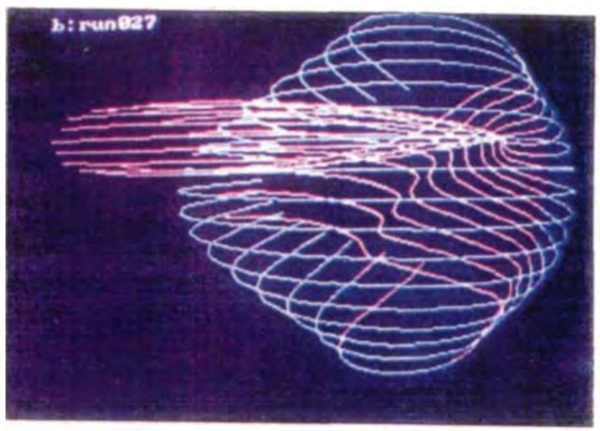
- BNEW y axis

1. THE NORTH AND SOUTH POLES OF A CURVED MAGNET:



2. THE FIELDS AROUND A CURRENT CARRYING WIRE (D.C.):

3. THE MAGNETIC BULLET FORMED IN A PERMANENT MAGNET RAILGUN OPERATION:



The Dynamo of Faraday and

The Piezomagnetic Dynamo

If a current is sent through a coil of wire between the poles of a large magnet, the coil will rotate. This is due to the directional magnetic field of the coil and the directional field of the magnet creating a squeeze effect in one direction.

The same action can be created by the reaction of two permanent magnet fields. A further refinement is to have the permanent magnet fields to attract one another until they are in a position where the fields are squeezed and the movement in the same direction is accelerated. This we call the piezomagnetic effect.

The secondary effect is also described as due to the quantum-mechanical exchange forces. Due to the squeeze effect, the spins become parallel instead of anti-parallel as they were in the original attraction. This molecular crowding is believed by some very good theorists to create an exchange force 1,000 times greater than
the purely attractive magnetic forces, we have noted this force for many years but did not have the explanation originally given by Heisenburg.

One thing we did notice was the fact that in a very strong field that a light armature did not run much faster than a unit that weighed four times that much.

Using the above method, we have constructed a strong shaded pole to attract a strong magnetic field into this intense magnetic field. Passing thru, this unit has developed effective thrust to accelerate the vehicle down a level track.

Carrying more than its own weight, the repeated actions of these cycling magnetic pressures have shown what a piezomagnetic effect can do.

It is a renewable energy source. Our maps of the fields show the forming of a composite magnetic field around the armature. This we have termed, the magnetic bullet. It is shown on the front cover of this book. We have entitled this activity THE PIEZOMAGNETIC RAILCAR because it is similar to the energy released by squeezing a piezoelectric crystal.

The crystal used does not get tired when used constantly; neither do the magnets, They will continue to generate the same amount of thrust as the car moves from section to section.

EYE TO EYE

You have been reporting a number of defects in our society these days. How would you like to consider something completely new, something that is positive, not a tired rework of a current bit of knowledge or philosophy.

Applying our latest science to something considered old and established has shown how little we know about it. We have seen the vast sea of ignorance in which we swim. It has shown how the life long work of one individual can penetrate the layers of false concepts, learned superstitions, and degreed security blankets.

Not taking for granted some textbook conclusion, we have used direct methods of measuring that reveal big gaps in our storehouse of knowledge. Using this along with the belief that enough clues will enable you to catch a criminal, we have found that enough information lets you solve age old problems.

As we struggle to conserve and not to contaminate, it has given great comfort to find that we can do both. The goal is achievable.

Our new approaches are documented in three patent applications. Two of these have been granted and the third is pending.

As shown in our new book, we have found a way to shade the poles of permanent magnets, a way to make north poles attract north poles and reject south poles, a way to increase spin intensity and magnetic thrust, and a way to use the transfer forces to accelerate masses.

The resulting motor does not destroy its energy source. It is a reusable atomic source that is available world wide.

In biology, the discovery of the double helix and the genetic code has provided a tremendous fund of information.

In our case we have discovered a similar situation where we have the double vortex that occurs in all permanent magnet configurations.

The exploration of the genetic code by biologists with extensive government funding has begun.

We have just started the exploration of the double vortex and the magnetic code, but the fallout thus far has been extremely rewarding.

Note in the pictures, the mapped spins, the pictures of north poles attracting north poles and rejecting south poles, and the thrust developed by these units without any outside energy contribution.