Wonju-Bajac
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RE-INVENTING THE WHEEL PART 1 – CLEMENTE FIGUERA AND HIS INFINITE ENERGY MACHINE

A year ago, I was working on a concept for an over unity transformer. I had several designs that I wanted to test. Because it was my belief that the extra energy must come from somewhere, I favored the used of permanent magnets. I modified an existing transformer and added permanent magnets and I was disappointed. It did not work as I had expected. I took a second look at the permanent magnet design and was planning to retry the experiment with some modifications. However, it has been more than sixteen months and I have not had the time to go back and test my theory.

It was in one of the forums when someone mentioned Clemente Figuera and provided some links to documents referring to the work of this person. In one of the documents, I found what looks to be the only page showing sketches from one of his patents. I was very surprise to see the similarities between the embodiment of Mr. Figuera's drawing and one of my own for the over unity transformers.

I was very eager to read any information about Figueras' work and the operation of this infinite energy device. It looks very suspicious that the pages describing the most important part of the machine have been lost. Then, I just decided to figure this machine out by myself. It really did not take me that long since I was able to deciphered the mystery relatively easy. This paper is my explanation of how the "infinite energy machine" built by Mr. Figuera, works.

Before I go on into the details of the operation of this machine, it is fundamental to understand the basic operation of existing transformers. I know that many of you might laugh to hear it but the majority of today's engineers and technicians do not really understand how transformers work. And, the reason for this lack of knowledge is also due to the fact that it is not found in technical and college text books. The reaction of some PhD. Professors, who also taught me electromagnetic waves theory in college, was just with denial. Their attitude is a closed minded one limited to whatever is shown in the text books only. Whenever I presented this theory to these scholars, none of them had any logical explanation to argue against it. At one time, the chief electrical of the engineering department I work for stated that the Faraday induction law does not apply to transformers. This is the reason why in this paper I invested so much effort explaining this theory.

Figure 1 is a typical transformer model shown in all technical literatures. This figure shows a primary winding with Np turns and a secondary winding having Ns turns, both of them wound around a common iron core. This model shows most of the magnetic field **B** flowing inside the iron core and the magnetic field losses indicated by **B1**, **B2**, **B3**, and **B4** responsible for the reactance components. These reactance components have great influence in the voltage regulation of the transformers. An alternating voltage source Vp is applied to the primary coil generating a primary current equal to Ip. Can you tell me what the value of the secondary voltage Vs is? Many of you will rush to use the known turns ratio formula but the truth is that for such a transformer model the voltage at the secondary coil shall be zero (Vs = 0).

I will provide two reasons why the secondary voltage is null. First, I want to turn your attention to Figure 2 (a), (b), and (c). In physics courses, we were told that if a conductor does not interact with a magnetic field **B** there would be not voltage induced in it - as shown in figure 2a. As soon as the magnetic field **B** flows and cut the conductor, a voltage is induced as shown in figure 2b. However, the electromagnetic theory tells us that the magnetic field **B** and the electric field **E** do not interact with each other. Then, how is a voltage induced in the conductor? The theory also says that when electric charges moves, a magnetic field is created around the charges. Therefore when a conductor moves in a magnetic field **B**, the free charges of the metal conductor create a magnetic field on their own which in turn interacts with the applied magnetic field **B**. The forces exerted on the electric charges are perpendicular to the plane formed by the magnetic field **B** and the speed **v** of the moving conductor. Mathematically, this law can be written in vector form as $\mathbf{F} = q(\mathbf{v} \times \mathbf{B})$. Note that for the positive charges, this formula follows the right hand rule and for the negative charges it follows the left hand rule. In other words, the free positive charges in the conductor will receive a force in one direction while the free negative charges will receive a force in the opposite direction as shown in figure 2c. The effect is to move the free positive and negative charges apart from each other resulting in an induced voltage in the conductor as shown in figure 2b. And second, the electromagnetic theory states that the magnetic flux lines are always closed loops. The magnetic lines do not have a beginning or end as is the case for the electric field. Therefore, it is not possible for a magnetic line to start in the primary coil, flows within the iron core, and back again to the primary as suggested in figure 1. Instead, a magnetic loop will start in a turn of the primary coil and will grow in a fashion similar to stretching a rubber band. This will be explained in more details later in this paper.

Figure 3 shows a typical sinusoidal waveform of the voltage source Vp applied to the primary coil and the current Ip flowing through the primary coil. When the voltage Vp is applied to the air core coil shown in figure 4, the magnetic flux will be distributed along the space surrounding the coil. The magnetic field B is weak and so is the self-inductance. The self-induction is the induced voltage in each turn due to the magnetic interaction with its neighbor. The magnetic field originating from a turn will cut through the other turns of the same coil inducing a voltage with a polarity that opposes to the applied voltage Vp. This action is also known as “reactance.” The direction of the magnetic field will depend upon the polarity of the voltage Vp. If for the positive semi-cycle the magnetic field B points down, then, it will point up for the negative semi-cycle. The direction of the magnetic field **B** can be determined by the right hand rule.

Figure 5 illustrates what happens to the magnetic field **B** of the coil when an iron core is added. Because the iron core has a much lower reluctance than air, the majority of the magnetic field **B** will move into the iron core. The reluctance is the unit that measures how much a given material opposes the flow of magnetic flux Ø. Reluctance is to the magnetic field **B** what resistance is to electric current. If two paths present different reluctances, a higher magnetic field will flow through the material with lower reluctance. The function of the iron core IC is to act as a magnetic guide way by concentrating the magnetic flux into a smaller space and considerably increasing the magnitude of the magnetic field **B**. It is very important to note that the magnetic field **B** moves across the air gap formed by the window of the iron core.

When the voltage Vp is applied to a coil, the following dynamics occurs:

1) At $\theta = 0$
   the magnitude of the primary current Ip and magnetic field **B** are zero.

2) At $0 < \theta < \pi/2$
   the magnitude of the primary current Ip and magnetic field **B** is increasing. In addition, the magnetic field **B** also moves to the right across the air gap. The direction of the magnetic field **B** is determined by the right hand rule; the North Pole is located at the top of the primary coil. Refer to figure 5.

3) At $\theta = \pi/2$
   the magnitude of the primary current Ip and magnetic field **B** are maximum. The majority of the magnetic field **B** has moved into the right column of the iron IC core as shown in figure 6.

4) At $\pi/2 < \theta < \pi$
   the magnitude of the primary current Ip and magnetic field **B** is decreasing. In addition, the magnetic field **B** also moves to the left across the air gap as shown in figure 7.

5) At $\theta = \pi$
   the magnitude of the primary current Ip and magnetic field **B** are zero.

6) At $\pi < \theta < 3\pi/4$
   the magnitude of the primary current Ip and magnetic field **B** is increasing. In addition, the magnetic field **B** also moves to the right across the air gap. The direction of the magnetic field **B** is determined by the right hand rule; the north Pole is now located at the bottom of the primary coil. Refer to figure 8.

7) At $\theta = 3\pi/4$
   the magnitude of the primary current Ip and magnetic field **B** are maximum. The majority of the magnetic field **B** has moved into the right column of the iron core as shown in figure 9.

8) At $3\pi/4 < \theta < 2\pi$
   the magnitude of the primary current Ip and magnetic field **B** is decreasing. In addition, the magnetic field **B** also moves to the left across the air gap as shown in figure 10.

9) At $\theta = 2\pi$
the magnitude of the primary current Ip and magnetic field **B** are zero.

Now, let us add a secondary coil to the iron core as shown in figure 11a. The dimension of the air gap is Wg (width) x D (depth) x Hg (height). Np and Ns represent the number of turns of the primary and secondary coils, respectively. As shown in figure 11b, the primary and secondary magnetic fields **Bp** and **Bs** are confined within the same air gap space and iron core IC. In addition, the voltage Vs is induced only in a section of the secondary coil that is inside the air gap. The sections of the secondary turns located outside of the air gap do not interact with the primary magnetic field **Bp**, and therefore, no voltage is induced. In other words, only a quarter of each turn of the secondary coil interact with the primary magnetic field **Bp** do not contribute with induced voltage. Figure 11b also shows the induced magnetic field **Bs** counteracting the primary magnetic field **Bp** within the same magnetic path.

Figure 12 shows what happen in a transformer when a power supply Vp is connected to the primary coil. The primary current Ip creates a magnetic field **Bp** that will cycle continuously through the iron core and air gap as explained in the steps 1 to 9 above. For argument sake, let us assume that Vp = 240Vac, 1φ, 60Hz, Ip = 0.25A, and that the magnitude of the generated magnetic field is Bp = 10,000 Gauss. Let us also assume that the voltage induced in the secondary coil is Vs = 120Vac. The voltage induced in the secondary coil can be estimated from the Faraday's induction law, $Vs = -Ns\left(\frac{dBp}{dt}\right)$. As seen from this formula, the voltage induced in the secondary coil is a function of the number of the secondary turns Ns and the rate of change of the magnetic field **Bp** cutting the secondary coil. The magnetic field interacting with the secondary coil is also known as magnetic linkage. The negative sign is introduced in the formula to account for the effects of Lenz's law and is of great significance because it is the element that makes all transformers inefficient. Simply stated Lenz's law dictates the polarity of the induced voltage Vs. In accordance with Lenz, the voltage induced in the secondary coil Vs must generate a current Is such that the magnetic field **Bs** opposes the magnetic field **Bp** that created it. The right hand rule can be used to determine the polarity of the secondary induced voltage Vs.

Assume that a current Is = 20A flows in the secondary coil when a load is connected and that this current generates a magnetic field Bs = 4,000 Gauss. For the sake of simplicity, disregard the Eddy and Joule losses, that is, the transformer does not heat up. In accordance with Lenz's law and as shown in figure 12, the polarity of the induced magnetic field **Bs** must opposed the magnetic field **Bp** that creates it. The resultant magnetic field **Br** is equal to **Br** = **Bp** – **Bs** = 10,000 – 4,000 = 6,000 Gauss. Because of a lower magnetic field cutting the lines of the primary coil, the self-inductance at the primary decreases, which in turn decreases the (self-induced) voltage that opposes the applied voltage source Vp. A lower self-induced voltage is equivalent to lower impedance as seen by the voltage source Vp. The result is an increase in the primary current Ip until the resultant magnetic field **Br** is again 10,000 Gauss. That is, the primary current Ip needs to produce a magnetic field **Bp** = 14,000 Gauss such that **Br** = 14,000 -

4,000 = 10,000 Gauss. Assume that the new **Bp** is obtained by increasing the primary current Ip from 0.25 to 10A. This process is also known as transformer auto-regulation or self-regulation. Since the only variable in the Faraday's formula is the magnitude of the changing magnetic field; if dBr/dt changes, then, the induced secondary voltage would not longer be a constant value of 120Vac. ***For the secondary voltage Vs to stay at a constant value of 120Vac the magnetic field Br must be 10,000 Gauss. It does not matter if the 10,000 Gauss are being generated by 3, 10, or 40A.*** The input and output power are estimated as
Pp = 240 x 10 = 2,400W (power in)
Ps = 120 x 20 = 2,400W (power out)
Notice that the primary magnetic field **Bp** and the secondary magnetic field **Bs** are operating within the same magnetic path or iron core. The following question is in order – is it possible to reroute some of the induced magnetic field **Bs** so as to not affect the primary magnetic field **Bp**? In other words, is it possible to minimize the effects of Lenz's law? The first approach that came to my mind is shown in figure 13. The secondary coil is also wounded around a second iron core IC2 separated by the first iron core IC1 by a non-magnetic material (high reluctance) NMM. The goal is to divert part of the secondary magnetic field **Bs** through the second core IC2 while preventing the primary magnetic field **Bp** from flowing into the second iron core IC2. The effect of the secondary magnetic field **Bs** is to increase the reluctance of the first iron core IC1. If the value of the reluctance of IC1 is comparable with the reluctance of the non-magnetic sheet NMM, then, the primary magnetic field **Bp** can easily move into the second iron core IC2. Assume that the reluctance of the NMM is high enough to keep most of the primary magnetic field within the iron core 1 (IC1). When the secondary magnetic field **Bs** starts flowing, part of the induced magnetic field **Bs** can flow in the iron core IC2 because it represents a lower reluctance path.

The following is a qualitative analysis performed for the purpose of giving an idea of how the variables changes relative to each other. The values of the variables are not the result of measurements but they are assumed based on an educated guess. This is a very simple method for explaining how the machine works. Assume that the induced magnetic field **Bs** = 4,000 Gauss is split into **Bs1** = 1,000 Gauss and **Bs2** = 3,000 Gauss, where **Bs1** and **Bs2** are the magnetic fields flowing within the iron cores IC1 and IC2, respectively. As shown in figure 13, the opposition to the primary magnetic field **Bp** is just 1,000 Gauss. Under these conditions and in order to keep the resultant magnetic field **Br** at a constant value of 10,000 Gauss, the primary magnetic field **Bp** will increase up to 11,000 Gauss, only. Also, assume that the primary current Ip required to generate the new primary magnetic field is 7A. Observe that the transformer is now supplying the same load as before, but at a lower primary current. The power flow for the transformer shown in figure 13 is estimated as:
Ps = 120Vac x 20A = 2,400 W (same output power)
Pp = 240Vac x 7A = 1,680 W (lower input power)
The efficiency = Pp/Ps = 2,400/1,680 = 1.43, that is, the output power is 43% higher than the input. At least in theory, it is possible to have higher output power from a transformer if the effects from the Lenz's law are reduced.

Two weeks ago - when I first look at Mr. Figuera's generator shown in figure 14 – I was amazed to see that someone had not only worked out the "impossible event" but had also been awarded patents for it. In accordance with Mr. Figuera, the over-unity transformer can be built without permanent magnets and based on a very simple concept. Figuera's generator consists of three rows of electromagnets, where each row is connected in series. The rows of "S" and "N" electromagnets function as the primary of the transformer, while the row of "y" electromagnets located in the center functions the secondary. The "S" and "N" stand for South and North poles, respectively. The apparatus includes a resistor "R" having multiple taps connected to a type of distributor formed by a cylinder "G" and brush "O". The brush "O" rotates around the cylinder "G" changing the location of the resistor taps. When the brush "O" rotates around the eight taps, it generates two stepped half-cycle sinusoids with 90° out of phase. I am proposing figure 15 to be the wiring diagram as originally disclosed by Mr. Figuera in his patents. The most significant component of the system is the arrangement of the electromagnets shown in section A-A taken from figure 14. Keep in mind that each electromagnet shown in figure 15 corresponds to a row of eight electromagnets connected in series as shown in figure 14. In addition, I would like to advice that when building this apparatus, at least for the first time, try to duplicate all details of the machine shown in the patent. For example, the figure shows the top area of the "S" and "N" electromagnets approximately equal to twice the top area of the "y" electromagnets, etc.

Even though Mr. Figuera used stepped sinusoidal currents Ips and Ipn, I considered the resistor in figure 15 to be a linear variable resistor having infinite taps and the voltage and current generated to be pure half-cycle sinusoids with 90° out of phase. The coils of the "S" and "N" electromagnets are tied together and connected to the negative potential of the external battery. The other terminals of the electromagnets are connected to both ends of the resistor "R". The bush "O" is connected to the positive potential of the external battery and is continuously moving from left to right and vice. The position of the brush "O" determines the amount of DC currents Ips and Ipn passing through the primary coils "S" and "N". For instance, when the brush is in position 1, the "S" coils see the full potential of the external battery corresponding to a maximum current Ips and magnetic field **Bps**, while at the same time, the current Ipn and magnetic field **Bpn** of the "N" coils are minimum because they are connected to the external battery through the maximum value of the resistor "R". Figure 21 shows the voltage, current, and magnetic field waveforms flowing through these coils. The voltage induced in the secondary coils "y" is a sinusoidal alternating voltage. The secondary voltage should be zero when the magnitudes of the currents Ips and Ipn are equal. At this point, the magnetic field **Bps** and **Bpn** induce two voltages of the same magnitude and opposite polarity.

The magnetic interaction of "S", "N", and "y" electromagnets are shown in figures 16 through 20. Figure 16 illustrates the scenario when the brush "O" is at position 1. As previously stated, when the brush is at position 1 the current Ips and magnetic field **Bps** are maximum, while the current Ipn and magnetic field **Bpn** have a minimum value. When the secondary current Isy starts flowing, the "y" coils generate a magnetic field **Bsy** that opposes **Bps** in accordance with Lenz's law. As a consequence, a south pole is created at the top of the "y" electromagnet and a north pole at the bottom. Because magnets of the same polarity repel and opposite polarities attract, it is likely that some of the induced magnetic field **Bsy2** is diverted through the iron core of the "N" electromagnet, which represents a lower reluctance path. And, if the induced magnetic field **Bsy** can be rerouted to not oppose the magnetic field **Bps** that generates it, then, it might be possible to have an over-unity transformer.

Figure 17 illustrates the scenario to be expected when the brush is at position 3. The primary current Ips and primary magnetic field **Bps** are decreasing in magnitude while the magnitude of the primary current Ipn and magnetic field **Bpn** are increasing. The primary current Ips (and Bps) is still larger than primary current Ipn (and Bpn). As shown in the figure, part of the induced magnetic field **Bsy2** is still coupled with the "N" electromagnets.

Figure 18 illustrates the scenario when the brush is at position M. This position is exactly at the center of the resistor "R" and both currents Ips and Ipn are of equal magnitudes, and as a result, the magnetic field **Bps** and **Bpn** are also equal. The net voltage Vsy, current Isy, and magnetic field Bsy induced in the secondary coils "y" are all zero.

Figure 19 illustrates the scenario when the brush is at position 6. The primary current Ips and primary magnetic field **Bps** are still decreasing in magnitude while the magnitude of the primary current Ipn and magnetic field **Bpn** are increasing. The primary current Ips (and Bps) is now of lower magnitude than primary current Ipn (and Bpn). Because the magnetic field **Bpn** of the "N" electromagnets is stronger than the magnetic field **Bps** of the "S" electromagnets, the polarity of the induced voltage Vsy, current Isy, and magnetic field **Bsy** are reverse in accordance with Lenz's law. In this situation, the secondary electromagnets "y" present the north poles at the top and the south poles at the bottom making the "y" and "N" electromagnets to repel and the "y" and "S" to attract. Because of the now higher reluctance of the "N" electromagnets and lower reluctance of the "S" electromagnets, it is expected that part of the induced magnetic field **Bsy** will coupled with the "S" electromagnets, and therefore, the effect of the Lenz's law is minimized.

Figure 20 illustrates the scenario when the brush "O" is at position 8. The primary current Ipn and the magnetic field **Bpn** have maximum values. The induced secondary voltage Vsy, current Isy, and magnetic field **Bsy** are also maximum and of opposite polarities than the scenario corresponding for position 1. Again, part of the induced secondary magnetic field **Bsy** is attracted by the "S" electromagnet mitigating the effect of the Lenz's law.

In summary, it seems that there are some advantages not only for splitting the primary into two coils but for operating them with quadratic voltages. If both primary voltages and currents are in phase, the primary magnetic fields **Bps** and **Bpn** will also be in phase. Then, it could happen that the attraction between the two primaries is strong enough as to couple their magnetic fields resulting in a zero induced secondary voltage. I am guessing that it was what happened to my first and only test of this concept using permanent magnets instead of electromagnets configured for quadratic operation.

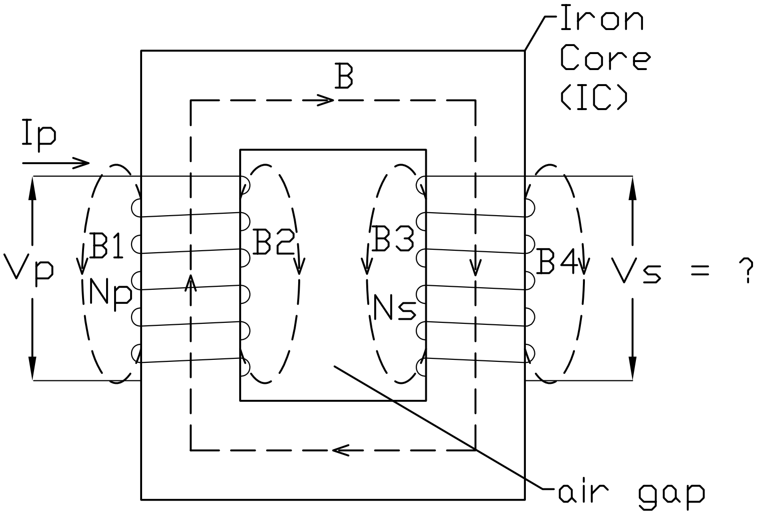
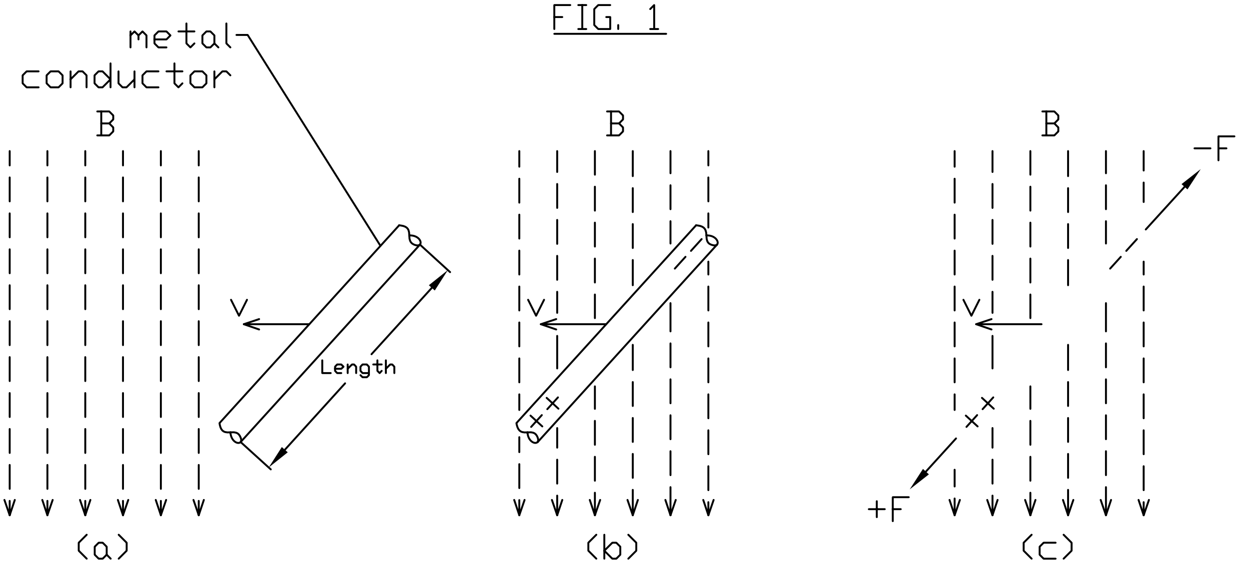


FIG. 1



(a)

(b)

(c)

FIG. 2

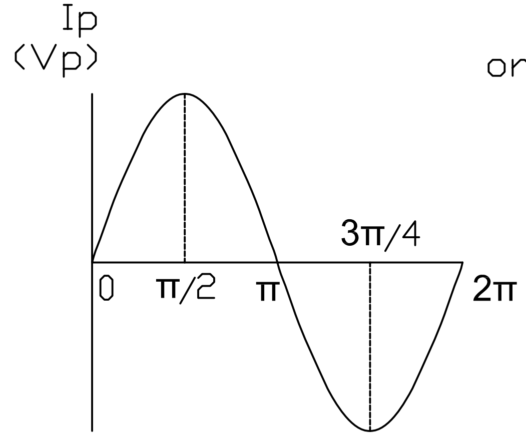


FIG. 3

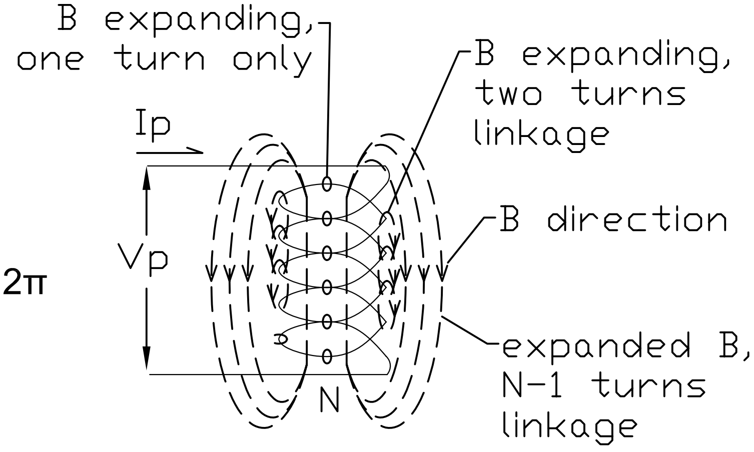


FIG. 4

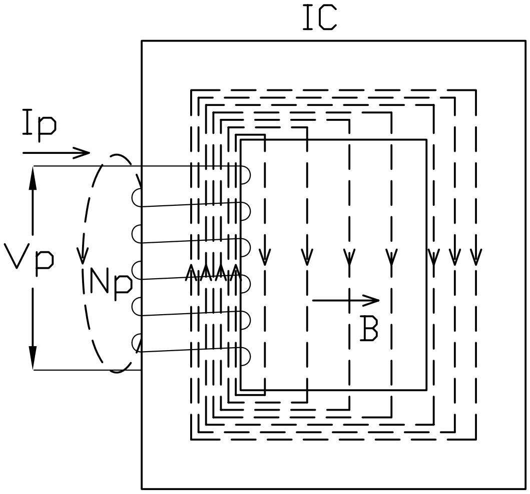


FIG. 5

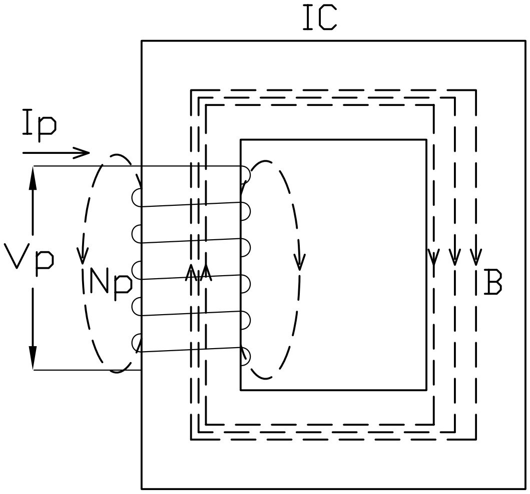


FIG. 6

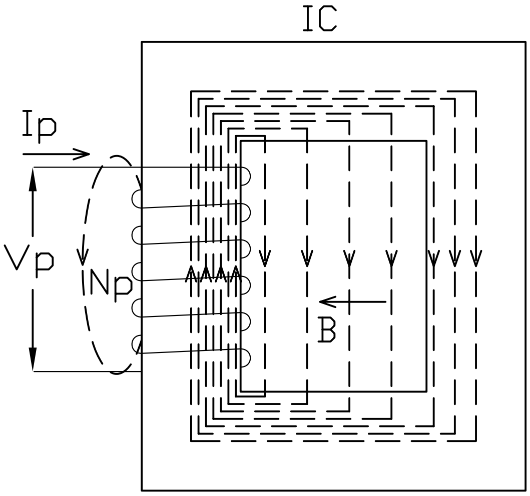


FIG. 7

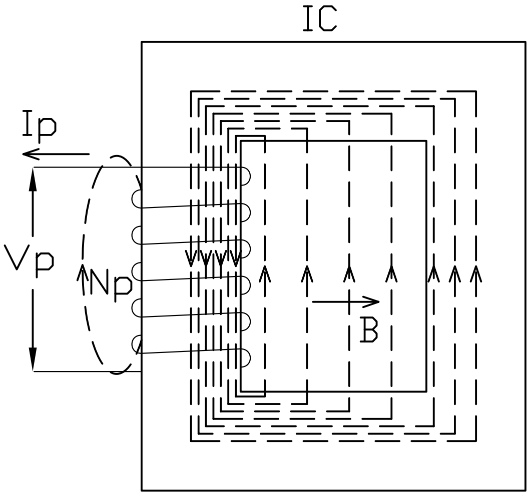


FIG. 8

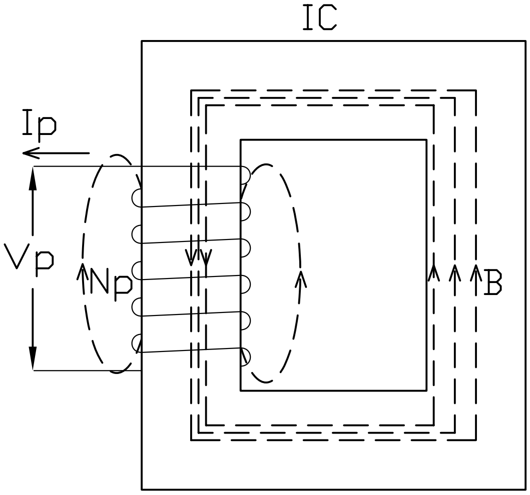


FIG. 9

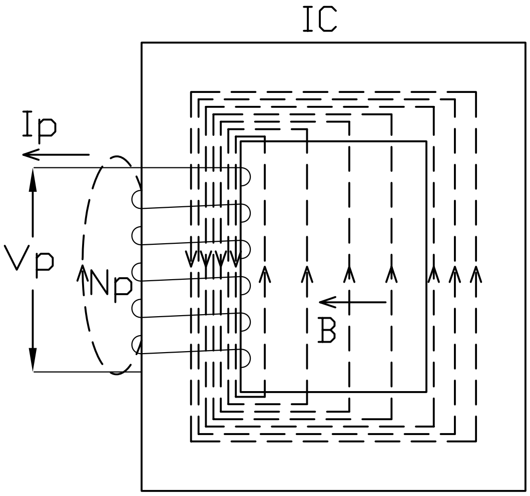
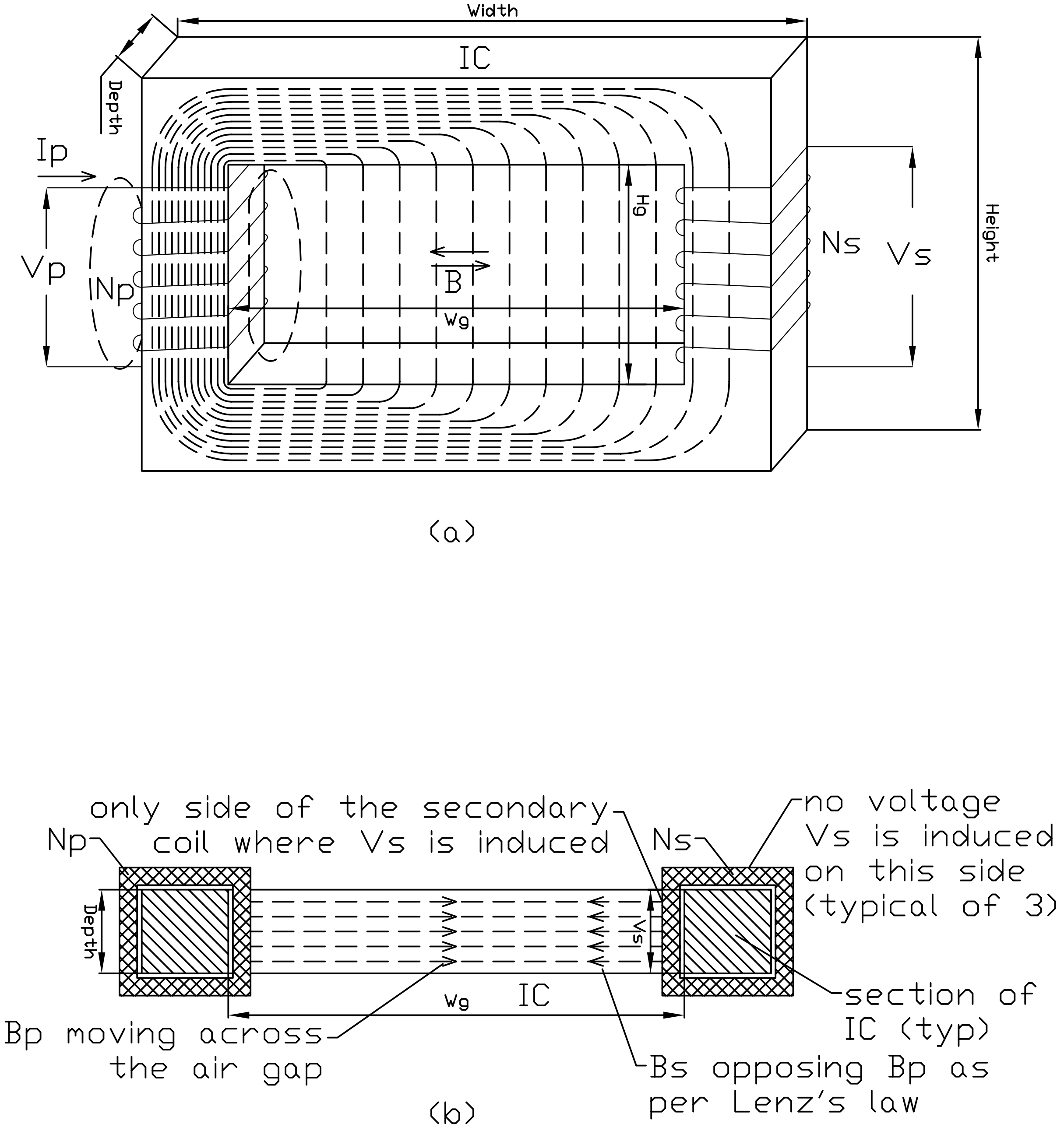


FIG. 10


Width
IC
Depth
Ip
Vp
Np
B
Wg
Hg
Ns
Vs
Height
only side of the secondary coil where Vs is induced
Np
Ns
no voltage Vs is induced on this side (typical of 3)
Depth
Vs
Wg
IC
section of IC (typ)
Bp moving across the air gap
Bs opposing Bp as per Lenz's law

(a)

(b)

FIG. 11

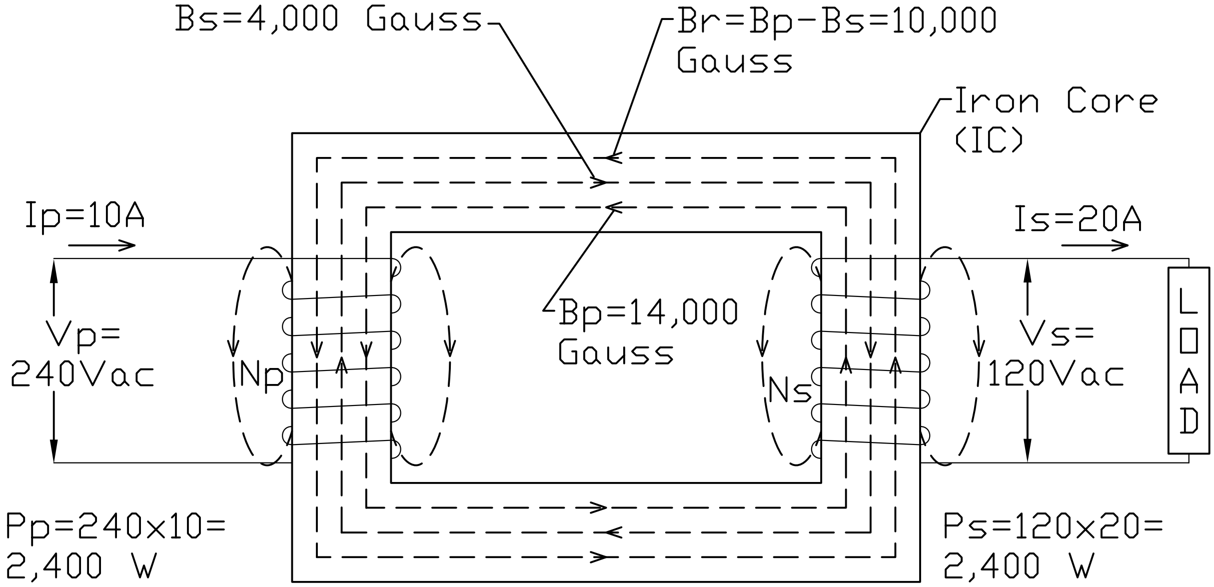

Bs=4,000 Gauss
Br=Bp−Bs=10,000 Gauss
Iron Core (IC)
Ip=10A
Is=20A
Vp= 240Vac
Np
Bp=14,000 Gauss
Ns
Vs= 120Vac
LOAD
Pp=240x10= 2,400 W
Ps=120x20= 2,400 W

FIG. 12

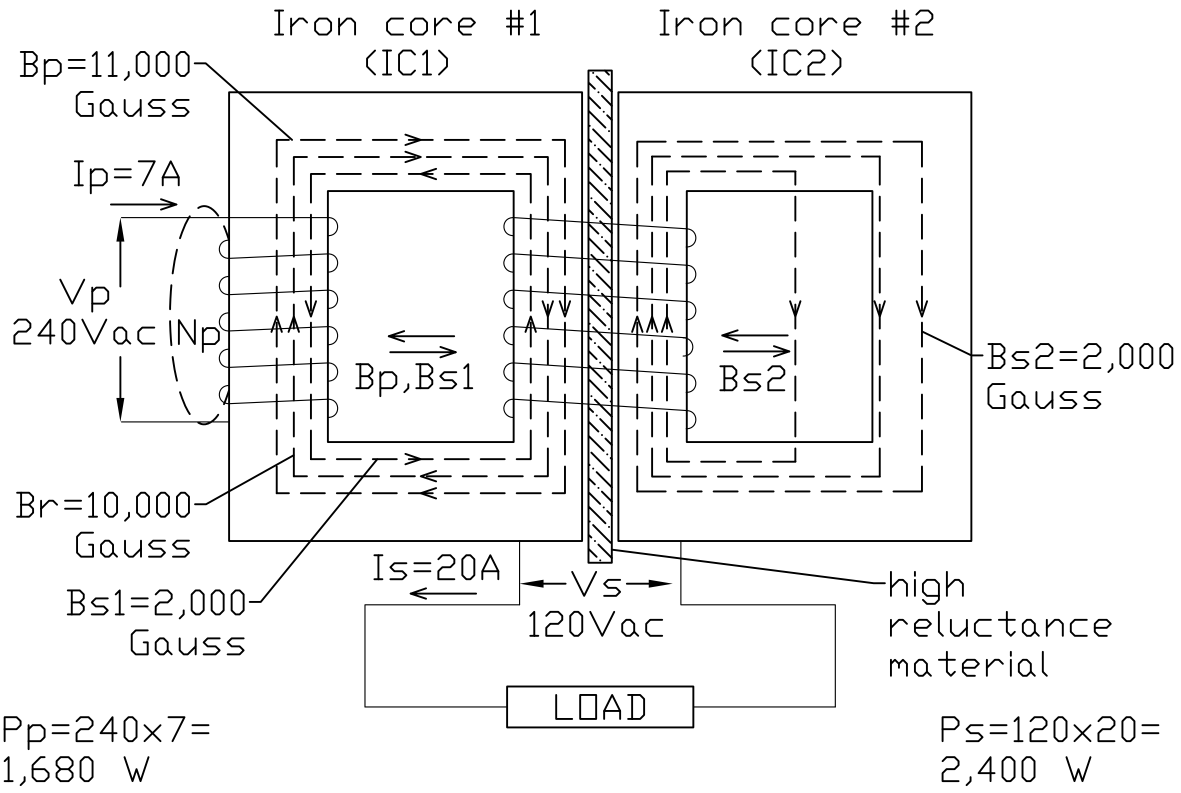

Iron core #1 (IC1)
Iron core #2 (IC2)
Bp=11,000 Gauss
Ip=7A
Vp 240Vac
Np
Bp,Bs1
Bs2
Bs2=2,000 Gauss
Br=10,000 Gauss
Is=20A
Vs
120Vac
high reluctance material
Bs1=2,000 Gauss
LOAD
Pp=240x7= 1,680 W
Ps=120x20= 2,400 W

FIG. 13

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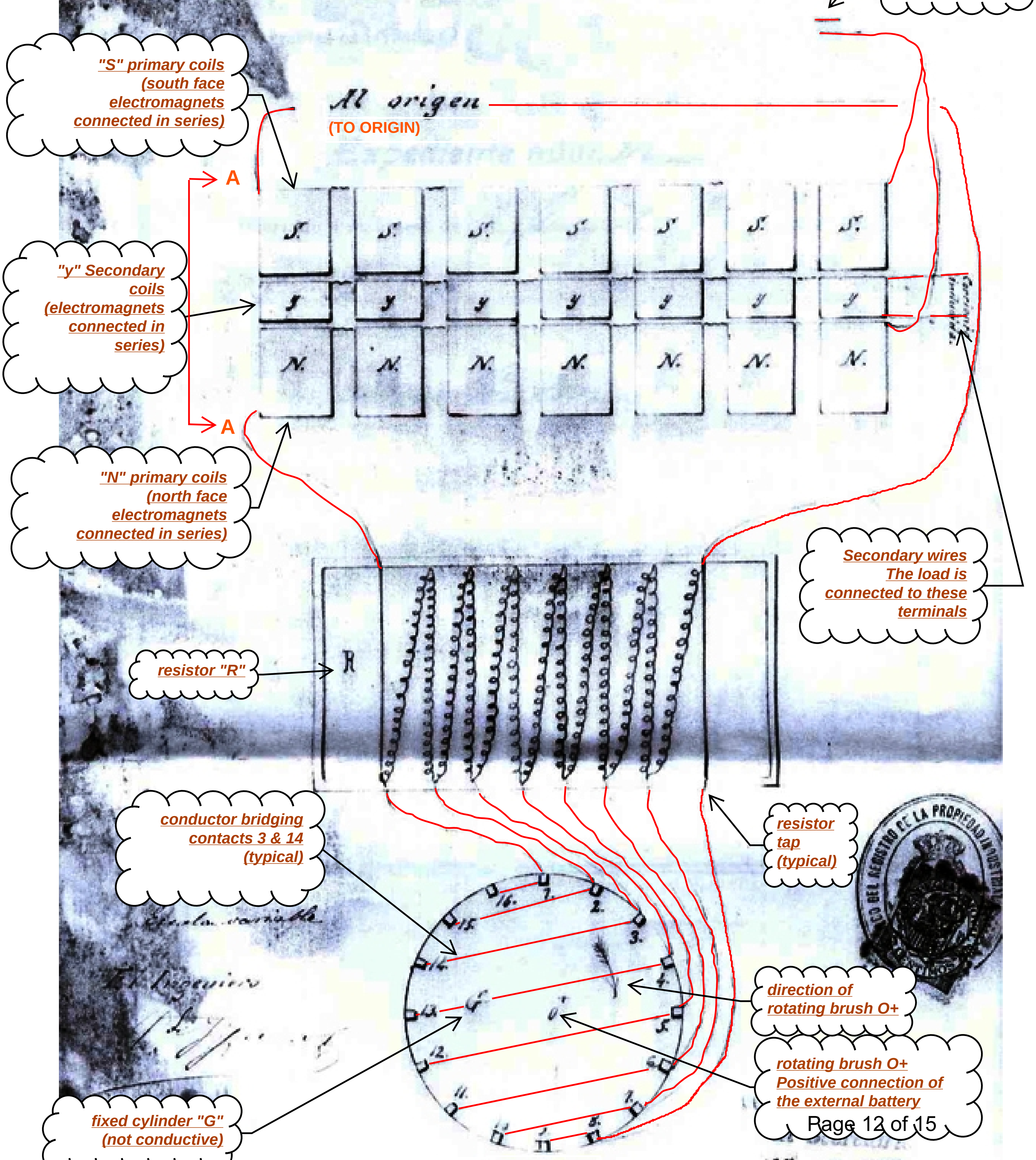
GENERADOR "FIGUERA"

(GENERATOR "FIGUERA")



Negative connection of the external battery

"S" primary coils (south face electromagnets connected in series)

"y" Secondary coils (electromagnets connected in series)

"N" primary coils (north face electromagnets connected in series)

Secondary wires The load is connected to these terminals

resistor "R"

conductor bridging contacts 3 & 14 (typical)

resistor tap (typical)

direction of rotating brush O+

rotating brush O+ Positive connection of the external battery

fixed cylinder "G" (not conductive)

Escala variable

El Ingeniero

FIG. 14

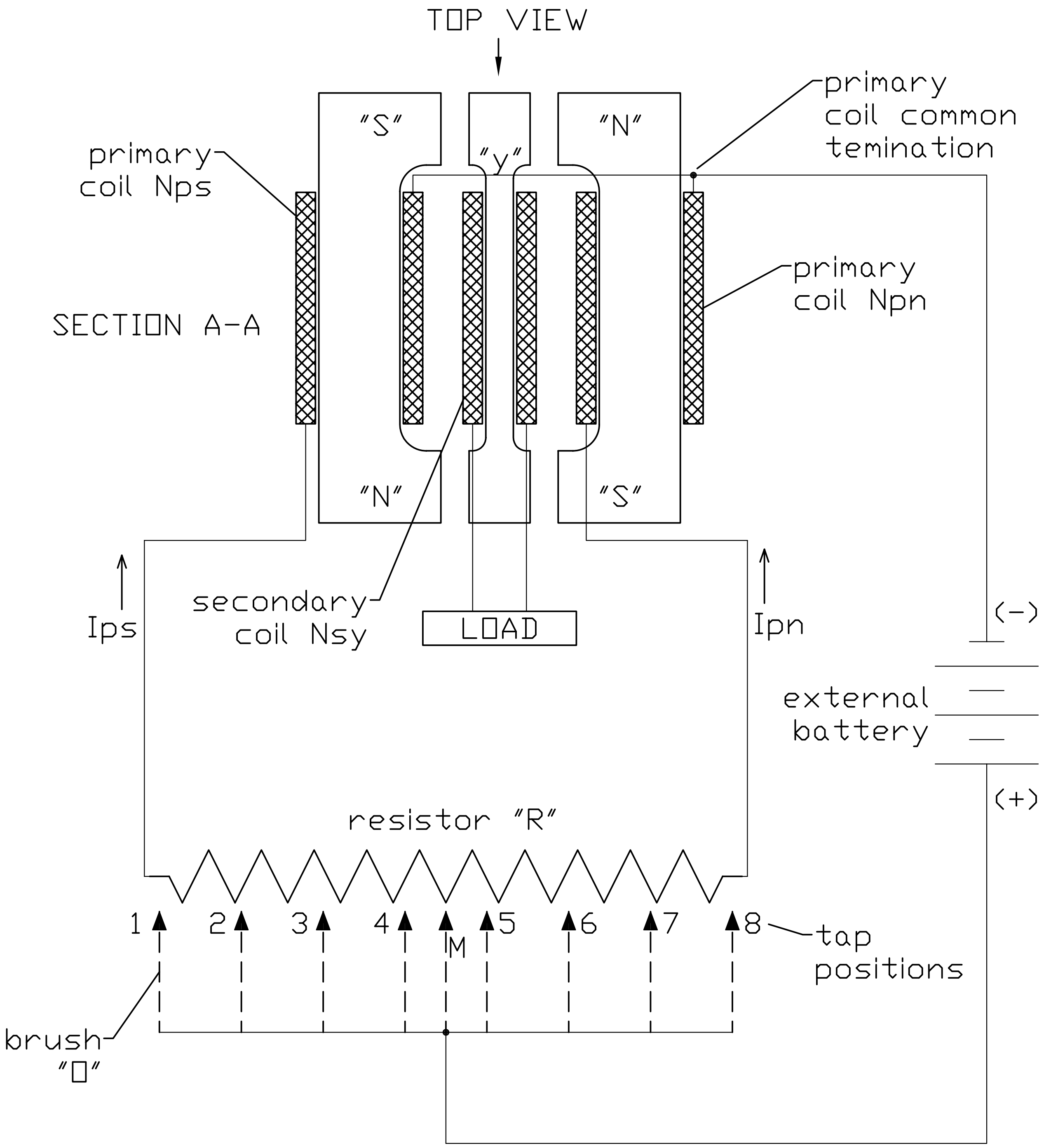
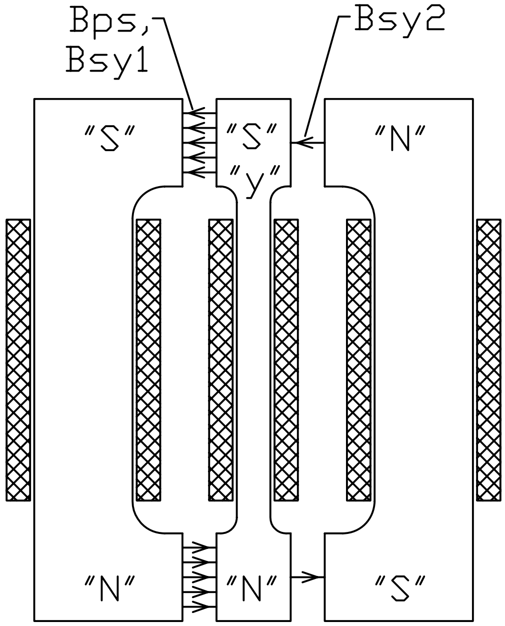
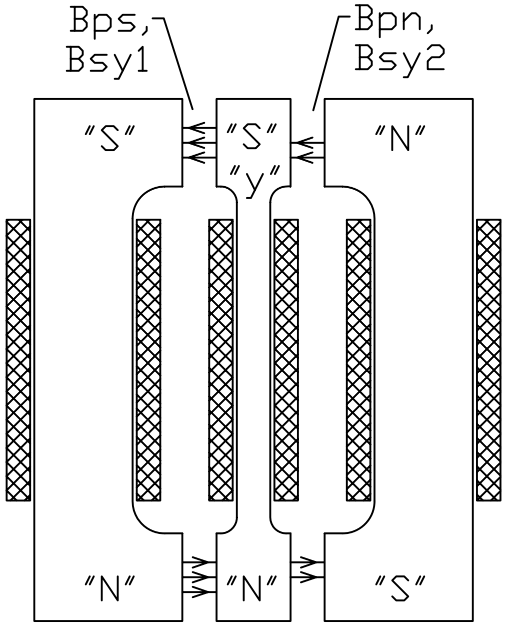

TOP VIEW
"S"
"y"
"N"
primary coil common temination
primary coil Nps
primary coil Npn
SECTION A-A
"N"
"S"
secondary coil Nsy
LOAD
Ips
Ipn
(-)
external battery
(+)
resistor "R"
1
2
3
4
M
5
6
7
8
tap positions
brush "O"

FIG. 15



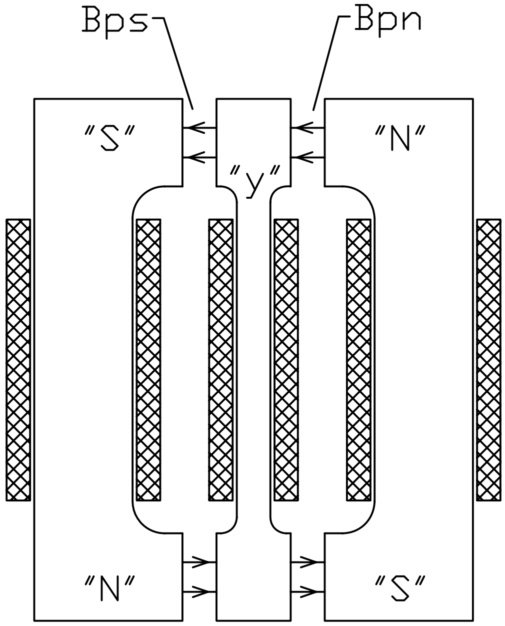
POSITION 1

FIG. 16



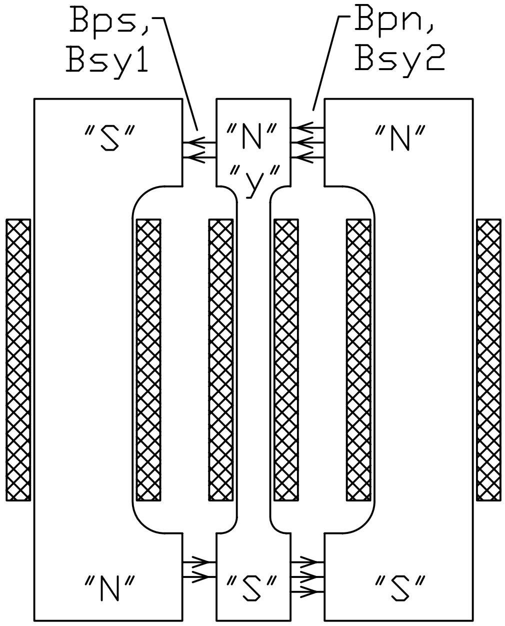
POSITION 3

FIG. 17



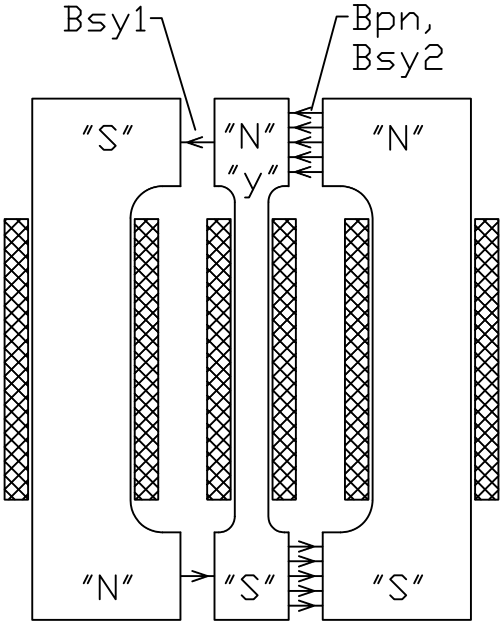
POSITION M

FIG. 18



POSITION 6

FIG. 19



POSITION 8

FIG. 20

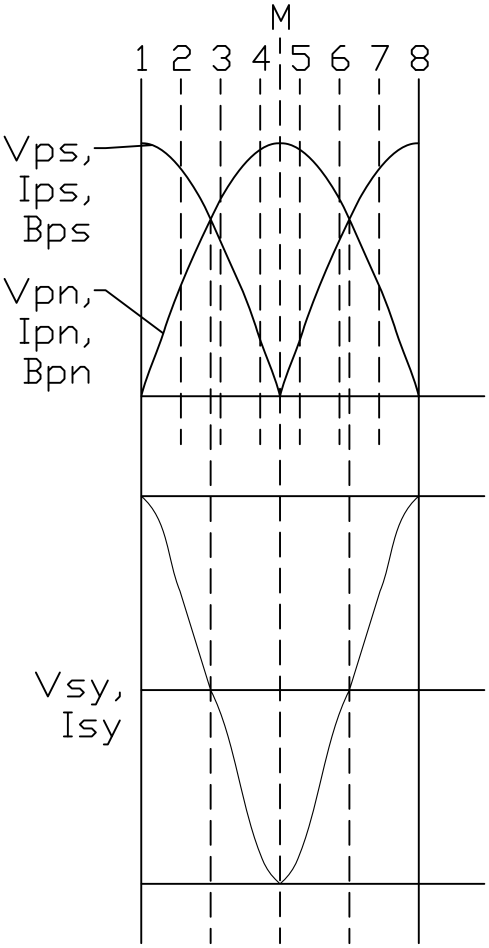


FIG. 21