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To begin with lets get the terminology right these are not strictly FREE ENERGY devices they are CONVERSION devices, which tune to the earths magnetic field and extract useful energy from it.

The technology is not magic and is in fact uses simple electronic concepts to achieve the demonstrated results. Therein lays the rub...
I hope to hear from you again.
Thank you for your time.
Sincerely,
SM

The problem that has plagued Steven and any others who tried to sell his technology is that most people want a gimme for free . I say agian get the idea of boxes and pre defined ideas out of your expectations. I know that this is hard But I honestly believe that Steven's Invention cane from getting away from assumptions...

If you have a cro and a good understanding of transformers you may enjoy what follows.

Steven,

It is very possible to generate electric power from the earth's magnetic field. Think about the fact that in just one revolution, the Earth generates enough electric power to supply North America with all it needs for over 100 years! All we have to do is tap into that energy and all our energy wishes come true.
I found the secret when I read in some books about electron tubes. I was a TV repair man as well. Back in the days of electron tubes. The good old days I think.
In one of the RCA engineering manuals I read that it has been measured in a wire that there exists a slight increase in current when first electrons are caused to flow in it. This was explained because the earth's magnetic field exerted some influence on the wire and the electron flow inside it. Or rather the electrons on the surface of the wire.
Even today you can find examples of discussion of this fact even in non scientific journals.
If you look in Morgan Jones book, Valve Amplifiers, 3rd edition, on page 262 he says, The inrush of current through the filament interacts with the earth's magnetic field to produce a small kick.
SMALL KICK. Those words mean a great deal. It PROVES that there is an interaction between the magnetic field of the earth and simple electrons running through wires. It may be a small influence but it is actual OVER UNITY. I have spent several years of my life thinking about that.
Scientists tell us that over unity is impossible. They say that you cannot get more out of something then you put into it.
Then I think about that wire with the small kick when first turned on. . .
There in lies the secret my friend.

In regard to your query about the pulse DC conversion and the potential use of the coil to provide motive force:
The multiple frequencies traveling around the coils are of too high a frequency to provide for any motive effort. They are only a means to achieve an end. The multiple frequencies begin to feed themselves and the multiple kicks become a combined big kick.

I call it resonating. That is why if you notice in the video tapes that it takes just a few seconds for the coil to begin to function at maximum effort. You see, one little kick amounts to nothing. However imagine if you had hundreds of thousands of little kicks combining into one big current kick . . .

I originally got the idea from electron circuits which use vacuum rectifiers like the 5U4 GB or 5AR4 etc. The plate has a high voltage potential with lots of useable power available. You cant get to it or use it for anything without applying a heating voltage to the cathode or what is the cathode potential of the tube. So, you put in a small voltage of 5 volts AC 60 Hz which heats up the cathode and welcomes the electron stream from the plate. Or actually the other way around, but not important for this example

of my thoughts. Now the high voltage power goes through the cathode and travels through the coils of the 5 volt transformer along with the 5 volt AC. if the plate voltage is not rectified then it is AC with a potential 60 Hz frequency. That combines with the 5 volt 60 Hz in the coil of the htr transformer and generally amounts to nothing. In fact the power of the 5 volt transformer amounts to nothing. It is an insignificant power supply except when the two transformers get slightly out of phase with each other, or when they are connected in reverse of one another.Then you can measure all kinds of things going on. You can generate all kinds of hash and multiple frequencies, and I do mean all kinds. What I measured during this process was very interesting. All these frequencies occasionally met at the same time with a much larger kick at the output.
I was working at a laboratory at the time with much more sophisticated equipment then is available to even most manufacturing companies. I was able to analyses everything coming out of this simple two transformer AC high voltage circuit. In most power supplies there is lots of hash coming out and designers use a .05 or so to short out as much as possible before it gets to the smoothing capacitors. This hash comes from the mains supply and especially from the transformers themselves.
Then the smoothing capacitors take out the rest of the multiple frequency hash along with the gigantic 60 Hz ac left in the B+.
I became interested in the interaction between the two AC transformers. The interaction can be very reveling, trust me.
Also, there is another interesting analogy. We seem to overlook so many things in our society. They are right in our faces but we just look around them without interest at all. When I began to study the effects of multiple frequencies combined together I found out that when you deliberately strive to create the worst case scenario of frequencies you start to get some very measurable kicks. In themselves they are not much. But if you make enough of them fast sendoff, you get a collectible power spike that is more then the power available to begin with. The destructive heating caused by the eddy currents become the problem we face when we make a really large powerful coil. Now you understand more about the heating problem and why using a fan does not work.

Steven,
Thank you for sharing the foundation of inspiration behind your device . I was surprised that I could indeed create what amounts to RF energy using out of phase ac voltage. I do see some "kick" but it is very early days and I am honored that you are helping people gain an understanding of your invention.

The inventor claims that the output of the unit is high voltage DC with a frequency component of around 5k Hz. Then the person trying to discredit me goes on to say that I am trying to fool people because you can't have DC and AC together, etc.

Why would that person keep harping about the frequencies not being possible within a DC output power?
I have made a great study of Vacuum tube power supplies as I have told you. It is all very interesting. Please remind me to tell you why Nicola Tesla used Vacuum tubes in his most powerful demonstrations of his power conversion technologies.
Anyway, I have taken a high voltage power supply as follows:
500 v-0-500 v 300 mV plate transformer run it through a full wave silicon circuit then run it through a 5U4 electron tube rectifier. Now you know that the 5U4 requires 5 volts AC at 3 amps for its heater to gather the electrons and complete the circuit. Well, I measured the output from the tube and the result is 500 volts DC at 250 mV. The loss is due to the high impedance of the tube and its limited ability to dissipate more than 250 mA.. The point I wish to make here is that also along with the 500 volt DC is, yes, you guessed it, the 5 volts three amp AC current! They are both completely independent of each other except for some very interesting things I will mention to you some other time..
First of all, obviously you can have several different output components in the power output signal. You can have DC and AC together without any problem. Why did that mystery person claim that it was a foolish to say DC output with a 5k Hz component? Because he was deliberately trying to mislead anyone who might want to figure out what I was doing.

What I am trying to say here is that believe I am not the only person who knows about the reality of the technology. There are others who know it can be done and have a desire to see to it that it's application is delayed for as long as possible.
Now about the DC output with AC signal.
There is a book about Nicola Tesla "The Man who Had lightning in his hand". I suggest that you find a copy of that book and read it. In that book it is related that Tesla states that you can have all kinds of

electrons flowing through a wire traveling in different directions relating only to their potential power source. He even said that you could have different electron flows through a single wire completely separate from each other. I tried it and he is right!
On to another point.
HE said that one day in his laboratory he was noticing that there were some reactions on his magnetometer for no reason he could understand. The next day he had many magnetometers brought into his laboratory and he began additional research. He found that the measurement of the earth's magnetic field was fairly straightforward. You have a device, which measures a very small magnetic force which comes from the generation of magnetic waves as the big iron ball we call the earth rotates. If you look at a scientific display of the earth you see that it resembles a big power generator. It has poles, a magnetic field, rotation, everything.
Now I am you know that anytime you have a magnetic field moving past a wire you have electron flow in that wire or more precisely on the surface.
So the earth is generating the most unbelievably huge amount of power all the time and we can't tap into it?! I don't believe it! Neither did Nicola Tesla.
He found a way to tap into the earth's power potential and he demonstrated it often.

Did you know that every single one of his patents was purchased by Edison and Westinghouse? He had a very large amount of patents and they purchased all of them but only utilized one for transmitting electric power via 60 cycle AC and step down transformers, which became the standard of power transmission throughout the earth to this day.
Anyway, back to his research in the laboratory. He noticed that most of the time the magnetometers stayed relatively sedate and around the same level. They would fluctuate just slightly. however one day he noticed that the meters jumped quite unpredictably. It attracted his attention and he began to find that the meters were reacting to a thunderstorm many hundreds of miles away. Interesting isn't it?
Then he continued his experiments and found that as a thunderstorm moved closer the magnetometers would register larger and larger fluctuations until they were off the scale and useless.
He was fascinated and consumed by this. He acquired better magnetometers and his research found that you could tune the magnetometers to certain specific frequencies and tap directly into large magnetic waves. When I say large, I am referring to huge. That was useable power.
However, you had to find a circuit potential in order for the electrons to flow. That was the difficulty which he overcame to produce his famous demonstrations of power from nowhere.
Please let me make another point.

Let us say that you have a magnetic field perhaps it is only a small permanent magnet. Now, you have a single copper wire twelve inches long. If you move the magnet across the surface of the wire from left to right at a certain speed you create an electron flow which is DC and it has a power potential based on how strong the field is and how fast the magnet if moved. So, if you increase the size of the magnet or the speed it moves you create a larger flow of electrons, larger as in higher voltage or more currant.
Everyone tells us that the earth's magnetic field is measured as being too insignificant to generate any useable power, that is not so.

Let me give you something to think about... If you had a short wire and you moved a magnet across it you would always have limited potential because the length of wire was so short. OK now what if we increase the length of the wire to many miles in length even with a very weak magnetic field moving across the wire you still have a much greater potential flow of power available. If we put it into a perspective of power per inch it may be easier to understand.
If you have a small magnetic field moving across a wire twelve inches long it can generate an electron flow equal to lets say one millivolt per inch. If you move the magnet twelve inches at the same speed you get 12 millivolts as you transgress the twelve inches of wire. Understand that I am trying to convey a principal that you can understand for use in the future.
So, you have a wire twelve inches long and you can make 12 millivolts moving a magnet across it. If you have a wire 1000 feet long and you move the same small magnetic field across the length of it you can create much more voltage potential perhaps 12,000 millivolts lets say.
So, you have managed to generate a significant amount of electric power with a weak magnetic force.
OK, how does this help us? where am I going with this?
Suppose you have 1,000 pieces of wire twelve inches long and you run the same weak magnetic field over them all at the same time..... you get the same flow of electrons.

If the wires are run in series then you will get the 12,000 millivolts etc. If you connect the wires in parallel you will get higher current but lower voltage. However, the power potential is the same whether you run the wires in series or parallel.
If you know how to find the circuit potential, you tune into the frequency and you have enough short pieces of wire you can convert as much power as you wish in a given space.
Things are more complex then what I have told you but I am just trying to give you an idea of how the technology works.
How it IS POSSIBLE to use what appears to be a weak magnetic force to generate large useable amounts of power.
By the way, when I met with Dr. Schinzinger many years ago we discussed a point you may find invaluable in your thought processes.
Did you know Lindsay, that it is a scientific impossibility to play a vinyl record with a diamond needle? Well it is. Science tells us that if you were to use a diamond, the hardest natural substance to play the soft groves of a vinyl record you would destroy the record with just one playing, but, as you know that is not the case. They have made millions and millions of vinyl records and people used millions of turntables equipped with diamond needles to play them repeatedly over and over again. How could something that could not possible survive one playing continually be played over and over again?
Science can not explain this. I say that if you run a diamond across a plate of glass you will invariably make a serious scratch in it with very little force, but if you play a vinyl record there is no damage or at least very little discernable wear. Something to think about, isn't it?

The reason the diamond needle phenomenon exists today is because of ignorance. You see when they started making grooved records back in the beginning of this last century they were using cactus needles to play the records. The cactus needles would wear down and need to be sharpened. So enterprising young men came up with steel needles. Unfortunately, they too would wear down and need to be sharpened. Eventually these enterprising men continued to use harder and harder materials eventually arriving at diamond to make their playing needles -- about the hardest thing they could come up with. They didn't know that according to science only one playing of the shellac disk would destroy it. They didn't know so they just kept on making and selling diamond needles for not only shellac disks but the new soft vinyl ones as well..
Trial and error is the best way to make new discoveries. If we rely completely on what we are told by scientists and engineers we will never make any relevant discoveries because we are told not to try, that they are impossible.

You mention that you find the inertial effects of my technology as being interesting to you. All I can say is, MY GOD YOU HAVE NO IDEA JUST HOW INTERESTING!!!
Do you remember our brief discussion about if it could provide a motive force?
I am not sure if I should comment more at this time. It is not that I am apprehensive about you, it is that I am pleased with what we have managed to get away with so far without intervention by higher sources. So why tempt them too much.
I have read more of Stefan's web site postings about my technology and I can see much good coming from it all.
Some of them are almost right on.
You have not posted all of my letters to you?
Have you posted some of the engineers reports I sent to you?
Did I send you Dr. Schinzinger first report?
Let me know your thoughts?

First of all:
1 There are several parts of the power unit which have patents. Remember that the power unit technology is owned by the UEC corporation and I have to be very careful about not stepping on their toes. I am not afraid of them or anything like that. It is just that they are the legitimate owners of the patents and most of the research ect. I would not like to break my trust with them.
However, I can, and will give to all of you as much information as I can. I believe that I will be able to give you enough information to begin research on your own. I just have to pass it in front of my attorney first so I do not get myself into trouble, that's all.
2 I will in time give out a basic Hardware diagram which you may find helpful.

3 No I will not publish a schematic diagram of the control circuit. It is proprietary information owned and controlled by the UEC corporation, so I won't go there.
4 I will tell you about my initial experiments and what Electron tube circuits I used to control the frequencies that gave us our significant breakthroughs way back when.
5 Yes, Stefan I do intend to point you in the right direction. You deserve at least that much for all of the good effort you have put forth for so long. And especially your kindness to me.
6 About the Flame like Discharge. Yes it does cause RF burns. I was going to tell about that, but I decided to wait and see how long it would take one of you to realize this on your own. Bravo!
7 The patents are in several segments pertaining only to the control units not the collector coil itself, so I will send you examples of the hardware diagrams. however, I do not have access to a PC at all times so it will take some time for me to be able to scan things and send them off, be patient please. Also I am not spending all my time sitting in front of a PC reading and sending. I must travel to a public place in order to safely send any information at all.
8 YES, torodial transformers have some very weird factors.. Study the strange factors.
9 Your interest in the harmonic resonance is also stepping toward the right direction of things. But then again it depends on your viewpoint about exactly what harmonic resonance is and how it relates to mag fields and converting energy as does my power unit.
10 We have done a great deal of experimentation with permanent magnets with some very astounding results.
I could stop now and start over again with that subject alone. Has anyone ever read any of the reports about our experiments with what was called, the Magnetic shadow casting material? No it wasn't some kind of paint. But you would be fascinated with the amount of renewable energy you can extract from a permanent magnet! We went through about ten thousand dollars worth of Neodymium and Super Cobalt 404 magnetic material in our experiments. I could write volumes of information about that stuff. Those experiments tie in to our development of the power unit.
11 Yes, I agree, why does everybody assume that magnetic fields are so single dimensional? they are not . . .they can't be.
12 Who ever it was that said there might be possibly military applications for this technology is a very wise man. We believe that is probably the primary government interest followed by the ever popular oil industry trying to stop it.
13 I am sorry, they are not piezo stacks. However, they do look like it. And some of what you said is not far off at all.
14 Both Freedomfuel and bushwacker have good and relevant points.
15 Yes there is an inertia.
16 Yes there is a genuine gyroscopic effect when the units are on. Everybody has noticed that when held and in operation, the units have a definite vibration and have a gyroscopic effect. They seam to resist being moved through the air. When placed on a smooth surface it is very pronounced. Some of you should think about that.
17 Rotation of field. . . How many people think about that. If you could have a field that you could think of as a big ball. And you could rotate it in two directions what would the ramifications be?
I hope some of you will appreciate this info, my direct response and the spirit in which it is given.
Sincerely,
SM

ROLAND SCHINZINGER PhD.

Report on Test of Energy Device

At the request of Mr. Richard Mincherton I was present on October 28th at a test demonstration of a device that its inventor claims will produce electric power without measurable energy input except as derived from the earth'' magnetic and gravitational fields. The test was conducted at the inventor's home. I was allowed to bring and use measuring instruments, but because the inventor had to leave after
1 ½ hours, I was not able to conduct independent tests on my own.

Based on my observations, I can attest to the fact that the three models of the device displayed and tested on that day did indeed light up one, two and six light bulbs (each rated at 100 watt and 120 volt)

respectively. This was less then the figures quoted to me before the test, but still adequate to demonstrate that the devices function in some fashion. The smallest unit produced 140 to 150 volts unloaded and 60 to 90 volts when lighting one 100-watt bulb.
The mid-sized unit produced 250 volts unloaded,
and was observed producing
142 Volts at .5 Ampere after 30 minutes of lighting two bulbs.
The largest unit produced 798 Volts unloaded. With a six-bulb load the voltage dropped to 420 Volts.

It was difficult to determine how many hours the devices may be able to operate because the inventor ended the demonstration after 1 ½ hours.

I could not detect any time-varying magnetic field that might have provided an external energy input.

After the test the inventor cut the toroidally shaped device into segments (though not the controller box located at the center of the device). These samples consisted of an array of circumferentially arranged coils and wires grouped around a core made of a cork like substance.

Just going thru what steven had told me

I do suggest that people who are not familiar with rf and the burns that can be had do not mess with this.

The coils get hot. THis problem has not been resolved. It apparently due to the windings moving.

Think of the ouput as dc (pulsed)5khz with lots of Hash in it.

When it is unloaded the voltage climbs substantially and I do not mean a spike. it lasts for several seconds and is a good third higher.
Steven calls it the turbine effect.

The large coils have control units (as seen) the small coils have the control unit mounted on the inside edge of the coil and they do have to be inside the coil.
Here is something interesting from Steven.

It has been a very long road from beginning to end. It took several years of experimentation to discover what frequencies and most importantly how to make small integrated circuits work to perform the control functions necessary to make the demonstrations you see on the video tapes available today.
So in many ways we have early RCA color TV engineers to thank for my discovery of the power generator. I am sure they are all dead now but they did contribute.
Perhaps a story which had impact on me at that time was told to me by my boss way back in 1970 I believe it was.
He told me that around 1965 or 66 there was an explosion in an apartment in Chicago. the authorities had concluded that for some unknown reason, a General Electric color television receiver had been the source of an explosion that killed a young black child in the apartment. My boss went on to relate that he was involved in the investigation because he was in Chicago at the time and he was invaluably experienced with television circuits and etc.
He told us that what they found was, the TV had exploded with some quick furry. The explosion did in fact kill the poor child who was sitting directly in front but sparred his mother who was some distance away in the kitchen.
The explosion was strange because of the absence of expected chemicals necessary to create the explosion. It appeared that the TV was the exact center of the explosion, however no one could find a reason for the explosion occurring. Also consider that there is not really much inside a TV to explode with enough force to kill people and destroy the living room a large apartment. Yes a CRT can explode and kill someone, however this was not the kind of explosion we are talking about. The most interesting part of the story is that according to our boss, metallic objects especially those containing large amounts of iron were dramatically displaced. He mentioned that some nails were actually removed from the walls and pulled toward the TV set. When they found them they were bent and shaped like cork screws! Everything in the room appeared to have moved or was moving toward the

TV as it exploded, or imploded as the case may be. The child was apparently killed by way of these metallic objects traveling through his body on their way toward the center of the TV set.
As far as my boss knew, there was never a good explanation for the occurrence. We found out that this was not the only unexplained explosion of TV sets worldwide. However, the fact that all the sets exploded while in operation may bear some light. Also most of the TV sets were made by the GE company or were TV sets made using GE circuits and of similar design.
However, this man who had been my mentor for so many years had his own theory which he never told anyone as far as i know, except me. His theory was that the TV while in operation, somehow managed to become a receiver of more then just television waves and so for a millisecond in time became a receiver and the discharger of a huge amount of electrical and magnetic energy. This discharge of magnetic energy is vary similar to the discharge of magnetic energy during an atomic explosion. . .
Now that is something I have thought about a great deal.
My employer's words had great impact on me. Not that they meant anything really, but I kept thinking about the possibility of many frequencies combining at one moment in time to produce an entirely different effect then intended by the designers. And so it goes. Some of the reasons why I thought **about things the way I did and perhaps why I set out to think along the lines I did when I discovered the power generator technology. Or more appropriately, the power converter technology, because that is actually what it does you know.**
Sincerely,
SM

Hi all,
Steven aked me to post this

Dear Lindsay,
I am perplexed that everyone thinks that GOOGLE is an accredited reference source.
It is NOT.
Google is a search engine. It is different then a reference library.
And it is very different then a SCIENCE LIBRARY.
NO accredited scientist does any serious reference work sitting at home with GOOGLE.
Google is comprised of information specifically put into in by interested parties.
No scientific information placed there by libraries.
People need to realize this before they die from lack of serious information.
Go to a library!
Sincerely,
SM

Please to not take this as anything but something to further you knowledge... Nothing that steven has revealed is wrong
he really is trying to help people understand his technology ....not DUPLICATE.

Re read this long thread ...relax perhaps some of it will fit.

Every body want somebody else to solve their problems and work out the puzzle.

Large peices of the jigsaw ARE here ...Im sorry to sound condesending.

Lindsay Mannix

NOT FROM SM OR LINDSAY, JUST THOUGHT IT MIGHT HELP:-

I appreciate the haphazard nature of information gathering using search engines, but not all of us have access to a university science library. There are sites that do have indexed science periodical and book collections like this one:

The Internet Public Library
http://www.ipl.org

Here is their URL for their energy science journals:
http://www.ipl.org/div/serials/browse/sci14.00.00/

Also Try Energy Science and Technology Virtual Library
http://www.osti.gov/energyfiles/

Physics Research Guide
http://www.lib.utah.edu/ResGuides/physics.html#ejournals

The British Library has an online index here but you have to attend their reading rooms to view the journals. They also have an online bookstore:
http://www.bl.uk/index.shtml

There are several online science libraries that require an annual subscription. This one only costs $30:

Science Direct
http://www.sciencedirect.com/

Or there is this completely free online science library with 919 journals and 1,213.606 full-text articles.

Highwire Press - Stanford University
http://highwire.stanford.edu/

Full text Physics articles are available here:

IoP - Electronic Journals
http://www.iop.org/EJ/

The best internet library is this site which has 35 million pages from 3000 sources going back 20 years. The sources include academic journals, newspapers, books, encyclopedias, etc. Subscription of $100 a year is required for full text access.

Highbeam Research
http://www.highbeam.com/browse

I could go on and on but I am not sure how useful these resources are when you consider that the subject we are researching is not allowed to enter the science mainstream because all the research is classified. However, I have been able to glean a some insight from recent research into natural phenomenon like ball lightning, solar magnetic waves and atmosphere physics in general.

END

Hi all,
A bit more from Steven

Roland Schinzinger
Ph.D.
29 Gilman St. Irvine, CA 92715-2703, Phone & FAX: (714) 786-7691

Dear Stephen,

Thank you for your kind words of sympathy regarding my loss. We both share similar feelings.

In your letter you asked my opinion: I think it is a miracle that your device works. Exactly how it converts energy is elusive to both of us at this time. That does not mean we shouldn't apply ourselves to know for sure. My offer to work with you still stands. I understand your difficulties with the gentlemen you work for and I will not take your decision personally. I will be glad to talk to you and help you all I can. My offer to work on the project was made with the greatest respect and not as some kind of

justification to the Foremost Corporation. I told them that from what I could see of your units they did supply substantial amounts of both voltage and current. I told them I could not give any indication of the value of the discovery without knowing more about it. I did recommend that they invest necessary funds to continue working on the discovery and that I was interested in working with you. That is about all I said to them on the subject. Anything you may have heard to the contrary is not true.

To further our discussion, the reason you can not use small transformers within or at close proximity to your unit is because of the leakage fields of magnetic flux. They induce currents into nearby circuitry and most likely cause frequency changes in the operating point of the control unit. Remember when you inject even a small frequency component into sensitive frequency dependant equipment you can have a disaster. That is exactly what I believe is occurring when you try to use a transformer close to your units. There will be all kinds of harmonics present within this field extending past the radio frequency range. If I were to compare the two I would say that toroidal transformers would be more susceptible. This may be contrary to common thought. Toroidal transformers have all their flux aligned with the grain of the steel used in them. This is the reason for their reduced size as compared with E I cores. When operated at higher flux density you can permit a smaller core. Toroids will always saturate quickly, however, E I transformers ramp up to saturation levels slowly. If anything, I would suggest you work with E I rather then Toroids. In either case I believe you will find that you will have to place the inverter well outside the collector coils.

You may also leave a message for me at my office at the University of California Irvine.

Sincerely,

Roland

Lindsay,
That is the reason why the power inverter is always placed well outside the coils of the power units shown in the videos.

Here is a page 262 scan courtousy of Jason Owens from
the Valve book !

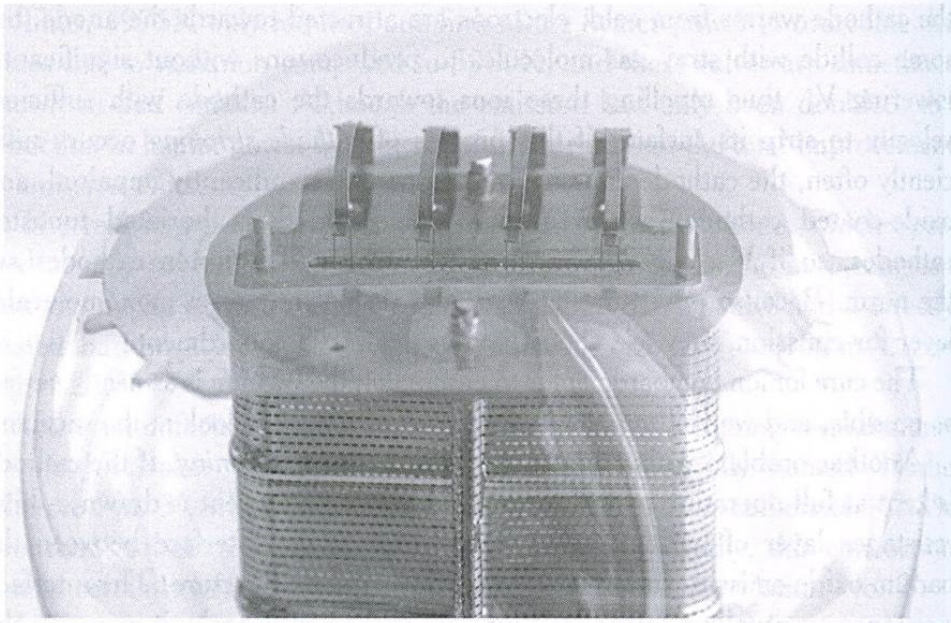

Fig. 4.26 *Tensioning a 'W' directly heated thoriated tungsten filament with leaf springs*

reduced filament life by 0.2% from its maximum life of 30 000 hours. This doesn't sound too bad, but it implies that 500 off/on cycles will destroy the filament, so if you switched the valve off and on every day, you could expect it to expire in less than 17 months. Unsurprisingly, the broadcasters took a dim view of this, and looked to see how life might be extended.

There are two reasons why the off/on cycle kills thoriated tungsten filaments:

- As the filament temperature passes through ≈900K, the Miller–Larson effect causes the grains of the metal to reorient themselves, so that the wire becomes thinner and longer. Worse, if a given section of the filament is slightly thinner, the increased current density causes increased localized heating which exacerbates the Miller–Larson effect and causes further necking of the filament. Eventually, this necking leads to such deep cracks that the remaining conductive material has sufficiently high current density and local heating to vaporize it, thus destroying the filament.
- The resistance of a cold filament is one tenth that of a hot one, so the cold inrush current is ten times higher than the operating current. The inrush current through the filament interacts with the earth's magnetic field to produce a small kick. Combined with Miller–Larson effect, this gradually deepens the surface cracks in the brittle filament. The damage done to the filament is proportional to the cube of inrush current, so a 'soft start' can be worthwhile.