PREVIEW

February 17
WORK WITH THE SMALL LEBIEZ MACHINE

I am not sure if I mentioned above that the electrostatic machines I am building are modeled after Lebiez machines. I decided on this type for several reasons. Its drawbacks compared to other machines are known to me, but for my purposes they are not important, and its simplicity and practicality led me to choose this design.

The choice was between a Holtz machine and this one, but since the Holtz machine is essentially sectorless, it didn't suit me at this moment—though a hybrid variant might be possible.

After all, they are all more or less similar to one another.

I have now tested exciting the machine with 24 sectors, where both collectors and neutralizers are placed, while drawing the voltage from the 48-sector unit... It turned out that the resulting voltage was somewhat lower than with the 24 sectors alone, but the discharge frequency was much faster and more uniform. I think this will have a positive application for the motor and other loads.

Essentially, I believe this can also be achieved with a conventional sectored disc in the usual manner, provided the collectors have as little capacitance as possible—because the capacitance of the holders and spheres on them contributes to a lower discharge frequency.

The next thing I want to test is exciting only the 12-sector unit, while drawing the charge from the peripheral sector unit.

To test this, I will need to make new brushes for the collectors and neutralizer, as the length of the existing ones is insufficient.

I have also purchased 36 spheres of 18 mm diameter and am preparing to mount them on a 400 mm platform for the 300 mm disc. I will likely use 30 spheres as terminals for the motor.

I shortened the cardboard inductors on the motor and attached them to the spheres:

Now I am able to achieve rotation of a polyethylene disc with no metal surfaces on it. The rotation is slow, and it is necessary to add more discs to increase the weight and to strengthen the field formation toward the disc. I observed this already at the very beginning of my work with the disc.

I tested disc rotation by comparing the rotation when using the intended collector outputs from the electrostatic machine (with increased capacitance) and when exciting the middle sector unit while drawing the charge from the peripheral unit. As expected, I obtained faster disc rotation, reaching around 180 rpm.

I compared the sparking rate when exciting only the peripheral sector unit versus the variant where the inner unit is excited and the charge is drawn from the outer one.

The results are unambiguous and show a much faster discharge when the inner sector unit is excited and the charge is drawn from the outer one.

This yields similar results in the reverse configuration as well, but importantly, the charge must not be drawn from the same sector unit that is being excited.

It remains to test the configuration where the central sector unit with 12 sectors is excited, and I am especially interested in drawing the charge from the peripheral sector unit. It is already evident that various combinations are possible here.

A potential problem may be that I will not be able to properly excite the inner sector unit due to its small diameter. I did not succeed earlier, but I believe some results can still be obtained.

I think these results I have just obtained can be easily explained. The excitation collectors have a higher capacitance and increase the excitation current, while the charge is drawn by collectors with low capacitance, resulting in a faster discharge frequency. It is desirable not to use the same sector unit because the excitation collectors draw their own amount of charge. This can be thought of as a kind of transformer.

I tested the configuration where the 12-sector unit is excited and the charge is drawn from the outer sectors.

The results were not particularly impressive in terms of achieved voltage or disc rotation speed, but they did confirm what had been assumed.

The difference in disc rotation speed when drawing from the outer versus the middle sector unit was small. Rotation speeds with the outer unit reached up to 100 rpm, while with the excitation unit itself it was around 50 rpm. With the middle unit, speeds were slightly below 100 rpm, mostly around 90.

I noticed that the motor driving the generator is more loaded when charge is drawn from a different sector unit than the one being excited.

This was now clearly observable, whereas in earlier trials—when I was not exciting the inner sector unit—I did not notice this, though I do not claim it wasn’t present. Logically, it should have been, only probably less pronounced. I must qualify this, as it was not a priority for me to observe at the time.

I believe this line of inquiry should be pursued further.

Tests carried out late in the afternoon of this same day confirmed the advantage of this new method.

A practical problem arises when charge is drawn from the outer sectors: the electric field of the entire device is not relieved as it is in conventional use, and if the insulation between discs is insufficient, breakdowns occur and sparks jump in other places.

However, this is not a flaw of the concept itself—rather, machines should fundamentally be constructed to withstand the voltages they generate, even under no-load conditions.

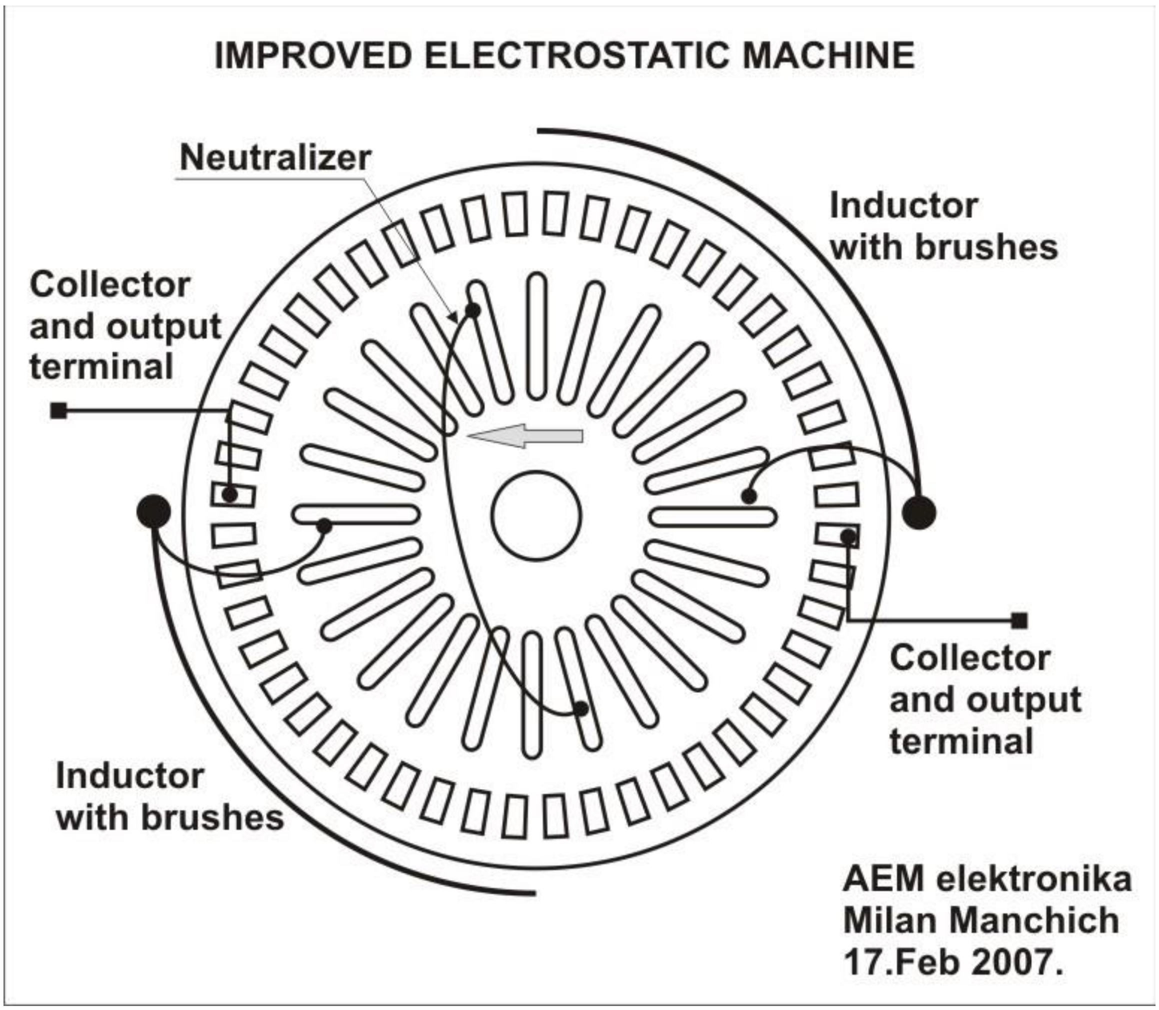
I partially solved this problem by short-circuiting one terminal from the inner sectors with its counterpart on the outer sector. I observed no significant difference in motor performance, and the breakdowns almost completely disappeared.

If both terminals are paired with their respective collectors on the same side, the operation is somewhat better than when the outer sectors are not used at all, but overall performance is still weaker.

Thus, for the time being, the configuration I studied today should be adopted.

Because the results and the improvement are evident.

Sketch of the improved machine:



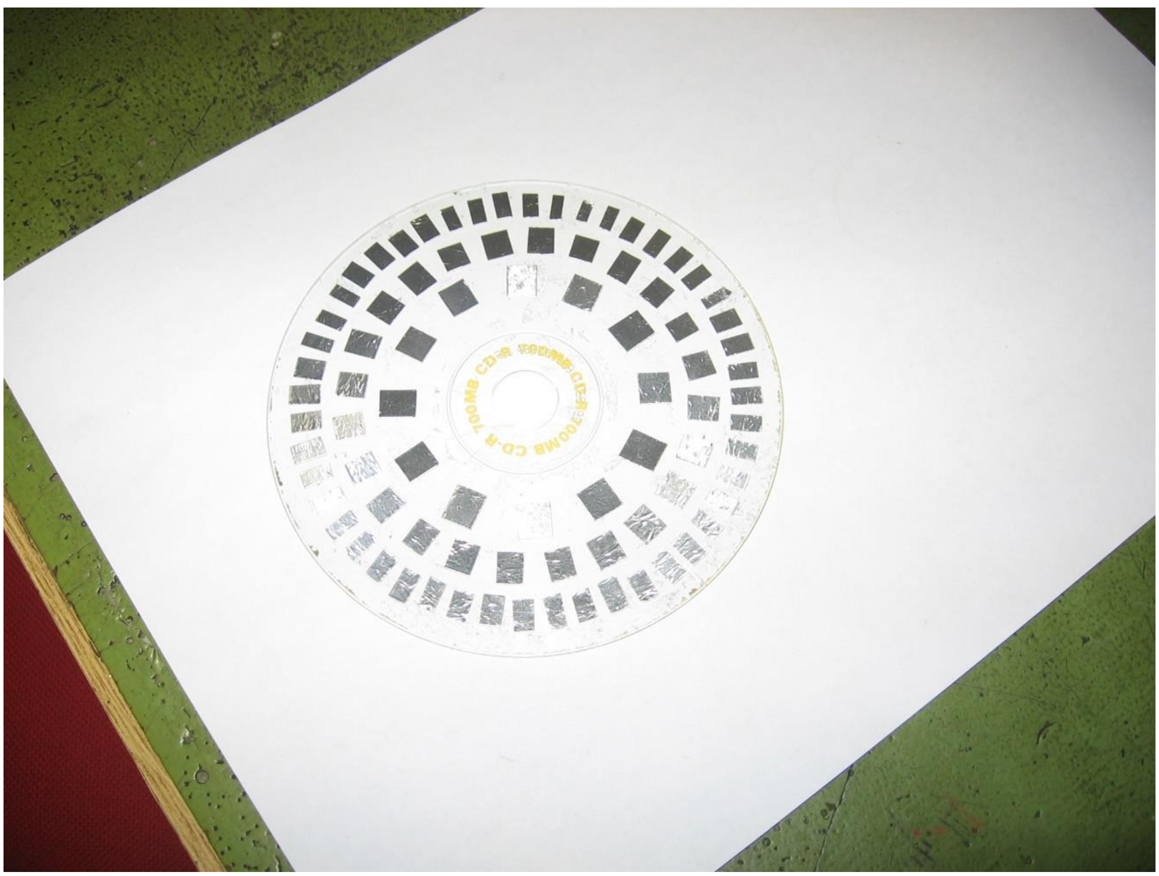
I tried placing a neutralizer on the outer sectors as well, but no benefit was observed.

I also tested having one collector on the outer sectors and the other on the inner one not shown in the sketch—this yielded equally good results in terms of disc rotation speed on the motor. However, for now, I do not plan to continue working with three sector units in the future.

Construction of the motor with 30 terminals on a 400 mm diameter platform for a 300 mm diameter disc has been paused for now, because the platform is not flat and I need to add tall washers to the terminals to achieve the required height. I am looking for another platform without this drawback, or I will have to make the washers myself.

February 18, 2007
WORK WITH THE ELECTROSTATIC MACHINE

Today I made a new disc with three sector units, the difference from the previous one being that the sector units are placed closer together. The first disc had a spacing of 5 mm, while this new one has 2.5 mm.



The first tests were carried out by exciting the inner sector unit and drawing the charge from the outer one. The middle unit had no collectors connected.

One of the terminals connected to the inductor was linked to the charge collector (on its own side of the inductor), while the other was left free and later grounded.

I started the motor disc first in the conventional way, directly, and achieved a rotation of about 80 rpm.

When drawing the charge from the middle sector unit, I obtained around 140 rpm, and from the outer unit, about 180 rpm.

It is interesting to note that at one point, by mistake, I removed the cable leading from the collector, leaving only the cable from the inductor (which has its own collector) connected to the motor terminal.
The motor disc then began rotating in the opposite direction. It should be noted that during this time, the other inductor was grounded.

For now, I am satisfied with the results when compared to those of the previous disc.

I have not yet tested the configuration where the middle sector unit is excited—something I mostly did with the previous disc—since with this new disc, excitation of the inner unit did not yield the best results due to the larger spacing relative to the peripheral sector unit.

I also need to make new charge-collecting brushes, as I have been improvising in these experiments; the results should improve once this is done properly.

I conducted the first tests with excitation of the middle sector unit. I did not observe any significant improvement in performance compared to today's earlier experiments.

The only thing that surprised me was that the movement of charge on the machine's disc could be clearly heard—both during acceleration when turned on and deceleration when turned off.

I do not believe the air has become that dry in such a short time, despite some operation of the machine.
Nor do I believe the air has become drier due to any other causes unrelated to the machine. Even if I have now adjusted the machine to be far more sensitive than before, that still does not strike me as the explanation.

At the moment, I see a possible explanation in the idea that the charge, during its distribution, is being divided from the middle sector unit onto the remaining two. In earlier experiments, this distribution was in some sense serial, whereas here it is parallel.

I am aware that even this explanation is debatable. For now, I do not attach much significance to it, and I will not waste time searching for an explanation.

Realistically speaking, the charge must be drained by collectors independent of the inductors. Introducing at least two sector units seems justified to me, as the results are better than when the charge is drawn from the same sector unit using independent collectors.

I think I should now devote some time to the motor and set aside work on the generator until new inspiration strikes.

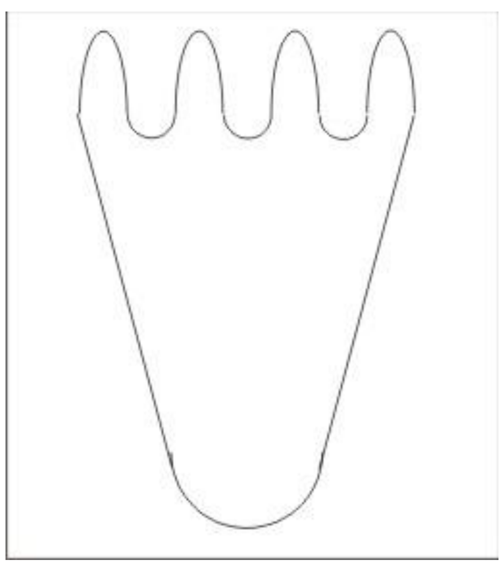
With the motor, increasing the number of terminals logically seems to cause faster rotation.

I have not yet definitively determined whether it is better to use terminals with a smaller radius of curvature—mostly points—or larger-radius spheres.

Increasing the number of terminals also means an increase in total capacitance, but I do not believe this increase in capacitance is a positive factor influencing rotation speed. By some logic, it could be attributed to that, though my intuition tells me that reducing total capacitance would yield the opposite result—or almost no noticeable difference.

As for the generator, the only idea that comes to mind now is to use only two sector units, but with an increased sector ratio.

I am also considering this shape for the sectors:



February 19, 2007
WORK WITH THE ELECTROSTATIC MACHINE

Yesterday's results clearly indicate that a higher frequency (larger number of sectors) contributes to faster rotation. This is not the only factor, but I will now focus on it. Although it could be argued that a larger number of sectors on the larger-diameter discs

I tested also means higher voltage, this does not negate the conclusion—since I also tested 12-sector discs with longer sectors and could not achieve the rotation speeds I obtained yesterday.

Increasing frequency on a small disc is problematic due to the small dimensions of the sectors, while on a larger disc, ensuring proper rotation is the challenge.

For now, my options are to increase the number of sectors as much as is practically feasible under current conditions, or to consider another way to increase the frequency.

One possible method is to discharge the machine via a spark gap through the primary circuit of a suitably sized small Tesla oscillator. However, this would be very difficult to implement and tune, especially the secondary.

It is possible to use the secondary directly with minor additions and without any diodes—I achieved this earlier—but in that setup, it is the initial voltage peak in the damped oscillations that transmits force to the disc, while the subsequent, much smaller oscillations are nearly unusable.

It follows that the frequency obtained at the spark gap will be the one that transmits usable force to the motor disc. And that is essentially the frequency of the machine itself; therefore, this approach may be redundant and impractical.

I have already observed one method: connecting a high-value resistor in series.
It remains to be seen to what extent increasing the resistance contributes to faster rotation.

I made another test disc, this time with a 24-sector unit in the middle as usual, and two rings of aluminum foil on the periphery and toward the center. The gap between these rings and the sectors was about 5 mm.

I did not expect any significant voltage difference on the rings—I simply wanted to see their effect on the machine, as I have something planned in the future along these lines.

The results showed a much lower voltage achieved at the sector collectors, and the voltage appeared to be alternating in nature.

If the voltage degradation had not been so severe, this might have been an interesting observation.

There was some small voltage between the sectors and either ring.

The achieved voltage was insufficient to start the motor disc, even through diodes.

WORK ON THE MOTOR

I built a platform with 16 terminals on a larger plastic disc.

For terminals, I used M4 blind nuts with a top radius of 2.5 mm.

The diameter of the circle described by the terminals is 110 mm, significantly larger than what I had used before.

I did not install cardboard inductors, as I have not yet found a solution for mounting them.

I tried to start the disc without inductors and was unable to achieve rotation.

A force was perceptible on the disc, but much weaker than when I worked with the 18 mm spheres.

I am becoming skeptical about the success of these terminals—unless the problem lies elsewhere, such as the plastic platform being unsuitable, radiation losses from the cables, or the terminals being too close together.

I must continue with this.

February 20, 2007
WORK ON THE MOTOR

I placed cardboard inductors next to the terminals:

The results remain unfavorable—only very weak rotation is achieved, and it eventually stops.

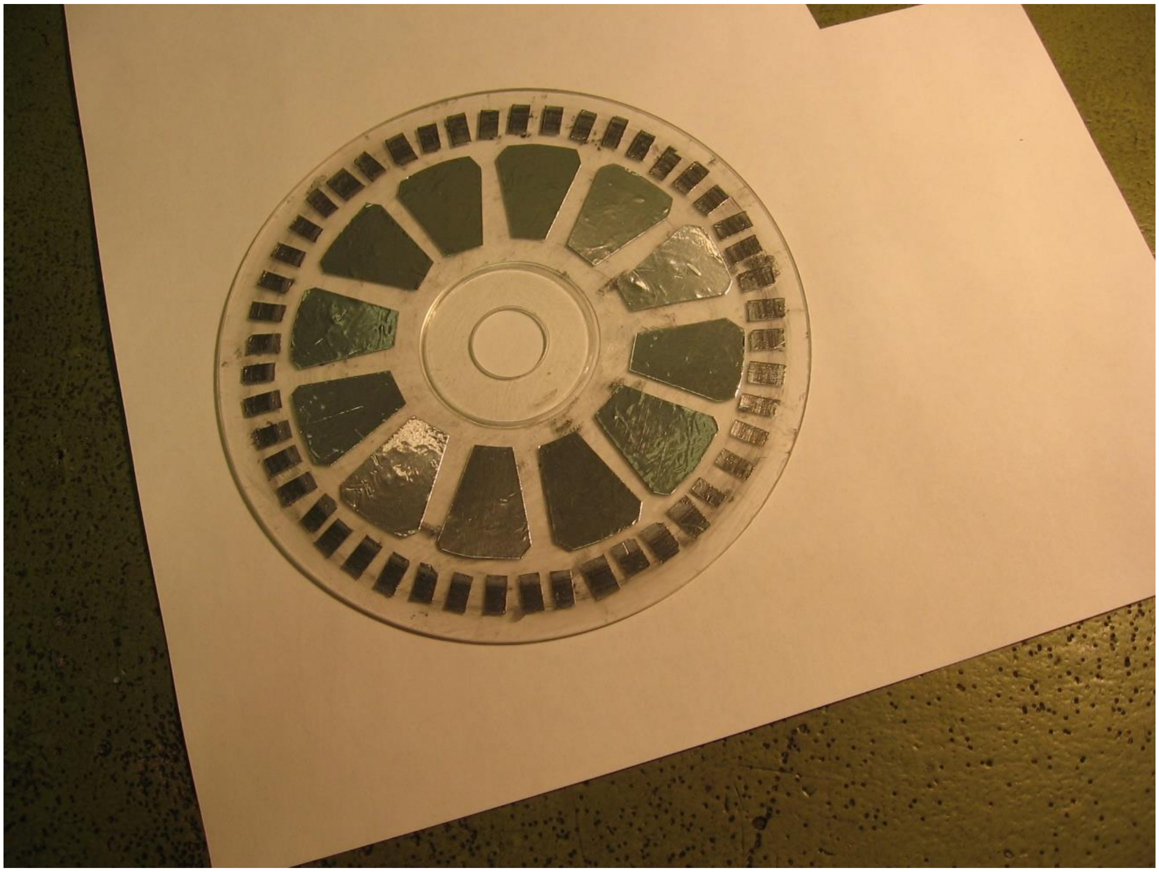
Possible causes:

- Low terminal capacitance — highly probable
- Terminals placed too far toward the periphery — I doubt it
- Use of cable with poor insulation for these conditions — plausible
- Plastic base inadequate — I doubt it
- Terminal geometry — there are real issues, but I do not believe they are the primary cause.

Solution: For now, I am considering simply replacing the cables.

February 21, 2007
WORK WITH THE MACHINE

I repeated the tests with the disc featuring three sector units and tried various combinations between them. Essentially, all results were similar, and the highest motor rotation achieved was between 190 and 200 rpm.



I also tested a disc with 12 and 48 sectors. The disc was evidently poorly made and conceptually flawed. When the inductor and neutralizer brushes were placed on the 12-sector unit, serious sparking occurred on the disc itself.

Due to this sparking, I could not achieve proper rotation.

The best result I obtained was when those brushes were connected to the 48-sector unit, and the collectors to the 12-sector unit, each connected to its own inductor. For some reason, the reverse connection was not possible, even though the collectors and collector brushes are almost in a short circuit.

I achieved a disc rotation of around 240 rpm.

I believe this disc needs to be redesigned and is worth further improvement.

February 22, 2007
WORK WITH THE MACHINE

I tested the following disc with three sector units:

As can be seen, the number of sectors here increases from the periphery toward the center.

The machine showed weaker results compared to the other discs I tested.

The best rotation I achieved was around 110 rpm, and it accelerated slowly.

Usually, the middle sectors were not used for brushes, although it also worked that way.

The first decent performance I obtained was when I used the inductor brushes on the outer sectors and the others on the inner ones. The reverse configuration gave the same result.

I think it is time to turn my attention again to some kind of high-voltage transformer, but one with lower power.

March 5, 2007
BRIEF NOTE

Over the past week, I have done almost no work in the workshop due to private obligations.

I tested the two-terminal motor again, and it now works—so does the four-terminal one, performing almost as well as with eight terminals.

Why it did not work before, with no apparent changes since my earlier attempts, I do not wish to comment on at this moment.

Yesterday I also managed to achieve rotation of a relatively heavy steel disc using four terminals, reaching about 100 rpm.

Today I noticed an interesting effect with the spark gap.

I set the spark gap to the maximum distance at which sparks would still jump, then disconnected one wire of the spark gap from the cable coming from the electrostatic machine.

I brought the stripped ends of these cables to within about 10 mm of each other. I obtained rapid sparks at the spark gap, which was set to nearly the same gap distance. As I brought the two cable ends closer together, the discharge frequency became slower and more energetic.

I believe this is the same effect achieved by inserting an extremely high-value resistor.

I see this as two series capacitors, where the capacitance of the two stripped ends is incomparably smaller, and that capacitance charges and discharges more quickly.

Naturally, this is a simplified analysis, as the capacitances within the electrostatic machine itself are not taken into account.

Using this effect, I succeeded in starting the disc on the platform with 16 terminals.

With that same platform, I was unable to achieve rotation on February 20.

I placed a lower-capacitance spark gap in series. The rotation is not impressive and is quite unstable.

I assume that due to the close proximity of these terminals and their smaller radius of curvature, significant current leakage occurs between them, thereby reducing the voltage from the electrostatic machine.

March 6, 2007
WORK WITH THE DISC

I succeeded in achieving rotation of a dielectric disc by using one terminal as a point and the other as a very thin wire.

With two very thin wires, I have not yet succeeded in achieving rotation.

I have not yet tested using points for all terminals—I will certainly try this, although I have done so before without success.

Increasing the number of dielectric discs also yields good rotation.

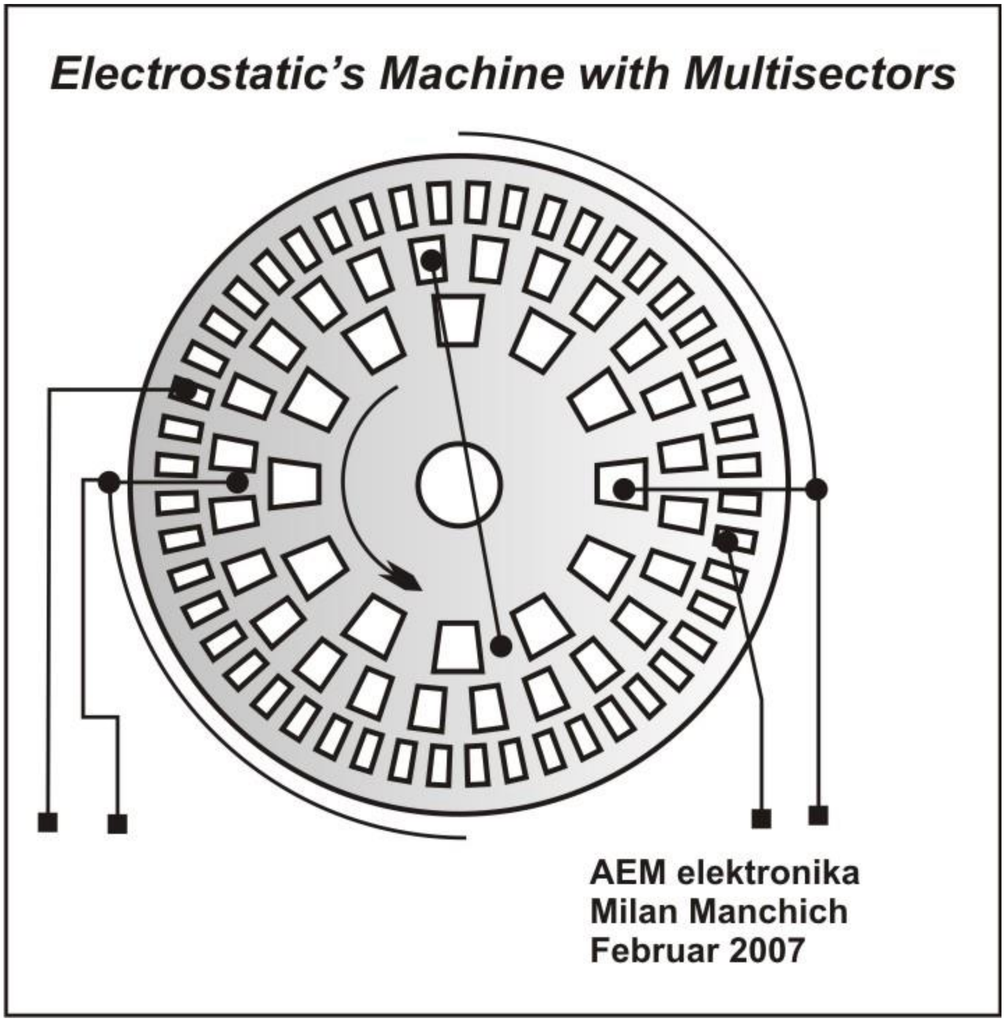
I tested four terminals with points, and the dielectric disc rotates quite solidly.

I placed five dielectric discs made from high-voltage floor insulation material. I noticed no reduction in rotation with the increased number of discs.

The terminals are made from an aluminum rod 15 mm in diameter with a conical tip.

I tested this earlier as well, and it was not possible to achieve rotation of a dielectric disc—even when I used a high-voltage transformer instead of the electrostatic machine.

Here I will take the opportunity to describe the electrostatic machine I have been using recently, with the note that nearly the same results can be obtained with a conventional sectored disc—though not always—and that this disc is not the reason why it now works and previously did not.



The outputs on the same side of the disc are short-circuited when working with two terminals, or connected 180 degrees apart when working with four terminals.

The same performance is achieved if the inductor brush on the left side is placed on the outer sectors and the collector brushes on the middle sectors. Naturally, one neutralizer brush that was on the middle sectors is then placed on the outer sectors.

These two combinations yield the best rotation. Other possible combinations give poorer results.