

UNITED STATES INTERNATIONAL TRADE COMMISSION

In the Matter of:	)	Investigation No.
CERTAIN CAPACITIVE DISCHARGE	)	337-TA-1390
IGNITION SYSTEMS, COMPONENTS	)	
THEREOF, AND PRODUCTS CONTAINING	)	
THE SAME	)	

OPEN SESSIONS

Pages: 813 through 1088 (with excerpts)
Place: Washington, D.C.
Date: September 26, 2024

HERITAGE REPORTING CORPORATION

Official Reporters
1220 L Street, N.W., Suite 206
Washington, D.C. 20005
(202) 628-4888
contracts@hrccourtreporters.com

1 UNITED STATES INTERNATIONAL TRADE COMMISSION

2 Washington, D.C.

3 BEFORE THE HONORABLE CLARK S. CHENEY

4 Chief Administrative Law Judge

5

6 In the Matter of:) Investigation No.

7 CERTAIN CAPACITIVE DISCHARGE) 337-TA-1390

8 IGNITION SYSTEMS, COMPONENTS)

9 THEREOF, AND PRODUCTS CONTAINING)

10 THE SAME)

11

12

13 International Trade Commission

14 500 E Street, S.W.

15 Washington, D.C.

16

17 Thursday, September 26, 2024

18

19 EVIDENTIARY HEARING - VOLUME IV

20

21 The Hearing commenced in Courtroom A, pursuant to the
22 notice of the Judge, at 9:00 a.m. Eastern.

23

24 Reported by: Marjorie Peters, FAPR, RMR, CRR

25

1 A. Yes, sir.

2 Q. What opinions were you asked to provide?

3 A. As summarized in this slide, my scope of
4 opinions were to opine whether MOTORTECH's MIC ignition
5 controllers practiced the claims of the so-called
6 '603 patent.

7 And two, whether Altronic's ignition controllers
8 practice the claims of the '603 patent.

9 Q. I know we've talked quite a bit about the
10 '603 patent, so I'll try not to belabor the point here, but
11 I would like to hear a little bit from you about your view
12 of the '603 patent.

13 If we could start out, tell us what field the
14 '603 patent relates to, in your view.

15 A. Well, it depends on how you ask the question.
16 From the technologist point of view, this is an application
17 of pulse power systems, but it's in the field of engine
18 ignition application.

19 More precisely, I guess, the scope of work can
20 be summarized -- can be discerned from the title of the
21 patent, high tension capacitive discharge ignition, with
22 reinforcing triggering pulses and high tension implying
23 high voltage.

24 Q. When we talk about reinforcing the ringing
25 action of an ignition transformer, what do you understand

1 And as a result of that inducing a much higher
2 voltage on the secondary, which will appear across the
3 spark gap. And as a consequence of particular regime of
4 toggling S1 on and off, under the control of the control
5 circuitry, succeeding in inducing a spark in the spark gap.

6 Q. Okay. I'd like to turn to talk about Claim 1 of
7 the '603 patent, and your analysis of it is.

8 If you could explain to us your understanding of
9 Claim 1.

10 A. Broadly speaking, Claim 1 describes, or teaches,
11 the method of creating the circumstance of what I call
12 constructive resonance, or enhanced resonance, which is
13 sequentially magnified to the point of being able to
14 successfully break down a spark gap, and all the hardware
15 and methodology thereof.

16 Q. I have here on the screen the ending part of
17 Claim 1, which is -- of the '603 patent, which is JX-0001,
18 column 7, lines 25 through 30.

19 It reads, "These pulses being arranged in time
20 to occur when it is possible to reinforce the ringing
21 action of the ignition transformer secondary voltage,
22 resulting from the previous primary pulses, such that the
23 open-circuit breakdown voltage capability of the ignition
24 transformer is increased."

25 Do you see that?

1 A. Yes, sir.

2 Q. The phrase "open-circuit breakdown voltage
3 capability" that you see in that claim language, do you
4 understand that to be a condition that is pre-breakdown of
5 the spark gap or post breakdown?

6 A. Pre-breakdown.

7 Q. I heard you earlier refer to the concept of
8 resonance. I've turned to column 5 of JX-001 where we
9 have -- column 5, lines 13 to 24, and I see a reference to
10 a behavior similar to that of an RLC circuit in resonant
11 condition.

12 Can you explain what's going on with this
13 resonant condition?

14 A. Repeat the last part of your question.

15 Q. Can you explain what's going on in a resonant
16 condition, in an RLC circuit?

17 A. In an RLC circuit.

18 Well, an RLC circuit, when excited, after it's
19 excited, proceeds with a natural behavior, which is an
20 exponentially decaying sinusoid oscillation.

21 Especially if the value of resistance is
22 sufficiently low, this phenomenon will appear, it's called
23 an under damped resonant tank.

24 The resonance occurs, and over time, the energy
25 that is trapped or stored in this system, sometimes in L,

1 A. Yes, sir.

2 Q. -- the claims as limiting?

3 A. Yes, sir.

4 Q. Did you apply that construction in your
5 analysis?

6 A. Yes, sir.

7 Q. I'd like to turn -- we've heard a couple of
8 terms in this case, one is "capacitive discharge," and one
9 is "pulse modulated."

10 I think we have talked about Figure 1 being a
11 capacitive discharge and you explained that earlier. We
12 are talking about Figure 1 of the '603 patent, JX-0001.

13 Let's turn and talk about the accused MIC
14 products.

15 In your opinion, are the accused MIC products
16 capacitive discharge systems?

17 A. No, sir.

18 Q. I put on the screen a copy of CX-0617C. What do
19 you understand this to be?

20 A. Well, as described in the title, the basic block
21 diagram of the MIC ignition product.

22 Q. Okay. Go ahead.

23 A. Do you wish for me to kind of give an overall
24 introduction?

25 Q. Just explain to us your understanding of how it

1 operates.

2 A. So on the right, you see the ignition coil,
3 so-called high-voltage transformer, on the secondary of
4 which in fact symbolically, the spark gap or the spark plug
5 is shown.

6 That is being driven by some switching -- the
7 primary winding of this transformer receives pulses of
8 voltage. Pulses of voltage. A pulse is -- well, square
9 pulse is a voltage. Rectangular pulse is a voltage.

10 Q. Okay.

11 From where does it receive those pulses?

12 A. Those pulses are received from a DC power supply
13 whose output voltage is exactly the voltage of the pulse
14 that you plan to apply.

15 The switch mechanism inside the box on the
16 right, the MOTORTECH output stage, simply connects the
17 250-volt DC voltage to the primary, or disconnects it.
18 That producing a pulse.

19 Q. The 250-volt voltage that you are referring to
20 as going into the MOTORTECH output stage, if you could -- I
21 see on the left side of the screen is a reference to 24
22 volts, and then coming out of this box labeled "power
23 supply DC/DC converter," there's the 250 volts.

24 Maybe if you could explain to me what the 24
25 volts is, and how we end up going from there to get to 250

1 volts.

2 A. The 250-volt is the design voltage that we
3 intend to apply to the primary of the ignition coil.

4 That has to come from some supply of power and
5 energy and voltage and power that is appropriate for this
6 application.

7 For example, the raw source of power may be a
8 24-volt DC power supply. Batteries, whatever. So that is
9 your -- so your desire is a rock-solid 250 volts. You may
10 receive either rock-solid, or even not rock-solid, maybe
11 floppy, soft, changing 24 volts. Whatever.

12 The object of this box called power supply DC/DC
13 converter is to step up the DC voltage from where it finds
14 it in this case, 24 volts to the specified desired output
15 voltage of 250 volts, and the technology inside the box is
16 in fact the mainstay -- classical power electronics, which
17 I was humbly involved in co-founding within the IEEE.

18 Q. Let me ask you this: A power supply DC/DC
19 converter like this, are these commonly used in these types
20 of circuits?

21 A. All the time. Almost all power supplies that
22 start with an initial voltage to deliver a desired terminal
23 voltage for which the customer bought the power supply go
24 through a switching DC/DC converter, and in this case, a
25 switching step-up DC/DC converter.

1 Q. What do you mean by step-up DC/DC converter?

2 A. The object inside the box is to start with a
3 24-volt DC, which is low, to 250-volt DC, which is higher,
4 and you basically step up this voltage.

5 Q. If I go to the next screen, I've got a pair of
6 slides here, one of which is on the left-hand side Figure 1
7 from the '603 patent, JX-0001. On the right-hand side, we
8 have placed beside it, the basic block diagram of CX-0617.

9 If you would, compare and contrast how these
10 systems operate.

11 A. Sure.

12 The system on the left by its name and intended
13 operation and design is a basic capacitive discharge
14 circuit. The idea is charge C1 capacitor from an external
15 DC voltage. Then things settle. Now the capacitor is
16 charged and stationary in its voltage.

17 Now, turn on the switch to discharge that
18 capacitor either fully or to a great extent, into the
19 primary of the transformer to produce some sort -- that
20 voltage is not going to be square, of course, because the
21 capacitor is discharging into an inductor, for example.

22 But the important intention is to inject the
23 intended quantity of energy, extract it from the storage
24 capacitor, discharge capacitor into the primary.

25 Because this is intended to be done

1 repetitively, you use a discharge capacitor to do this, and
2 the intention is to -- well, let's stop there.

3 Q. Okay.

4 Let's take that, and if you would, compare it to
5 how the MIC devices from MOTORTECH are operating, as we see
6 on the right-hand side of the screen, and as reflected in
7 CX-0617.

8 A. Yes.

9 The concept here is different. The concept here
10 is produce a pulse of voltage, a rectangular pulse of
11 voltage from a DC voltage source. A DC voltage source.

12 Give me a pulse whose amplitude is 250 volts.
13 250 volts, and nothing else. Therefore, it must come from
14 a 250-volt rock-solid DC supply.

15 Then the duration of the pulse is controlled, or
16 the pulse width as it's called controlled by the -- in this
17 case, the yellow box, the switch is there and the
18 controller is interconnected to it, MOTORTECH output stage.

19 There are a lot of subtleties, but at the first
20 pass, that's enough.

21 Q. It looks like scrolling back is -- well, let's
22 do it this way.

23 In the DC/DC converter -- I wanted to go back to
24 the power supply. Can we go back two slides, Abe?

25 When I'm looking here at the basic block

1 diagram, inside the power supply, there is a capacitor
2 that's shown.

3 Do you see that?

4 A. Yes, sir.

5 Q. What's your understanding of what that capacitor
6 is?

7 A. That would be the output filter capacitor of the
8 DC/DC supply. It has to necessarily be there for reasons
9 that I think you're going to ask me.

10 Q. Yeah. I apologize.

11 What's the purpose? Why is a filter capacitor
12 there in a DC/DC converter?

13 A. Well, I was going to explain that in the next
14 stage, but I'll do it here.

15 Q. Okay.

16 A. As I said, the modern way, the efficient way of
17 stepping up the 24-volt to 250 volts is through a switching
18 power converter, and there are many different technologies
19 of switching.

20 The key point is: You use a high frequency
21 switching action within the power supply to achieve the
22 ultimate purpose of stepping from 24 volts to 250 volts.

23 That switching action, in fact, will produce a
24 pulsating current and/or a very ripply voltage at the
25 output, which is not the intention of the use of the power

1 supply. So you must somehow smooth those ripply pulsating
2 power energies that are being dumped at the output. You
3 must smooth that out to convert it to a clean DC output
4 voltage of 250 volts. And the technical term for that is a
5 stiff voltage. A stiff voltage. In other words, if you
6 sit on it, it won't bend.

7 MR. BLAKE: At this point, Your Honor, I am
8 going to show where this capacitor is located in the
9 device, one of MOTORTECH's schematics, and I'll need to go
10 on the confidential record to do so.

11 CHIEF JUDGE CHENEY: We're on the MOTORTECH
12 confidential record.

13 (Whereupon, the trial proceeded in confidential
14 session.)

15

16

17

18

19

20

21

22

23

24

25

1 assuming that by the time we reach that peak value of
2 output voltage before saturation, we have broken the spark
3 gap down. We didn't, but the system is trying to induce
4 current in the non-existent arc in this case.

5 Those pulses then distort the natural ringing
6 frequency -- waveform of the output voltage, and that's why
7 you see a couple of unnatural bumps. Totally parasitic,
8 and not interesting to the intentions of this experiment.

9 Once those pulses are taken away, and this
10 distortion is taken away, it goes back to the -- relaxation
11 oscillation, which is characteristics -- unique -- whose
12 frequency is characteristic of the inductance and
13 capacitance and the resistance that constitutes that.

14 It is interesting to notice that the relax
15 oscillation that starts and ends is disturbed in the middle
16 by the injection of those pulses, and that goes back to,
17 you know, injecting energy into a natural resonance of a
18 system, which distorts its behavior.

19 Q. Okay.

20 If I look at Figures 3 and 4 of the patent, do
21 they teach the use of kind of a single-pulse to generate
22 the secondary voltage waveform?

23 A. In Figure 3, correct.

24 Q. In Figure 4, there's a little wide -- there's a
25 wider initial pulse to generate the waveform?

1 A. Correct.

2 Q. Okay.

3 Does the patent teach away from the use of this
4 type of a single-pulse system?

5 A. That's the intention of these figures, to put
6 the narrative in the specifications that this is the
7 background which we want to go away from.

8 Q. So this is the prior art system that the patent
9 is teaching away from; correct?

10 A. That's the intelligence way of putting it, yes.

11 Q. It uses a single-boost pulse the way that the
12 MIC5 uses a single-boost pulse; is that right?

13 A. Correct.

14 Single long pulse.

15 Q. Okay.

16 I'd like to change topics and talk for a minute
17 about the concept of the difference between -- in a
18 sinusoidal waveform between the initial down cycle and a
19 ringing down cycle.

20 A. Okay.

21 Q. If we go back to Figure 8 of the '603 patent,
22 JX-0001, if I look at this initial pulse of energy, the
23 single pulse on the down cycle, would you consider that
24 initial down cycle of the first pulse to be a ringing down
25 cycle?

UNITED STATES INTERNATIONAL TRADE COMMISSION

In the Matter of:	)	Investigation No.
CERTAIN CAPACITIVE DISCHARGE	)	337-TA-1390
IGNITION SYSTEMS, COMPONENTS	)	
THEREOF, AND PRODUCTS CONTAINING	)	
THE SAME	)	

Pages: 1089 through 1320
Place: Washington, D.C.
Date: September 27, 2024

HERITAGE REPORTING CORPORATION

Official Reporters
1220 L Street, N.W., Suite 206
Washington, D.C. 20005
(202) 628-4888
contracts@hrcourtreporters.com

1 THE WITNESS: Yes, Your Honor.

2 CHIEF JUDGE CHENEY: Great.

3 Please proceed when you're ready, Mr. Blake.

4 I'll remind you, doctor, that you are under the
5 same oath that you took yesterday.

6 Whereupon--

7 MARK EHSANI, PhD,
8 having been previously duly sworn, was examined and
9 testified as follows:

10 THE WITNESS: Yes, sir.

11 CONTINUED DIRECT EXAMINATION

12 BY MR. BLAKE:

13 Q. Good morning, Dr. Ehsani.

14 A. Good morning.

15 Q. I'd like to turn to talking about Claim 8 of the
16 '603 patent.

17 Is that okay?

18 A. Yes, sir.

19 Q. If we go here in RDX-0002, to slide 47, I've put
20 up the final limitation of Claim 8, which reads, "...these
21 pulses being arranged in time to occur when it is possible
22 to reinforce the ringing action of the ignition transformer
23 secondary voltage resulting from the previous primary
24 pulses, such that the secondary circuit current capability
25 of the ignition transformer is increased."

1 That's from JX-0001, column 8, lines 15 through
2 20.

3 Do you see that?

4 A. Yes, sir.

5 Q. Do you understand Claim 8 as a result of this
6 portion to be talking about a condition where the spark is
7 present in the circuit?

8 A. Yes, sir.

9 Q. I'm going to put up with respect to that claim
10 limitation, the Court's claim construction shown here on
11 RDX-0002C page 48.

12 Do you see that construction?

13 A. Yes, sir.

14 Q. Did you apply it in providing your opinions?

15 A. Yes, sir.

16 Q. Okay.

17 If we move to the next slide, I've put up here
18 Figure 10 of the '603 patent.

19 Do you see that?

20 A. Yes, sir.

21 Q. I'd like you to take a moment, if you could, in
22 Figure 10 to explain how the pulses -- the control pulses
23 we see here are extending the duration of the spark
24 current.

25 A. Sure.