AMICA's "FUNDAMENTAL DIFFERENCES"

Article By Jeffrey Morgan. A Lesson Unlearned

In the Article "Fundamental Differences," an exposition on differences between Ampico models, first published in the March/April 1996 issue of the Amica Bulletin and as the "newly revised and updated" version for the July/August 2003 issue reprinted (if you can believe this), there are still some glaring technical errors that need to be corrected. I think I can prove them wrong here verbally, very simply with logic. This is serious only because it is one of several articles which continually discredits the combined wisdom of the Automatic Musical Instrument Collector's Association, an international organization.

The author Jeffrey Morgan writes, pg 127, excerpted, "**Because the** (spring pneumatic is connected to the crescendo pneumatic**) ... the motion produced... is transferred to the driver pneumatic.**" Physically this is wrong, which I will examine. In the first place, "driver pneumatic" is not an Ampico term nor a third device somewhere, and it's confusing. Where's the "driver?" Jeffrey is saying in exaggerated, erudite-sounding phrases that because the spring and crescendo pneumatics are connected, they affect each other and therefore respond inversely to the pressure of the expression lever. Sounds right at first glance, but let's read on; "**There it (motion transmitted by the lever) is mechanically conveyed to a pallet valve mounted externally on the driver's control unit. In this instance, the crescendo driver pneumatic becomes the slave of its 'spring pneumatic,' ie. their roles are momentarily reversed.**"

Totally incorrect in all ways. If Jeffrey wants to use weirdo terminology like "driver" for the crescendo, then I'm going to call it one time what it's called in engineering terms– a set point controller. **When one writes about any documented device** they are obliged to use the same terminology as the developers *whenever possible*, and otherwise, use an extant term that everyone today should understand. Jeffrey doesn't do this and it makes for difficult reading and misunderstanding, but since he is also the technical editor for AMICA, as long as he knows what he means, then he's just fine. It's all the rest of us that are wrong. He uses personal coined terminology when he could use the correct terms. This by itself should force the publisher to demand a rewriting of the article, even if he didn't understand anything else.

Now back to the physical principles.

The philosophy of a set point controller (in this instance the crescendo mechanism) is (theoretically) to overcome any external forces acting upon it 100% so that it may become an absolute reference. The Ampico crescendo regulator does this with an extension spring (Jeffrey calls this "**a metallic coil**" pg. 128) that is adjustable for the first intensity and a pallet position sensor and from there, all other intensities are developed. So the crescendo has its own feedback loop and no other loop can affect its set pressure, or it isn't a set point controller.

If air pulses try to affect the crescendo pneumatic from the mechanical pulsing action of the expression lever into the spring pneumatic, what happens? The balance between the spring tension and the crescendo pallet is upset, and just before this variation can change the first intensity, the crescendo valves compensate, keeping the pressure in the crescendo constant. Jeffrey doesn't realize this or he would not call it part of the negative feedback system, "**similar to that used by electronic audio amplifiers.**" Since I used to design hi-fi audio amplifiers, I can personally promise him that he obviously doesn't know how they work at all. I also designed single and multiple electronic set-point controllers as well as troubleshooting bench setups that would check them out automatically for industrial uses, and can attest to the fact that if they were affected even slightly by the components they were intended to control, they would be useless. Likewise with the pneumatic versions and particularly the Ampico crescendo bellows.

So the purpose of the Crescendo and its pallet is to maintain a reference called the first intensity which must by definition be completely independent of stack variations and pressure changes of the device it is controlling. It accomplishes this by its own "internal feedback" which must be totally independent of all external forces including the spring pneumatic it controls.

It's so simple.

During crescendos and decrescendos (*which he doesn't mention and so didn't think of*), the variations will theoretically be present because the pallet is closed, but during that time they are immaterial, since they cannot be detected during excursions back and forth. The explanation for this is instantly obvious to anyone. The spring pneumatic is 2-1/4 x 4-1/4, or **9.5 sq. in.** The crescendo is 5 x 6, or **30 sq. in.** The tiny almost imperceptible pulses which do feed through the spring pneumatic to the crescendo therefore are pitted against a bellows having **3 times the power**, hence variations through the expression lever into the spring pneumatic are totally insignificant.

Just HOW insignificant, you ask? **Good question**. In the average excursion between levels #4 and #6 with about 2 valves playing, the change of the regulator valve up and down in the expression block is measured to be about .00035. That's 3-ten-thousandths of an inch. Multiply .0003 by 9.5 and you get a figure relative to displacement volume, do the same for the crescendo. Now since the only difference between these 2 bellows is a multiplier of 3.16, instead just divide 3.16 into .0003 and you get the actual displacement of the crescendo reacting to a relatively large intensity change during an actual crescendo or decrescendo when the pallet is closed. What is the effect then (because everything has an effect)? It is .000095." It doesn't even come within the mechanical tolerances for the blade system of a jet engine! No lathe can cut that close, much less a cloth covered wooden device put together with glue and screws. It's nonsense! The average fine human hair is about .005. You could lay about 17 average excursions of the reg. valve side-by-side and equal the width of a human hair, and the travel of the crescendo bellows in sympathy would be 1/54th the width of a fine human hair! This is something I have meticulously measured, using one of the finest machine gauges available today, and you can duplicate it if you wish. Volume displacement is related to linear displacement of the regulator valve by a formula, and I have that, too. It's all too ridiculous to mention, except to see just HOW ridiculous!

Jeffrey goes on to say that "**This motion (of the expression lever) actually represents an additional inverted-feedback channel from the stack, in a manner similar to that used by electronic audio amplifiers.**" And he goes on elaborately to describe how it "**greatly enhances the efficiency of the closed- loop vacuum regulators described previously.**" Yet he clearly states just below another totally contradictory (but correct) comment, "**This regulating capability of the crescendo driver device maintains a dynamic equilibrium under all conditions while at rest (unsignaled) that provides rapid corrective action for even the slightest stack transients.**" In modern English that means the crescendo keeps a constant vacuum tension regardless of feedback forces to change it.

In other words, Jeffrey says on the one hand, "**We have an inverse feedback system from the stack, through the expression lever to the spring pneumatic and transmitted to the crescendo which further enhances the overall efficiency of the closed-loop vacuum regulators."** Then he says, **"All these fluctuations between the stack, expression lever and spring pneumatic will not change the pressure in the crescendo because it instantly compensates.**"

That's what you call, "not really knowing what you're talking about, but trusting in outlandish generalized verbiage to make the reader think you do!"

Jeffrey is obliquely correct in that there is truly inverse (negative) feedback from the stack in the system. He just didn't know where it was, apparently. At least, he didn't mention it. The feedback is between the stack and the expression valves with their 3 expression bellows attached to the expression lever, in turn opposing the spring pneumatic through the regulator valve shaft connection.

As more notes are played at one time, the vacuum from the stack which powers the expression valves and 3 bellows fluctuates with the stack. If the vacuum drops instantly, so does the force against the spring pneumatic, so the spring pneumatic overcomes the lever proportionally, raising it, opening the regulator valve and passing more air. Since this is all a matter of opposed vacuum tension on either side of the regulator valve, and since less than a thousandth of an inch is required to move the regulator enough to make large compensations, you can imagine how quickly this could probably happen. It's a very well thought-out system. I think we in the 21st century should also be able to understand it and explain it, especially after we've restored dozens of them, we should ideally know what we're talking about. Apparently not.

When one can write two blatant contradictions in the same article and not see how inconsistent they are, then you might wonder about what's next. And sure enough, such appears to be the case in the next "column of ambiguities."

On page 128, 3/4ths of the page in double columns is spent talking about the Ampico model A's crescendo system, overall. Jeffrey calls it the "**only true crescendo system in an Ampico.**" This is a subtle dig at the model B. Then Jeffrey states halfway down the page in the first column that the 2 signal inputs to the crescendos from the tracker bar are "binary." I

presume he thinks binary because there are **two** of them, or perhaps "binary" is a personal Jeffrey term. But words have meanings. The inputs are strictly real-time analog inputs. Binary input requires a short pulse or pulse train which the mechanism can count and respond to proportionally. Real time is analog and binary is digital. Jeffrey demonstrates for us all his wisdom and technical expertise here as well.

Next, Jeffrey starts out again talking about the "***Ampico crescendo drivers,***" (??), and comparing them to the model B Ampico (as *inapplicable as apples and oranges when you understand the B system*). In the large paragraph subsequent to this he states that this "*crescendo driver*" (singular this time) can both open and close with only 2 holes (just imagine-- how awesome). He states this in another 3" long paragraph of incredibly diluted and drawn-out rambling verbiage, then sums up the previous column about Ampico's crescendo system this way:

"**From the above, it can be seen that all speeds and directions (4 modes) can readily be selected by only two tracker bar ports...quite an economical configuration.**"

Remember, he switched objects from "the Ampico crescendo drivers"(plural) to "the crescendo driver"(singular) and back to referring to the overall Ampico A crescendo system and implies that 2 ports economically operate the system. The system of course requires 4 ports, not just 2. One pair for each crescendo. That is NOT economical. That's just ordinary stuff– no biggie. Why should we be thrilled? Then I began to see a possible reason for his elation.

Why is this notable to me? It wasn't until the model B Ampico made its debut that Ampico went to a 2 port crescendo system! Yet Jeffrey very ambiguously made it sound like the Ampico model A crescendo system itself requires only 2 ports. Jeffrey makes it clear he doesn't care for the model B, from other articles I have read. As I understand he doesn't rebuild them, he denies they play Ampico A rolls as well or better than the model A, and I think that his own explanation of the workings of the model A crescendo system should be indicative of why that may be so. He ascribes "binary crescendo coding" to the model B, too. It's just as well. Model B Ampico is a very difficult instrument to restore, and few are done correctly or thoroughly.

While explaining the spill system in the different pianos, Jeffrey states that the spill system in the type 1A early Ampico used a sleeve-type regulator to minimize the possibility of oscillation (which is correct). But then he says "**Because of the virtually instantaneous action of its curtain-type spill valve, the model B spill system is more prone to oscillation.**" The model B curtain is operated by a sleeve pneumatic, too. He then tells the story both ways. "**Actually, the Model B pump spill system is similar in concept to the first (Type 1A) Ampico expression system (see Figure 11). Both employ a moveable pneumatic elastically coupled to a valve in opposition to another pneumatically tensioned device.**" (Elastically coupled? That means it uses an extension spring. Or, maybe we should say, "An extensively differentially tensioned metallic coil device driver.")

Possibly Jeffrey is just clever to contradict himself directly. If anyone were to accuse him of error, he can point out that if they had just read the article, they would discover that he's already

said that! All I can add is, it's such a relief to me that someone so knowledgeable as Jeffrey is so comfortable to take exception with himself. I also appreciate the fact that he was wise enough to put all his technical analysis down in print, twice, in an international publication, for posterity. It looks like Jeffrey Morgan may have the pneumatic piano technical guru position in both AMICA and MUSIC BOX SOCIETY all to himself from now on.

There are a number of other statements in this and other Morgan articles which are dead wrong, and many which are partly wrong, all of which are too numerous and ambiguously stated to consider them as a technical article by any publication. But if that's the sort of reputation AMICA wants to acquire, and if they have also been turning a deaf ear to other credible authors who document their conclusions and claims in this field, then AMICA may never again receive well-documented articles by any real expert who wants to be associated with this caliber of techno-nonsense. Clearly there will have to be some difficult and sweeping changes made before it can ever happen. That implies that people on the board of directors may have to stand up against a few audacious threats from individuals known for doing it. Political associations and technical wisdom are opposite poles, as any engineer will swiftly tell you. So one must ask why such nonsense is continually published and that's one possibility as I see it.

AMICA has a responsibility to "get it right." They have their by-laws and the rules are good rules. If they will simply go by their own rules, then in time, they may be accepted again as knowledgeable. But they're going to have to make the rules inviolable from now on, and they are going to also have to make just one more rule and add it to their by-laws:

If any article is discovered to have errors, that article must be corrected– not covered up, ignored, and reprinted. And letters from members respectfully critical of any article will be published by the Bulletin in the letters section. This is society policy, and will not be the decision of the publisher. These things can be tactfully presented and respectfully submitted, and this is why there must be a board of several technical editors, definitely not one "high priest" who does almost all the writing himself and sends back all other submissions as unacceptable (which is what is happening today).

Some who have written letters correcting possible errors or commenting on the articles in question are no longer being published, their letters are tossed, and I happen to have first-hand knowledge of this. This will always happen when the board of directors do not stand firm for the principles on which the group was founded, and let those in control take over and tell them what they will and will not abide by. No group like this can put themselves in a position to be blackmailed by a few people who are willing to take control, otherwise, they're going to end up with whatever those few wish to do, and the rules be damned. That's exactly what we have, now.

You members will perhaps notice how many other authors have written pneumatically technical articles for the AMICA Bulletin in the past 3-4 years? There is a reason. Do you care? You should.

Why is this letter being written? Simple. It's all because past administrations did not take care of business as a team, and would not stand up for their own rules when the situation demanded it.

Familiar? Compromising with principle is dealing with the devil. It always looks “practical.”