Paper No. ________

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MICRO MOTION, INC.
Petitioner
v.

INVENSYS SYSTEMS, INC.
Patent Owner

Patent No. 6,311,136
Issue Date: March 17, 2009
Title: DIGITAL FLOWMETER

Inter Partes Review No. 2014-00170

SUPPLEMENTAL DECLARATION OF DR. MICHAEL D. SIDMAN

1. I, Dr. Michael D. Sidman, resident at 6120 Wilson Road Colorado Springs, CO, hereby declare as follows:

2. Independent claim 36 concludes with "wherein the control and measurement system uses digital processing to adjust a phase of the drive signal to compensate for a time delay associated with the sensor and components connected between the sensor and the driver." I previously opined that that Romano discloses this feature and therefore anticipates claim 36 of the '136 patent.

3. Romano discloses phase compensation for time delay due to the system components:

> Input circuit 310 samples both the left and right velocity sensor signals appearing over leads 165L and 165R, respectively, on an interleaved basis to produce "128" samples per tube cycle: "64" samples for right velocity sensor 160R interleaved between "64" samples for the left velocity sensor 160L, respectively (see FIG. 1). Specifically, both velocity signals cannot be sampled at the same time. Consequently, the two velocity sensor signals are continuously sampled on an alternating basis. As a result, the <u>samples for one sensor</u>, illustratively the left sensor, <u>will always lead the corresponding samples for the right sensor</u> by a phase shift of 2P/128 [sic 2π/128] radians. In calculating the fourier components, microprocessor 330, as shown in FIG. 2 and discussed in detail below, utilizes a "128" point look-up table of sine values. Now, <u>to compensate for this phase shift</u> between the sampled velocity signals, each of the "64" samples for every tube

> cycle produced by the left velocity sensor is multiplied by a corresponding sine term, while, as discussed below, each of the "64" samples produced by the right channel is multiplied by a corresponding sine term that includes a phase shift of 2P/128 [sic 2π/128] radians.

(Romano, Ex. 1006, 22:10-32, emphasis added.)

4. As I explained in my first declaration, it is my opinion that one of skill in the art would consider Romano to disclose the use of both the left and the right sensor signals to generate the drive signal using the alternative digital drive disclosed in column 24 of Romano. In the analog embodiment (Fig. 4), the right and left channel sensor signals are both used to generate the drive signal. One of skill in the art would interpret the digital drive embodiment to use the same scheme and to base the drive signal on both the left and the right sensor. In that case, as I have previously explained, Romano expressly teaches to correct for the phase shift of the right sensor signal.

5. Invensys argues that the DFT routine 700 (Fig. 7) discloses using only a single channel (either the left or the right). However, this routine is merely used to determine the resonant frequency - by determining the frequency component with the maximum magnitude over a predetermined range of frequencies. (Romano, Ex. 1006 at 31:14-18.) "The only purpose in the magnitude is to determine the corresponding frequency at which the magnitude reaches a

maximum value." Nevertheless, the drive signal still must be synchronized to the oscillation of the tube, as explained by the Romano patent: "[t]he drive circuit … produces a drive signal that is in phase with the sum of the left and right velocity sensor waveforms." (Romano, Ex. 1006 at 18:46-49.) Just as this description of Figures 2 and 4 teaches to use both the left and the right sensor signal to produce a drive signal in phase with the left and right sensor signals, so one of skill in the art it would understand the digital drive embodiment of column 24 also to use the left and right sensor signals to produce an in-phase drive signal.

6. In addition, contrary to Invensys's arguments, Romano discloses the use of the right sensor signal in the determination of the resonant frequency in the digital drive embodiment discussed in column 24. As Invensys itself quotes, the discussion of the use of the left sensor signal throughout Romano is merely "illustrative": "To save processing time, a power spectrum is computed at a fairly 'coarse' resolution, using the discrete fourier transform, for ***one of the velocity waveforms, illustratively that produced by the left velocity sensor.***" (Invensys Br. at 13, quoting Romano, Ex. 1006 at 29:17-21 (emphasis in Invensys brief)). This same use of the "illustrative" left sensor is found throughout the Romano patent, for example at col. 6, lines 60-64; col. 7, lines 49-53; col. 35, lines 21-26 and col. 40, lines 26-31.

7. Column 40, lines 26-31 of the Romano patent expressly states that the right sensor could also be used: "Frequency changes are proportional to the phase difference between the real and imaginary components of ***either one of the velocity sensor waveforms*** measured with respect to the zero crossing of that waveform. ***Illustratively***, the left velocity sensor waveform is used for these calculations."

8. Accordingly, one of skill in the art would understand that the disclosure of the use of the left sensor signal in column 24 merely to be illustrative and that the digital drive could also use the right sensor signal to determine the resonant frequency. Under those circumstances, as discussed above, and in my first declaration, Romano teaches that the phase of the right sensor signal would inherently be delayed by $2\pi/128$ radians. Romano states that, after determining the frequency, the microprocessor accesses a "sine look up table" to produce the sine wave: "once the frequency component is found, microprocessor 330 could easily set the period at which a sine look up table (not shown and which can either be situated internal to or more likely external to the microprocessor) is successively and consecutively indexed, through well known circuitry not shown, to produce a continuous series of multi-bit digital values that represent this waveform." (Romano, Ex. 1006 at 24:45-52.) As discussed above and in my first declaration, Romano had previous taught (in column 22) that, when the sine look up table is

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