United States District Court,
E.D. Texas, Tyler Division.

FERGUSON BEAUREGARD/LOGIC, CONTROLS, Division of Dover Resources, Inc,
Plaintiff.
v.
MEGA SYSTEMS, LLC, et al,
Defendants.
FERGUSON BEAUREGARD/LOGIC CONTROLS, Division of Dover Resources Inc. and Delaware Capital Formation, Inc,
Plaintiffs/Counter Defendants.
v.
MEGA SYSTEMS,
L.L.C. and James Bartley Defendants/Counter Plaintiffs.

No. Civ.A. 6:99CV437

Dec. 13, 2001.

T. Earl LeVere, Edward A. Matto, Bricker & Eckler, Columbus, OH, Gerald L. Smith, Mueller & Smith, Columbus, OH, for Plaintiffs.

L. Charles Van Cleef, Flowers, Davis & Van Cleef, L.L.P., Texarkana, TX-AR, Dr. Charles Wesley Alworth, Alworth Law & Engineering, Tyler, TX, Gregory A. Fraser, Gregory A. Fraser, P.C., Lindale, TX, for Defendants.

ORDER ADOPTING SPECIAL MASTER'S FINDINGS OF FACT AND CONCLUSIONS OF LAW

STEGER**, J.**

After careful consideration, the Court is of the opinion that the following order should issue *sua sponte*.

By agreement of the parties and pursuant to this Court's Order of April 30, 2001, this cause was referred to Special Master Gale Peterson. Special Master Peterson presided over a bench trial which was held in Tyler during May 21-25, 2001. A transcript of that trial has been prepared and filed with the Court. Following trial, the parties submitted post-trial briefs and proposed findings of fact and conclusions of law.

Pursuant to Fed.R.Civ.P. 53(e)(2), the Court held a hearing on the parties' objections to the *Special Master's Findings of Fact and Conclusions of Law* On December 5, 2001. After careful consideration of the oral arguments, briefs filed by the parties, the *Special Master's Findings of Fact and Conclusions of Law,* and the record, the Court issues the following order.

BACKGROUND

The Parties

Plaintiff Delaware Capital Formation, Inc. ("Delaware Capital") is the owner of U.S. Patent Nos. 4,150,721 ("the '721 patent"), 4,352,376 ("the '376 patent"), and 5,146,991 ("the '991 patent").

Plaintiff Ferguson Beauregard/Logic Controls ("Ferguson Beauregard"), is the exclusive licensee of the '721, '376, and '991 patents. Ferguson Beauregard makes, sells, and offers for sale an oil and gas well controller known as the AutoCycle controller.

Defendant Mega Systems makes, sells, and offers for sale an oil and gas well controller known as the APC 1000.

Defendant James Bartley is the president and majority owner of Mega Systems. Bartley designed the APC 1000 controller, created the computer code used in the APC 1000 controller, and drafted various versions of the user's manuals for the APC 1000 controller.

Ferguson Beauregard brought this action against Mega Systems and James Bartley, individually, asserting that Mega Systems' APC 1000 controller infringes the '721, '376 and '991 patents-in-suit. Ferguson Beauregard asserts that Mega Systems is a direct infringer and that James Bartley is individually liable for having induced such infringement.

The Contentions of the Parties

Mega Systems is the owner, by assignment, of U.S. Patent No. 4,921,048 ("the '048 patent"). The '048 patent lapsed due to non-payment of maintenance fees prior to Mega Systems' acquisition. Mega Systems' acquisition was contingent upon reviving that patent which Ferguson Beauregard says was "improper." In any event, Mega Systems counterclaims that Ferguson Beauregard and Delaware Capital have infringed the '048 patent by making, using and selling the AutoCycle controller. By Order dated December 5, 2000, the Court referred the issues of claim construction to Special Master Danny L. Williams. Special Master Williams issued a *Report of Special Master on Claim Interpretation*. None of the parties filed any objections to that report. The Court adopted the Special Master Williams' report in its entirety by Order dated March 21, 2001.

The Ferguson Beauregard and Mega Systems' patents-in-suit are all generally drawn to controller systems and related methods used in the production of petroleum products from a well using what is termed "plunger lift" technology and a technique known as "intermitting." Intermitting involves shutting in a well for a predetermined period of time to allow pressure in the well to build up to a point where that pressure is sufficient to expel fluids when the well is subsequently opened. Well production occurs when the well is opened.

Plunger lift technology uses a plunger that rests at the lower end of a well tubing string while the well is shut in and pressure is building. During that time, fluid, e.g. oil, water etc., accumulates in the tubing string above the plunger. At a predetermined time, a motor valve at the surface is opened and the difference in pressure between the well and the surface equipment propels the plunger to the surface, pushing the production fluids above it out of the tubing string into surface equipment, such as lines or separators, where the production product can be recovered. The motor valve is then closed shutting in the well. The plunger returns to the bottom of the well, and the process is repeated.

The patents-in-suit are drawn to controllers, specifically electronic controllers, that control the timing of the opening and closing of the motor valve to repetitively shut in and open a well.

DISCUSSION

The Court has now carefully considered all of the objections of each party. The Court hereby overrules all objections to the *Special Master's Findings of Fact and Conclusions of Law,* with two exceptions.

The first objection the Court will discuss relates to the following two findings that the Special Master made:

para. 294. For Defendants' infringement of the '376 patent, Plaintiffs' are entitled to a judgment in their favor against Mega Systems, but not defendant Bartley, for lost profits of $837.00 for each of the APC 1000 controllers made, used or sold prior to October 5, 1999. The total amount to be awarded will be determined in a subsequent accounting.

para. 295. In lieu of lost profits and at a minimum, Plaintiffs are entitled to a judgment in their favor against Mega Systems, but not defendant Bartley, for not less than a reasonable royalty of $100,000.00 for Mega Systems' infringement of the '376 patent from 1996 through the expiration date of such patent.

See Special Master's Findings of Fact and Conclusions of Law, para.para. 294-295.

The Special Master expressly found that the Plaintiff was entitled to recover its lost profits. Id. at para.para. 185, 294. The Special Master also found that the Plaintiff demonstrated lost profits of $837.00 per controller that the Defendant sold. The Plaintiffs now object to the fact that the Special Master decided to award them a reasonable royalty of $100,000.00 instead of damages in the amount of $837.00 per APC 1000 controller. Plaintiffs introduced evidence at the trial of the Defendants' sales of the infringing APC 1000 controllers. *See Plaintiffs' Trial Exhibit 57*. The evidence submitted by the Plaintiffs show that the Defendant sold 488 APC 1000 controllers prior to the expiration of the '376 patent on December 15, 2000. Id. The Court sustains the Plaintiff's objection on these grounds, and hereby finds that the judgment in this case should be modified as follows:

1) The reasonable royalty of $100,000.00 award in the *Special Master's Findings of Fact and Conclusions of Law* para. 295, is hereby stricken.

2) The Court hereby finds that the Plaintiffs are entitled to a judgment in their favor against Mega Systems, but not Defendant Bartley, for $837.00 per infringing APC 1000 controller that they sold prior to the expiration of the '376 patent on December 15, 2000. Based on the record, the Court finds that the Defendants sold 488 APC 1000 controllers, thus entitling the Plaintiffs to $408,456.00 in damages.

Secondly, the Plaintiffs also object to the fact that the Special Master specifically found that the Defendants infringed the '991 patent by selling its APC 1000 version two controller, but failed to discuss damages related thereto. The Plaintiffs note that the Defendant admitted that they sold ten (10) APC 1000 version two controllers. Id. at para.para. 144, 157, 181. The Plaintiffs contend that the judgment in this case should award them the previously mentioned $837.00 per infringing controller. The Court agrees, and hereby sustains this objection by the Plaintiff. The Court amends the Special Master's report by adding the following language:

The Court hereby finds that the Plaintiffs are entitled to a judgment in their favor against Mega Systems, but not Defendant Bartley, for $837.00 for each of the ten infringing APC 1000 version two controllers that they sold. Based on the record, the Court finds that the Defendants sold ten APC 1000 version two controllers, thus entitling the Plaintiffs to $8,370.00 in damages. The Defendants are also hereby enjoined from manufacturing, using, selling, the APC 1000 version two controller.

As stated earlier, the Court overrules all other objections to the Special Master's report.

CONCLUSION

Having reviewed the record *de novo,* the *Special Master's Findings of Fact and Conclusions of Law,* the parties' objections, and the applicable laws, the Court hereby adopts the Special Master's Report as its opinion in this matter in all respects except for the above-mentioned modifications. The Plaintiffs will have until January 14, 2002, to draft the Final Judgment and Injunction in this case in strict accordance with this order. The Defendants will have until January 28, 2002, to file objections thereto.

It is therefore

ORDERED that *Special Master's Findings of Fact and Conclusions of Law* is hereby adopted as the Court's opinion in this matter in all respects except for the above-mentioned modifications.

It is further

ORDERED that the Plaintiffs have until January 14, 2002, to draft the Final Judgment and Injunction in this case in strict accordance with this order. The Defendants will have until January 28, 2002, to file objections thereto.

It is further

ORDERED that all pending motions in this case are hereby DENIED AS MOOT.

IT IS SO ORDERED.

SPECIAL MASTER'S FINDINGS OF FACT AND CONCLUSIONS OF LAW

PETERSON, J.

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FINDINGS OF FACT

By agreement of the parties and pursuant to this Court's Order of April 30, 2001, this cause was referred to the undersigned for trial. A bench trial was accordingly held in Tyler, Texas, in the courtroom of The Honorable William M. Steger, Senior United States District Judge, during May 21-25, 2001. A transcript of that trial has been prepared and filed with the Court. Following trial, the parties have submitted post-trial briefs and proposed findings of fact and conclusions of law.

The following are the special master's findings of fact and conclusions of law. Any objections are due in accordance with this Court's orders, and Rule 53, Fed.R.Civ.P.

FINDINGS OF FACT

To the extent that these findings of fact are conclusions of law, they should be so construed.

I. Introduction

A. The Parties

1. Delaware Capital Formation, Inc. ("Delaware Capital"), referred to as an "Involuntary Plaintiff," is the owner of U.S. Patent Nos. 4,150,721 ("the '721 patent"), 4,352,376 ("the '376 patent"), and 5,146,991 ("the '991 patent"). Amended Joint Final Pretrial Order at 5, Section (E)(1); Tr. May 24, 2001, at 130; Plaintiffs' Exhibits 8-11. Delaware Capital is referred to as an "Involuntary Plaintiff," apparently, because Delaware Capital joined Ferguson Beauregard's assertion of infringe ment in response to claims made by Defendant Mega Systems, L.L.C. ("Mega Systems").

2. Plaintiff Ferguson Beauregard/Logic Controls, Division of Dover Resources, Inc. ("Ferguson Beauregard"), is the exclusive licensee of the '721, '376, and '991 patents. Amended Joint Final Pretrial Order at 5, Section (E)(1); Tr. May 24, 2001, at 131. The parties have stipulated that Ferguson Beauregard has the right to enforce the patents-in-suit. Id. at 131-32.

3. Plaintiff Ferguson Beauregard makes, sells, and offers for sale an oil and gas well controller known as the AutoCycle controller. Amended Joint Final Pretrial Order at 5, Section (E)(8).

4. Defendant Mega Systems makes, sells, and offers for sale an oil and gas well controller known as the APC 1000. Amended Joint Final Pretrial Order at 5, Section (E)(9).

5. Defendant James Bartley is the president and majority owner of Mega Systems. Tr. May 23, 2001, at 76-78. In view of the fact that Mega Systems and Bartley have filed joint pre-trial and post-trial briefs and submissions, references herein to "Mega Systems" are to Mega Systems and Bartley, jointly. Refereces to "Bartley" are to defendant Bartley, individually.

6. Defendant Bartley designed the APC 1000 controller, Tr. May 23, 2001, at 80, created the computer code used in the APC 1000 controller, id. at 80-84, and drafted various versions of the user's manuals for the APC 1000 controller. Tr. May 23, 2001, at 66.

B. Nature of the Suit

7. Ferguson Beauregard brought this action against Mega Systems and James Bartley, individually, asserting that Mega Systems' APC 1000 controller infringes the '721, '376 and '991 patents-in-suit. Ferguson Beauregard asserts that Mega Systems is a direct infringer and that James Bartley is individually liable for having induced such infringement.

8. Mega Systems is the owner, by assignment, of U.S. Patent No. 4,921,048 ("the '048 patent"). That patent lapsed due to non-payment of maintenance fees prior to Mega Systems' acquisition. Mega Systems' acquisition was contingent upon reviving that patent which Ferguson Beauregard says was "improper." In any event, Mega Systems counterclaims that Ferguson Beauregard and Delaware Capital have infringed the '048 patent by making, using and selling the AutoCycle controller.

II. The *Markman* Hearing and Order

9. By Order dated December 5, 2000, the Court referred the issues of claim construction to Special Master Danny L. Williams. Special Master Williams issued a "Report of Special Master on Claim Interpretation" ("Special Master Williams' Report") on January 22, 2001. Apparently, none of the parties filed any objections to that report. Accordingly, the Court adopted the special master's report in its entirety by Order dated March 21, 2001.

10. Special Master Williams' Report and the Court's subsequent Order adopting that report, control claim construction here. Tr. May 21, 2001, at 226-27.

III. The Technology

11. The Ferguson Beauregard and Mega Systems' patents-in-suit are all generally drawn to controller systems and related methods used in the production of petroleum products from a well using what is termed "plunger lift" technology and a technique known as "intermitting." "Intermitting" involves shutting in a well for a predetermined period of time to allow pressure in the well to build up to a point where that pressure is sufficient to expel fluids when the well is subsequently opened. Well production occurs when the well is opened. The well is then again shut in to allow pressure to build up, opened to allow production, and so forth. *See* Special Master Williams' Report at 7-9. *See also* Tr. May 21, 2001, at 15-17.

12. Plunger lift technology uses a plunger that rests at the lower end of a well tubing string while the well is

shut in and pressure is building. During that time, fluid, *e.g.* oil, water etc., accumulate in the tubing string above the plunger. At a predetermined time, a motor valve at the surface is opened and the difference in pressure between the well and the surface equipment propels the plunger to the surface pushing the production fluids above it out of the tubing string into surface equipment, such as lines or separators, where the production product, *e.g.*, oil, may be recovered. The motor valve is then closed shutting in the well, the plunger returns to the bottom of the well, and the process is repeated. Alternatively, the motor valve may be left open for a period of time when the plunger reaches the surface to permit additional petroleum products to be produced from the well. After that additional period of time, the motor valve is closed and the plunger falls to the well bottom. The process is then repeated for so long as production is desired. *Id.*

13. The patents-in-suit are drawn to controllers, specifically electronic controllers, that control the timing of the opening and closing of the motor valve to repetitively shut in and open a well.

IV. The Ferguson Beauregard Patents-In-Suit

A. "Pioneer Patents"

14. Ferguson Beauregard urges that the Court should find that the '721 and '376 patents are "pioneer" patents. Plaintiffs' Post-Trial Brief at 8, 15. There is, however, no need to do so.

15. Although there are cases that discuss "pioneer patents," and Ferguson Beauregard collects a number in its post-trial brief, there is no objective legal test for determining what may or may not be a true "pioneer patent." Even accepting the testimony by one of the founders of Ferguson Beauregard, Paul Ferguson, that the commercial embodiment of the '721 patent "was the first controller to make intermitting plunger lift a viable option for well operators," that the '721 patent "describes the first electronic well controller," that the '721 patent "represented a significant advancement in the industry," and that "Lee Norword had the only electronic oil and gas well controller on the market that could successfully be used for plunger lift," id., the test for literal infringement of a "pioneer" patent is the same as for "non-pioneer" patents. The Federal Circuit has instructed the courts that "[t]he actual words of the claim are the controlling focus." Digital Biometrics, Inc. v. Identix, Inc., 149 F.3d 1335, 1344 (Fed.Cir.1998). "Absent a special and particular definition created by the patent applicant, terms in a claim are to be given their ordinary and accustomed meaning." Renishaw PLC v. Marposs Societa' Per Azioni, 158 F.3d 1243, 1249 (Fed.Cir.1998) ("Thus, when a claim term is expressed in general descriptive words, we will not ordinarily limit the term to a numerical range that may appear in the written description or in other claims. * * * Nor may we, in the broader situation, add a narrowing modifier before an otherwise general term that stands unmodified in a claim. * * *."). To the extent that words and phrases in a claim require construction, such construction is necessarily based on the intrinsic record of the patent. *See* Vitronics v. Conceptronic, Inc., 90 F.3d 1576, 1583 (Fed.Cir.1996). Moreover, the Federal Circuit has pointed out that the peripheral claiming system itself makes the best distinction between pioneer and non-pioneer patents because pioneers are not encumbered by extensive prior art and may obtain the benefits of broader claims. *See* Augustine Med. Inc. v. Gaymar Indus., Inc., 181 F.3d 1291, 1301 (Fed.Cir.1999). Accordingly, there is no need here to dub the '721 and '376 patents as "pioneer" because doing so adds little, if anything, to the analysis.

B. United States Patent No. 4,150,721 (the '721 Patent)

1. Disclosure of the '721 Patent

16. The '721 patent-in-suit, issued to William L. ("Lee") Norwood on April 24, 1979. As background, the

'721 patent explains that "[f]or the most part, control over these wells has been one based simply upon a somewhat crude clock-operated device, the cyclical closing and opening of a motor valve being determined by the operator following the periodic monitoring of a variety of parameters such as the differential pressure between casing and tubing string, sales line pressure, experience with adjacent wells, etc." '721 patent, col. 2, lines 32-39. According to the '721 patent, then available controllers were not capable of responding to a variety of operational parameters, and did not provide for easily adjusted on-off cycles. Id., lines 48-68.

17. The '721 patent explains that the "present invention is addressed to an improved flowing gas well control system and apparatus in which the well operator is given wide latitude of control in seeking the optimization of well production. Utilizing a controller incorporating solid state digital electronics greatly expanded production and shut-in cycle intervals are available with highly accurate time-out techniques." '721 patent, col. 3, lines 13-19.

18. Fig. 1 of the '721 patent is said to generally illustrate a "flowing gas well installation with components shown sectionally and out of scale:"

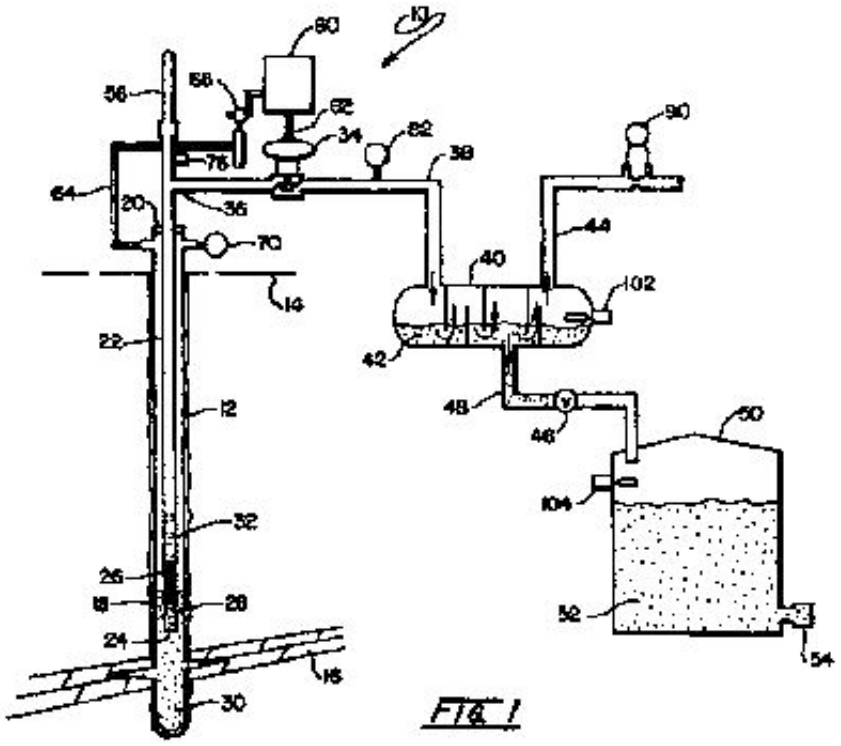


FIG. 1

'721 patent, col. 4, lines 44-46. Fig. 1 illustrates a casing 12 extending through surface 14 to a strata 16. A wellhead 20 provides, *inter alia,* support for a tubing string 22. A plunger or "rabbit" 26 is shown near lower opening 24, and is kept from falling through opening 24 by constriction 28. As discussed briefly above, in using a "plunger lift" technique, well installation 10 is operated on a cyclical basis, being shut-in for an interval during which gas pressure builds-up within casing 12. Liquid, *e.g.,* oil and salt water 30, accumulates within casing 12 and migrates through tubing string 22 above plunger 26, as represented by reference numeral 32. At a predetermined time taking into account the pressure within casing 12 and the level of accumulated liquid 32, a motor valve 34 is opened. Accumulated pressure causes plunger 26 to be

propelled from the lower end of the tubing string 22 pushing liquid and gas above plunger 26 to move through a horizontal T-connection 36 and open motor valve 34 into conduit 38, the initial component of a "sales line" to a separator 40. Heavier liquids fall to the bottom of the tank, as represented at 42. Gas is collected and enters outlet conduit 44. Valve 46 is used to draw liquids 42 through conduit 48 to an oil and water storage facility 50, where natural separation may occur. '721 patent, col. 5, line 6-col. 6, line 16.

19. Plunger 26, propelled under gas pressure, passes T-connection 36 and strikes a "bumper structure and/or lubricator" 56. The '721 patent explains that "plunger 26 remains at this upward location against the bumper structure until [the] gas flow rate diminishes to an extent permitting it to fall under gravity to its initial position against, for example, construction 28." According to the '721 patent, "[t]o permit optimized production for the well installation 10, motor valve 34 is closed to shut-in the well for an interval of time prior to the commencement of a next plunger lift and removal of the gas cap." The '721 patent explains that "the production and shut-in cycles providing optimum production varies from well to well. As a consequence, the well technician is called upon to examine various parameters of its initial performance to derive a form of signature representing the best cycling of the well through the opening and closing of motor valve 34. Usually, this initial evaluation is carried out by observing the differential pressure between tubing string 22 and casing 12. This difference, in general, represents the height of fluid 32 above plunger 26. When the timing of such pressure responses is determined for optimum production, a controller, in the past being provided as a mechanical clock operated device, is present to provide sequentially occuring [sic. occurring] off and on or shut-in and producing states of performance for the installation 10." '721 patent, col. 6, lines 17-44.

20. The '721 patent further explains that a "controller for carrying out the timing of the cyclical operation is represented generally in the figure at 60. Controller 60, at appropriate cyclical intervals, applies or releases lower pressure drive gas, *i.e.*, at a pressure of about 25 p.s.i.g., through a conduit 62 to the diaphragm drive of motor valve 34. The supply of this lower pressure gas is derived from the well head as through conduit 64 which leads to a filter and regulator 66 and thence to the input of a control valve positioned within controller 60." '721 patent, col. 6, lines 45-54.

21. Fig. 2 is said to illustrate generally the control panel of a controller according to the invention of the '721 patent-in-suit:

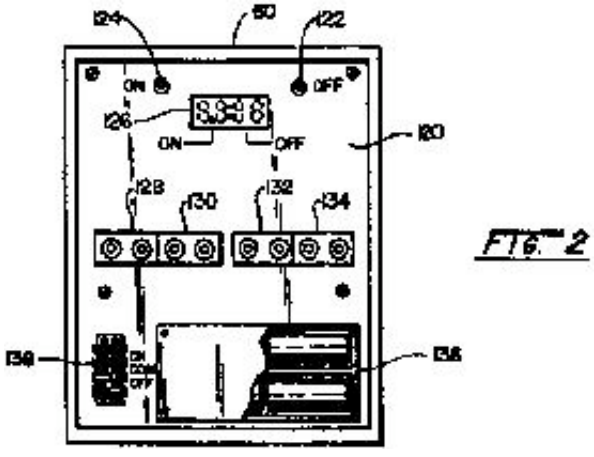


FIG. 2

'721 patent, col. 4, lines 47-49. According to the '721 patent, depressing switch 122 commences timing of an "off" cycle, *i.e.*, when the well is shut in and pressure is off the diaphragm of motor valve 34. Depressing switch 124, according to the patent, commences timing the "on" cycle, *i.e.*, when pressure is on the diaphragm of motor valve 34 and the well is being produced. A numerical readout is illustrated at 126. Banks of rotary input switches are below readout 126. Switches 128 and 130 are used to set hours and minutes for cycle time when pressure is on the diaphragm of motor valve 34, and switches 132 and 134 are used to set hours and minutes for the time when pressure is off the diaphragm of motor valve 34. Power is supplied through batteries 136. '721 patent, col. 8, line 42-col. 9, line 12.

22. The foregoing is believed sufficient to understand the general construction and operation of the described system. Other figures and accompanying description illustrate and describe the circuitry of the controller and the valve that operates motor valve 34. Portions of those figures and accompanying disclosure will be discussed below in conjunction with resolving the various infringement issues.

23. Ferguson Beauregard, and/or its predecessor, has manufactured and sold controllers pursuant to the '721 patent under the mark "Digitrol." Tr. May 21, 2001, at 22.

2. Claims of the '721 Patent

24. In general, the claims of the '721 patent are drawn to a controller or a control system for actuating the motor valve between open and closed positions. The claimed controller or control system includes various components, including, for example, a "pneumatic valve means" that is used to direct gas under pressure to cause the motor valve to open and close, and "manually programmable switch means" that are used in programming the time intervals at which the value will be operated.

25. Ferguson Beauregard asserts that Mega Systems' APC 1000 controller infringes claims 1 and 10 of the '721 patent, FN1 which provide as follows:

FN1. Ferguson Beauregard, during trial, dismissed its charge of infringement *vis-a-vis* the dependent claims of the '721 and '376 patents. Tr. May 23, 2001, at 13. Additionally, in its post-trial submissions, Ferguson Beauregard argues only claims 1 and 10. Accordingly, Ferguson Beauregard's assertion of infringement *vis-a-vis* any of the other claims of the '721 patent are deemed withdrawn. Similarly, Mega Systems' post-trial submissions, including its proposed findings of fact and conclusions of law, neither raise nor argue its previous allegations of invalidity, on various grounds, except for the assertion that the '991 patent is invalid under s. 102(b) due to an "on sale" bar. Accordingly, all of Mega Systems' prior assertions of invalidity *vis-a-vis* the patents-in-suit, except for the sole assertion that the '991 patent is invalid due to an "on sale" bar, are deemed withdrawn.

1. In a flowing gas well installation of a variety having a casing, a tubing string therein having its lower end open adajcent [sic. adjacent] the lower level of the casing, said tubing string being connectable to a sales line and having a motor valve positioned intermediate said tubing string and sales line actuable in response to an on or off designated pneumatic state between open and closed orientations to derive respective producing and shut-in conditions of performance for said installation the improved controlled for actuating said motor valve, comprising:
means providing a d.c. source of power;

pneumatic valve means connectable between a source of gas under pressure and said motor valve and including first and second electromagnetically actuated valve means energizable from said source of power to direct said gas under pressure to effect respective said motor valve actuating on and off pneumatic states;

oscillator means coupled with said power supply for deriving a pulse train of predetermined stable frequency;

frequency divider means including multi-stage solid-state ripple carry counters for deriving at least one pulse train of frequency f_1;

display means selectively energizable from a plurality of driver input signals thereto to provide multi-segment derived visible indicia representative of time in hours and subdivisions thereof;

manually programmable switch means coupled with said source of power for generating binary coded decimal signals representative of selected time intervals represented in hours and subdivisions thereof for each said designated pneumatic state;

multiplexer means for receiving said binary coded decimal signals and responsive to a selected state input select signal and for transferring corresponding binary coded decimal signals at the outputs thereof;

binary counter means coupled for receiving said corresponding binary coded decimal signals from said multiplexer means and responsive in the presence of an asserted load signal and count command signal to in-crementally [sic. incrementally] alter said received binary coded decimal signals in diminishing arithmetic progressional fashion and provide the initial received and altered binary coded decimal signals at outputs thereof and deriving a carry-out signal at the termination of said diminishing arithmetic progression;

driver means connected for receiving said binary counter means initially received and altered binary coded decimal signals to derive said driver input signals asserted at said display means;

off-state switch means actuable to derive an off-start signal;

on-state switch means actuable to derive an on-start signal; and

control circuit means responsive to a said off-start signal and a said carry-out signal occurring at the termination of an on designated pneumatic state and including timed switching means for effecting the energization of said second electromagnetically actuated valve means for a predetermined interval, for simultaneously generating said load signal and said count command signal at said frequency, f_1 and responsive to a said on-start signal and a said carry-out signal occurring at the termination of an off designated pneumatic state for effecting the energization by said timed switching means of said first electromagnetically actuated valve means for a predetermined interval for simultaneously generating said load signal and said count command signal at said frequency, f_1.

10. A control system for use in conjunction with flowing gas well installations of a variety having as components, a casing, a tubing string therein, the lower level thereof being adjacent the lower level of the casing, a plunger movable between said lower level and a bumper situate at a well head through which said tubing string extends and is connected with the upper level of said casing, said tubing string being connected in gas and liquid flow relationship through a motor valve and separator facility to a sales line, and a liquid

storage facility connected to receive liquid from said separator facility, said motor valve being pneumatically actuable between open and closed orientations to derive respective producing and shut-in states of performance, select said components exhibiting a sensible physical phenomenum [sic. phenomenon] representing an operational condition for which actuation of said motor valve to said closed orientation is appropriate, said system comprising:

a controller, including:

means providing a d.c. source of power;

pneumatic valve means connected between a source of gas under pressure and said motor valve and including first and second electromagnetically actuated valve means energizable from said source of power to direct said gas under pressure to effect respective said motor valve open and closed orientations;

manually programmable switch means coupled with said source of power for generating binary coded decimal signals representative of selected time intervals represented in hours and subdivisions thereof for each said state;

solid state timing means responsive to said binary coded decimal signals and to a count command signal to commence the timing of a said selected time interval and deriving a carry-out signal at the termination of said interval;

solid state display means responsive to said timing means for providing multi-segment derived visible indicia representative of time in hours and subdivisions thereof;

a normally open off-state switch having contact means closeable upon actuation to derive an off-start signal;

a normally open on-state switch having contact means closeable upon actuation to derive an on-start signal;

first terminal means electrically coupled with said off-state switch contact means for providing an auxiliary normally open switching function actuable to derive said off-start signal;

control circuit means responsive to a said off-start signal and a carry-out signal occurring when said motor valve is in said open orientation and including timed switching means for effecting the energization of said second electromagnetically actuated valve means for a predetermined interval and for simultaneously generating said count command signal, and responsive to said on-start signal and a carry-out signal occurring when said motor valve is in said closed orientation for effecting the energization by said timed switching means of said first electromagnetically actuated valve means for a predetermined interval and for simultaneously generating said count command signal; and

detector means coupled with a select said component [sic.] and including normally open switch means electrically associated with said first terminal means off-state switch contact means and responsive to a sensed said physical phenomenum [sic.] of said select component to dose for deriving said off-start signal.

C. United States Patent No. 4,352,376 (the '376 Patent)

1. Disclosure of the '376 Patent

26. The '376 patent issued to William L. ("Lee") Norwood on October 5, 1982. The '376 patent is directed to what are asserted to be improvements to the controller described in the '721 patent-in general terms, a microprocessor based controller. The '376 patent explains that the use of a microprocessor "permits operational flexibility as well as the elimination of switches" and "is structured so as to be capable of operating for extended periods of time utilizing a conventional D battery power source. This is achieved through a unique timing system permitting the microprocessor to operate at a relatively slow frequency." '376 patent, col. 4, lines 11-18. The '376 patent further explains that the "controller includes an oscillator which is energizable to provide a clock output at a frequency selected to minimize the power requirement of the device." Id. at lines 27-30.

27. Additionally, according to the patent, "a terminal input is provided which is connectable with switches external to the controller for receiving external signals resulting from operational parameter monitoring. " The '376 patent explains that "[b]ecause such signals may have a very short duration and in view of the relatively low clock frequency of the controller, a detection arrangement having an output of select duration in response to a received external signal is provided." The controller includes a processor and a memory for storing input time data. The processor is said to be "responsive to the clock output of the oscillator for carrying out time interval definition in correspondence with addressed time interval data to derive actuation signals at the timed limit of a defined time interval." The processor is further said to be "responsive to the detected outputs of select duration for generating actuation signals to operate a motor valve or the like and is responsive to clock outputs for deriving time increment outputs energizing the display to show a lapsed time within a given control interval. " The '376 patent says that "[t]he controller additionally includes a valve which is responsible [sic. responsive] to the actuation signals to derive control inputs serving to operate the noted motor valve." Id. at lines 30-53.

28. Fig. 4 illustrates an external view of the controller:

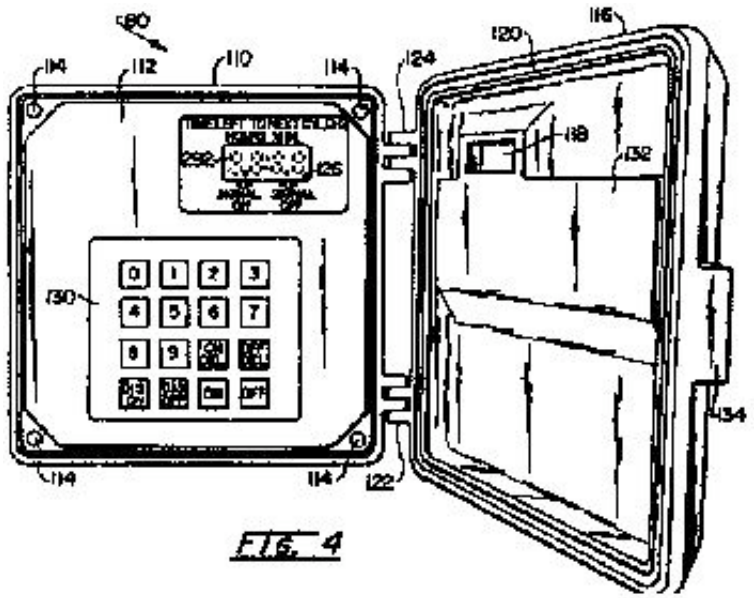


FIG. 4

A keypad provides for operator input through ten numeric keys and six function keys. A display selectively shows the number of hours and minutes or minutes and seconds remaining in a given on or off period for

motor valve 134, as well as the condition of the cycle, *i.e.,* whether the motor valve is "in an on timing state or condition * * * or is off, a state or condition representing a shut-in period." '376 patent, col. 12, lines 18-51.

29. Other figures and accompanying description illustrate and describe the circuitry and programming of the controller, and a valve that is used in conjunction with the controller. As in the case of the '721 patent, portions of those figures and accompanying disclosure will be discussed below in conjunction with resolving the various infringement issues.

30. Ferguson Beauregard, and/or its predecessor, has sold controllers manufactured pursuant to the '376 patent under the mark "Liquilift." Tr. May 21, 2001, at 26.

2. Claims of the '376 Patent

31. In general, the claims of the '376 patent-in-suit are, like the claims of the '721 patent-in-suit, drawn to a controller for use in controlling a "control valve." The claims call for various components in the controller including a "display means," "manual input means," "oscillator means," "terminal means," "detection means," "processor means," and "valve means."

32. Ferguson Beauregard asserts that the Mega Systems' APC 1000 controller infringes claims 1, 16 and 35 of the '376 patent, FN2 which provide:

FN2. These are the only claims that Ferguson Beauregard includes in its post-trial submissions. Accordingly, any assertions of infringement *vis-a-vis* any other claims of the '376 patent are deemed withdrawn.

1. A controller for use in conjunction with the control of well installations of a variety wherein a control valve regulating the flow of fluid hydrocarbon is selectively actuated between an on state and an off state in response to corresponding control inputs thereto, comprising
display means selectively energizable to provide visible digital characters representative of select components of time;

manual input means including an array of keys each being actuable to have a numeric output condition to represent a discrete one of a decade of numbers;

oscillator means energizable to provide a clock output of frequency selected to minimize the power requirement of said controller;

terminal means connectable with switches external to said controller for receiving an external signal therefrom;

detection means having an output of select duration in response to a received said external signal;

processor means including memory means for selectively retaining time interval data representing said numeric output conditions of said manual input means at addressable locations, said processor means being responsive to said clock output for carrying out time interval definition in correspondence with addressed

said time interval data to derive actuation signals at the time limit of a said defined interval, responsive to said output of select duration for generating said actuation signals, and responsive to said clock output for deriving time increment outputs energizing said display means to show elapsed time within a given said interval; and

valve means responsive to said actuation signals to derive said control inputs.

16. A controller for use in the control of well installations of a variety wherein a control valve regulating the flow of fluid hydrocarbon is selectively actuated between an on state and an off state in response to corresponding control inputs thereto, said installations including operational parameter monitoring switch means actuable to provide external signals, said controller comprising:

display means selectively energizable to provide visible digital characters representative of select components of time;

manual input means including an array of keys each being actuable to have a numeric output condition representing a discrete one of a decade of numbers and further including delay designated key means actuable to provide a delay output condition;

terminal means connectable for reception of said external signals;

processor means including memory means for selectively retaining time interval data representing said numeric output conditions of said manual input means at addressable locations, said processor means including counter means for providing time interval definition in accordance with addressed said time interval data to derive actuation signals at the timed limit of a said defined interval, said processor means being responsive to a said external signal at said terminal means to derive a said actuation signal following a selected delay interval; and

valve means responsive to said actuation signals to derive said control inputs.

35. A controller for use in the control of well installations wherein a control valve regulating the flow of fluid hydrocarbon is selectively actuated between on and off states in response to corresponding control inputs thereto and wherein operational parameter monitoring devices are actuable to provide external signals, comprising:

display means selectively energizable to provide visible digital characters representative of select components of time;

manual input means selectively actuable to provide numeric output conditions, each representing a number and further actuable to provide a delay output condition;

terminal means connectable for reception of said external signals as state change inputs;

control circuit means responsive to said manual input means numeric output conditions for deriving actuation signals defining selectively timed said on and off states, responsive to a said delay output condition and a subsequently asserted said numeric output condition to define a select delay interval;

said control circuit means being responsive to a said external signal state change input and to a delay output condition when occurring prior to said external signal for deriving a said actuating signal following an interval of time corresponding with said select delay interval; and

valve means responsive to said actuation signals to derive said control inputs.

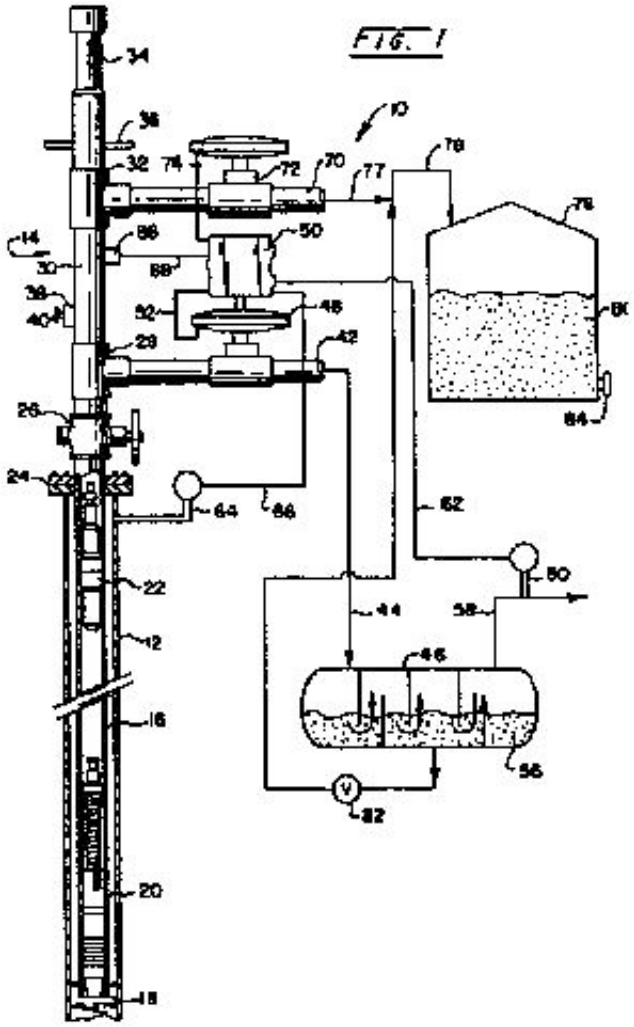
D. United States Patent No. 5,146,991 (the '991 Patent)

1. Disclosure of the '991 Patent

33. The '991 patent issued to Jack R. Rogers, Jr. on September 15, 1992. The Abstract explains that the '991 patent is, *inter alia,* drawn to a "method for producing a plunger lift well which optimizes production through the evaluation of the speed at which a plunger arrives at the wellhead within a fixed on-cycle interval. Time interval windows representing fast, good, and slow plunger performance are established and, based upon plunger performance with respect to these windows, afterflow time and off-cycle intervals are varied toward an achievement of plunger arrivals within the good window. " '991 patent Abstract. *See* Hill-Rom Co., Inc. v. Kinetic Concepts, Inc., 209 F.3d 1337, 1344 n. 1 (Fed.Cir.2000)(the abstract may be used in evaluating the disclosure and claims of a patent despite 37 C.F.R. s. 1.72(b)).

34. The '991 patent further explains that the "present invention is addressed to a method for operating a well installation employing plunger lift procedures. Utilizing the operational flexibility of the microprocessor based controller, a continuous monitoring and adjustment of well performance is carried out through an evaluation of plunger speed. The speed at which the plunger travels from the bottom of the tubing string of the well to the wellhead is evaluated by each cycle. Based upon that evaluation, changes may be made to the off-cycle time and afterflow cycle time to tune the well toward a performance which is optimized at a consistent plunger speed considered to achieve maximized production." '991 patent, col. 3, lines 11-23.

35. Fig. 1 is said to illustrate "a well installation for a plunger lift production according to the method of the invention." '991 patent, col. 6, lines 32-34.



Well installation 10 includes a casing 12 extending from the surface into a gas-oil formation. Well-head 14 supports a tubing string 16 having an open lower end 18 in the vicinity of the lower region of casing 12. A plunger 22 is disposed in tubing string 16. A master valve 26 and T-connections 28 and 32 are disposed above flange 24. T-connection 28 provides fluid communication between tubing string 16 and a conduit 42 which extends to a separator represented 46. A motor valve 48, termed a "sales valve," provides control over conduit 42. Valve 48 is controlled to open and close conduit 42 by a microprocessor driven controller 50. The '991 patent explains that "controller 50 may be fashioned similar to that described in Norwood, U.S. Pat. No. 4,352,376, * * *. Preferably, the controller 50 will be provided as a controller marketed under the trademark "Liquilift Autocycle" wellhead controller marketed by Ferguson-Beauregard, Logic Controls, of Tyler, Tex." The pressure in the "sales line" is monitored by a sales line gauge 60. When the pressure in the sales gathering system is too high, and a set threshold is reached or exceeded, a "high line contact" is generated as an electrical signal and conveyed to the controller 50. A conduit 70 extends from T-connection 32 and is controlled by a second motor valve 72-a tank valve or tank control valve. Tank valve 72 is also controlled between on and off states by controller 50. Opening tank valve 72 opens tubing string 16 to the low pressure of a tank or reservoir 76. A plunger detector 86 located above plunger catcher 38 provides a magnetic shut-off on arrival signal (MSO) to controller 50. '991 patent, col. 7, line 58-col. 9, line 27.

36. The '991 patent explains that "[i]n general, the control technique of the invention is one based upon plunger speed and seeks to operate the well such that the plunger performs consistently at an optimum value

of speed which initially is determined by the well operator at the time of set-up." According to the patent, an "operator will select an on-cycle time for the operation of the sales valve 48 and that value is constant, never being decremented or incremented. Then, with the on-time as a base, windows are established representing time element values corresponding with fast plunger rate, a slow plunger rate, and a normal plunger rate. These rates lie within the constant on-time selection of the operator." The patent explains that "[i]nstead of the operator forcing the well to perform to preconceived operating times and pressures, a requirement is made only to change the operating windows to be more or less aggressive in producing the well. No change is made to operating times if the plunger continues to surface within what may be deemed a good window. However, the technique will decrease the off-time and increase an afterflow time if the plunger surfaces in a fast window. The system will increase the off-time and decrease the afterflow time if the plunger surfaces in the slow window and if the plunger fails to surface during an on-time, then additional off-time is added to allow for pressure build-up." '991 patent, col. 9, line 66-col. 10, line 23.

37. Other figures and accompanying description illustrate and describe the circuitry and programming of the controller. Once again, portions of those figures and accompanying disclosure will be discussed below in conjunction with resolving the various infringement issues.

38. Ferguson Beauregard, and/or its predecessor, has sold controllers for performing the method of the '991 patent under the mark "Liquilift Autocycle." Tr. May 21, 2001, at 26-27.

2. Claims of the '991 Patent

39. The claims of the '991 patent are drawn to a method for operating a well using plunger lift technology. Specifically, the claimed method includes assigning values that correspond with the rate of movement of a plunger from the lower end of the well tubing string to the wellhead that represent normal plunger performance, then detecting arrival of the plunger at the wellhead to determine whether the plunger arrived within a "normal," "fast," or "slow" window.

40. Ferguson Beauregard asserts that the Mega Systems' APC 1000 controller infringes claims 1-3 and 5-15 of the '991 patent. FN3 Independent claims 1, 8 and 14 are representative:

FN3. As was the case with the '721 and '376 patents, these are the only claims addressed in Ferguson Beauregard's post-trial submissions. Accordingly, any assertions of infringement *vis-a-vis* other claims in the '991 patent are deemed withdrawn.

1. The method for operating a well installation having a control valve regulating the flow of fluid hydrocarbon from a well tubing string to a sales line which is selectively actuated between an on-state and an off-state, and wherein a plunger is located within the said tubing string of said well for movement between a lower region and a wellhead sensing position, comprising the steps of:
assigning first values corresponding with the rate of movement of said plunger from said lower region to said wellhead which represent normal plunger performance;

assigning second values less than said first values corresponding with the rate of movement of said plunger from said lower region to said wellhead which represent slow plunger performance;

assigning a predetermined value for the time interval of said on-state;

assigning a predetermined value for time interval of said off-state;

actuating said control valve to transition from an off-state to an on-state;

then detecting the arrival of said plunger at said wellhead prior to expiration of said predetermined value for the time interval of said on-state, and determining the time elapsed from said actuation;

determining the presence of any coincidence of said time elapsed from said actuation of said control valve with said assigned second values;

then increasing said predetermined value for the time interval of said off-state by a predetermined first time increment when a said coincidence with said assigned second value is present; and

terminating the said on-state in response to said plunger detection, and actuating said control valve to transition from said on-state to the next off-state in response to said termination of said on-state.

8. The method for operating a well installation having a sales control valve regulating the flow of fluid hydrocarbon from a well tubing string to a sales line-is selectively actuated to establish an on-state and an off-state, wherein a tank is provided for receiving fluid, and wherein a plunger is located within said tubing string for movement between a lower region and a well head sensing position, comprising the steps of:

providing a tank control valve coupled for regulating the flow of fluid hydrocarbon from said well tubing string to said tank, said tank control valve being actuable to establish a tank on-state and further actuable to close fluid flow communication between said tubing string and said tank;

assigning select values corresponding with the rate of movement of said plunger from said lower region to said wellhead which represent predetermined plunger performance;

assigning a value for a tank-on-time interval;

assigning a predetermined value for the time interval of said on-state;

assigning a predetermined value for the time interval of said off-state;

actuating said sales control valve to transition from an off-state to an on-state and commencing the timing of said on-state;

providing an arrival signal when said plunger arrives at said wellhead subsequent to the actuation of said sales control valve to transition to a said on-state;

actuating said sales control valve to said off-state when said time interval of said on-state is concluded in the absence of said arrival signal;

determining the presence of a tank cycle condition when said time interval of said on-state is concluded in the absence of said arrival signal;

actuating said tank control valve in response to said tank cycle condition to establish said tank on-state and commencing the timing of said tank-on-time interval; and

actuating said tank control valve to close and terminate said fluid flow communication in response to said arrival signal and commencing the timing of said off-state.

14. The method for operating a well installation having a control valve regulating the flow of hydrocarbon from a well tubing string to a sales line which is selectively actuated between an on-cycle and an off-cycle, each having time intervals, and wherein a plunger is located within said tubing string of said well for movement at a given rate between a lower region and a wellhead sensing portion, comprising the steps of:

assigning a predetermined fixed value for the time interval of said on-cycle;

assigning first values corresponding with a said rate of movement of said plunger from said lower region to said wellhead which represent normal plunger performance;

assigning second values corresponding with the rate of movement of said plunger from said lower region to said well head which represent fast plunger performance;

assigning a predetermined initial value for a said time interval of said off-cycle;

assigning a predetermined minimum value for a said time interval of said off-cycle;

actuating said control valve to transition from said off-cycle to said on-cycle;

providing an arrival signal when said plunger arrives at said wellhead subsequent to the said actuation of said control valve to transition to said on-cycle;

determining the presence of a fast plunger rate when said arrival signal occurs within a time interval from said control valve actuation to transition to said on-cycle corresponding with said second values;

decreasing said initial value for the time interval of said off-cycle by a predetermined increment of time in response to said determination of a fast plunger rate to derive an adjusted value for said time interval of off-cycle; and

maintaining said predetermined minimum value for said time interval of said off-cycle when said adjusted value is equal thereto.

V. Mega Systems' APC 1000 Controller

41. The accused APC 1000 controller is also used in the production of petroleum products from a well using "plunger lift" technology and "intermitting." In particular, the APC 1000 is an electronic, microprocessor based controller, that, like the Ferguson Beauregard patents-in-suit, controls the timing for opening and closing a motor valve for repetitively shutting in and opening a well.

42. Various APC 1000 manuals were introduced during trial. *See, e.g.,* Plaintiffs' Exhibits 104-105. Additionally, printouts of various versions of the software used by the APC 1000 were introduced as sealed

exhibits due to their proprietary nature. *See, e.g.,* Plaintiffs' Exhibits 100-103.

43. Although certain features of the APC 1000 will be discussed more fully below in connection with the parties' infringement contentions, in general, Mega Systems says that the APC 1000 does not use a "low power" microprocessor and urges doing so avoids the '376 patent, and does not use a "good" or "normal" window in which no adjustments are made to the operating parameters which Mega Systems says avoids the '991 patent.

VI. Infringement *Vel Non* of the '721 Patent

A. Two-Step Infringement Analysis

44. A finding of infringement *vel non* requires a two-step analysis. First, the asserted claims of the patent(s)-in-suit must be construed as a matter of law to determine their proper meaning and scope. Markman v. Westview Instr., Inc., 52 F.3d 967, 976 (Fed.Cir.1995), *aff'd,* 517 U.S. 370, 116 S.Ct. 1384, 134 L.Ed.2d 577 (1996). Claim construction is a matter of law reviewed *de novo* on appeal and without deference to the trial court's construction. Cybor Corp. v. FAS Techs., Inc., 138 F.3d 1448, 1454-56 (Fed.Cir.1998)(*en banc*). As noted above, Special Master Williams' Report resulting from a prior *Markman* hearing in this case controls claim construction here. Also, however, additional claim construction issues have arisen as a result of the parties' current arguments. Those issues are addressed in turn below.

45. Second, the claims, as construed, are compared to the accused device or process. *Id*. That is a question of fact. WMS Gaming, Inc. v. International Game Tech., 184 F.3d 1339, 1346 (Fed.Cir.1999). In order to prevail, the plaintiff/patent owner must establish by a preponderance of the evidence that the accused device or process infringes one or more claims of the asserted patent(s) either literally or under the doctrine of equivalents. *Id*. Literal infringement requires that every limitation of a patent claim be found in the accused device or process. *See* General Mills, Inc. v. Hunt-Wesson, Inc., 103 F.3d 978, 981 (Fed.Cir.1997).

46. Although Ferguson Beauregard's pre-trial submissions were unclear, Ferguson Beauregard clarified during trial that it was asserting literal infringement, and not infringement under the doctrine of equivalents. Ferguson Beauregard further clarified that its references to "equivalents" or "equivalence" in its pre-trial submissions were to "equivalents" in the context of 35 U.S.C. s. 112(6), as discussed further below. Tr. May 21, 2001, at 211-212, 214.

B. Mega Systems' Position During Trial Versus Post-Trial

47. Claims 1 and 10 of the '721 patent, in largely identical terms, call for "pneumatic valve means" and "manually programmable switch means":

Claim 1	Claim 10
pneumatic valve means connectable between a source of gas under pressure and said motor valve and including first and second electromagnetically	pneumatic valve means connected between a source of gas under pressure and said motor valve and including first and second electromagnetically

actuated valve means energizable from said source of power to direct said gas under pressure to effect respective said motor valve actuating on and off pneumatic states;	actuated valve means energizable from said source of power to direct said gas under pressure to effect respective said motor valve open and closed orientations;
manually programmable switch means coupled with said source of power for generating binary coded decimal signals representative of selected time intervals represented in hours and subdivisions thereof for each said designated pneumatic state;	manually programmable switch means coupled with said source of power for generating binary coded decimal signals representative of selected time intervals represented in hours and subdivisions thereof for each said state;

In pre-trial briefs, Mega Systems' non-infringement arguments were somewhat unfocused (referring broadly, for example, to a "myriad other differences"), but principally appeared to advocate that (1) the valve used in Mega Systems' APC 1000 was not an "equivalent," in a doctrine of equivalents sense, to the valve disclosed in the '721 patent specification, FN4 and (2) the Mega Systems' APC 1000 controller did not have a "manually programmable switch means," as claimed, or an "equivalent" thereof, in a s. 112(6) sense. FN5

FN4. Mega Systems argued: "Under *Hilton Davis/Warner-Jenkinson* and because the '721 Patent file wrapper cannot be produced, then the '721 Patent is estopped from equivalents. * * * Additionally, the valve used by Mega in its APC 1000 controller has been available since 1975, several years before Norwood filed his '721 Patent application (January 1978). Thus, Plaintiffs cannot claim the doctrine of equivalents, as Norwood simply did not claim this particular valve as an alternative embodiment." Defendants'/Counter-Claimants' Joint Pre-Trial Brief ("Defendants' Pre-Trial Brief") at 10-11.

FN5. Mega Systems argued: "The switch means in the Mega APC 1000 controller is not connected in this manner [*i.e.*, directly or indirectly to a source of power]. The Mega APC 1000 switches themselves do not generate the time signals and are, therefore, different from what is described in the '721 Patent." Defendants' Pre-Trial Brief at 11.

48. During trial, however, Mega Systems advised the Court that its non-infringement defense would focus on the fact that claims 1 and 10 of the '721 patent called for discrete circuit elements and that the Mega Systems' APC 1000 used a microprocessor. Mega Systems' argument was that a programmed microprocessor was not an "equivalent" in terms of s. 112(6) to the claim elements or limitations calling for discrete components:

THE COURT: * * * Dr. Alworth, turning to the '721 patent and really focusing on independent Claims 1

and 10, at least at this stage, as I more or less understand where the testimony has been the last couple days and from the briefs, I take it that the defense of noninfringement is primarily focused on [that] the claims call for discrete elements and you-all are using a microprocessor, and your argument is that your program[med] microprocessor is not an equivalent in terms of 112, 6 to the claim elements calling for discrete components in independent Claims 1 and 10 of the '721 patent. Is that about it?

DR. ALWORTH: In summary, that's about it, yes, sir.

THE COURT: All right. Is that an issue that we can address; in other words, focus the infringement analyses on whether a program[med] microprocessor that performs the functions that your microprocessor does is or is not a 112, 6 equivalent to the various means clauses in Claims 1 and 10?

DR. ALWORTH: I think we can do that. We also need to focus also on the issue that microprocessors were available at that time.

THE COURT: I believe that's-that would be part of that issue, would it not?

DR. ALWORTH: Yes, sir.

Tr. May 23, 2001, at 10-11. In its pre-trial brief, Mega Systems phrased the issue as "under Pennwalt [Pennwalt Corp. v. Durand-Wayland, Inc., 833 F.2d 931 (Fed.Cir.1987)], Plaintiff's [sic.] cannot claim the doctrine of equivalents contained within a microprocessor simply because Norwood did NOT claim microprocessors as an alternate. Norwood simply patented his CMOS hardware." [Emphasis in original.] Defendants' Pre-Trial Brief at 12-13.

49. In its Post-Trial Brief, Mega Systems solely argues that the Mega Systems' APC 1000 does not have a "pneumatic valve means" or a "manually programmable switch means" as claimed and as construed in Special Master Williams' Report. Defendants' Post-Trial Brief at 1, 4-6. Ferguson Beauregard argues that "[b]ased upon Defendants' counsel's representations to the Court and opposing counsel at trial, however, Defendants should not be permitted now to assert arguments of non-infringement other than those that they specifically stated at trial were the basis of their non-infringement defense." Plaintiffs' Joint Post-Trial Reply Brief ("Plaintiffs' Post-Trial Reply") at 3.

50. Ferguson Beauregard, of course, has a point. Reasonable management of the myriad issues that arise during litigation in general, and during patent litigation in particular, require that parties be forthright and accurate in their representations to the Court. The Court and opposing counsel have a right to rely on, and do rely on, those representations. It is fundamentally unfair, both to the Court and to opposing counsel, to make representations during trial that are then ignored post-trial, as Mega Systems does here. However, out of an abundance of caution, Mega Systems' two non-infringement arguments advanced in its post-trial brief will be addressed.FN6

FN6. Accordingly, Mega Systems' infringement defense announced during trial that the microprocessor-based system used in the APC 1000 is not an "equivalent" in a s. 112(6) sense to the various components set forth in claims 1 and 10 of the '721 patent is deemed withdrawn. It is clear from Mega System's post-trial submissions, including both its briefs and its proposed findings of fact and conclusions of law, that Mega Systems now relies solely on the asserted lack of a "pneumatic valve means" or a "manually programmable switch means" in its APC 1000 controller as its basis for asserting non-infringement. Indeed, Mega Systems

does not even mention, let alone address, the testimony and documentary evidence that Ferguson Beauregard presented during trial on the issue of "equivalents" in a s. 112(6) sense.

C. "pneumatic valve means"

1. Prior Construction of the Terms in Dispute

51. With respect to the "pneumatic valve means," although there are slight differences between that claim element as phrased in claim 1 and as phrased in claim 10, none of the parties contend that such differences are substantive. Accordingly, the limitation as phrased in claim 1:

pneumatic valve means connectable between a source of gas under pressure and said motor valve and including first and second electromagnetically actuated valve means energizable from said source of power to direct said gas under pressure to effect respective said motor valve actuating on and off pneumatic states

will be used for discussion.

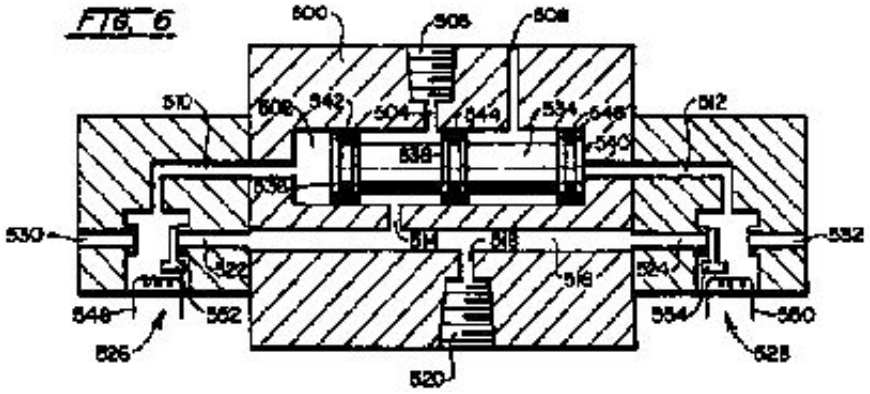
52. The language of the claim is somewhat awkward, but is nevertheless sufficiently clear. First, the limitation calls for a "pneumatic valve means" that includes "first and second electromagnetically actuated valve means." Special Master Williams concluded that "[t]he 'pneumatic valve means' and the 'first and second electromagnetically actuated valve means' should each be construed in accordance with 35 U.S.C. s. 112, para. 6, in that they are written in 'means plus function' form." Special Master Williams Report at 12. Special Master Williams noted that "[e]ach of the two recited 'means' 'direct[s] said gas under pressure to effect respective said motor valve actuating on and off pneumatic states.' " Id. Special Master Williams explained that:

In particular, the first and second electromagnetically actuated valve means direct pressurized gas to control the central shuttle portion to assume one of two alternative positions. In each of the two positions, the central shuttle portion directs gas pressure in such a way as to effect the opening or closing of the motor valve. The motor valve is the valve that opens and closes the well tubing in an intermitting fashion.

Id.

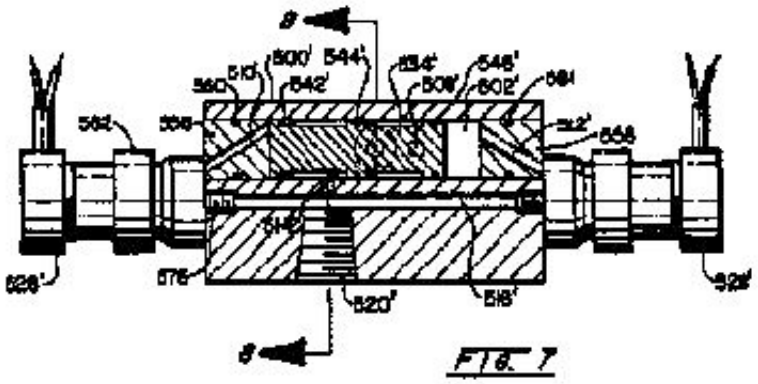
53. Special Master Williams concluded that "[t]he 'pneumatic valve means * * * including first and second electromagnetically actuated valve means' are shown in Figure 6 of the '721 patent and described at col. 17, line 12-col. 18, line 10, of the '721 patent," and that "[a]n alternative form of the 'pneumatic valve means * * * including first and second electromagnetically actuated valve means' is shown in Figures 7-9 and described at col. 18, lines 11-55, of the '721 patent." Id. at 13. *See* Ishida Co., Ltd. v. Taylor, 221 F.3d 1310 (Fed.Cir.2000)(the "corresponding structure" may different between embodiments).

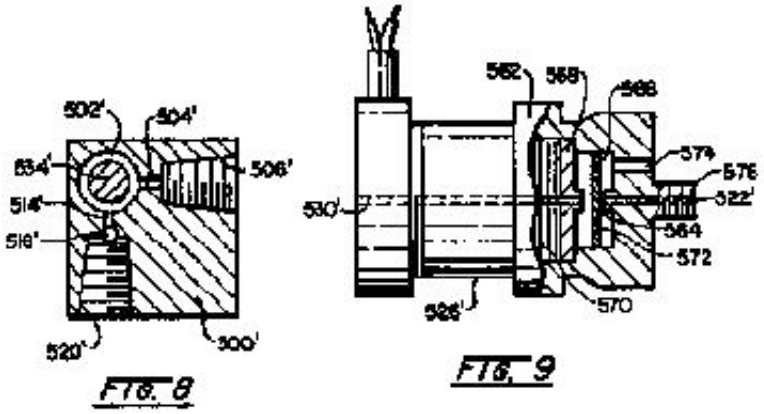
54. Fig. 6 of the '721 patent illustrates the following:



Special Master Williams explained that "Figure 6 shows a main valve body 500 housing a shuttle piston 534 and various passageways through which the pressurized gas may flow. Two electromagnetically actuated valves 526 and 528 may be controlled to direct the gas through selected ones of the passageways to effect movement of the shuttle piston 534. Movement of the piston 534 then directs gas through selected passageways to effect opening and closing of a motor valve." Id. As noted above, this Court's Order of March 22, 2001, adopted Special Master Williams' Report, and none of the parties contends that Special Master Williams' construction is incorrect.

55. Figs. 7-9 of the '721 patent illustrate the following:





Special Master Williams explained that "Figure 7 shows a main valve body 500' housing a shuttle piston 534' and various passageways. Two electromagnetically actuated valves 526' and 528' direct the gas through selected passageways to effect movement of the piston 534' and thereby effect opening and closing of the motor valve. Figure 8 shows a cross-sectional view of the structure of Figure 7, and Figure 9 shows select details of one of the electromagnetically actuated valves 526'." Id. Once again, this Court's Order of March 22, 2001, adopted Special Master Williams' Report, and none of the parties contends that Special Master Williams' construction is incorrect.

56. Special Master Williams concluded that "[t]he phrase 'pneumatic valve means * * * including first and second electromagnetically actuated valve means' should be interpreted to mean the structures illustrated in Figures 6-9 of the '721 patent 'and equivalents thereof' that perform the function of 'direct[ing] said gas under pressure to effect respective said motor valve actuating on and off pneumatic states." Id.FN7

FN7. As noted, Special Master Williams construed the entire phrase "pneumatic valve means * * * including first and second electromagnetically actuated valve means" as a means-plus-function limitation governed by s. 112(6), and none of the parties have contested that construction. Moreover, none of the parties have separately addressed "first and second electromagnetically actuated valve means," *i.e.*, whether that clause requires identification of other, more specific, "corresponding structure." Accordingly, whatever issues or arguments that could have been raised *vis-a-vis* "first and second electromagnetically actuated valve means" are deemed waived.

2. Testimony and Arguments

57. At trial, Mr. Stanley F. Quayle, an expert witness appearing on behalf of Ferguson Beauregard, described the results of his examination of the valve used in Mega Systems' APC 1000 controller. Initially, that testimony was given in connection with the claims of the '376 patent.FN8

FN8. The independent claims of the '376 patent-in-suit call for a "valve means responsive to said actuation signals to derive said control inputs." Special Master Williams did not specifically address "valve means" as used in the claims of the '376 patent in his report, apparently because none of the parties requested that he do so. That is, Special Master Williams noted in his report that "[d]uring the course of the [*Markman*] hearing on January 7-8, the Special Master confirmed with each of the parties that the following terms and phrases are in dispute. Moreover, the Special Master confirmed with the parties during the hearing that no other claim terms or phrases have disputed meaning." Special Master Williams' Report at 10. "Valve means" as used in the claims of the '376 patent is not listed among the terms in dispute. In any event, during his testimony *vis-a-vis* the '376 patent and "valve means," Mr. Quayle identified the "corresponding structure" in the '376 patent as valve 766 shown in Fig. 19 of the '376 patent. Tr. May 22, 2001, at 47-48. That is the same valve as shown in Fig. 6 of the '721 patent. Tr. May 22, 2001, at 82.

THE COURT: All right. And you found something, some structure that was identical or similar to that in the APC 1000?
THE WITNESS: Yes. The Mega APC 1000 has a different valve structure. It's not in here, so I don't know where it's gone.FN9 But it has a valve. It looks different, but it has the elements that are the same. Both valves, both the one in the patent and in the Mega APC 1000, its biggest primary feature is that it can-it has three ports on it to drive the motor valve to the desired states. Also, they have two windings. Now, in the

drawing here, the windings, which are 274 and 288 are separate.

FN9. The witness, Mr. Quayle, had been handed a controller in which the valve, apparently, had been removed. Mr. Quayle was permitted to testify as to his recollection of his examination of that valve over defendants' objection. Tr. May 22, 2001, at 48-49. The defendants now cite that testimony in urging that the APC 1000 does not have a "pneumatic valve means" as claimed. Defendants' Post-Trial Brief at 5. Accordingly, that objection is deemed waived.

* * *

MR. LeVERE: Your Honor, for purposes of time, Mr. Quayle, why don't you describe the extent of your evaluation of the valve, what you did-

* * *

THE WITNESS: Yes. Okay. I was saying that the windings are separate here in the Figure 19, 274 and 288 are the separate windings. Now, in the case of the valve used by the Mega APC, when you-unfortunately, I don't have a photograph of the valve. If you look at the valve, there's actually one block that winds around the valve stem. It has three wires that come out of it. By using my own meter, I was able to determine that what's really there are two windings connected to a common center.

The Mega APC 1000's valve also has a magnet on there to hold-magnetically latch it into one of two states. So you energize one of the coils, it drives the valve-there's a little-very small little pilot piece on the inside that goes to one end to the other, opening and closing appropriate ports. And the magnet keeps that orientation, and the current can be shut off.

So the really important feature of both the valve in the patent and the valve in the Mega APC 1000 is that there are two stable states that don't require any current. Again, because of the low-power operation, that's a very important and salient feature.

* * *

THE COURT: Please complete your answer and then-my only question was is that the basis for your opinion that these two valves that may be physically different exteriorly are, in your opinion, equivalent?

THE WITNESS: That is the basis of my opinion.

THE COURT: Okay.

Q. (BY MR. LeVERE) When you say that, did you mean just the two stable nonpowered state or the three or four characteristics that you just mentioned in total?

A. All the characteristics are shared by the two valves.

Q. Now, again, perhaps to assuage Mr. Fraser somewhat, why don't you describe for the Court what analysis

you did of that valve that you found in the APC 1000 controller?

A. Gladly. My very first part of the analysis, I removed it from the device, which is why it's not in the controller today. I first examined the windings on the coil, and again, as I said, I used my own meter to determine that they, in fact, are two separate windings that are just connected together in a common point.

I then went and disassembled the valve to find out what was the internal structure. When I opened up the valve, there was a port on top. There was a nut-green nut I removed to disassemble the valve body. There's a part that's screwed together. And inside, with a little spring, because of how it operates, there's a little small shuttle. It was actually hexagonal in cross-section, approximately an inch long, and it would move in the valve a small fraction of an inch, less than a quarter of an inch, into the two states.

I then-we had that photographed at Ferguson Beauregard-I mean Mueller & Smith, both assembled and disassembled. I put it back together to make sure it still worked. I hooked a battery to it and was able to drive it to the two states and verify that which port-you know, which two ports were connected were different between the two states of the valve.

I then took it to a radiographer and actually had it radiographed-x-rayed basically-in both states so that we could actually see by how much the shuttle had moved. And again, like I said, it wasn't very far.

* * *

Tr. May 22, 2001, at 48-52. With respect to the '721 patent, Mr. Quayle testified:

Q. Thank you. Would you describe for the Court your analysis on an element-by-element basis of the elements of Claim 10 in the '721 patent, please, and your comparison to that to the APC 1000 controller?

* * *

A. * * * The second substantive element talks about the valve means. And there's a section of the Markman report that talks about the pneumatic valve means, so let me reference that, please. The page-on page 13 of the Markman report, the last paragraph before Section 2 begins: The phrase pneumatic valve means, etc., should be interpreted to mean the structures illustrated in Figures 6 through 9 of the '721 patent and equivalents thereof that perform the function of directing said gas under pressure to effect said motor valve actuating on and off pneumatic states.

So in the '721 patent claim, in this element it's talking about the valve that is in the controller itself. That valve is, in turn, corrected to the motor valve and opens and closes the well by operation of the valve. It also calls out in both the claim and in the specification that there are two-basically two electromagnetic states that open and close the valve and change how the gas is routed.

Now, this valve is basically the same one we've already discussed in the '721, and-but Drawing 6 through 9 give much more detail on how that valve is constructed in the '721 patent, as opposed to the 369 patent.

Q. I'm sorry, let me just interrupt for a second. You referenced the 369 patent?

A. '376. I'm sorry. My mind wandered off into space there for just a second, but I'm back now.

Anyway, so taking all of this into account, the function of the valve in both the Mega APC 1000 and in the patent and the specification is to drive the motor valve to one of two states. And so the way that that's done is similar between the two-between the Mega APC 1000 and the patent and the specification itself, although the physical construction looks a little different. And so the result is that both drives the motor valve.

Features of the valve that we previously mentioned are that it has two windings. In the case of the Mega valve, it's two windings connected together at a common point in a single unit. In the case of the '721 patent, it's two separate windings at opposite the valve, but electrically, it's equivalent. And also that the valve is stable in either of two states without any power being applied. And that's the case for both the valve in '721 and the valve in the Mega APC 1000. And so it's my opinion that this claim element reads on the Mega APC 1000.

Tr. May 22, 2001, at 80-83.

58. Mega Systems argues that the "pneumatic valve means" called for in claims 1 and 10 of the '721 patent is a "pneumatically-operated valve," while the APC 1000 control valve is a "solenoid-actuated valve." Referring to the testimony by Mr. Quayle, Mega Systems argues that "the APC 1000 control valve is, in effect, the solenoid. When one side of the windings is energized, the shuttle moves in one direction; when the other side of the windings is energized, the shuttle moves in the opposite direction. The APC 1000 control valve operates the motor valve pneumatically, but the control valve itself is not pneumatically operated." Defendants' Post-Trial Brief at 5.

59. Mega Systems notes that "Quayle testified that the pneumatic valve of the '721 patent and the solenoid valve of the APC 1000 were the [sic.] substitutes for one another," and concedes that "if the '721 patent claimed only a 'valve means' then perhaps Quayle's testimony would be enough for this Court to find that the two valves are structurally equivalent." But, Mega Systems argues, "the '721 patent claims a '*pneumatic* valve means,' " [emphasis in original.] and "[t]o hold that a solenoid valve is the structural equivalent of a pneumatic valve would in effect, remove (or vitiate) the claim term 'pneumatic' from Claims 1 and 10," which the Court is not permitted to do. Id. at 6. Accordingly, Mega Systems concludes that the APC 1000 cannot, as a matter of law, infringe claims 1 and 10 of the '721 patent. Id.

60. Ferguson Beauregard, in response, notes that the valve "disclosed in the specification of the '721 patent and recited in claims 1 and 10 is 'pneumatic' because it directs the flow of gas under pressure to operate the motor valve, not because a shuttle contained within the valve is moved pneumatically." Plaintiffs' Post-Trial Reply at 4. According to Ferguson Beauregard, "Mr. Quayle testified that the two valves [*i.e.,* the valve described in the '721 patent specification and drawings and the APC 1000 valve] are equivalent because both valves have two windings selectively energized to open and close two ports, which effects movement of a shuttle or piston inside the valve. Movement of the shuttle from one position to another directs the flow of gas under pressure onto the diaphragm of a motor valve to cause the motor valve to open and close. Once the shuttle has been moved into position, the coil need no longer be energized." Id. at 4-5. Ferguson Beauregard notes that Mr. Quayle "acknowledged that there were structural differences between the two valves. For example, the APC 1000 controller's valve has two windings with a common return rather than two individual windings. However, despite the minor differences, Mr. Quayle stated that in his expert opinion the two valves were interchangeable." Id. at 5.

3. Discussion

61. Ferguson Beauregard is correct. Indeed, Mega Systems' concession that "if the '721 patent claimed only a 'valve means' then perhaps Quayle's testimony would be enough for this Court to find that the two valves are structurally equivalent," is sufficient to decide the issue.

62. 35 U.S.C. s. 112(6) provides that:

An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

Section 112(6) thus allows "an applicant [to] describe an element of his invention by the result accomplished or the function served, rather than describing the item or element to be used * * *." Warner-Jenkinson Co. v. Hilton Davis Chem. Co., 520 U.S. 17, 27, 117 S.Ct. 1040, 137 L.Ed.2d 146 (1997). "Means-plus-function" limitations are construed, as required by s. 112(6), to cover the corresponding structure, material or acts described in the specification and equivalents thereof. Therefore, because none of the parties quarrel with Special Master Williams' identification of the claimed function, *i.e.,* "to direct said gas under pressure to effect respective said motor valve actuating on and off pneumatic states," or with his identification of the "corresponding structure" described in the specification of the '721 patent that is "linked" to that function, *see,* Medtronic, Inc. v. Advanced Cardiovascular Sys., Inc., 248 F.3d 1303, 1311 (Fed.Cir.2001), and because Mega Systems does not dispute that the valve in the APC 1000 performs the identical claimed function, *i.e.,* it "direct[s] said gas under pressure to effect respective said motor valve actuating on and off pneumatic states," the only remaining issue is whether the structure of the APC 1000 valve is "equivalent" to the "corresponding structure" that Special Master Williams identified in the '721 patent specification. Mega Systems' foregoing concession leads to the conclusion that they are.

63. That the claims call for "*pneumatic* valve means," as opposed to "valve means," does not change either the claimed function or the "corresponding structure" described in the specification. Consequently, the question of infringement under s. 112(6), at least insofar as this claim limitation is concerned, turns on whether the structure of the valve in the APC 1000 is "equivalent" to the "corresponding structure" identified in the '721 specification and drawings. In that respect, calling for a "*pneumatic* valve means," as opposed to a "valve means," does not change the result.

64. Furthermore, Ferguson Beauregard is correct that in the context of the claims (again using claim 1 as being representative):

pneumatic valve means connectable between a source of gas under pressure and said motor valve and including first and second electromagnetically actuated valve means energizable from said source of power to direct said gas under pressure to effect respective said motor valve actuating on and off pneumatic states;

"pneumatic" plainly refers to the fact that the valve is directing the flow of gas under pressure to operate the motor valve. And, Ferguson Beauregard is correct that the claims, on their face, call for "pneumatic valve means" rather than a "pneumatically-operated valve." But that similarly does not affect the end result here, and also highlights why a finding of "equivalents" under s. 112(6) does not ignore "pneumatic" as Mega

Systems contends.

65. In describing the "corresponding structure," *i.e.*, first alternative valve illustrated in Fig. 6 of the '721 patent, Special Master Williams accurately noted that "[t]wo electromagnetically actuated valves 526 and 528 may be controlled to direct the gas through selected ones of the passageways to effect movement of the shuttle piston 534. Movement of the piston 534 then directs gas through selected passageways to effect opening and closing of a motor valve." Special Master Williams' Report at 13. The second alternative illustrated in Figs. 7-9 is similar, *i.e.*, electromagnetically actuated valves 526' and 528' direct gas through various passageways to cause movement of piston 534' and thereby effect opening and closing of the motor valve. In other words, the "corresponding structure" described in the '721 patent specification is, in fact, a valve that uses gas to move shuttle piston 534 or 534'. Even if Mega Systems was correct that "pneumatic valve means" should be read as a "pneumatic-operated valve," the actual "corresponding structure" identified by Special Master Williams uses gas to move a shuttle piston. Again, as a result, when that "structure" disclosed in the '721 patent specification that corresponds to the "pneumatic valve means" is compared to the APC 1000 valve to determine "equivalents" under s. 112(6), it simply makes no difference in this instance whether the claim calls for "pneumatic valve means" or simply "valve means." The bottom line issue of "equivalents" under s. 112(6) remains the same.

66. As noted above, Mega Systems' Post-Trial Brief may be read as conceding that the structure of the valves disclosed in the '721 patent specification and the structure of the APC 1000 valve are equivalent based on Mr. Quayle's testimony. To the extent that Mega Systems has not so conceded, Mega System's argument fails for want of proof. As Ferguson Beauregard correctly notes, "Defendants point to no testimony anywhere in the record to support the argument in their brief that the APC 1000 valve is, in fact, a 'solenoid-actuated valve.' No witness in the entire trial offered any testimony whatsoever regarding a 'solenoid-actuated valve.' " Plaintiffs' Post-Trial Reply at 5. The testimony by Mr. Quayle that Mega Systems relies on (which is the only testimony that Mega Systems cites in its brief), plainly supports the conclusion that the valves disclosed in the '721 patent specification and the structure of the APC 1000 valve are equivalent for purposes of s. 112(6). A fair reading of Mr. Quayle's testimony is that the valves disclosed in the '721 patent specification and the APC 1000 valve all perform the identical function required by claims 1 and 10 of the '721 patent, and do so in the same or substantially the same way to achieve the same or substantially the same result. Mega Systems did not introduce any rebuttal evidence at trial, FN10 and points to none in its post-trial submissions.

FN10. Although Mr. Bartley was questioned on direct examination about the "pneumatic valve means," his testimony was simply that the valve used in the APC 1000 was common in the industry, had been available since 1975, and that he had one in his travel trailer refrigerator. Tr. May 24, 2001, at 192.

67. Additionally, Mega Systems' argument is premised on the assertion that the components of a "solenoid-actuated valve" are different from a "pneumatically-operated valve." Mega Systems stresses that "Mr. Quayle, described for the Court how the APC 1000 control valve has two windings, connected with a common center wire, that wind around the valve's stem, or shuttle." Thus, Mega Systems concludes, "the APC 1000 control valve is, in effect, the solenoid." Defendants' Post-Trial Brief at 5. But the Federal Circuit has emphasized that component-by-component equivalence is not the test under s. 112(6). *See* Caterpillar, Inc. v. Deere & Co., 224 F.3d 1374, 1380 (Fed.Cir.2000). *See also* Odetics, Inc. v. Storage Tech. Corp., 185 F.3d 1259, 1267-68 (Fed.Cir.1999)("The individual components, if any, of an overall structure that corresponds to the claimed function are not claim limitations. Rather, the claim limitation is the overall

structure corresponding to the claimed function. This is why structures with different numbers of parts may still be equivalent under s. 112, para. 6 * * *."). Even if the components of a "solenoid-actuated valve" are different from a "pneumatically-operated valve," that does not preclude a finding that such valves are equivalent for purposes of s. 112(6). And on the record testimony and evidence in the present case, in the context of claims 1 and 10 of the '721 patent, they are.

D. "manually programmable switch means"

1. Prior Construction

68. Again, although this limitation in claims 1 and 10 of the '721 patent differ slightly, none of the parties contend that such differences are substantive. Accordingly, the limitation as phrased in claim 1:

manually programmable switch means coupled with said source of power for generating binary coded decimal signals representative of selected time intervals represented in hours and subdivisions thereof for each said designated pneumatic state

will be used for discussion.

69. Special Master Williams concluded that "[t]he 'manually programmable switch means' should be construed in accordance with 35 U.S.C. s. 112, para. 6, because it is written in 'means plus function' form. The recited function performed by the 'switch means' is that of 'generating binary coded decimal signals representative of selected time intervals represented in hours and subdivisions thereof for each said designated pneumatic state.' " Special Master Williams' Report at 14. Special Master Williams rejected Mega Systems' argument that "coupled with said source of power" requires a direct connection, reasoning that, in light of the specification, the "switches may be 'coupled' with a source of power by way of, or through, another device." Id. at 14-15. Accordingly, Special Master Williams concluded that:

The phrase "manually programmable switch means coupled with said source of power" in the claims of the '721 patent should be interpreted to mean the structures shown in Figure 2 (devices 128, 130, 132 and 134) and Figure 3C (device 142) of the '721 patent "and equivalents thereof" that perform the function of "generating binary coded decimal signals representative of selected time intervals represented in hours and subdivisions thereof for each said designated pneumatic state." 35 U.S.C. s. 112, para. 6. The "manually programmable switch means" must be connected, either directly or indirectly, to the source of power.

Id. at 15.FN11

FN11. As noted above, apparently none of the parties filed objections to Special Master Williams' Report and the Court has adopted that report, in its entirety, by Order of March 21, 2001. These findings of fact and conclusions of law are, therefore, necessarily governed by that report and Order. The undersigned, however, is constrained to respectfully disagree with Special Master Williams' conclusion, quickly mentioning, though, that the undersigned has not had the benefit of either the briefing or the record from the *Markman* hearing. Nevertheless, it is appropriate to mention that the trial court, initially, and the Federal Circuit, ultimately, has the obligation to construe the claims as a matter of law irrespective of the parties' arguments, *see* Exxon Chem. Patents, Inc. v. Lubrizol Corp., 64 F.3d 1553, 1555 (Fed.Cir.1995), *cert. denied,* 518 U.S. 1020, 116 S.Ct. 2554, 135 L.Ed.2d 1073 (1996), including the obligation to independently decide whether claims recite means-plus-function limitations governed by s. 112(6). *See* Rodime PLC v. Seagate Tech., Inc., 174 F.3d 1294 (Fed.Cir.1999), *cert. denied,* 528 U.S. 1115, 120 S.Ct. 933, 145 L.Ed.2d 812 (2000).

The subject limitation uses the term "means" and therefore raises a presumption that there was an intent to invoke s. 112(6). *See Al-* Site Corp. v. VSL Int'l, Inc., 174 F.3d 1308, 1318 (Fed.Cir.1999)("If the word 'means' appears in a claim element in combination with a function, it is presumed to be a means-plus-function element"). However, deciding that a claim limitation is drawn as a means-plus-function limitation governed by s. 112(6) also requires finding that there is no definite structure, material or acts set out in the claim for achieving the specified function. *See* Cole v. Kimberly-Clark Corp., 102 F.3d 524 (Fed.Cir.1996), *cert. denied,* 522 U.S. 812, 118 S.Ct. 56, 139 L.Ed.2d 20 (1997). Special Master Williams' Report did not expressly so find, and "manually programmable switch," especially when coupled with the further recitation that it is "coupled with said source of power," certainly adds "structure" that might be considered analogous to "perforation" in "perforation means" at issue in *Cole* or "baffle" in "baffle means" at issue in Enviro Corp. v. Clestra Cleanroom, Inc., 209 F.3d 1360 (Fed.Cir.2000).

That is, a "manually programmable switch" arguably recites structure capable of performing the recited function, *i.e.,* "generating binary coded decimal signals representative of selected time intervals represented in hours and subdivisions thereof for each said designated pneumatic state." The limitation is clear both in the instance if the claim had called for (1) a "manually programmable switch coupled with said source of power for generating binary coded decimal signals representative of selected time intervals represented in hours and subdivisions thereof for each said designated pneumatic state," *i.e.,* excluding the word "means," or (2) as actually written, "manually programmable switch means coupled with said source of power for generating binary coded decimal signals representative of selected time intervals represented in hours and subdivisions thereof for each said designated pneumatic state," *i.e.,* including the word "means."

Alternatively, the patentee could have said "means coupled with said source of power for generating binary coded decimal signals representative of selected time intervals represented in hours and subdivisions thereof for each said designated pneumatic state," *i.e.,* excluding the words "manually programmable switch," which undoubtedly would have resulted in a conclusion that the limitation was drawn in means-plus-function form governed by s. 112(6). Doing so would also have resulted in a claim limitation of identical scope and construction to that at issue here, *i.e.,* "manually programmable switch" is being, essentially, ignored. That, of course, is improper. Courts must give meaning to all of the words in a claim, Ethicon Endo-Surgery, Inc. v. United States Surgical Corp., 93 F.3d 1572, 1577 (Fed.Cir.1996), and are not free to read any limitations out of a claim. Exxon Chem. Patents, 64 F.3d at 1555. Thus, construing this limitation under s. 112(6) would, to some degree, ignore, or at least not give sufficient consideration to, "manually programmable switch."

In short, the word "means" is clearly used in the claim, but is unwarranted for any reason of record, and adds nothing to the claim as in the frequently used example of "hammer means for driving a nail meals into a board means." As was the case in *Cole,* the drafter of the '721 patent was "clearly enamored of the word 'means.' " 102 F.3d at 531. Every claim element begins "xxxx means."

Perhaps most importantly, though, the Supreme Court has explained that s. 112(6) allows "an applicant [to] describe an element of his invention by the result accomplished or the function served, rather than describing the item or element to be used * * *." Warner-Jenkinson Co. v. Hilton Davis Chem. Co., 520

U.S. 17, 27, 117 S.Ct. 1040, 137 L.Ed.2d 146 (1997). Here, the "manually programmable switch means" is described not solely in terms of the result accomplished or the function served, as the patentee might have done using the illustrative claim form discussed above. Rather, the "manually programmable switch means" limitation also specifies (1) the "structure," *i.e.,* at least one "manually programmable switch," (2) what that switch or switches are "coupled" to, *i.e.*, a "source of power," and (3) the result, *i.e.,* "for generating binary coded decimal signals representative of selected time intervals represented in hours and subdivisions thereof for each said designated pneumatic state." Thus, with all due respect to Special Master Williams, the undersigned believes that the "manually programmable switch means" limitation should not necessarily be construed as a means-plus-function limitation governed by s. 112(6), although the present findings of fact and conclusions of law adopt that interpretation.

2. Arguments

70. Mega Systems argues that the APC 1000 does have a structure that is identical or equivalent to the structure disclosed in the '721 patent specification corresponding to the "manually programmable switch means." Specifically, Mega Systems argues that the corresponding switches or keypad in the APC 1000 does not generate binary coded decimal signals. Rather, the APC 1000 generates binary signals. Accordingly, Mega Systems concludes that as a matter of law the APC 1000 cannot literally infringe either claims 1 or 10 of the '721 patent. Ferguson Beauregard, acknowledging that the APC 1000 generates binary signals, argues that "[e]ach [*i.e.,* binary coded decimals and binary signals] is a signal using 1s and 0s to represent a decimal digit, *i.e.,* the numbers 0-9. Thus, the APC 1000 controller performs the function recited in this element." Plaintiffs' Post-Trial Reply at 6.

3. Discussion

71. Based on the claim construction adopted in Special Master Williams' Report, resolution of the infringement issue becomes self-evident. Mega Systems is correct.

72. In resolving infringement of claims containing means-plus-function limitations, the Federal Circuit has emphasized that "[t]o determine whether a claim limitation is met literally, where expressed as a means for performing a stated function, the court must compare the accused structure *with the disclosed structure,* and must find equivalent *structure* as well as *identity* of claimed *function* for that structure." Chiuminatta Concrete Concepts, Inc. v. Cardinal Indus., Inc., 145 F.3d 1303, 1308 (Fed.Cir.1998), quoting, Pennwalt Corp. v. Durand-Wayland, Inc., 833 F.2d 931, 934 (Fed.Cir.1987)(*en banc*) (emphasis in original). The decisive question here is whether the APC 1000 contains an equivalent structure that performs the claimed function. It does not. And Ferguson Beauregard effectively concedes as much.

73. Special Master Williams concluded that the claimed function (and thus the function that the APC 1000 must perform in order to support a finding of literal infringement) is "generating *binary coded decimal* signals representative of selected time intervals represented in hours and subdivisions thereof for each said designated pneumatic state." [Emphasis added.] The binary coded decimal system is a "system of number representation in which each digit of a decimal number is represented by a binary number. Abbreviated BCD system." MCGRAW-HILL DICTIONARY OF SCIENTIFIC AND TECHNICAL TERMS (5th ed.1994) at 224. The Supreme Court, in Gottschalk v. Benson, 409 U.S. 63, 66-67, 93 S.Ct. 253, 34 L.Ed.2d 273 (1972), in the course of discussing the patentability of a method of programming a general-purpose digital computer to convert signals from binary coded decimal form into pure binary form, further described the binary coded decimal system:

The decimal system uses as digits the 10 symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. The value represented by any digit depends, as it does in any positional system of notation, both on its individual value and on its relative position in the numeral. Decimal numerals are written by placing digits in the appropriate positions or columns of the numerical sequence, *i.e.*, "unit" (10^0), "tens" (10^1), "hundreds" (10^2), "thousands" (10^3), etc. Accordingly, the numeral 1492 signifies $(1 \times 10^3) + (4 \times 10^2) + (9 \times 10^1) + (2 \times 10^0)$.

The pure binary system of positional notation uses two symbols as digits-0 and 1, placed in a numerical sequence with values based on consecutively ascending powers of 2. In pure binary notation, what would be the tens position is the twos position; what would be hundreds position is the fours position; what would be the thousands position is the eights. Any decimal number from 0 to 10 can be represented in the binary system with four digits or positions as indicated in the following table.

Shown as the sum of powers of 2									
	2^3	2^2	2^1	2^0					
Decimal		(8)		(4)		(2)		(1)	Pure Binary
0	=	0	+	0	+	0	+	0	= 0000
1	=	0	+	0	+	0	+	2^0	= 0001
2	=	0	+	0	+	2^1	+	0	= 0010
3	=	0	+	0	+	2^1	+	2^0	= 0011
4	=	0	+	2^2	+	0	+	0	= 0100
5	=	0	+	2^2	+	0	+	2^0	= 0101
6	=	0	+	2^2	+	2^1	+	0	= 0110
7	=	0	+	2^2	+	2^1	+	2^0	= 0111
8	=	2^3	+	0	+	0	+	0	= 1000
9	=	2^3	+	0	+	0	+	2^0	= 1001
10	=	2^3	+	0	+	2^1	+	0	= 1010

The BCD system using decimal numerals replaces the character for each component decimal digit in the decimal numeral with the corresponding four-digit binary numeral, shown in the righthand column of the table. Thus decimal 53 is represented as 0101 0011 in BCD, because decimal 5 is equal to binary 0101 and decimal 3 is equivalent to binary 0011. In pure binary notation, however, decimal 53 equals binary 110101. The conversion of BCD numerals to pure binary numerals can be done mentally through use of the foregoing table. * * *

74. Special Master Williams concluded that the "corresponding structure" for the "manually programmable switch means" was the structures shown in Figure 2 (devices 128, 130, 132 and 134) and Figure 3C (device 142). Fig. 3C illustrates the following:

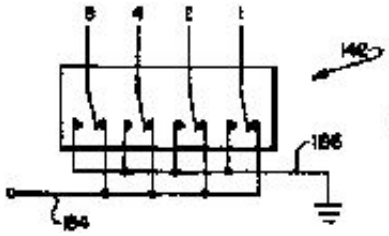


FIG. 3C

The accompanying description explains that Fig. 3C is "a schematic representation of the manually settable switches described at 128-134 in connection with FIG. 2." The '721 patent explains that "the switch arrangement may be of a two-pole binary variety, one set of four poles, represented at 184, being coupled to the positive side of the battery supply, while the opposite set of poles 186 are commonly coupled to ground. By appropriate manipulation of a dial or the like, a binary coded decimal signal (BCD) may be developed for insertion into the count circuitry." '721 patent, col. 10, lines 18-28.

75. Those switches are further described in conjunction with Fig. 3A:

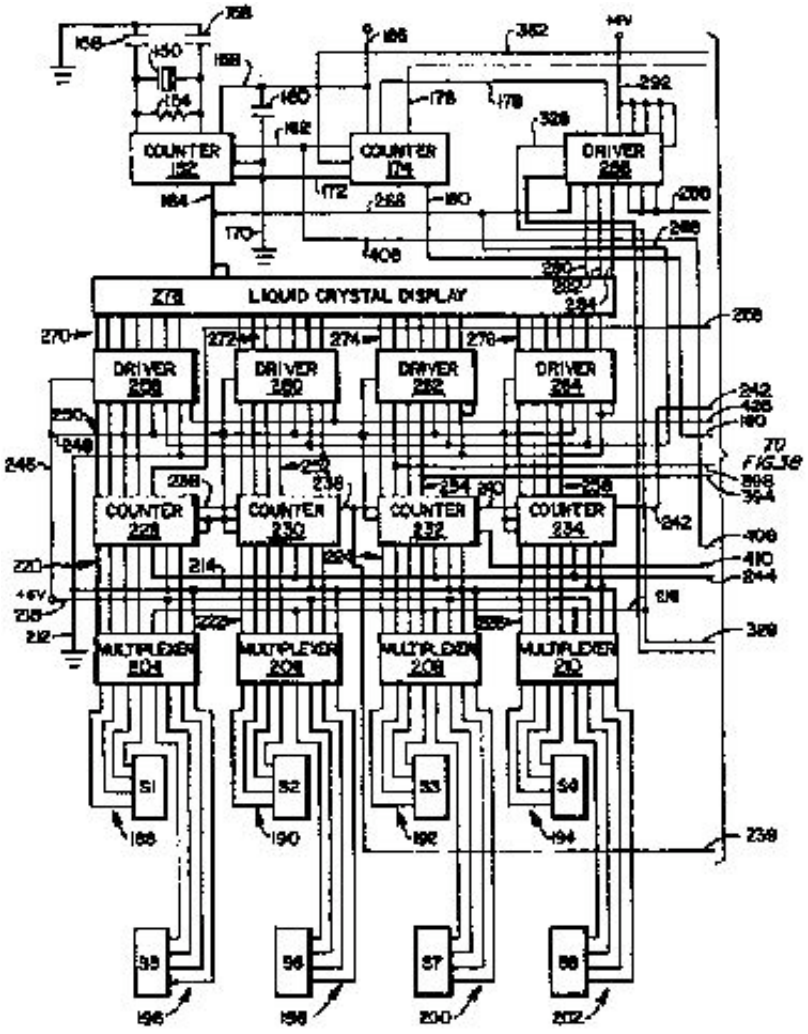


FIG. 3A

The switches are shown schematically as S1-S8. The specification of the '721 patent explains that "switches S1-S4 provide time selection for a state wherein pressure is off the diaphragm of motor valve 34. Conversely, switches S5-S8 provide time data inputs for determining the cycle wherein pressure is on the diaphragm of motor valve 34." In the off-condition, the specification explains that "switch S1 is positioned to provide BCD signals representing tens of hours through the grouping of four leads represented at 188. Switch S2 provides BCD signals in hour units through the grouping of four leads 190. Switch S3 provides BCD signals representing tens of minutes through the grouping of four leads 192 and switch S4 provides BCD signals representing minute units through the grouping of four leads 194." '721 patent, col. 10, lines 32-47. In the "on" condition, the '721 patent specification explains that "switch S5 provides BCD signal inputs along the grouping of four lines 196 representative of tens of hours. Switch S6 provides BCD signals representing hour units along the grouping of four leads 198. Switch S7 provides BCD signals along the grouping of four leads 200 representing tens of minutes and switch S8 provides BCD signals representing minute units along the grouping of four leads 202." '721 patent, col. 10, lines 48-56.

76. During trial, on direct examination, Mr. Quayle testified:

Q. Mr. Quayle, did you find any structures in the APC 1000 controller that perform the identical function as the manually programmable switch means described in the '721 patent?

A. Yes. The Mega APC 1000 has a series of switches. It's a membrane keyboard, much newer than the switches in the old controller. But each one opens and closes the microprocessor, in the case of the Mega APC 1000, scans the switches, determines whether they're on or off. The manual part is the operator holds the button down until the processor has a chance to determine that that switch is the one that's being depressed. And the number or the switch location is-becomes a binary signal and is put into the processor and becomes the time that the operator selected, so the function is the same. The way the numbers get read into the processor in the case of Mega APC 1000 is similar to the way it's done in the Digitrol. And so the result, I believe, is the same.

THE COURT: Let me ask you, Mr. Quayle, the claim refers to binary-coded decimal signals. I believe that's commonly referred to as BCD signals. Those are different than binary signals, are they not?

THE WITNESS: BCD is a coding scheme which represents each decimal digit as a four-bit number. Now, however, if you look from a computational point of view, whether you're doing arithmetic in BCD, which I'm sure the Mega APC 1000 does not, as opposed to the Digitrol, which it's only choice was to do BCD, computationally, that's identical.

THE COURT: All right.

Tr. May 22, 2001, at 85-86. On cross-examination, Mr. Quayle testified:

Q. (BY DR. ALWORTH) When I say Exhibit 1, with the new numbering system, we're talking about Plaintiffs' Exhibit 1. Mr. Quayle, you testified earlier that a number entered into the APC 1000 keyboard becomes a BCD signal; is that correct?

A. No. I testified that it became a binary signal.

Q. You also testified that the number is entered as a single stroke which is multiplexed by address lines in the keypad; is that correct?

A. Yes.

Q. And then you went ahead and stated that the multiplexed keystroke enters the microprocessor where it is stored as a binary number, is that correct?

A. Yes.

Q. Now, when we talk about binary numbers, are we talking, in this particular microprocessor, as a hexadecimal representation or a strict binary-coded decimal representation?

A. The microprocessor internally uses a binary representation of all the information. You can't really call it a hexadecimal representation. That's what a human being would look at. There's a bit pattern inside the processor that corresponds to all the information it has.

Tr. May 22, 2001, at 153.

77. Ferguson Beauregard urges that "[a]s indicated by the language of the claim and the corresponding description in the specification, the purpose of the switch means is to enter time into the system. Mr. Quayle testified that the APC 1000 does perform this function." Plaintiffs' Post-Trial Reply at 6. Both are true statements. However, the function set out in claims 1 and 10 of the '721 patent for the "manually programmable switch means" is not "for entering time into the system" or "for generating signals representative of selected time intervals." If either of those functions had been recited in the claims, then Ferguson Beauregard's argument would likely carry the day. But the claims call not for "signals" in general; rather, the claims call specifically and narrowly for particular types of signals, *i.e.*, "generating *binary coded decimal* signals representative of selected time intervals." FN12 Ferguson Beauregard correctly observes that Mr. Quayle testified that "[b]y pressing a key on its keypad, the APC 1000 controller generates *binary* signals representative of select time intervals." Id. As a result, though, Ferguson Beauregard confesses nothing more than the truth-the keypad or switches in the APC 1000 controller do not "generat[e] *binary coded decimal* signals representative of selected time intervals" as required by the claims.

FN12. The file wrapper or prosecution history for the '721 patent is not in evidence and, apparently, has been lost by the U.S. Patent and Trademark Office ("PTO"). Accordingly, the record does not reveal why the claims were so drafted.

78. Even accepting Mr. Quayle's unrebutted testimony and Ferguson Beauregard's argument that "computationally, binary signals are identical to binary-coded decimal signals," the fact remains that the keypad or switches in the APC 1000 do not perform a function identical to that required by the claims. It may be an equivalent function, but it is not the identical function. Courts cannot ignore the actual words of the claims, and are not free to rewrite or redraft claims. Becton Dickinson & Co. v. C.R. Bard Inc., 922 F.2d 792, 799 n. 6 (Fed.Cir.1990) ("Nothing in any precedent permits judicial redrafting of claims."). Accordingly, insofar as this limitation is concerned, the structure of the APC 1000 cannot be deemed an "equivalent" under s. 112(6) to that described in the '721 patent specification and, as a result, there can be

no literal infringement of claims 1 or 10 of the '721 patent.

VII. Infringement *Vel Non* of the '376 Patent

A. Mega Systems' Position During Trial Versus Post-Trial

79. Similar to the situation discussed above *vis-a-vis* the '721 patent, Mega Systems' Pre-Trial Brief asserted somewhat unfocussed non-infringement arguments, although principally Mega Systems asserted that the APC 1000 did not contain a structure "equivalent" in the s. 112(6) sense to the structure disclosed in the '376 patent specification corresponding to a claimed "oscillator means," as discussed further below. Consistent therewith, during trial, Mega Systems advised the Court that its non-infringement defense *vis-a-vis* the '376 patent would be focused on the "oscillator means" limitation and that the remainder of the claim limitations were "really not an issue:"

THE COURT: All right. And then turning to the '376 patent, and that's, I guess, precisely what we were just talking about. My understanding, '376 is-the noninfringement defense is primarily focused on the oscillator means selected to minimize the power requires. Is that-

DR. ALWORTH: That is correct, yes, sir.

THE COURT: And so the remainder of the claim, again talking about the display means or the input means or processor means, that's really not an issue, is it?

DR. ALWORTH: That is not an issue.

Tr. May 23, 2001 at 11-12. In their post-trial submissions, however, Mega Systems argues that the APC 1000 does not have structure equivalent to the structure corresponding to the claimed (1) "oscillator means," (2) "detection means," (3) "processor means," (4) "valve means," or (5) "control circuit means." Defendants' Post-Trial Brief at 7-13. Ferguson Beauregard urges that Mega Systems has waived any non-infringement arguments directed to limitations other than the "oscillator means" and urges that the "Court should not allow Defendants to raise these additional four elements after their representation to the Court and opposing counsel that their defense of non-infringement of the '376 patent was limited to the 'oscillator means' recited therein." Plaintiffs' Post-Trial Reply at 7.

80. Once again, Ferguson Beauregard has a point. As noted above, reasonable management of the numerous issues that attend litigation such as the present require that the Court and opposing counsel be able to rely on representations such as those made by Mega Systems above. It is fundamentally unfair here, as it was in conjunction with the '721 patent above, both to the Court and to opposing counsel, to make representations during trial that are then ignored post-trial. When counsel advises the Court that the limitations in the remainder of the claims are not "an issue," that may be reasonably understood to mean that a decision has been made not to challenge whether those limitations are met in the accused device or process. Accordingly, it would not be difficult to find that Mega Systems has waived its non-infringement arguments for limitations other than the "oscillator means" limitation. Once again, however, out of an abundance of caution, Mega Systems' other non-infringement arguments advanced in its post-trial brief will be addressed in these findings and conclusions. Doing so, however, should not be construed as sanctioning or approving such conduct, and expressly does not preclude Ferguson Beauregard from raising the waiver issue on *de novo* review by the District Court.

B. "oscillator means"

1. Prior Construction

81. Claim 1 of the '376 patent calls for:

oscillator means energizable to provide a clock output of frequency *selected to minimize the power requirement of said controller* [Emphasis added.]

Claims 16 and 35, *i.e.,* the other claims of the '376 patent that Ferguson Beauregard is asserting, do not share that limitation.

82. Infringement, insofar as this limitation is concerned, turns on the phrase "selected to minimize the power requirement of said controller." In construing this limitation, Special Master Williams rejected both the parties' proposed constructions. Mega Systems had argued that the limitation should be limited to a clock output having a frequency of 300 KHz or less. Special Master Williams noted that claim 1 did not specify any particular frequency value or range for the clock output, and that claim 10, dependent upon claim 1, provided that the clock output frequency was "selected as less than about 300 KHz." Relying on the doctrine of "claim differentiation," Special Master Williams concluded that claim 1 "should not be construed to be limited to providing a clock output of a frequency less than about 300 KHz." Special Master Williams' Report at 17.

83. On the other hand, Special Master Williams, pointing to several excerpts from the '376 specification, concluded that "the power requirement should be minimized to a reasonable extent, although not necessarily to an absolute minimum level, to permit operation over a relatively long period of time using relatively small sources of power." Id. Special Master Williams rejected Ferguson Beauregard's proposed construction, namely "a frequency less than the processor's maximum-rated clock frequency," because "[s]imply operating at a frequency less than the maximum-rated frequency many not 'minimize the power requirement of said controller.' " Id. at 17-18.

84. Accordingly, Special Master Williams concluded that the plain language of the claim controlled, and that "[t]he 'oscillator means' is to provide 'a clock output of frequency selected to minimize the power requirement of said controller.' That is, the clock output must be of a sufficiently low frequency that the power requirement of the controller is minimized to a reasonable extent." Id. at 18.

85. Although Special Master Williams did not specifically find or conclude that "oscillator means" should be construed as a means-plus-function limitation governed by s. 112(6), that is Ferguson Beauregard's position, and Mega Systems does not contend otherwise:

THE COURT: Let me ask, Counsel, on this claim element, oscillator means, is it Ferguson Beauregard's contention that this claim element should be read as a means plus function clause under Section 112, paragraph 6?

MR. LeVERE: Yes, your Honor.

Tr. May 22, 2001, at 29. Ferguson Beauregard also agrees, and Mega Systems' does not dispute, that the "corresponding structure" is crystal oscillator 152:

THE COURT: All right. And at least the way I read special master's-Special Master Williams' report, he identified crystal oscillator 152 in the specification of the '376 patent as the corresponding structure. Is that your understanding as well?

* * *

MR. LeVERE: Yes, that is correct. * * *

* * *

THE COURT: Well, actually, my question is much simpler than that. My question really is what the corresponding structure disclosed in the specification is for the oscillator means of Claim 1 of the '376 patent.

MR. LeVERE: I've been advised, your Honor, that it is, in fact, 152.

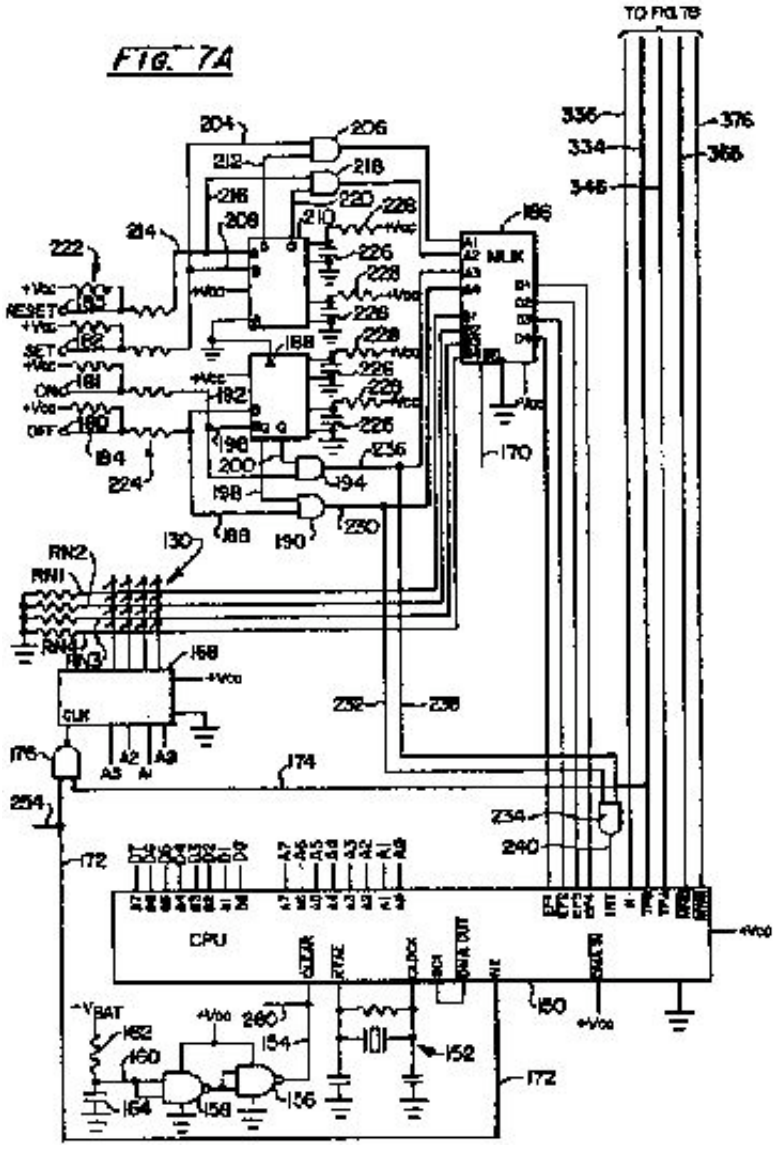
Id. at 29-30. That was also Mr. Quayle's understanding in giving his testimony on the issue, discussed further below:

THE COURT: All right. Mr. Quayle, was that your understanding as well?

THE WITNESS: Yes.

Id. at 30-31.

86. Fig. 7A of the '376 patent illustrates oscillator 152, at the bottom of the drawing, connected to a CPU 150:



2. Testimony and Arguments

87. In discussing this claim element, Mr. Quayle, on direct examination, acknowledged that power consumption was an issue addressed in the '376 patent (which was frequently referred to as the "LiquiLift patent"):

Q. Excuse me, the LiquiLift. Was power consumption an issue in that patent?

A. Absolutely. This device is intended to be operated out in the field for a long period of time without requiring the repetitive maintenance of changing the batteries frequently.

That is confirmed at several points in the '376 patent, including a summary portion that Special Master Williams referenced in his report which explains:

As another feature and object of the invention, the noted microprocessor, the use of which permits operational flexibility as well as the elimination of switches, is structured so as to be capable of operating

for extended periods of time utilizing a conventional D battery power source. This is achieved through a unique timing system permitting the microprocessor to operate at a relatively slow frequency.

'376 patent, col. 4, lines 11-18. Other portions of the patent emphasize low power consumption as well. For example, in discussing the selection of a microprocessor, the '376 patent explains:

Referring to FIG. 7A, the circuit of controller 60 is shown to operate in conjunction with a microprocessor (CPU) represented at 150. Microprocessor 150 is one selected for use within a system having limited power supply capability which, for the instant case, is provided by onboard conventional D-type batteries. Accordingly, the device as well as all components of the circuit utilize complementary-symmetry MOS technology (CMOS). Responding to read only memory contained microinstructions in conventional fashion, microprocessor 150 requires no minimum clock frequency * * *.

'376 patent, col. 14, lines 40-50. In the next column, the '376 patent explains that, *inter alia,* the clock input to CPU 150 is driven by oscillator 152 at a frequency level that is "one tenth of the frequency levels generally utilized for central clock inputs to microprocessor systems:"

The CLOCK and XTAL inputs to CPU 150 are driven by a crystal oscillator 152 which operates at a relatively low frequency of less than about 300 KHz, for example, 288 KHz. This frequency value is, for example, one tenth of the frequency levels generally utilized for central clock inputs to microprocessor systems. The utilization of this low frequency, while accommodated for later herein, lowers the power demand of the entire system to an extent permitting the use of the noted conventional dry cell battery inputs. It may be observed in the above regard that power utilization by the circuitry is proportional to the square of this frequency.

'376 patent, col. 15, lines 14-25. That low frequency, apparently, required other circuit features, such as described in column 17:

This pulse detecting and stretching feature is required inasmuch as the externally derived low signal applied at terminals 180-183 may be of such short duration that the cycling rate of CPU 150 may be inadequate to detect them. Recall in this regard that clock function 152 operates as 288 KHz, a relatively low frequency value selected to achieve low power drain and permit continuous operation over lengthy intervals of time. On the other hand, the direct connection of the terminals to gates 190, 194, 206 and 218 permits a signal which continues and is persistent to be continually observed beyond the pulse width otherwise defined at multivibrators 186 and 210.

'376 patent, col. 17, lines 18-29.

88. During his direct examination, Mr. Quayle also discussed the relationship between the "oscillator means" and power consumption:

Q. And does this-excuse me. Does this oscillator means have anything to do with power consumption?

A. Absolutely. The faster the processor operates the more current it consumes.

Q. And just for the record, what's the relationship, if any, between the oscillator and the speed of the processor?

A. The oscillator, which is part of the microprocessor in the case of Mega APC 1000, requires an external crystal to run that oscillator. The oscillator synchronizes all the functions of the microprocessor. Without it, the processor couldn't keep time or execute instructions or do anything else.

Tr. May 22, 2001, at 24-25.

89. With that background, Mr. Quayle testified that he found structure corresponding to the "oscillator means" in the APC 1000:

Q. Did you find corresponding microprocessor, oscillator, and/or crystal in the APC 1000?

A. Yes, I did.

Q. Describe for the Court what you found, please.

A. I found a 11.05 megahertz crystal installed on the circuit board very close to the processor.

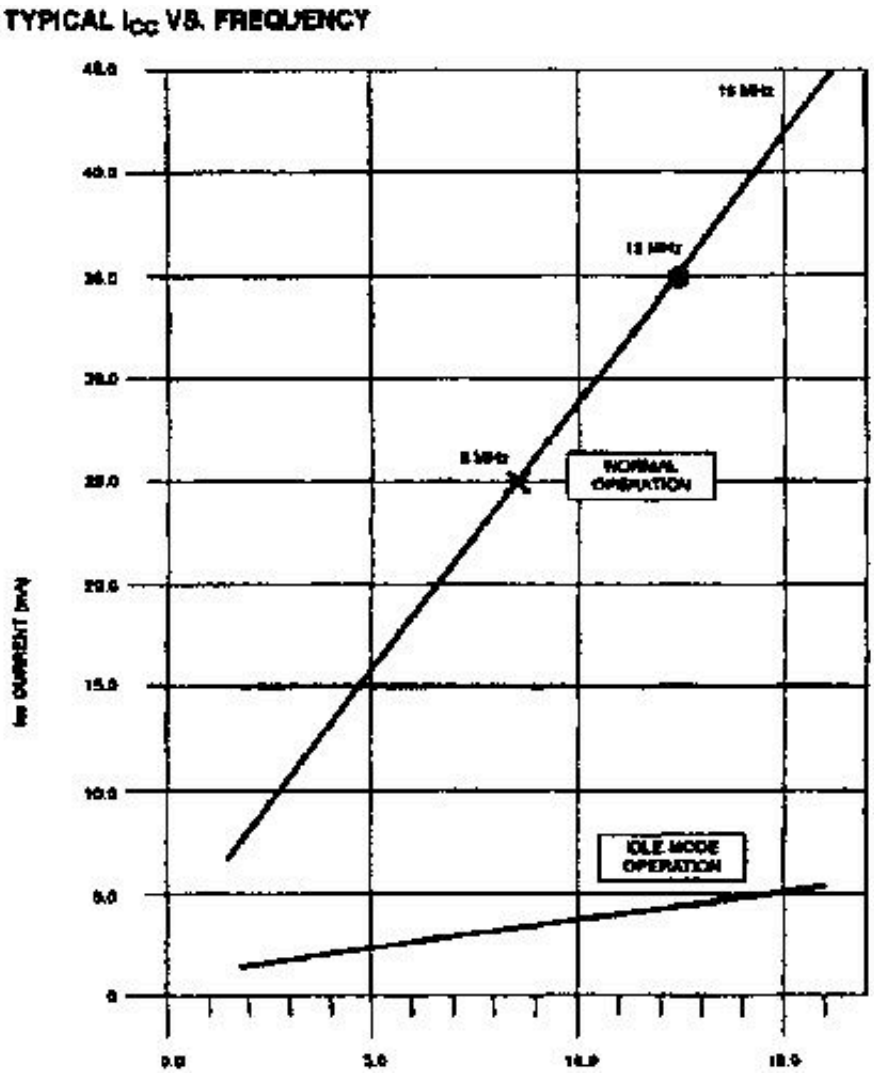
Q. Which processor is used in the APC 1000 controller?

A. It's a Dallas Semiconductor DS 5000.

Q. Would you describe to the Court the significance of the 11.05 megahertz crystal, if any, in conjunction with that processor, please.

A. Well, I looked up the DS 5000 spec sheet and noticed that the DS 5000 is rated for a maximum speed of 16 megahertz.

Tr. May 22, 2001, at 25. That specification or "spec" sheet was introduced as Plaintiffs' Exhibit 20, and includes the following graph on page 17:



In reference to that graph, Mr. Quayle testified:

Q. Let me stop you right there. Would you take a quick look at what's been marked as Plaintiffs' Exhibit 20?

* * *

Q. I'm sorry. What did you say the maximum speed was for that processor?

A. 16 megahertz.

Q. And then the oscillator speed or-excuse me-the crystal frequency in the APC 1000 was what?

A. 11.05.

Q. Megahertz?

A. Megahertz, right.

Q. Go ahead, please.

A. And if you look on page 17, the numbers are very small, unfortunately-the page numbering-because this document came from Dallas Semiconductors, you'll see a curve of, which is actually more like a straight line-

* * *

A. If you see the upper line here, you'll see that there-this is a display of typical IC means-means current draw-versus frequency, and there is a defined data point at 12 megahertz of 35 milliamps. Now, actually, the APC 1000 is operating a little bit below that, and I would guess-well, I would estimate from the line here that we would be expecting a current draw of about 32 milliamps. This is a typical number. Of course, there can be some variability on parts.

But if you notice the current at 16 megahertz, that's 45 milliamps. So going from 45 to about 32 or 33 would be a savings of roughly 25 percent. It's my professional opinion that saving 25 percent of power used of the processor is a significant savings and, therefore, comes under the special master's interpretation of minimizing the power to a reasonable extent.

Tr. May 22, 2001, at 26-27. In response to questions from the special master, Mr. Quayle testified:

THE COURT: All right. Now, I take it from your testimony that oscillator 152, that structure disclosed in the specification and drawings of the '376 patent, you found a physically different microprocessor running at a different clock speed in the APC 1000, the accused infringing device; is that correct?

THE WITNESS: Yes, your Honor. The oscillator is inside the Dallas Semiconductor DS 5000 and only requires an external crystal, not a crystal oscillator to be present.

* * *

THE COURT: Yes. Actually, what I'm getting at is, when you were deciding that there was infringement, I'm really getting at your thought processes here, you looked at oscillator means. We've heard counsel say that that claim limitation should be construed as required by a portion of the patent law, Section 112, paragraph 6. You looked at the accused infringing device, found something that was physically different than what's disclosed in the specification, but yet, you concluded that there was infringement. So I'm really asking, once you found there was a difference structure, how did you arrive at your conclusion that there nevertheless was infringement, at least of this element?

THE WITNESS: I understand, your Honor. Well, rather than using an outboard external oscillator, which is then fed into the processor, in the case of the patent, the Dallas Semiconductor-the Dallas Semiconductor 5000 actually has the oscillator as part of its block diagram. So it wasn't necessary to have an external oscillator. The DS 5000, using just a crystal as the frequency determining element, is completely sufficient to perform that clock function and so physically different because we don't have a crystal with an oscillator

built into it as one component and the processor. Instead, what we have is we have the crystal and the oscillator parts just over in the processor itself.

THE COURT: All right. And I don't mean to put words into your mouth and tell me if I'm wrong, but I take it from your testimony, then, that as one versed in the art or skilled in the art, you would consider those to be interchangeable or equivalent; is that-

THE WITNESS: That's right.

THE COURT: All right. Now, that's the first part of the function, at least as recited in the claim, to provide a clock output of frequency. The second part of the function in the claim is, quote, selected to minimize the power requirements, etc. And I take it from your reference to the Dallas Semiconductor web site, you're relying on that chart to say one who is skilled in the art could look at that and select a clock frequency to adjust for power output; is that about right?

THE WITNESS: That's correct.

THE COURT: Okay. You may proceed, Counsel.

MR. LeVERE: Thank you.

A. So to tie this up, basically, it is my professional opinion that this claim element reads on the Mega APC 1000.

Tr. May 22, 2001, at 31-33.

90. Mega Systems argues that the structure corresponding to oscillator 152 in the '376 patent specification is an oscillator attached to the APC 1000 microprocessor that "does not 'minimize the power requirement' of the APC 1000 'to a reasonable extent,' " as required by Special Master Williams' claim construction. Mega Systems asserts that the APC 1000 was "not designed to be a low power device, and its oscillator was not selected to minimize the APC 1000's power requirements." Instead, Mega Systems argues, "Mega chose its oscillator so that the controller would have a baud rate of 9600 baud." Defendants' Post-Trial Brief at 7.

91. The testimony that Mega Systems relies on is that of defendant Bartley. Mr. Bartley testified:

Q. How long does the APC 1000 last on a battery?

A. Without the solar panel, approximately two weeks, 14 days.

Q. How long does the Digitrol last on a set of batteries, based on your experience in the field?

A. Typically over a year on four D cell batteries.

Q. Now, bearing in mind that there's also a '376 patent, microprocessors, what engineering decisions did you make regarding the microprocessors used in the APC 1000?

A. Well, regarding the '376, I don't use a low oscillator, eliminate certain circuits, and don't be as concerned

about power, getting a year out of four D cell batteries. It makes the unit more expensive but ...

* * *

Q. * * * We've touched on this before, Mt. Bartley,FN13 but what criteria did you use to choose the oscillator frequency in your APC 1000?

FN13. Mr. Bartley earlier also testified that he had selected the frequency rate of 11.0592 megahertz because of the baud rate. Tr. May 24, 2001, at 147-149.

A. There was only one, and that was to be able to have a baud rate of 9600 baud. It was in the table. It's just the frequency I chose, 11.0592 megahertz.
Tr. May 24, 2001, at 195-96. The baud rate for various frequencies is also illustrated in Plaintiffs' Exhibit 20.

SERIAL LOADER BAUD RATES FOR DIFFERENT CRYSTAL FREQUENCIES Table 2

CRYSTAL FREQ (MHz)	BAUD RATE					
	300	1200	2400	9600	19200	57600
14.7458		Y	Y	Y	Y	
11.0592	Y	Y	Y	Y	Y	Y
9.21600	Y	Y	Y	Y		
7.37280	Y	Y	Y	Y		
5.52960	Y	Y	Y	Y		
1.84320	Y	Y	Y	Y		

After discussing why he was concerned about baud rates, Tr. May 24, 2001 at 196-97, Mr. Bartley testified:

Q. On page 8 of 19 [referring to Plaintiffs' Exhibit 20], Table 2, serial loader baud rates, do you see that?

A. Yes.

Q. I notice that it shows for 11.0592 megahertz there's varied baud rates.

A. Yes.

Q. Why did you use 9600?

A. I didn't particularly use 9600. I chose that particular frequency, that upper frequency, that would work with the 12 megahertz chip and that would have to be 11.0592 megahertz and it gave me all these baud rates, possible baud rates.

Q. Well, what power considerations did you undertake in designing this chip-or not in designing this chip but in designing this device?

A. Well, I had to have enough battery life that I could recharge it with our average sun hours per day. For instance, in East Texas we have an average of three sun hours per day. So with the solar panel in the summer, of course, it's a lot longer and winter it's even shorter. But on the average, yearly average, it's 3 sun hours per day.

So I managed to get-with changing external circuits, using different chips, powering them down and not using them at certain times, I was able to maintain a two-week battery life. If it just sat on the shelf plugged in, it would last about two weeks without the sun.

Tr. May 24, 2001, at 198-99.

3. Discussion

92. From the testimony during trial, of which the foregoing is illustrative, several facts become clear. The controller described in the '376 patent, as well as the commercial embodiment of the same, was designed to run for extended periods of time on battery power-indeed, on common D-cell battery power. That being a design goal, there were, apparently several design choices made in achieving that goal, such as the choice of microprocessor, CMOS technology, an oscillator 152 that operated at a relatively low frequency, etc., as discussed in the specification and briefly above. But to put that fact in context, conserving power was plainly only one of quite a number of design objectives and features described in the '376 patent. As a matter of fact, the extensive litany of objectives and features of the invention disclosed in the '376 patent span, even in summary form, nearly three columns of text. '376 patent, col. 3, line 56-col. 6, line 23. The point is, the specification of the '376 patent on its face shows that although power conservation was a design criterion, and perhaps even one of the principal design criteria, power conservation was by far not the sole objective sought or disclosed.

93. Secondly, the accused APC 1000 is also a battery-operated controller. Although during trial Mr. Bartley generally attempted to paint a picture that power conservation was not one of his design objectives-at least insofar as the oscillator frequency was concerned-that testimony was simply not credible. And, in fact, his testimony reveals the opposite.

94. As noted in the testimony above, the APC 1000 includes a solar panel for recharging the batteries.FN14 As that testimony also reveals, using such a solar panel did not result in a limitless source of power rendering any consideration of power conservation of no great concern or unimportant. Rather, Bartley's testimony indicated that design choices turned to conserving enough power to run the controller until there was sufficient sunlight to recharge the batteries. Or, in Mr. Bartley's words: "I had to have enough battery life that I could recharge it with our average sun hours per day." Then, according to Mr. Bartley: "So I managed to get-with changing external circuits, using different chips, powering them down and not using them at certain times, I was able to maintain a two-week battery life." In other words, design choices were made to conserve battery power for a two-week battery life given Mr. Bartley's assumption of "3 sun hours

per day."

FN14. *See also,* Tr. May 25, 2001, at 64.

95. Although a two-week battery life is far shorter than the one-year battery life Mr. Bartley attributed to Ferguson Beauregard's commercial embodiment of the '376 patent, power conservation was necessarily a consideration for both. A design objective for the controller of the '376 patent was to conserve power until the batteries required replacement. A design objective for the APC 1000 controller was to conserve power until there was sufficient sunlight to recharge the batteries. In either event, a dead battery, either (1) because it was not replaced, or (2) because it was not recharged, is still a dead battery.FN15

FN15. Mr. Bartley also agreed, after some prodding, on cross-examination that power was a consideration when batteries were used:
Q. * * * You would agree, wouldn't you, as a designer of circuits, that to the extent you can do so without affecting the performance of the circuits, it is better to use less power than more power?
A. I still don't understand what the question is. I'm-you said for performance of the circuit, it's better to use less power than more power?
Q. To the extent that you can use less power without affecting the performance of the circuit, isn't it better to use less power than more power?
A. It depends on each individual application. Some applications, I've designed controllers where power was not a consideration.
Q. Yeah, but my question is, to [the] extent that using less power wouldn't affect how it performed, isn't it better to use less power than more power; the battery will less [sic. last] longer?
A. If you're talking about a battery application, definitely. Definitely better to use less power.
Q. And in fact, the APC 1000 has a battery, doesn't it?
A. Yes, it does.

Tr., May 25, 2001, at 63.
96. Further, Mega Systems did not rebut Mr. Quayle's testimony that using a frequency of 11 megahertz (approximately) resulted in a power savings of roughly 25 percent, or Mr. Quayle's further testimony that such a savings would be significant. Rather, Mega Systems argues that "this argument would be the same for *any* controller, regardless of its speed, as long as it was paired with a microprocessor having a faster maximum frequency." Defendants' Post-Trial Brief at 8. Mega Systems points out that Special Master Williams observed that "[s]imply operating at a frequency less than the maximum-rated frequency may not 'minimize the power requirements of said controller.' " Id. Perhaps not, but here the evidence indicates that it does.

97. In context, when Special Master Williams observed that "[s]imply operating at a frequency less than the maximum-rated frequency may not 'minimize the power requirements of said controller' " he was rejecting Ferguson Beauregard's argument that the limitation "oscillator means energizable to provide a clock output of frequency selected to minimize the power requirement of said controller" simply meant "a frequency less than the processor's maximum-rated clock frequency." Special Master Williams' Report at 18. Special Master Williams was obviously unwilling to issue a blanket statement for all "controllers." But, according to the unrebutted testimony proffered by Ferguson Beauregard, *in this case* the microprocessor that the APC 1000 uses, namely the Dallas Semiconductor DS 5000, by its "specs" that both parties refer to, in fact

exhibits a linear relationship between clock frequency and power consumption. As the frequency is reduced, power consumption reduces as well.

98. The claim, however, calls for "oscillator means energizable to provide a clock output of frequency selected to minimize the power requirement *of said controller*" not just the microprocessor. Mr. Quayle did not analyze the power requirements of the APC 1000. Tr. May 22, 2001, at 197. Mr. Quayle also testified on cross-examination, however, that microprocessors, in his experience, use more power at higher clock speeds, Tr. May 22, 2001, at 194-95, and formulated his opinion based on the DS 5000 "specs" similarly showing lower power consumption at slower clock frequencies. Mr. Quayle's ultimate opinion that this claim limitation was met by the APC 1000, therefore, was obviously based on the assumption that given no other changes in the circuitry, the power requirements of the APC 1000 controller would decrease as the clock frequency of the microprocessor was decreased. Such an assumption, of course, is consistent with the teachings of the '376 patent and was consistent with Mr. Quayle's experience and the DS 5000 "specs." Perhaps most importantly, Mega Systems points to no testimony or evidence rebutting Mr. Quayle's opinion or the evidence and assumptions on which it was based. Accordingly, although Special Master Williams may be correct that one cannot say generically or generally that operating at a frequency less than the maximum-rated frequency of a microprocessor would necessarily minimize the power requirements of a controller, in this case, the weight of the evidence indicated that in the APC 1000 it would.

99. In short, Ferguson Beauregard presented credible evidence that selecting a clock frequency of 11.0592 MHz for the DS 5000 microprocessor used in the APC 1000 controller would minimize the power requirements of the controller, and would meet this limitation of claim 1 of the '376 patent. Mega Systems had an opportunity to refute or rebut that evidence, but did not. The evidence that Mega Systems presented, namely that Mr. Bartley chose a frequency of 11.0592 MHz because of the baud rate rather than power consumption, does not rebut or refute the testimony and evidence that such frequency would result in a lower power requirement for the APC 1000 controller than if a higher frequency were chosen, all other things being equal. On balance, therefore, the unrebutted testimony and documentary evidence introduced during trial tips in favor of finding that adopting a 11.0592 MHz frequency, as the APC 1000 does, results in a "minimiz[ation of] the power requirements of said controller" as claimed.

100. Mega Systems secondly argues that the APC 1000 oscillator is not the structural equivalent of oscillator 152 because oscillator 152 is disclosed as operating "at a relatively low frequency of less than about 300 KHz, for example, 288 KHz," while the APC 1000 oscillator operates at 11.05 MHz, almost 40 times faster. Defendants' Post-Trial Brief at 8. Pointing to the disclosure in the '376 patent that "power utilization by the circuitry is proportional to the square of this frequency," Mega Systems argues that "the APC 1000 circuitry would be expected to use over 1,000 times the power of the circuitry described in the '376 patent, assuming all other factors are equal." Id. Although Special Master Williams, according to Mega Systems, "declined to construe 'oscillator means' as being the same or equivalent to the structure disclosed in the patent specification, he did note that 'the frequency of the clock output in Claim 1 is [not] without limits.' " Id.

101. That argument has already been addressed by Special Master Williams. Contrary to what Mega Systems says, Special Master Williams did not "decline [ ] to construe 'oscillator means' as being the same or equivalent to the structure disclosed in the patent specification." Rather, Special Master Williams rejected Mega Systems' argument that the "oscillator means" limitation should be construed as being limited to a clock output of 300 KHz or less. That similarly addresses Mega Systems' argument here. This limitation of claim 1 is not limited to a specific frequency or range of frequencies other than in the sense that the "corresponding structure" disclosed in the '376 patent specification is oscillator 152 which in turn is

disclosed as running at less than 300 KHz, and preferably at 288 KHz. That the APC 1000 oscillator runs at 40 times the speed of oscillator 152, by itself, does not preclude a finding that the APC 1000 oscillator is an "equivalent" within the meaning of s. 112(6) to oscillator 152, although that is, of course, a factor that must be considered. In rejecting Mega Systems' claim construction argument, though, Special Master Williams noted that the terms of this limitation itself imposed a limitation on clock frequency, *i.e.,* "the clock output must be of a sufficiently low frequency that the power requirement of the controller is minimized to a reasonable amount." Special Master Williams' Report at 18. As discussed above, the weight of the evidence introduced during trial falls in favor of finding that the APC 1000 meets this limitation of claim 1. That is not, of course, to say that the evidence was flawless or, in hindsight, could not have been more complete. But Ferguson Beauregard presented sufficient credible evidence that the APC 1000 met this limitation to satisfy its burden of proof, and Mega Systems, when it had an opportunity to do so, simply failed to produce credible, more weighty evidence to the contrary.

C. "detection means"

1. Prior Construction

102. Claim 1 of the '376 patent calls for:

detection means having an output of select duration in response to a received said external signal

The parties apparently did not present this limitation to Special Master Williams for construction during the prior *Markman* hearing. Accordingly, there is no prior construction.

2. Testimony and Arguments

a) s. 112**(6)**

103. Mega Systems urges that this limitation should be construed as a means-plus-function limitation governed by s. 112(6). Defendants' Post-Trial Brief at 9. Ferguson Beauregard does not say otherwise. Plaintiffs' Post-Trial Reply at 10. In any event, even though the parties may agree that the subject expression should be construed under s. 112(6), the Court must independently decide whether that construction is correct. *See* Rodime PLC v. Seagate Tech., Inc., 174 F.3d 1294 (Fed.Cir.1999), *cert. denied,* 528 U.S. 1115, 120 S.Ct. 933, 145 L.Ed.2d 812 (2000).

104. The three general hallmarks of a means-plus-function element are: (1) the element is expressed in terms using "means" which raises a presumption that the element should be construed as a means-plus-function element under s. 112(6), *see Al-* Site Corp. v. VSL Int'l, Inc., 174 F.3d 1308, 1318 (Fed.Cir.1999) ("If the word 'means' appears in a claim element in combination with a function, it is presumed to be a means-plus-function element"); *see also* Greenberg v. Ethicon Endo-Surgery, Inc., 91 F.3d 1580, 1584 (Fed.Cir.1996); (2) a specified function follows the "means" and is linked to the "means," York Prods., Inc. v. Central Tractor Farm & Family Ctr., 99 F.3d 1568, 1574 (Fed.Cir.1996); and (3) there is no definite structure, material, or acts set out in the claim for achieving the specified function. Cole v. Kimberly-Clark Corp., 102 F.3d 524 (Fed.Cir.1996), *cert. denied,* 522 U.S. 812, 118 S.Ct. 56, 139 L.Ed.2d 20 (1997).

105. The expression "detection means" uses the word "means" and thus raises the foregoing presumption that the expression should be construed under s. 112(6). However, there is no stated function, and Mega Systems points to none. FN16 The words following "means," *i.e.,* "having an output of select duration in

response to a received said external signal," describe a physical characteristic not a function. *See* Wenger Mfg., Inc. v. Coating Mach. Sys., Inc., 239 F.3d 1225 (Fed.Cir.2001) (construing "means defining a plurality of separate product coating zones longitudinally spaced along said reel" as either (1) stating no function, or (2) defining sufficient structure to take the phrase outside the ambit of s. 112(6)). Accordingly, it would be improper to construe this limitation under s. 112(6).

FN16. Mega Systems says in its post-trial brief that a function is stated, but nowhere identifies what that function is. *See* Defendants' Post-Trial Brief at 9.

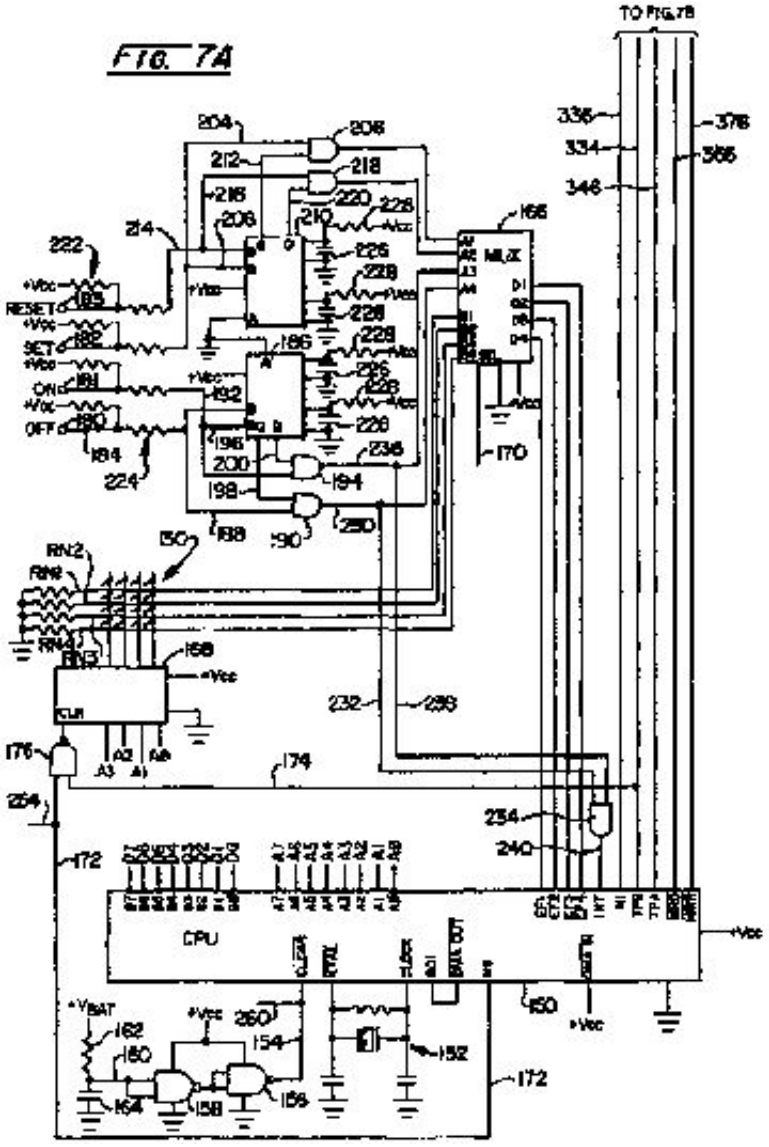
b) Claim Construction-"detection means"

106. The "detection means" limitation can best be understood when considered with the immediately preceding "terminal means" limitation:

terminal means connectable with switches external to said controller for receiving an external signal therefrom;

detection means having an output of select duration in response to a received said external signal;

The specification of the '376 patent explains that "a terminal input is provided which is connectable with switches external to the controller for receiving external signals resulting from operational parameter monitoring. Because such signals may have a very short duration and in view of the relatively low clock frequency of the controller, a detection arrangement having an output of select duration in response to a received external signal is provided." '376 patent, col. 4, lines 30-37. Referring to Fig. 7A of the '376 patent:



the '376 patent specification explains that "override or external switching inputs to the circuit are represented in the figure as a terminal 180 labeled 'OFF'; a terminal 181 labeled 'ON'; a terminal 182 labeled 'SET'; and a terminal 183 labeled 'RESET'." '376 patent, col. 16, lines 39-43. Using terminal 180 as an example, terminal 180 is coupled through line 184 to the B input terminal of monostable multivibrator 186. According to the specification and as illustrated in the drawing, the "signal level" at line 184 also extends through line 188 to one input of AND gate 190 "coupled to provide a NORing function." The Q output of multivibrator 186 corresponding with line 184 input is connected through line 198 to the other input of gate 190. The other terminals are similarly connected. '376 patent, col. 16, line 43-col. 17, line 3. The '376 patent specification further explains:

The normal logic level asserted at lines 188, 196, 204 and 216 of respective gates 190, 194, 206 and 218 are high. The opposite inputs to these gates are normally low. The B input terminals of multivibrators 186 and 210 have corresponding logic levels. Discrete pull up resistors represented within the grouping 222 thereof maintain high values at their corresponding line couplings. The resistors within array 224 serve a current limiting function. Thus, a logic low at any one of the terminals 180-183 represents an active switching condition. Monostable multivibrators 186 and 210 produce an accurate output pulse of predetermined width,

the duration of which is determined by external timing capacitors operating in conjunction with associated external timing resistors 228. This pulse detecting and stretching feature is required inasmuch as the externally derived low signal applied at terminals 180-183 may be of such short duration that the cycling rate of CPU 150 may be inadequate to detect them. Recall in this regard that clock function 152 operates as 288 KHz, a relatively low frequency value selected to achieve low power drain and permit continuous operation over lengthy intervals of time. On the other hand, the direct connection of the terminals to gates 190, 194, 206 and 218 permits a signal which continues and is persistent to be continually observed beyond the pulse width otherwise defined at multivibrators 186 and 210.

'376 patent, col. 17, lines 3-30. It is thus clear that the "detection means" is simply, as the phrase implies, circuitry that provides an output in response to an "external signal" from the "terminal means" of sufficient duration that the system may detect that such "external signal" has occurred. The embodiment disclosed in the specification has a "stretching" feature, in addition to the detecting feature, that is apparently implemented by external timing capacitors and resistors associated with the multivibrators. That "stretching," according to the specification, was necessary because of the slow clock frequency. The claim element, however, refers only to a "select duration" which in the context of the claim can only mean a duration sufficient to permit the system to detect that an "external signal" at the "terminal means" has occurred.

c) Trial Testimony

107. Initially, Mr. Quayle testified:

Q. (BY MR. LeVERE) Mr. Quayle, * * *. Would you proceed with the fifth [limitation in claim 1 of the '376 patent], which I believe is a detection means?

A. Yes, sir. Now, just referring here to the special master's report to make sure the detection means is not covered and it's not, so I'll proceed with my analysis that I've previously done.

This reads, Detection [sic.] means, having an output of selector ratio, a response to receive set external signal. In the case of the patent specification, it talks about having some way for the processor to receive an external signal, and that function is present in the Mega APC 1000. Otherwise, the terminals that we've already discussed would not be useful at all. Now, some of the find structure that's in the patent specification that is not present in the Mega APC 1000, you know, identically, is a pulse structure.

But this processor is running approximately 40 to 50 times faster than the one that was-that's in the patent specification. And so the difference is that at 288 kilohertz, which the original specification covers, that's a really long time because the processor software went out and polled to see is the switch on, is the switch on. And that takes a-you know, that wouldn't happen very often at 288 kilohertz.

This processor running at 11 megahertz, considerably faster, doesn't have to check near as often to-well, I mean, it will-it can check a lot more instructions in between and get more work done and still check to see if the switch is on. So I believe that the two are equivalent in terms of since we have a faster processor, we don't need some external hardware to capture that signal.

Also, I don't know specifically whether the Mega APC 1000 has used it, but there are interrupt inputs to the processor which are latched and will catch a pulse of significantly shorter duration and cause the software to

jump elsewhere to say, oh, the switch is open, now I need to do something to change state.

Tr. May 22, 2001, at 36-38, which is no more than marginally helpful. After some prodding, though:

THE COURT: All right. Mr. Quayle, if you could, what I'm really interested in hearing, I guess, at least for those limitations that are in means plus function form that, frankly, the Court is constrained to construe under the statute, Section 112, paragraph 6, is the structure that's disclosed in the specification for, in this case, the detection means and then the identification for performing that stated function and then the identification of the corresponding structure in the accused APC 1000 and why it's your opinion that those structures are the same or equivalent for one of ordinary skill in the art and that those disclosed structures perform the identical function that is stated in the claim. That's ultimately the point that we all have to get to here.

Tr. May 22, 2001, at 38, Mr. Quayle testified:

THE WITNESS: Yes, your Honor. I understand. Well, in the case of-in the case of the specification patent, I'm looking here in Column 17, and the reference is line 13 through 25. Actually, just the line above that, if you look, it says, Thus, a logic low at any one of the terminals 180 through 183-this is the terminals on/off, set, and reset that we previously discussed-represents an active switching condition; that is, an indication to the system that it needs to change state. Monostable multivibrators 186 and 210 produce an accurate output pulse of predetermined width, the duration of which is determined by external timing capacitors-

* * *

THE WITNESS: Line No. 23, it says-I'll just paraphrase here for brevity, the clock function 152 operates as-I believe that should be "at," but 288 kilohertz, a relatively low frequency selected to achieve low power drain. And again, that was a very important guiding principle behind the invention.

Continuing on and skipping down a few lines, the direct connection of terminals to gates 190, etc., permits a signal which continues as persistent to be-so that the processor could come back and find this signal, even if it's been a very short duration.

THE COURT: And again, my question really is much more narrow than that. I understand about the oscillator. I'm asking for the detection means, what the corresponding structure is. Are you saying that's the logic circuit consisting of gates 190, 194, and so forth?

THE WITNESS: Well, not actually, your Honor. If you continue down to line 33, the output of these gates go into the input lines of a multiplexor which, for this particular processor, is a necessary part of getting the signal into the computer, into the microprocessor. But if I can refer to this schematic here.

Ultimately, after these inputs are processed and the gates-it goes into the multiplexor and then from the multiplexor directly into the microprocessor, if you refer to Figure 7(a), you'll see, over towards the right at the bottom, inputs EFE to E384, and those are the inputs. And so the structure of how this is performed is basically there are external terminals, there is some conditioning logic in the case of this particular implementation, and then they go into the processor.

THE COURT: All right.

THE WITNESS: Now, the Mega APC 1000, there are input terminals. And by observing on the behavior of the device, they obviously are-affect the operation of the microprocessor somehow. And I didn't trace through the circuits to see if any of these capacitors or other devices were specifically involved in input processing, but they eventually do wind up with inputs into the microprocessor. And so I concluded that the-let's see here, the function that it performs is the same, the way that it performs that is equivalent, and so therefore the result is identical.

Tr. May 22, 2001, at 38-41

108. Mega Systems urges that the "APC 1000 does not have a pulse stretcher-and does not need a pulse stretcher-because its control circuit runs at 11.05 MHz, which allows the processor to detect smaller signals," relying on the following testimony by Mr. Bartley:

Q. Turn to the detection means having an output of select duration and [sic. in] response to said received signal.

A. Okay, I'm there.

Q. Do you have that circuit physically located in your device?

A. No, or nothing equivalent to it.

Q. The microprocessor can't perform that function?

A. It doesn't need to because it's running at 11 megahertz. We pull [sic. poll] the ports more often. We catch the small signals. We don't need to have a pulse stretcher circuit on the inputs. I understand that another method of doing that is using interrupts.

Tr. May 24, 2001, at 199-200.

3. Discussion

109. As noted above, the limitation "detection means having an output of select duration in response to a received said external signal" is not properly construed as a means-plus-function limitation under s. 112(6). Although the phrase uses the word "means," there is no stated function. The limitation is clear and means, simply, circuitry that provides an output in response to an "external signal" from the "terminal means" of sufficient duration that the system may detect that such "external signal" has occurred. Mr. Quayle's testimony during trial established that the APC 1000 has terminals for receiving external signals and that such signals are detected and processed by the microprocessor in the APC 1000. Mr. Bartley's testimony does not refute or dispute that testimony, but simply also establishes that the APC 1000 does not have a "stretcher circuit" and does not need one. That, however, is consistent with Mr. Quayle's testimony. There is no factual dispute between the parties. The only issue is whether this limitation of claim 1 of the '376 patent requires such a "stretcher circuit." It does not. The claim only requires an "output of select duration," which in the context of the claim, can only mean a duration sufficient to permit detection. The APC 1000 detects and processes external signals and thus meets that limitation.

D. "processor means"

1. Construction

110. Claims 1 and 16 of the '376 patent (but not claim 35) call for a "processor means using similar, but not identical, language:

Claim 1	Claim 16
processor means including memory means for selectively retaining time interval data representing said numeric output conditions of said manual input means at addressable locations, said processor means being responsive to said clock output for carrying out time interval definition in correspondence with addressed said time interval data to derive actuation signals at the time limit of a said defined interval, responsive to said output of select duration for generating said actuation signals, and responsive to said clock output for deriving time increment outputs energizing said display means to show elapsed time within a given said interval	processor means including memory means for selectively retaining time interval data representing said numeric output conditions of said manual input means at addressable locations, said processor means including counter means for providing time interval definition in accordance with addressed said time interval data to derive actuation signals at the timed limit of a said defined interval, said processor means being responsive to a said external signal at said terminal means to derive a said actuation signal following a selected delay interval

Mega Systems does not draw any distinction between the "processor means" limitation in claim 1 as opposed to claim 16, and vice versa. Ferguson Beauregard notes that claim 16 contains neither a clock frequency nor a clock output function. That distinction is addressed further below. Therefore, the limitation as it appears in claim 1 will be used for discussion.

111. Special Master Williams did not construe these limitations *per se*. Rather, Special Master Williams rejected Mega Systems' argument that the phrase "processor means" required a low-power device, noting that "Mega Systems did not point to anything in the claims of the '376 patent or in the specification that suggest that the term 'processor means' requires a low-power device." Special Master Williams' Report at 18. In light of the parties' current arguments, however, the "processor means" limitation must be construed.

112. Initially there is the persistent question whether these "processor means" limitations should be construed as means-plus-function limitations under s. 112(6). Mega Systems does not directly say that these limitations should be so construed, but says "[s]o we must construe this element as having the identical functions recited in the claims, and a structure identical to or insubstantially different from the structure disclosed in the specification." Defendants' Post-Trial Brief at 10. Although not correctly stated, that would suggest that Mega Systems views these limitations as means-plus-function limitations governed by s. 112(6). Ferguson Beauregard, in its post-trial submissions, similarly does not say whether these limitations should be governed by s. 112(6), but presents arguments responding to Mega Systems' arguments more or less in a manner suggesting that Ferguson Beauregard agrees (or perhaps concedes) that these limitations should be construed as means-plus-function limitations.FN17

FN17. It should be noted that the parties have provided virtually no guidance on how the "processor means" limitations should be construed.

113. Using claim 1 for discussion, the "processor means" limitation obviously uses the word "means" thus raising a presumption that s. 112(6) applies. Indeed, there are two recited "means," namely a "processor means" that includes a "memory means." Turning then to "memory means," it is clear that in the phrase "memory means for selectively retaining time interval data representing said numeric output conditions of said manual input means at addressable locations," that the word "means" is used followed by a stated function, *i.e.,* "for selectively retaining time interval data representing said numeric output conditions of said manual input means at addressable locations." Thus, the first two hallmarks of a means-plus-function limitation are satisfied. *See Al-* Site, 174 F.3d at 1318; York Prods., 99 F.3d at 1574. The remaining question is whether there is sufficient structure, material, or acts set out in the claim for achieving the specified function. If so, s. 112(6) does not apply. *See* Cole, 102 F.3d at 531.

114. The term "memory" is a familiar term in electrical engineering and computer science, if not to the public at large, and certainly evokes in one's mind a particular "structure," as much so as "perforation" might. *Id.* Although no exhaustive study has been made, readily available references indicate that "memory," in the context in which it is used, also seems to enjoy a generally common definition or understanding. For example, the MCGRAW-HILL DICTIONARY OF SCIENTIFIC AND TECHNICAL TERMS (5th ed.1994) at 1237 offers the following definition for "memory" in the field of computer science:

Any apparatus in which data may be stored and from which the same data may be retrieved; especially, the internal, high-speed, large-capacity working storage of a computer, as opposed to external devices. Also known as computer memory.

The non-technical MERRIAM-WEBSTER'S COLLEGIATE ENCYCLOPEDIA (2000) provides the following similar and consistent, albeit more extensive, definition:

In (middle dot)digital computers, a physical device used to store such information as data or programs on a temporary or permanent basis. Most digital computers have two types of memory, the main memory and one or more auxiliary storage units. In most cases, the main memory is a high-speed (middle dot)RAM. Auxiliary storage units include (middle dot)hard disks, (middle dot)floppy disks, and magnetic tape drives. Besides main and auxiliary memories, other forms of memory include (middle dot)ROM and optical storage media such as (middle dot)videodiscs and (middle dot)compact discs (see (middle dot)CD-ROM).

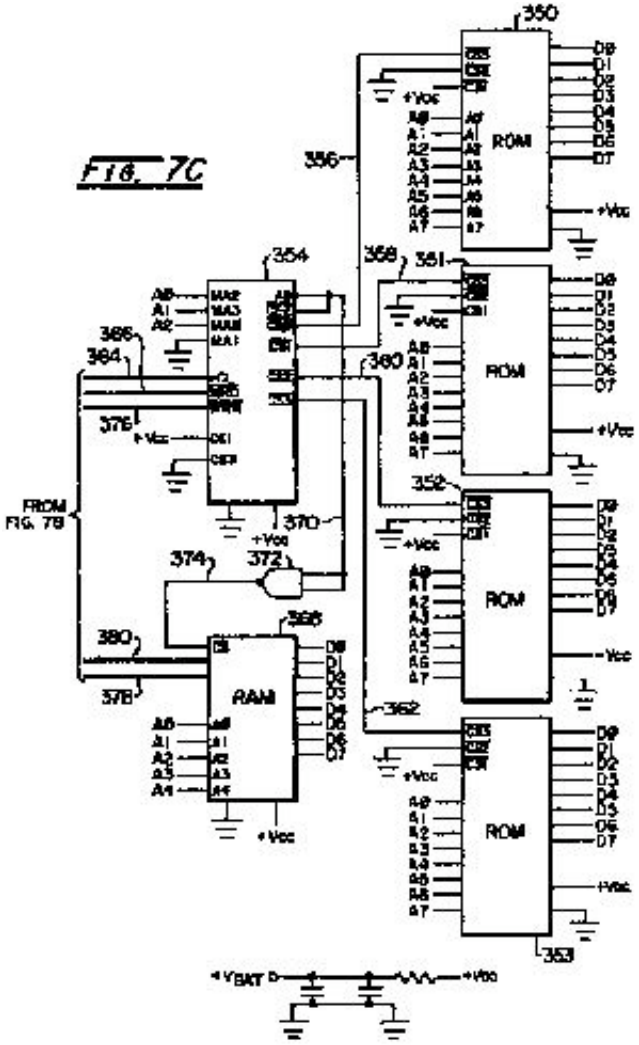
A shorter and easily understood definition appears in THE ILLUSTRATED DICTIONARY OF ELECTRONICS (6th ed.1994) at 413:

The section of a digital computer that "remembers" material, *i.e.,* the section that records and holds data until needed.

Id. (approving use of dictionaries in deciding whether a claim term recited structure capable of performing the recited function). As commonly understood, therefore, a "memory" may be said to evoke sufficient "structure" for accomplishing the stated function, namely "for selectively retaining time interval data representing said numeric output conditions of said manual input means at addressable locations." Indeed, the limitation at issue is just as easily understood without the word "means," *i.e.,* "memory for selectively retaining time interval data representing said numeric output conditions of said manual input means at addressable locations," as with the word "means," *i.e.,* "memory means for selectively retaining time interval data representing said numeric output conditions of said manual input means at addressable locations." Thus, it would not be difficult to conclude that the term "memory" provides sufficient "structure," *in this instance,* to carry the limitation outside the ambit of s. 112(6).FN18

FN18. There certainly may be (and likely are) instances in which the actual "memory" disclosed in the specification is unique or otherwise important in discerning the true scope of the claims. In such a case, construing "memory" in "memory means" according to its generally understood meaning would not accurately reflect the true scope of the claims. This is not one of those instances. The "memory" disclosed in the '376 patent is the common or generic forms of ROM and RAM memories.

115. For similar reasons, however, it makes little difference, if any, whether the "memory means" limitation is construed under s. 112(6), or not. Fig. 7C of the '376 patent illustrates:



The memory components are described in the '376 patent as off-the-shelf or common components. '376 patent, col. 19, line 57-col. 20, line 62. Read-only memories, ROMs 350-353, for example, are described as "type CDP1842C marketed by RCA, Inc." '376 patent, col. 19, lines 664-65. Thus, the scope of "memory means," whether construed under s. 112(6) or not, would not appear to affect the outcome of this case, and neither party has asserted that it should. Jumping to the bottom line, Mega Systems does not contest that the APC 1000 has a "memory" or structure corresponding to a "memory means," whether construed under s. 112(6) or not, that performs the function of "selectively retaining time interval data representing said numeric output conditions of said manual input means at addressable locations."

116. Resolving the meaning of "memory means" does not, of course, resolve the meaning of "processor means" or whether that phrase should be construed under s. 112(6). Turning to that question, the limitation says that the "processor means" performs three functions in response to three signals, *i.e.*, "said processor means [response-1] being responsive to said clock output [function-1] for carrying out time interval definition in correspondence with addressed said time interval data to derive actuation signals at the time limit of a said defined interval, [response-2] responsive to said output of select duration [function-2] for generating said actuation signals, and [response-3] responsive to said clock output [function-3] for deriving time increment outputs energizing said display means to show elapsed time within a given said interval." Once again, using the word "means" followed by statements of function, of course, satisfies the first two

hallmarks of a means-plus-function limitation. The question then becomes whether "processor" by itself recites sufficient structure for achieving the specified function. *See* Cole, 102 F.3d at 531.

117. As in the case of "memory," "processor" has a readily understood meaning in the field of electrical engineering and computer science. The MCGRAW-HILL DICTIONARY OF SCIENTIFIC AND TECHNICAL TERMS (5^{th} ed.1994) at 1582, for example, says that a "processor" is "[a] device that performs one or many functions, usually a central processing unit." Also, here the word "means" adds little to the claim limitation. Calling for a "processor" "being responsive * * * " is equally as clear as calling for a "processor means" "being responsive * * *." Lastly, that "processor" can be said to add sufficient structure for performing the claimed functions may be illustrated by considering the limitation without the word "processor," *i.e.,* "means being responsive * * *." In that instance, few could argue that the limitation should be construed as a means-plus-function limitation under s. 112(6). Claim construction would then require consulting the specification to determine the disclosed structure that is linked to performing the recited functions. Doing so would reveal what the patentee refers to as "microprocessor (CPU) [*i.e.,* central processing unit] represented at 150." '376 patent, col. 14, lines 40-42. The specific microprocessor is disclosed as "Model CDP 1802CE by RCA, Inc., Summerville, New Jersey." '376 patent, col. 15, lines 12-13. In short, referring to the specification for the corresponding structure reveals precisely what one already knows from the word "processor."

118. Mega Systems does not contend that the APC 1000 lacks a "processor." There is no doubt that the APC 1000 uses a microprocessor. Mega Systems, however, argues that the proof Ferguson Beauregard presented at trial was insufficient to prove that the APC 1000 performs the actual functions required by this claim element. Defendants' Post-Trial Brief at 9-12. Ferguson Beauregard responds that its proof, *i.e.,* Mr. Quayle's testimony, identified "structure in the APC 1000 controller that performed the identical functions recited in this element." Plaintiffs' Post-Trial Reply at 11. In light of the arguments of the parties, therefore, this limitation will be construed more narrowly as a means-plus-function limitation governed by s. 112(6), even though a broader construction would be permissible. It should be noted, however, that in any event a finding of literal infringement would require proof that the accused APC 1000 meets the functional terms of these limitations regardless of whether the limitations are construed under s. 112(6).

2. Testimony and Arguments

119. Mega Systems presents four arguments in asserting that the APC 1000 does not have a "processor means" as claimed, *i.e.,* (1) Mr. Quayle's testimony was merely a conclusory assertion of functional identity and structural equivalence which is not enough to prove infringement, citing Robm & Haas Co. v. Brotech, Corp., 127 F.3d 1089, 1092 (Fed.Cir.1997); (2) the claim requires that the "processor means" be responsive to "said clock output" which is produced by the "oscillator means," and the APC 1000 does not have a low-power oscillator like the one disclosed in the '376 patent, thus the APC 1000 cannot perform the recited function; (3) the APC 1000 does not have a "pulse stretcher" and thus cannot meet the requirement that the "processor means" is "responsive to said output of select duration;" and (4) "limited power supply capability" was not a design criterion and thus the processor that the APC 1000 uses is structurally different from microprocessor 150 described in the '376 patent as being "selected for use within a system having limited power supply capability." Defendants' Post-Trial Brief at 9-12.

120. Ferguson Beauregard responds that (1) Mr. Quayle testified at length concerning the basis for his opinion and that testimony was supplemented by four detailed claim charts containing an element-by-element analysis and five detailed reports rendering *Robm & Haas* inapplicable; (2) Mega Systems'

arguments *vis-a-vis* the "oscillator means" and the "detection means" were addressed in connection with those elements; and (3) Special Master Williams rejected Mega Systems' argument that "processor means" was limited to a low-power device. Ferguson Beauregard also notes that claim 16 contains neither a clock frequency nor a clock output function. Plaintiffs' Post-Trial Reply at 11-13.

3. Discussion

121. Ferguson Beauregard is correct. Mr. Quayle testified, *inter alia:*

Q. Moving on, then, I believe the next element was the processor means, the sixth substantive element?

A. Yes. And on page 18 of the special master's report, processor means is covered. Mega Systems argued that processor means required-implies a low-power device. Ferguson Beauregard didn't respond to that except talking about the oscillator output frequency, which we've already covered.

* * *

A. Ferguson Beauregard didn't respond to that except arguing that the meaning of the oscillator means clock output frequency. And-anyway, so skipping down to the last sentence in that section, it says the feature was discussed above, which is-they're referring to the oscillator means-and no further definition is required. From that, I'm concluding that the special master is not requiring any special kind of processor or any special low-power device or anything like that, in which case processor means just means of processor.

Now, in a case of this particular claim element, the specification and the patent claim calls for a microprocessor that has memory. The Dallas Semiconductor processor is a processor that, in fact, has its own internal memory. It doesn't require external memory. But again, that's exactly equivalent. It can retain time interval data entered by the operator so that-and it knows what the off time is, the on time that the operator selected.

And you know, in response to manual input means, which we've already covered, and the addressable locations because the patent in question and its specification calls for external memory, those are still addressable locations inside the Dallas Semiconductor. They just happen to be inside the processor. But they're still at discrete locations. So the function that both the Mega APC 1000 and the patent in question performs is identical. In other words, the operator enters a time, the processor remembers it, does the appropriate thing with it at the appropriate time due to the software that's present in both Mega and in the patent.

So the function is the same and the means are-I mean the way that they're done is virtually identical. It's just a matter of moving the memory into the processor-onto the processor module, which is here, and not requiring an external module. So that's identical.

And so the result is exactly the same; that is, you know, the program executes, it does the-it uses the operator's input of times to do the appropriate countdown of either on time or off time and afterflow, etc. So it's my professional opinion that this claim element reads on the APC 1000.

Q. (BY MR. LeVERE) All right. Mr. Quayle, is there a relationship between the processor and the display?

A. Well, yes. Without the processor-without the display, you wouldn't be able to see what the processor was doing.

Q. That may seem like an obvious question. I was looking at the claim, Element 6, and I saw some reference in the Element 6 itself to the display, and I just wanted you to, perhaps, address that portion of the substance-the sixth substantive claim element to the extent that you considered it.

A. Oh, yes, I'm sorry.

* * *

THE WITNESS: Oh, yes, absolutely. And it's my fault. I was looking in the claim chart, which is Section D of Exhibit 30. And for the sake of increasing the indexing capability, some of the claim elements were broken into separate pieces. I addressed the first piece of that claim element.

I'd be glad to address the second piece, which is said processor means-this is on page 24 of Exhibit 30-being responsive to said clock output, etc., etc. And again, what it's talking about here is that there is a clock running inside the software or the processor, and it will compute this time interval, count down to change state appropriately. And again, those functions are the same between the two devices, and how they're implemented is virtually identically the same. Different software but, obviously, both have software and the result is the same.

Q. (BY MR. LeVERE) Anything else on Claim 6, Mr. Quayle, that you considered or looked at-excuse me, Element 6 of Claim 1 that you considered the same?

A. Yes, we have one little piece left, I believe. And that starts with-and it's on page 25 of Exhibit 30-responsive to said output of select duration for generating actuation signals. And again, what's going on here is that the processor creates an output which commands the valve to go to the proper state, and then that's, again, both the same function, the same way, and the same result.

Tr. May 22, 2001, at 42-46. *See also,* Tr. May 22, 2001 at 71-72. In short, Mr. Quayle reviewed each of the "responsive to" and functional requirements of the "processor means" limitation and expressed his view that the APC 1000 performed the same function in response to signals as required by the claims.

122. The Federal Circuit has noted that "reasonable inferences by the fact finder are appropriate." and that testimony, such as the foregoing, provides substantial evidence on which to base a finding of infringement. *See* In re Hayes Microcomputer Prods., Inc. Patent Litigation, 982 F.2d 1527 (Fed.Cir.1992). Mr. Quayle's testimony was analogous to that found sufficient in *Hayes*. Moreover, Mega Systems had the opportunity to present countervailing evidence, but did not. Indeed, in its post-trial submissions, Mega Systems does not point to any testimony questioning the accuracy of Mr. Quayle's conclusions. Moreover, Mega Systems had the opportunity during trial to introduce rebuttal evidence, for example, that although the APC 1000 performed the functions required by the claims, the APC 1000 did so in a substantially different way and with a substantially different result. But Mega Systems did not do so, and points to no such testimony or evidence in its post-trial submissions. Thus, taken in light of the other testimony and documentary evidence introduced at trial, Mr. Quayle's testimony provides credible, substantial evidence supporting the conclusion

that the APC 1000 contains structure meeting the "processor means" limitation, especially in the absence of evidence coming from Mega Systems to the contrary.

123. Mega Systems' arguments *vis-a-vis* the "oscillator means" and the "detection means" are addressed above. Suffice to say that Ferguson Beauregard produced sufficient, credible evidence enabling a fact finder to conclude that the APC 1000 contained structure meeting those limitations.

124. Mega Systems' final argument that the processor used in the APC 1000 is not a low-power device and was not "selected for use within a system having limited power supply capability" is, for the most part, addressed above in the discussion of "oscillator means" and by Special Master Williams in rejecting Mega Systems' assertion that "processor means" is limited to a low-power device. There is no doubt that the physical microprocessors (1) used in the APC 1000 and (2) described in the '376 patent are not identical. The APC 1000 uses a DS 5000 microprocessor and the '376 patent suggests the use of an RCA Model CDP 1802CE microprocessor that was selected for its low power requirements. The various circuit components making up those microprocessors likely differ, although none of the parties, including Mega Systems, introduced any evidence describing such differences except for Mr. Quayle's testimony above that the DS 5000 had internal memory while microprocessor 150 used external memory. Mega Systems does not raise any challenge to Mr. Quayle's conclusion that internal and external memory are, in this instance, equivalent. The only difference between the microprocessors that Mega Systems relies on is that the DS 5000 has a minimum clock speed, *i.e.,* 1 MHz, and microprocessor 150 disclosed in the '376 patent does not. From that, Mega Systems argues that the " 'processor means' in the APC 1000 controller is structurally different-and substantially so-from the 'processor means' claimed and described in Claims 1 and 16 of the '376 patent, and the APC 1000 cannot infringe these claims." Defendants' Post-Trial Brief at 11-12. But the only two factors that Mega Systems mentions in support are that Mr. Bartley allegedly did not consider "limited power supply capability" in designing the APC 1000 and the difference in minimum clock speeds. Neither provides support for concluding that the processors are substantially different.

125. Moreover, that argument is apparently based on a misunderstanding of the analysis under s. 112(6). "Structure disclosed in the specification is 'corresponding' structure only if the specification or prosecution history clearly links or associates that structure to the function recited in the claims," Medtronic, Inc. v. Advanced Cardiovascular Sys., Inc., 248 F.3d 1303, 1311 (Fed.Cir.2001). Furthermore, the "statute does not permit limitation of a means-plus-function claim by adopting a function different from that explicitly recited in the claim," nor "does the statute permit incorporation of structure from the written description beyond that necessary to perform the claimed function. Micro Chem., Inc. v. Great Plains Chem. Co., Inc., 194 F.3d 1250, 1258 (Fed.Cir.1999). The only function recited in the "processor means" limitation of claim 1 (which, as an aside, does not appear in the "processor means" limitation of claim 16) that could arguably be said to imply a frequency or power limitation is "said processor means being responsive to said clock output for carrying out time interval definition * * *." But it is clear from the claim itself that this clause simply requires that the "processor means" perform the claimed function of "carrying out time interval definition * * *," in *response* to the clock output. This portion of the claim thus does not specify what that clock output is (or is not). The clock output is defined in the earlier "oscillator means" limitation addressed above. Nothing in the claim or specification links the function of "carrying out time interval definition * * * " to a particular clock speed or low power. Indeed, Mega Systems notably does not argue that the APC 1000 cannot, or does not, perform the function of "carrying out time interval definition * * * " in response to clock output which is all that the claim requires. That the DS 5000 microprocessor used in the APC 1000 has a minimum clock speed of 1 MHz, and microprocessor 150 disclosed in the '376 patent does not, has no bearing on this limitation.

126. Moreover, Mega Systems' statement that " 'limited power supply capability' was not an issue when Jim Bartley designed the APC 1000," Defendants' Post-Trial Brief at 11, is an exaggeration. As discussed above in conjunction with the "oscillator means" limitation, Mr. Bartley's testimony, *inter alia,* that:

Q. Well, what power considerations did you undertake in designing this chip-or not in designing this chip but in designing this device?

A. Well, I had to have enough battery life that I could recharge it with our average sun hours per day. For instance, in East Texas we have an average of three sun hours per day. So with the solar panel in the summer, of course, it's a lot longer and winter it's even shorter. But on the average, yearly average, it's 3 sun hours per day.

So I managed to get-with changing external circuits, using different chips, powering them down and not using them at certain times, I was able to maintain a two-week battery life. If it just sat on the shelf plugged in, it would last about two weeks without the sun.

Tr. May 24, 2001, at 198-99, and that it was "[d]efinitely better to use less power," Tr., May 25, 2001, at 63, indicate that power *was* a consideration. Not, of course, in the sense that Mr. Bartley was attempting to design a controller that would run for a year on a set of D cell batteries like the commercial embodiment of the '376 patent. Rather power, in this case, was required to run the controller until the batteries could be recharged with the solar panel, and was thus, on the record testimony, indisputably, an issue. Once again, the effect of a dead battery in either the APC 1000 or the commercial embodiment of the '376 is the same. If Mega Systems is suggesting that Mr. Bartley "chang[ed] external circuits, us[ed] different chips, power[ed] them down and [did] not us [e] them at certain times" in an effort to "maintain a two-week battery life" but did not consider power at all when choosing a microprocessor, that is neither convincing nor plausible.

127. Accordingly, as noted above, the testimony and documentary evidence introduced at trial provide substantial evidence supporting the conclusion that the APC 1000 contains structure meeting the "processor means" limitation.

E. "valve means"

1. Construction

128. Claims 1, 16 and 35 all call for, using identical language, a "valve means:"

Claim 1	Claim 16	Claim 35
valve means responsive to said actuation signals to derive said control inputs.	valve means responsive to said actuation signals to derive said control inputs.	valve means responsive to said actuation signals to derive said control inputs.

The parties apparently did not submit this limitation to Special Master Williams for construction, and therefore Special Master Williams' Report does not address it. Special Master Williams did, however,

address the "pneumatic valve means" in claim 1 of the '721 patent, discussed above.

129. The parties do not directly state, but couch their respective arguments assuming, that this limitation should be construed as a means-plus-function limitation governed by s. 112(6). Although it is true that the limitation uses the word "means" and states a function "to derive said control inputs," thereby raising a presumption that the limitation should be construed as a means-plus-function limitation, it is at least questionable whether "valve" recites sufficient structure to take the limitation outside the ambit of s. 112(6). After all, peppering the beginning of each claim limitation with "means," as in "display means," "manual input means," "oscillator means," "terminal means," "detection means," "processor means," and "valve means," more likely reflects a claim drafting style prevalent during the time the application maturing into the '376 patent was being prosecuted rather than an intent to invoke s. 112(6). *See* Cole, 102 F.3d at 531. Also, the limitation is equally clear whether written "valve means responsive to said actuation signals to derive said control inputs" or "a valve responsive to said actuation signals to derive said control inputs" thus similarly suggesting that "means" adds nothing substantively to the claim.

130. Nevertheless, in light of the arguments of the parties and Special Master Williams' construction of "pneumatic valve means" in claim 1 of the '721 patent as a means-plus-function limitation governed by s. 112(6), the "valve means" limitation in claims 1, 16 and 35 will be likewise construed.

131. Thus, the first step is to identify the corresponding structure disclosed in the specification for performing claimed function, *i.e.,* "to derive said control inputs." The limitation also requires that the "valve means" be "responsive to said actuation signals," *i.e.,* the "actuation signals" mentioned in the immediately preceding "processor means" limitation in claims 1 and 16, and the "control circuit means" limitation of claim 35. In connection with claim 1 of the '721 patent, Special Master Williams identified the structures illustrated in Figures 6-9 of the '721 patent "and equivalents thereof" that perform the function of claim 1 of the '721 patent, namely "direct[ing] said gas under pressure to effect respective said motor valve actuating on and off pneumatic states." Here, of course, the function is different, but Fig. 19 of the '376 patent illustrates, and accompanying disclosure describes, *see* '376 patent, cols. 36-37, the same valve as in Fig. 6 of the '721 patent:

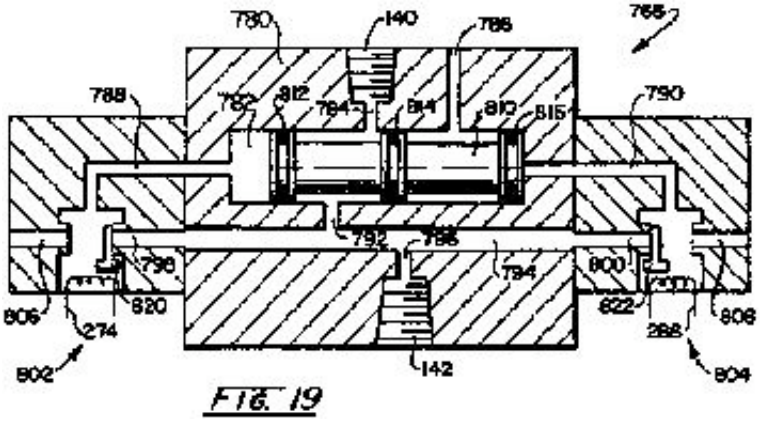


FIG. 19

Accordingly, the description above in connection with Fig. 6 of the '721 patent is sufficient for understanding the valve of Fig. 19 of the '376 patent.

132. Thus, the structure "corresponding" to the "valve means" of claims 1, 16 and 35 of the '376 patent is that illustrated in Fig. 19 of the '721 patent that is "responsive to said actuation signals" and which performs the function of "to derive said control inputs." Accordingly, under s. 112(6), this limitation covers that "structure" and "equivalents thereof."

2. Testimony and Arguments

133. Mr. Quayle's testimony above was given both with respect to the "valve means" of the '376 patent and the "pneumatic valve means" in claim 1 of the '721 patent. Mega Systems repeats its "pneumatically-actuated valve" versus "solenoid-actuated valve" argument initially advanced in connection with the '721 patent above, and says that "Quayle never describes whether the APC 1000 valve performs this same function in substantially the same way to achieve substantially the same result." Defendants' Post-Trial Brief at 12. Ferguson Beauregard responds that Mr. Quayle did indeed testify how the "valve means" limitation reads upon the APC 1000, and points out that in the context of the '721 patent, Mega Systems confessed that "if the '721 patent claimed only a 'valve means' then perhaps Quayle's testimony would be enough for this Court to find that the two valves are structurally equivalent." Plaintiffs' Post-Trial Reply at 14, quoting Defendants' Post-Trial Brief at 6. Ferguson Beauregard observes that claims 1, 16 and 35 in the '376 patent do, in fact, refer only to a "valve means." Id.

3. Discussion

134. In fact, Mr. Quayle testified:

Q. (BY MR. LeVERE) Mr. Quayle, if you would, describe for the Court the 6th substantive element of Claim 35, which I believe is the final element of that claim.

A. Yes. Valve means responsive to said actuation signals to derive said control inputs.

Q. Now, when you reviewed the specification of the '376 patent, did you find a structure that performs that function?

A. Yes. The structure referred to in the patent is a control valve inside the controller itself, and the control valve is connected to the external motor valve, which actually turns the well on and off.

Q. And so it's a smaller valve inside the patent that drives-excuse me, inside the controller that drives the motor valve; is that right?

A. That's correct.

Q. And did you look at the APC 1000 controller in order to find a device to perform that function?

A. Yes, I did.

Q. What did you find, Mr. Quayle?

A. It has a valve of that identical description.

Q. And in your expert opinion, to a reasonable degree of engineering certainty, do you find that the valve in the APC 1000 controller is the same as or equivalent to the valve that is described in the specification of the '376 patent?

A. I did.

Tr. May 21, 2001, at 223-224.

135. Mr. Quayle thus testified that he found structure within the APC 1000 that met the claim limitation "responsive to said actuation signals" and the function "to derive said control inputs," that was the same as or equivalent to the valve described in the '376 patent. It is evident from his testimony that his opinion was that (1) the APC 1000 valve and (2) the valve described in both the '721 and '376 patents which corresponds to both the "pneumatic valve means" limitation in the '721 patent and the "valve means" limitation in the '376 patent, were "equivalent" in terms of s. 112(6). Mr. Quayle, in other testimony, acknowledged that there were differences between the valves, but explained why he nevertheless considered the valves to be equivalent in the environment in which they were used. His testimony was credible and Mega Systems points to no testimony or evidence rebutting or refuting that testimony. Thus, Mega Systems is left with its "pneumatically-actuated valve" versus "solenoid-actuated valve" argument which has been fully addressed and thus meets the same fate here as it did in connection with the '721 patent above. That fate is further sealed by Mega Systems' concession, accurately quoted by Ferguson Beauregard, that "if the '721 patent claimed only a 'valve means' then perhaps Quayle's testimony would be enough for this Court to find that the two valves are structurally equivalent." Defendants' Post-Trial Brief at 6. In that regard, Mega Systems is correct.

F. "control circuit means"

1. Construction

136. Claim 35 of the '376 patent calls for:

control circuit means responsive to said manual input means numeric output conditions for deriving actuation signals defining selectively timed said on and off states, responsive to a said delay output condition and a subsequently asserted said numeric output condition to define a select delay interval;

said control circuit means being responsive to a said external signal state change input and to a delay output condition when occurring prior to said external signal for deriving a said actuating signal following an interval of time corresponding with said select delay interval; and

According to Special Master Williams' Report, there was no dispute as to meaning, at least with respect to "said control circuit means being responsive to * * * said select delay interval." The Report says that Ferguson Beauregard urged that clause meant that "if the delay output condition applied through the keypad is present, the microprocessor will accept number key inputs to define a delay interval such as the interval of afterflow." Special Master Williams' Report at 19. Mega Systems, apparently, did not contest that construction, and Special Master Williams accordingly recommended the same.

2. Testimony and Arguments

137. Mr. Quayle's testimony on the "control circuit means" is set out at length below because of Mega

Systems' argument that such testimony is insufficient to find that the accused APC 1000 infringes claim 35 of the '376 patent, namely that such testimony is insufficient to find that the APC 1000 has structure meeting the "control circuit means" limitations:

Q. If you'd turn your attention to the fourth substantive element of Claim 35.

A. Control circuit means responsive to said manual input means, numeric output conditions, for deriving actuation signals defining selectively timed said on and off states responsive to a said delay output condition and as subsequently asserted said numeric output condition to derive a select delay interval.

Q. Mr. Quayle, describe, if you would, just in your own words, what that claim element is reciting.

A. Well, what they're talking about here in the claim element is the capabilities of being able to have the operator enter on and off times, also to be able to enter delay times, and to be able to actually see those on the display.

Q. So essentially, is it fair to say that this claim element recites two functions?

A. Yes.

Q. Is that right? And that was your description?

A. Yes.

Q. Okay. And then the specification of the '376 patent, does that disclose any structures to perform the functions recited in the 4th substantive claim element?

A. Yes.

Q. What structures does this specification describe?

A. Well, the specification describes the function key being able to retrieve those times via function key and being able to retrieve the delay time.

Q. Now, as you were doing your analysis, did you check the APC 1000 controller for a structure therein that would perform those functions?

A. Yes.

Q. Did you find one?

A. Yes, I did.

Q. Tell me what you found, Mr. Quayle.

A. You can retrieve the on, off, and delay times by appropriate sequence of key presses on the device keypad.

Q. And what's the structure that houses the information that you can retrieve on the keypad?

A. Well, the information is stored in the memory of the microprocessor, so the structure is the microprocessor, its built-in memory, and the associated software that makes that all possible.

Q. In your expert opinion, to a reasonable degree of scientific certainty, is that microprocessor, the memory and the code, the same as or equivalent to the structure described in the specification of the '376 patent?

A. Yes, it is.

Q. Now, with respect to the fifth substantive claim element, could you describe what that element recites?

A. Yes. Said control circuit means being responsive to a said external signal state change input and to a delay output condition when occurring prior to said external signal for deriving a said actuating signal following an interval of time corresponding a said select delay interval.

Q. I'm going to sidetrack here for just a second. We're talking about the '376 patent. Correct?

A. That's correct.

Q. And that was the LiquiLift patent?

A. Yes.

Q. Does that patent recite a microprocessor?

A. Yes, it does.

Q. I think I confused myself because I sort of took the patents out of chronological order and I just wanted to make sure that I haven't lost anybody else, which probably was unlikely

After you looked at the fifth substantive element of Claim 35, did you have occasion to compare that element of specification of the '376 patent?

A. Yes, I did.

Q. And did you find a structure in the specification that performs that function?

A. Yes.

Q. What did you find, Mr. Quayle?

A. Well, again, that's dependent on the microprocessor, its memory, and its program to perform these functions.

Q. Now, are you talking, then, about the specification, or are we talking specifically about the controller?

A. We're talking about the-the specification talks about the capability of having these inputs connect to the device, their external inputs we're talking about, and those would change the behavior of the device when those conditions occur.

Q. And did you find an identical or equivalent structure in the APC 1000 controller that performs that function?

A. Yes, I did.

Q. Tell the Court what you found, please.

A. The APC 1000 also contains a microprocessor, memory, and external inputs so that its behavior can be modified by the presence of external signals.

Q. And in your expert opinion, then, does the 5th substantive element of Claim 35 of the '376 patent read on APC 1000 controller?

A. Yes, it does.

* * *

Q. Now, Mr. Quayle, have we discussed all of the elements, substantive claim elements of Claim 35 on the '376 patent?

A. Yes, we have.

Q. And do you have an opinion, Mr. Quayle, to a reasonable degree of scientific certainty, as to whether or not each of those claim elements reads on the APC 1000 controller?

A. I do.

Q. And what is that opinion, sir?

A. I believe that the-it is my opinion that the '376 patent in the case of element-I mean of Claim 35 reads on the APC 1000.

Q. And in that analysis and in forming that opinion, I believe your testimony indicates but I'd like to just underscore that you did compare the original claim elements described in Claim 35 to the specification patent?

A. Yes.

Q. And you did, in fact, after finding structures in the APC 1000 controller that perform the identical function as that described in the claim elements, compared those structures to the structures described in the specification?

[Sustaining a leading question objection]

Q. (BY MR. LeVERE) Mr. Quayle, if you would, just again for purposes of clarity, describe your thought process and analysis in comparing the claim elements and specification in the APC 1000 controller.
A. Okay. I went through each claim element one by one, looked at the corresponding elements of specification and looked at how those structures and those functions in the Mega APC 1000 operated the same way. And it's my professional opinion that the Mega APC 1000 infringes each and every element of the claim.

Tr. May 21, 2001, at 219-226.
138. Mega Systems says that the control circuit "is described over the course of almost six and one-half columns of text in the '376 specification. Yet Quayle describes the corresponding structure as 'the function key being able to retrieve first times via function key and being able to retrieve the delay time,' 'Or, alternatively, the structure is "dependent on the microprocessor, its memory, and its program to perform the functions." ' And the allegedly equivalent structure in the APC 1000 is 'the microprocessor, its built-in memory, and the associated software that makes that all possible,' or 'a microprocessor, memory, and external inputs so that its behavior can be modified by the presence of external signals.' " Defendants' Post-Trial Brief at 13. Thus, says Mega Systems, "does Quayle in a few words describe what the drafter of the '376 patent required three full pages of figures-and six and one-half columns of text-to describe. Similarly, in just a few words Quayle declares that the APC 1000 has an equivalent structure. But he provides this Court with *no* analysis of *bow* the structures perform the same functions in substantially the same way." Id. Ferguson Beauregard responds by noting that simply comparing a patent disclosure governed by the disclosure requirements of 35 U.S.C. s. 112(1) to evidence required to show infringement under s. 112(6) is analogous to comparing apples to oranges. Ferguson Beauregard further notes that Mr. Quayle's testimony described the function recited in the claim element and then identified structure in the APC 1000 that performed that identical function. Ferguson Beauregard further notes that Mr. Quayle considered the actual structure disclosed in the '376 specification corresponding to the claimed "control circuit means" and that his testimony "clearly establishes that the 'control means' limitation reads on the APC 1000 controller * * *." Plaintiffs' Post-Trial Reply at 15-16.

3. Discussion

First, with respect to the "control circuit means" limitation *per se:*

control circuit means responsive to said manual input means numeric output conditions for deriving actuation signals defining selectively timed said on and off states, responsive to a said delay output condition and a subsequently asserted said numeric output condition to define a select delay interval

Mega Systems having failed to bring a disputed claim construction issue before Special Master Williams during the *Markman* hearing has little cause to complain. Furthermore, Mr. Quayle's colloquial construction:

A. Well, what they're talking about here in the claim element is the capabilities of being able to have the operator enter on and off times, also to be able to enter delay times, and to be able to actually see those on the display.

is correct. With respect to the second requirement, namely that the "control circuit means" is "responsive" to a certain signal:

said control circuit means being responsive to a said external signal state change input and to a delay output condition when occurring prior to said external signal for deriving a said actuating signal following an interval of time corresponding with said select delay interval

Mega Systems likewise has little basis to complain, but Mr. Quayle's interpretation:

Q. Now, with respect to the fifth substantive claim element, could you describe what that element recites?

A. Yes. Said control circuit means being responsive to a said external signal state change input and to a delay output condition when occurring prior to said external signal for deriving a said actuating signal following an interval of time corresponding a said select delay interval.

* * *

Q. * * * After you looked at the fifth substantive element of Claim 35, did you have occasion to compare that element of specification of the '376 patent?

A. Yes, I did.

Q. And did you find a structure in the specification that performs that function?

A. Yes.

Q. What did you find, Mr. Quayle?

A. Well, again, that's dependent on the microprocessor, its memory, and its program to perform these functions.

Q. Now, are you talking, then, about the specification, or are we talking specifically about the controller?

A. We're talking about the-the specification talks about the capability of having these inputs connect to the device, their external inputs we're talking about, and those would change the behavior of the device when those conditions occur.

Q. And did you find an identical or equivalent structure in the APC 1000 controller that performs that function?

A. Yes, I did.

Q. Tell the Court what you found, please.

A. The APC 1000 also contains a microprocessor, memory, and external inputs so that its behavior can be modified by the presence of external signals.

Q. And in your expert opinion, then, does the 5th substantive element of Claim 35 of the '376 patent read on

APC 1000 controller?

A. Yes, it does.

is accurate. Indeed, Mega Systems' sole argument is *not* that Mr. Quayle's testimony is inaccurate or that the APC 1000 does not meet the claim limitations, but rather that Mr. Quayle's testimony is insufficient.

139. Mega Systems' argument on this issue is, unfortunately, boarding on the frivolous. Mr. Quayle gave his view of the claim limitations, the corresponding structure that he found in the '376 specification, and why he viewed the APC 1000 as containing the same or equivalent structures that performed the same functions as claimed. Yes, there are a myriad of other questions that Mr. Quayle could have been asked, but all of the parties were under agreed time restrictions for the entirety of the trial, and this was not a typical trial before a jury that perhaps was unfamiliar with the technology, as well as patent law and procedure. In light of the circumstances of trial, Mr. Quayle's testimony was sufficient to constitute substantial evidence that the APC 1000 contained structure corresponding to the "control circuit means" limitation. Mega Systems had the opportunity through cross-examination and through introduction of its own testimony and evidence to rebut or refute that testimony, but did not.

140. For the foregoing reasons, the substantial evidence introduced at trial was sufficient to enable a fact finder to conclude that the APC 1000 satisfied the "control circuit means" limitation.

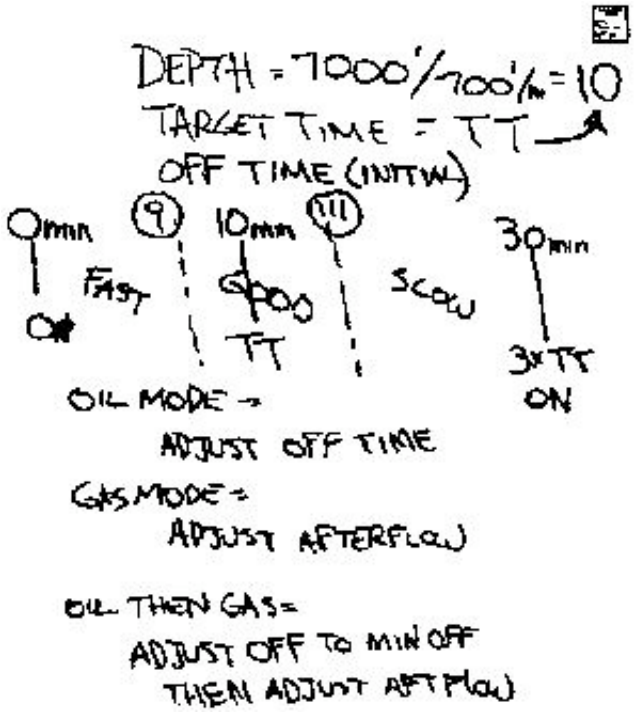
VIII. The '991 Patent

A. Infringement *Vel Non*

1. The Dispute

141. As discussed above, the '991 patent is generally a "method for producing a plunger lift well which optimizes production through the evaluation of the speed at which a plunger arrives at the wellhead within a fixed on-cycle interval. Time interval windows representing fast, good, and slow plunger performance are established and, based upon plunger performance with respect to these windows, afterflow time and off-cycle intervals are varied toward an achievement of plunger arrivals within the good window." '991 patent Abstract. *See also* '991 patent, col. 3, lines 11-23, Defendants' Post-Trial Brief at 14.

142. According to the '991 patent, "the well technician, relying on experience and judgment, selects a consistent on-cycle interval and, within that interval, windows are then set to reflect fast, good, and slow speeds for the plunger to arrive at the wellhead." '991 patent, col. 3, lines 24-28, col. 10, lines 2-10. The "fast" window starts at the beginning of the on-cycle and runs to the beginning of the "normal" or "good" window. The "slow" window starts at the end of the "normal" window and runs to the end of the on-cycle, as shown in the following trial exhibit, Plaintiffs' Exhibit 95:



Defendants' Post-Trial Brief at 14. Mega Systems says that "[a] key feature of the '991 invention is that the plunger arrival windows correspond to plunger (or well) performance: 'The plunger arrival windows are set by the operator based upon the judgment of well performance.' " Id., quoting '991 patent, col. 18, lines 56-57.

143. According to Mega Systems, "[t]he '991 patent optimizes well production in gas mode as follows: If the plunger arrives at the wellhead during the fast window, the method decreases off-cycle time or increases afterflow time. Conversely, if the plunger arrives at the wellhead during the slow window, the method for the '991 patent increases off-cycle time or decreases afterflow time. But the '991 patent's method will not change any of the operating times if the plunger arrives during the good-or normal window. Id. at 14-15, referencing '991 patent, col. 3, lines 34-43. Mega Systems again emphasizes that "the windows are defined by the operator, who relies on experience and judgment to select the proper windows." Id. at 15.

144. During trial, Mega Systems said that the primary non-infringement issue was that "we do not have a slow window, a good window, or a fast window." Tr. May 23, 2001, at 12. In its post-trial briefs, however, Mega Systems argues that the current version of the APC 1000 does not have a "good window." Specifically, Mega Systems asserts that "[t]he current version of Mega's APC 1000 (the 3-series) does not have a "good window" as described in the '991 patent. (Mega's version 2 did have a 'good window.' Mega sold ten of this model.)." Defendants' Post-Trial Brief at 15. Rather, according to Mega Systems, in the current version of the APC 1000, "the operator selects and enters into the controller only one value, a 'target time.' Alternatively, the operator enters the well depth, and the controller calculates the target time based on a given plunger speed. If the plunger arrives at the wellhead before the target time, the APC 1000 shortens the off-cycle, extends the afterflow time, or both." Id. On the other hand, according to Mega Systems, "[i]f the plunger arrives at the wellhead more than one minute after the target time, the APC 1000 extends the off-cycle, shortens the afterflow, or both." Id. As Mega Systems notes, "[i]t is this window-from the target time ("IT") to the target time plus one minute ("TT+1")-that Ferguson contends is the same "good window" described in the '991 patent." Id.

145. Mega Systems urges that in the '991 patent, the operator defines the "good window" by selecting and entering high-time and low-time settings, which correspond to normal plunger performance, into the controller, while "the operator of the APC 1000 selects and loads only one value into the computer-the target time (or well depth)." Id. Mega Systems points out that the APC 1000 automatically selects the second time-TT+1-"which bears no relation whatsoever to plunger performance." And, Megan Systems adds, "the APC 1000's alleged 'good window' cannot be changed-it is always one minute wide." Id. at 15-16.

146. With respect to the claims of the '991 patent, Mega Systems centers its non-infringement argument on the following step in claims 1 and 14:

assigning first values corresponding with the rate of movement of said plunger from said lower region to said wellhead which represent normal plunger performance

According to Mega Systems, Special Master Williams "construed the term 'values' in these claims as having 'more than one value,' " and "determined that 'values' must define a window of time, or time interval." ' Thus, Mega Systems says, "this 'assigning first values' claim element in Claims 1 and 14 requires that the user select two different values defining a time interval that 'represent[s] normal plunger performance,' or a 'good window.' " Id.

147. Mega Systems argues that the current version of the APC 1000 cannot infringe because its method of operation does not include that step. Specifically, Mega Systems reiterates that "[i]nstead of selecting two values defining normal plunger performance, the user enters a target time or the well depth. The APC 1000 controller then automatically adds one minute onto the target time." Id. Mega Systems notes that the APC 1000 thus "does select a window, or time interval," "[b]ut this window does not correspond to normal plunger performance. Rather it is an arbitrary, one-minute window regardless of the well condition." Id. Mega Systems concludes that because "the 'window' of the APC 1000 does not 'represent normal plunger performance,' " "the APC 1000 cannot infringe Claims 1 and 14 of the '991 patent." Id.

148. Claim 8 contains a similar step:

assigning select values corresponding with the rate of movement of said plunger from said lower region to said wellhead which represent predetermined plunger performance

which refers to "values." Mega Systems says that "values" indicates "more than one value" or a window of time, referring to Special Master Williams' Report, and thus concludes that this claim limitation "requires that multiple values be assigned, and that these multiple values represent plunger performance." Id. Mega Systems states: "The APC 1000 does not do this. Instead, the operator enters one value based on well depth or target time and the controller automatically adds one minute. But this one minute does not correspond to plunger performance." Id. Accordingly, Mega Systems urges that the APC 1000 does not infringe claim 8. Id.

149. In sum, Mega Systems says, "[s]imply put, the APC 1000 cannot infringe the '991 patent because the asserted independent claims require a step of "assigning * * * values [*i.e.,* more than one value] * * * corresponding with * * * [a] rate of movement * * * which represent normal [or predetermined] plunger performance. The APC 1000, by contrast, assigns only *one* value that corresponds to plunger performance-

the target time (or, alternatively, well depth, from which the controller calculates a target time). Neither the operator nor the controller selects or assigns a second value that corresponds to plunger performance. Rather, a rounding function in the control algorithm creates a one-minute period following the target time where the controller makes no adjustments to off time or afterflow." Defendants' Post-Trial Reply at 17. Thus, according to Mega Systems, "the latter value in the APC 1000's one-minute "window" bears no relation to plunger performance-normal, predetermined, or otherwise-and the APC 1000 cannot infringe the '991 patent." Id. at 17-18.

150. Ferguson Beauregard responds that the claims of the '991 patent do not require the well operator to set the beginning and end of the "good window." Ferguson Beauregard notes that Special Master Williams, when defining "predetermined * * * time increment" found that a "predetermined" time increment "may be preset by an operator or computed by a program algorithm." Plaintiffs' Post-Trial Reply at 19, quoting Special Master Williams' Report at 24. Ferguson Beauregard argues that "[t]here is no reason to find that timing representing 'predetermined plunger performance' recited in claim 8 and the 'normal plunger performance' recited in claims 1 and 14 could not likewise be computed by a program algorithm such as the one contained in the APC 1000." Id.

151. Ferguson Beauregard secondly responds that the fact that the "window" in the APC 1000 cannot exceed one minute does not avoid a finding of infringement because the specification of the '991 patent explains that an operator may "change the operating times to be more or less aggressive." Id., quoting '991 patent, col. 3, lines 33-34. Ferguson Beauregard further says that Special Master Williams found that an operator may do so "by widening *or narrowing* the window," id. at 19-20, quoting Special Master Williams' Report at 21 (emphasis by Ferguson Beauregard), and found "that the '991 patent allows the good window to be narrowed so long as it is not narrowed to the extent where low time and high time of the good window are the same and the good 'window,' in effect, is reduced to a single point." Id., quoting Special Master Williams' Report at 21, 23.

152. With respect to what Ferguson Beauregard perceives as Mega Systems' argument *vis-a-vis* "normal plunger performance," Ferguson Beauregard asserts that the '991 patent does not limit "normal plunger performance" to 600 to 800 feet of travel per minute, and points to testimony by Mr. Ronald Gibson, its expert, that "600-800 is just a ballpark, a yardstick for a person who lacks judgment to come up to a certain type of controller and use that as an initial range of operating velocities." Id. at 21, quoting Tr. May 24, 2001, at 15. Ferguson Beauregard concludes that "when the APC 1000 adds one minute to the 'target time' selected by the operator, the controller, by definition, represents normal or predetermined plunger performance under the '991 patent. Thus, the one-minute window, although aggressive, still falls under the claims of the '991 patent." Id.

153. Ferguson Beauregard also asserts that "an operator using the teachings of the '991 patent might select a one-minute good window," and that "in certain cases, the APC 1000's one-minute good window is tied to normal plunger performance even when one defines normal plunger performance as an average plunger velocity of 600 to 800 feet per minute." Id. at 22. Thus, Ferguson Beauregard concludes, "in at least some instances, the TT+1 good window does bear a relationship to Defendants' asserted definition of normal plunger performance," and that Mr. Bartley conceded that a one-minute good window would be appropriate for a well that was 2400 feet deep. Id.

154. Lastly, Ferguson Beauregard argues that the programming of the APC 1000 may be readily altered to provide for a larger or adjustable "good window," and that "the nature of Defendants' invention places

Defendants" in a position to continue or augment their alleged infringement "with little difficulty or even inconvenience." Id. at 23.

2. Discussion

155. According to Special Master Williams' Report, Ferguson Beauregard, during the *Mark-man* hearing, contended that "first values" in the limitation "assigning first values corresponding with the rate of movement of said plunger from said lower region to said wellhead which represent normal plunger performance" could, in fact, be a single value such that no "window" existed between the "first values." Special Master Williams' Report at 20. Special Master Williams rejected that argument based on the plain meaning of "values," *i.e.*, it is plural, and, in the context of the specification and prosecution file history, concluded that such "values" "must be different so as to define a window of time, or time interval. The 'values' cannot 'merge' so as to become the same and thereby transform the window into a single point in time." Id . at 23.

156. Special Master Williams did not address "assigning first values * * * *which represent normal plunger performance,*" [emphasis added.] namely the crux of the current dispute. However, Special Master Williams *did* conclude, in rejecting Ferguson Beauregard's argument, that "first values" (plural) meant different values. Normal grammatical construction, therefore, suggests that "first values * * * which represent" means that each of those different values, or the combination of those values, "represent normal plunger performance." That is confirmed by the specification which, for example, describes a scenario having an on-time interval of 30 minutes. In that instance, the fast window is defined as 0-12 minutes, the good window as 12-20 minutes, and the slow window as 20-30 minutes. '991 patent, col. 18, line 56-col. 19, line 16. In referring to that example, Special Master Williams concluded that "the 'first values' assigned by the well operator to correspond to normal plunger performance are 12 and 20 minutes." Special Master Williams' Report at 21. FN19

FN19. Special Master Williams also noted that the specification contained a typographical error. Special Master Williams' Report at 21 n.1.

157. Turning to the APC 1000, Mega Systems' arguments in its post-trial submissions relate solely to the current version of the APC 1000 which Mega Systems refers to as "the 3-series." Mega Systems apparently concedes that the prior "version 2" infringes the asserted claims of the '991 patent, noting, however, that only ten of that version were sold. Accordingly, "version 2" will be addressed below when the issue of damages is considered.

158. With respect to the current "3-series" of the APC 1000 in which the operator enters a single target time and the system generates a second TT+1 time, Ferguson Beauregard is correct that the claims do not require a manual input for each of the "values" constituting "first values." Although the specification of the '991 patent discloses such manual input, the claims simply call for "assigning" which is sufficiently broad to cover a situation in which the system automatically calculates or "assigns" a second different value that defines a window upon input of an initial value. Ferguson Beauregard is thus correct that automatically generating a second TT+1 time creates a "window" bounded by different times thus satisfying "first values" as Special Master Williams has construed that term. Ferguson Beauregard is also correct that "normal plunger performance" in the claims is not limited to any specific range, and that the testimony at trial supported the conclusion that 600-800 feet per minute was simply a "yardstick."

159. However, the evidence was clear, and Ferguson Beauregard does not dispute, that the TT+1 time generated by the current "3-series" APC 1000 does not *per se* represent "normal plunger performance." Although it is true, as Ferguson Beauregard says, that an operator "*might* select a one-minute good window," Plaintiffs' Post-Trial Reply at 22, and that examples discussed during trial resulted in a "good window" of approximately one minute, in those instances the one-minute "good window" was selected based on well parameters. For example, Mr. Gibson testified:

Q. Would a well operator ever select a good window of 1 minute?

A. He could.

Q. What would it depend on?

A. It would depend on how deep the well is and how comfortable he was that the well could recover if indeed a slow arrival occurred, how aggressively he wants to adjust the performance of the controller to-and also how frequently he could expect some sort of line disturbance or change in the operating system. If he's producing into a huge pipeline that never varies pressure and he's got a short flow line, there's very-there's very little chances of disturbances in his system, he can shrink that window down without fear of sending a lot of-making a lot of unnecessary changes, let's say.

Tr. May 24, 2001, at 41-42. Mr. Bartley's testimony, in response to the question "Would you use a one-minute good window?

A. Sure. If your well was exactly 2400 foot, then the six- to eight-hundred foot range of values would fit that almost exactly, I think.

Tr. May 25, 2001, at 83, similarly only establishes that given certain well parameters, a one-minute window may be chosen. In the instances discussed by Messrs. Gibson and Bartley, though, both the initial and second value have some relationship to "normal plunger performance." In the current "3-series" APC 1000 the TT+1 value does not bear any relationship to "normal plunger performance," and thus the current "3-series" APC 1000 cannot infringe the claims of the '991 patent.

160. With respect to Ferguson Beauregard's argument that the APC 1000 may be modified to provide for a wider window or an adjustable window, that a device may be modified such that it infringes is not a valid or sufficient ground for finding that the instant accused device infringes. *See* Kegel Co. v. AMF Bowling, Inc., 127 F.3d 1420 (Fed.Cir.1997).

B. Validity-"On Sale"

161. In light of the finding above that Mega Systems' APC 1000 does not infringe the asserted claims of the '991 patent, Mega Systems' additional argument that the '991 patent is invalid becomes somewhat academic. Nevertheless, that argument will be addressed for sake of completeness and in the event that the foregoing finding is found to be in error.

162. Mega Systems contends that the '991 patent is invalid under 35 U.S.C. s. 102(b) for having been "on sale" more than one year before the filing date of the application maturing into that patent. The filing date of

that patent is April 11, 1991. Therefore, the "critical date" is April 11, 1990.

163. Mega Systems contends that the evidence shows that on April 2, 1990, nine days before the critical date, Ferguson Beauregard shipped a "Liqui-Lift II Controller AutoCycle s/n 2219" to one of its customers. Defendants' Post-Trial Brief at 17. Mega Systems says the price was $1,500, Defendants' Exhibit 206, and that although the invoice is marked "Experimental Offer," Ferguson Beauregard did not introduce sufficient evidence to show that the sale was in connection with primarily an experimental use. Id. at 17-18. Specifically, Mega Systems argues that Ferguson Beauregard did not introduce evidence on the experimental use factors listed by the Federal Circuit in Lough v. Brunswick Corp., 86 F.3d 1113, 1120 (Fed.Cir.1996). *Id*. at 18. Mega Systems also contends that the testimony supports the conclusion that the AutoCycle that was the subject of that "sale" embodied the invention of the '991 patent. Accordingly, Mega Systems concludes that (1) an AutoCycle controller embodying the invention of the '991 patent was the subject of a commercial sale prior to the critical date, and (2) the invention at the time of that alleged "sale" was "ready for patenting." *See* Pfaff v. Wells Elec., Inc., 525 U.S. 55, 67, 119 S.Ct. 304, 142 L.Ed.2d 261 (1998).

164. Ferguson Beauregard responds that the evidence at trial was that the "sale" of that controller was not commercial in nature, but was for purposes of experimentation. Ferguson Beauregard points to testimony by Mr. Stan Morrow, president of Ferguson Beauregard, that the 2219 controller was a prototype, having a laminated faceplate, was installed for purposes of experimentation, and was not available for commercial sale until May 1990. Plaintiffs' Post-Trial Reply at 24. Ferguson Beauregard points out that both the invoice and the delivery ticket for the 2219 controller, Defendants' Exhibits 206 and 206B, stated that the "sale" was "experimental." *Id*.

165. With respect to the *Lough* factors, Ferguson Beauregard urges that the testimony at trial indicated that Ferguson Beauregard had manufactured several AutoCycle prototypes that were tested on wells over a period of approximately six months, and that Ferguson Beauregard received oral progress reports concerning the testing and functionality of the 2219 controller as well as the other AutoCycle controllers. Although there was no secrecy agreement between Beautech, Inc., the company that received the controller and which installed and serviced it, and Ferguson Beauregard, Ferguson Beauregard points out that there was a close relationship between the companies that negated any requirement for a secrecy agreement. *Id*. at 25-26. That is, Beautech was an exclusive distributor for Ferguson Beauregard and was wholly owned by Bo Beauregard, a co-founder and then president of Ferguson Beauregard. Ferguson Beauregard lastly urges that the testimony demonstrated that Ferguson Beauregard maintained control over the testing of the initial AutoCycle controllers. *Id*. at 26.

166. Ferguson Beauregard also urges that the evidence did not support a conclusion that the 2219 controller was "ready for patenting" in early April 1990. *Id*. Ferguson Beauregard notes that the controller at issue was a "Liquilift II" controller that entered the market in the early 1980s, but that the 2219 controller used different software and a different algorithm. *Id*. at 27. Ferguson Beauregard argues that "[t]here was no evidence at trial as to how the software in the 2219 controller operated, whether it was even functional, or whether it utilized any or all of the teachings that ultimately became the subject of the '991 patent." Id. Ferguson Beauregard points out that testimony that Mega Systems relies on was inconclusive, *i.e*., the deponent actually testified that he could not recall anything specific about an installation for the 2219 controller and could have installed the controller after the April 2, 1990 date. In short, Ferguson Beauregard urges that there is no clear and convincing proof that the 2219 controller was either ready for patenting or the subject of a commercial sale prior to the critical date. Id. at 27-28.

167. Mega Systems' arguments primarily fail for want of proof. As Mega Systems notes, in order to show that claims are invalid under the "on-sale" bar of s. 102(b), *Pfaff* requires proof that, prior to the critical date, a product embodying the claimed invention is the subject of a commercial offer for sale, and that the claimed invention was, at the time of the alleged "sale," "ready for patenting." The Supreme Court in *Pfaff* noted that the second condition may be satisfied "in at least two ways," namely (a) "by proof of reduction to practice before the critical date," or (b) "by proof that prior to the critical date the inventor had prepared drawings or other descriptions of the invention that were sufficiently specific to enable a person skilled in the art to practice the invention." 525 U.S. at 68. Clear and convincing proof is required both that (1) a product embodying the claimed invention was the subject of a commercial sale or offer for sale prior to the critical date, and (2) at that time the claimed invention was "ready for patenting." In other words, even though an invention may have been "ready for patenting" at the time of the alleged "on sale" activity, the party asserting invalidity must nevertheless provide clear and convincing evidence that the ultimately claimed invention was, in fact, embodied within the product assertedly placed "on sale." *See* Tec Air, Inc. v. Denso Mfg. Michigan Inc., 192 F.3d 1353 (Fed.Cir.1999)(the sale documents did not establish that fans placed "on sale" were made using the ultimately claimed method.). Also, the Federal Circuit has held that a "commercial offer for sale" means a formal offer in a contract sense. *See Group One, Ltd. v. Hallmark Cards, Inc.*, --- F.3d ---- (Fed.Cir.2001). The Federal Circuit has further held that in order for an "invention" to be "on sale" under s. 102(b), there must be evidence of a complete conception and "the test for determining whether that invention is complete also requires proof that the invention was enabled prior to the critical date." Robotic Vision Sys., Inc. v. View Eng'g, Inc., (Robotic Vision II), 249 F.3d 1307, 1313 (Fed.Cir.2001).

168. The '991 patent has some 22 claims of varying scope and complexity, some of which are reproduced above. Ferguson Beauregard is asserting infringement of claims 1-3 and 5-15. Mega Systems, however, made little effort during trial or in its post-trial submissions to present proof that the 2219 controller actually embodied the limitations of the asserted claims, or, indeed, any of the claims of the '991 patent. It is at least questionable whether this Court has subject matter jurisdiction to adjudge the validity of claims that have not been asserted to have been infringed. That is, there is no private cause of action to cancel or invalidate patents. Mowry v. Whitney, 81 U.S. (14 Wall.) 434, 20 L.Ed. 858 (1872).

169. Even with respect to those claims asserted to have been infringed, Mega Systems asked Jack Rogers, the inventor of the '991 patent, questions such as "The Auto-Cycle series of controllers uses the methods described in your patent; is that correct?" and "Are there any controllers sold during your tenure as manager of engineering and manufacturing for Ferguson Beauregard that have the Auto-Cycle name that do not incorporate the methods stated in your '991 patent?" Tr. May 25, 2001, at 116-17. Mega Systems notably did not ask Mr. Rogers the most pertinent question whether the 2219 controller actually incorporated all of the elements of any of the asserted claims of the '991 patent, or, indeed, any of the other claims of the '991 patent. There is no substantial evidence of record that the 2219 controller that was allegedly "on sale" actually incorporated the limitations of the claims being asserted against Mega Systems' APC 1000 controller, or any of the other claims in the '991 patent.

170. Asserting that a claim (or claims) is invalid under s. 102(b) because the invention defined by such claim has been "on sale" is no different than, for example, asserting that a claim (or claims) is invalid based on the disclosure of a printed publication having an effective date prior to the critical date. In both instances, the assertion is that the claimed invention is "anticipated" by (1) a prior publication, or (2) a product that has been placed "on sale" within the meaning of s. 102(b). In both instances, the burden is on the party asserting invalidity to show, by clear and convincing evidence, that all of the limitations of a particular claim (or

claims) is disclosed in or embodied in the publication or product. Mega Systems' proof falls short. Mega Systems would have the Court assume that, based on Mr. Rogers' testimony, the 2219 controller actually met every limitation of every claim in the '991 patent. That is insufficient, particularly in light of the clear and convincing burden of proof, for a fact finder to conclude that all claims of the '991 patent, including claims that Ferguson Beauregard has not asserted, are invalid under s. 102(b).. Such insufficiency is further confirmed by the fact that each claim of a patent is presumed valid independently of other claims. 35 U.S.C. s. 282. Patents are valuable property interests that may not be so easily and summarily found invalid. Mega Systems called Mr. Rogers as a witness and had the opportunity to examine him about the 2219 controller, but did not. The broad testimony that was elicited does not establish, at least to a clear and convincing level of proof, that the 2219 controller actually met all of the limitations of the asserted claims of the '991 patent, or any other claims of the '991 patent.

171. Furthermore, the testimony and evidence adduced at trial did not establish that the 2219 controller was actually "sold" prior to the critical date. When Mr. Morrow was asked on cross-examination, for example:

Q. (By Mr. Van Cleef) On the invoice, invoice for the 2219 controller, what does the term or what does "experimental offer" mean? Does that mean that the item was offered for experimental use or what does that mean?

the response was:

A. That means that it was still a prototype controller. It was something that we were still in the process of testing the algorithm. It was not something that we made commercially available yet.

Tr. May 21, 2001, at 110-111. Although Mega Systems attempted to discredit Mr. Morrow's testimony, Mega Systems did not introduce any rebuttal proof. Mr. Morrow, in reviewing the documents, also believed that the actual "ship date" for the 2219 controller was April 9 rather than April 2. Id. at 100.

172. Similarly, during trial, the testimony indicated that the dates in the "invoice" and related exhibits did not necessarily represent the actual day that events occurred. The testimony during trial also indicated that the person who would know whether the 2219 controller had been "sold" prior to the critical date was Jack Hunter, and arrangements, at Mega Systems' insistence, were made for his deposition. However, Mr. Hunter's recollection of the 2219 controller and what occurred *vis-a-vis* the 2219 controller were at best uncertain. In a nutshell, even with the addition of Mr. Hunter's deposition testimony, Mega Systems did not produce competent, credible, clear and convincing proof that the a product embodying *all* of the elements of *all* claims of the '991 patent had been placed "on sale" prior to the critical date.

173. As the record now stands, the 2219 controller may or may not have embodied all of the elements of one or more of the claims asserted against Mega Systems, or one or more of the other claims in the '991 patent. The transaction that Mega Systems relies on may or may not have been a commercial sale. The 2219 controller may or may not have contained software (recognizing that the '991 claims are directed to methods) that was "ready for patenting" either in the sense that such software had been reduced to practice or that there was a complete conception of such software. Mega Systems produced no evidence that the actual software in the 2219 controller had been reduced to practice at that time, or that, at the time of the alleged "sale," there was a complete enabling conception, whether in the manner permitted by *Robotic Vision* II, or otherwise. The counter-vailing evidence was that the 2219 controller was part of Ferguson Beauregard's "experimental" development of its controllers, that the "sale" was not necessarily a

"commercial sale," that the 2219 controller did not necessarily include all of the limitations of the '991 patent claims, and that at least the software in the 2219 controller, and hence the method performed by the controller, may or may not have reduced to practice, or, indeed, fully conceived in the sense of a complete conception. After all, the classic definition of "conception" adopted universally by the courts and the U.S. Patent and Trademark Office for over 100 years has been: "Conception is the formation in the mind of the inventor of a definite and permanent idea of the complete and operative invention as it is thereafter to be applied in practice." Mergenthaler v. Scudder, 11 App. DC 264 (1897). Perhaps the 2219 controller met those requirements, perhaps not. The "perhaps," indicating the state of the current record and Mega Systems' quantum of proof, effectively decides the issue.

174. Mega Systems has not satisfied its burden of proving, by a clear and convincing standard of proof, that the asserted claims of the '991 patent, or any of the claims of the '991 patent, are invalid due to the "on sale" bar of s. 102(b).

IX. Bartley's Personal Liability

175. Liability for patent infringement extends to "whoever actively induces infringement of a patent." 35 U.S.C. s. 271(b). Corporate officers who actively aid and abet infringement by their corporations may be personally liable for inducing infringement under s. 271(b) regardless of whether the "corporate veil" is pierced and regardless whether the corporation is shown to be the alter ego of the corporate officer. *See* Ortbokinetics, Inc. v. Safety Travel Chairs, Inc., 806 F.2d 1565 (Fed.Cir.1986). Proof of intent to induce infringement is a necessarily element, but may be satisfied through circumstantial evidence. *See* Water Techs. Corp. v. Calco, Ltd., 850 F.2d 660 (Fed.Cir.1988). Inducement also requires evidence that the accused infringer had actual or constructive notice of the asserted patent or patents. See Insituform Tech. Inc. v. Cat Contr. Inc., 156 F.3d 1199 (Fed.Cir.1998). In general, a patentee must show that the individual charged with inducement took actions that actually induced infringement and that such individual knew or should have known that such actions would induce direct infringement. *See Micro Chem. Inc. v. Great Plains Chem. Co.,* 194 F.3d 1258 (Fed.Cir.1999); Manville Sales Corp. v. Paramount Sys., Inc., 917 F.2d 544, 553 (Fed.Cir.1990)("it must be established that the defendant possessed specific intent to encourage another's infringement and not merely that the defendant had knowledge of the acts alleged to constitute infringement.").

176. Ferguson Beauregard asserts that Mr. Bartley is personally liable for having actively induced Mega Systems to directly infringe the '721, '376 and '991 patents. *See* Plaintiffs' Post-Trial Reply at 28-33.FN20 Ferguson Beauregard says that the evidence at trial "clearly showed that Defendant Bartley was the 'moving force' behind Defendant Mega Systems' decisions to make, use, sell, and encourage others to use the APC 1000 controller, each of which constitutes an infringement of the '721, '376, and '991 patents." Id. at 28.

FN20. Ferguson Beauregard's Second Amended Complaint asserts that "Defendant James Bartley has admitted that he is the 'principal officer and owner of Mega," and that "[a]s such, Defendant James Bartley in such capacity as an officer and owner of Defendant Mega has knowingly initiated and participated in, including approving, such acts of infringement by Defendant Mega of [the '721 patent]. As such, the Defendant Mega Systems, L.L.C., is believed to be the alter ego of Defendant James Bartley." Second Amended Complaint, Counts IV. Similar allegations are *vis-a-vis* the '376 and '991 patents. Second Amended Complaint, Counts V and VI. In its post-trial submissions, however, Ferguson Beauregard asserts only infringement by inducement. Ferguson Beauregard does not argue that Mr. Bartley is the "alter ego" of Mega Systems. Accordingly, any assertions that Mr. Bartley is individually liable for infringement as a

result of actions by Mega Systems based on an "alter ego" theory are deemed withdrawn.

177. Mr. Bartley knew about the '721 and '376 patents as early as 1987 or 1988, and had read both patents before designing any version of the APC 1000 software. Tr. May 23, 2001, at 95, 98. Mr. Bartley, indeed, worked at Ferguson Beauregard in 1987 and '88. Id. at 94-95. Mr. Bartley learned of the '991 patent in June or July of 1996, when he saw an AutoCycle controller on a well. He noted the patent number and then acquired the patent. Id. at 95. He was not aware of the '991 patent when he wrote versions 1 and 2 of the APC 1000 software, but testified that version 3 "was a direct result of reading the '991 patent." Id. at 97. When he became aware of the '991 patent, he stopped selling version 2 of the APC 1000. Tr. May 24, 2001, at 142. By that time he had sold ten units. Id. Mr. Bartley testified that at the time he began working on the APC 1000, he was aware of the Digitrol and LiquiLift controllers, and used knowledge that he had gained from working on those controllers at Ferguson Beauregard in developing the APC 1000. Id. at 146-47. Mr. Bartley testified, however, that he believed a "key difference" between the LiquiLift controller and the APC 1000 was "that the LiquiLift had to be run at a very low frequency in order to save power * * *." Id. at 147. That, of course, was one of the defenses raised at trial, and is addressed above.

178. In general, the evidence adduced by Ferguson Beauregard does not show that Mr. Bartley "possessed specific intent to encourage" acts of direct infringement by Mega Systems, even if all of the asserted claims of the '721, '376 and '991 patents were found to have been infringed. Ferguson Beauregard argues that *Manville* does not "impose a requirement that the alleged inducer have made the legal determination that the actions induced would rise to the level of infringement." Plaintiffs' Post-Trial Reply at 29. Perhaps not to that degree. But the Federal Circuit has likewise recognized that inducement has a knowledge and intent requirement. *See Micro Chem., supra*. In Manville, 917 F.2d at 553, for example, the Federal Circuit explained that "The plaintiff has the burden of showing that the alleged infringer's actions induced infringing acts *and* that he knew or should have known his actions would induce actual infringements." In National Presto Indus., Inc. v. West Bend Co., 76 F.3d 1185 (Fed.Cir.1996), in concluding that s. 271(b) cannot reach acts committed before the asserted patent issues, the Federal Circuit observed that "[t]he statutory liability for inducement of infringement derives from the common law, wherein acts that the actor knows will lead to the commission of a wrong by another, place shared liability for the wrong on the actor," citing Sims v. Western Steel Co., 551 F.2d 811, 817 (10th Cir.1977)(comparing inducer of infringement to an accessory before the fact). The Federal Circuit further observed that "[a]s discussed in Camp v. Dema, 948 F.2d 455 (8th Cir.1991) with respect to violation of the securities laws, 'aiding and abetting not only requires assistance, but also knowledge of a wrongful purpose." ' Although those comments were made in the context of concluding that liability for "aiding and abetting" the wrongful acts of others cannot be imposed retroactively, which is not a consideration here (*i.e.,* the subject patents had issued at the time of Mr. Bartley's conduct), nevertheless, the underlying rationale remains applicable.

179. Although Mr. Bartley no doubt actively participated in causing Mega Systems to develop and market the APC 1000 that is now accused of infringing Ferguson Beauregard's patents, there was no evidence that he did so with "knowledge of a wrongful purpose," or that "he knew or should have known his actions would induce actual infringements." Accordingly, regardless of whether Mega Systems is ultimately found liable for infringement of the '721, '376 and '991 patents-in-suit, Ferguson Beauregard has not shown that Mr. Bartley is individually liable under s. 271(b) for having induced infringement.

X. Damages

180. Following proof of infringement, "the court shall award damages adequate to compensate for the infringement but in no event less than a reasonable royalty for the use made of the invention by the infringer." 35 U.S.C. s. 384. "Damages adequate to compensate for the infringement" means full compensation for any damages that the patent owner suffered as a result of the infringement. General Motors Corp. v. Devex Corp., 461 U.S. 648, 654, 103 S.Ct. 2058, 76 L.Ed.2d 211 (1983).

181. Although the foregoing finds that Mega Systems' APC 1000 controller does not infringe either the '721 or '991 patents (except for ten "series 2" units), the APC 1000 controller *was* found to infringe the '376 patent. Accordingly, Ferguson Beauregard is entitled to damages.

182. The '376 patent issued on October 5, 1982, and therefore expired on October 5, 1999. As an aside, the '721 patent issued on April 24, 1979, and therefore expired on April 24, 1996. With respect to a reasonable royalty, Ferguson Beauregard presented evidence through its president, Mr. Morrow, that a minimum reasonable paid-up royalty for infringement of those two patents, prior to expiration, would be "[s]omewhere in the range of $100,000." Tr. May 21, 2001, at 52. Agreements introduced during trial, Plaintiffs' Exhibit Nos. 40, 41, 42 and 43, that included the '721 and '376 patents, reflected paid-up royalties ranging from approximately $300,000 to over $800,000. Id. at 40-46. However, those agreements also covered the '991 patent. Thus, those agreements do not necessarily support a conclusion that there is an established royalty rate for the '376 patent. Nevertheless, Mega Systems has not presented any evidence or argument in its post-trial submissions on the question of damages at all, and thus is viewed as conceding that $100,000 would constitute a reasonable paid-up royalty for infringement of the '376 patent while it was in effect. In all events, Mega Systems did not introduce any evidence rebutting Mr. Morrow's testimony that a reasonable royalty would be "in the range of" $100,000.

183. Ferguson Beauregard also introduced evidence of lost profit damages. In order to establish an entitlement to lost profits damages, a patent owner must show, by a preponderance of the evidence, that the patent owner would have made the allegedly lost sales "but for" the infringement. *See* Rite- Hite Corp. v. Kelley Co., 56 F.3d 1538 (Fed.Cir.)(*en banc*), *cert. denied,* 516 U.S. 867, 116 S.Ct. 184, 133 L.Ed.2d 122 (1995). However, the patent owner need not negate all possibilities that a prospective purchaser might have bought a different product or might have foregone the purchase altogether. *See* State Indus., Inc. v. Mor-Flo Indus., Inc., 883 F.2d 1573, 1577 (Fed.Cir.1989), *cert. denied,* 493 U.S. 1022, 110 S.Ct. 725, 107 L.Ed.2d 744 (1990). One approach to establishing lost profits damages, *see* Ryco Inc. v. Ag-Bag Corp., 857 F.2d 1418 (Fed.Cir.1988)., is to establish the four factors set out by the court in Panduit Corp. v. Stahlin Bros. Fibre Works, Inc., 575 F.2d 1152, 1156 (6th Cir.1978)(Markey, Chief Judge, U.S.Ct. of Customs and Pat.App., sitting by designation). Those factors are "(1) demand for the patented product, (2) absence of acceptable noninfringing substitutes, (3) his [the patent owner's] manufacturing and marketing capability to exploit the demand, and (4) the amount of the profit he [the patent owner] would have made."

184. Ferguson Beauregard presented unrebutted testimony that it had sold some 5000 AutoCycle controllers during 1993 and through the first quarter of 2001, and that the controller was popular. Ferguson Beauregard urges that evidence suffices to show product demand. Plaintiffs' Post-Trial Brief at 33. Ferguson Beauregard is correct. *See* Gyromat Corp. v. Champion Spark Plug Co., 735 F.2d 549 (Fed.Cir.1984)(demand shown by combining the total sales of the patent owner and the infringer). Ferguson Beauregard secondly produced unrebutted evidence that in the states in which Mega Systems was doing business, namely Texas and Louisiana, there were no non-infringing substitutes. Tr. May 21, 2001, at 52, 54. Thirdly, Ferguson Beauregard produced unrebutted evidence that it had the capability to produce a sufficient number of AutoCycle controllers to exploit the demand, and could have done so without any additional personnel or

additional work shifts. *Id*. at 53-54. Lastly, Ferguson Beauregard presented unrebutted evidence that its average gross margin for its AutoCycle controllers, determined by deducting all variable costs, during 1996 to 2000, was $837.00 per controller. Ferguson Beauregard thus asserted $502,000 in lost profits damages based on sales of 600 APC 1000 controllers.

185. Ferguson Beauregard is entitled to lost profits damages. However, the testimony concerning the number of APC 1000 controllers actually sold, namely 600, covered the time period "since the company was started" to the time of trial. Tr. May 23, 2001, at 74. As noted above, the '376 patent expired on October 5, 1999, and Ferguson Beauregard is not entitled to damages after that date. Accordingly, if Ferguson Beauregard chooses to pursue a claim for lost profits damages, an accounting will be necessary. Alternatively, Ferguson Beauregard may accept reasonable royalty damages in the amount of $100,000.

XI. Mega Systems' United States Patent No. 4,921,048 (the '048 Patent)

A. Background re Ownership of the '048 Patent

186. The '048 patent issued to Robert W. Crow *et al*. on May 1, 1990, and was most recently assigned to Mega Systems by Camco International Inc. by assignment dated September 14, 1999, Defendants' Exhibit 201, after having been revived after failure to pay the 7 1/2 year maintenance fees due November 1, 1997. That has given rise to Ferguson Beauregard's contention that the '048 patent was revived "improperly." That contention is addressed below.

B. Disclosure of the '048 Patent

187. In general, Mega Systems' '048 patent-in-suit is also drawn to a programmable system and method for optimizing the operation of a plunger completion oil or gas well. The system and method provides for an "oil well mode" and a "gas well mode." A controller monitors whether or not the plunger arrives during an "on-time" cycle of intermitting the well, and changes either the off-time or the exhaust-time for the next cycle in response thereto. In the oil well mode, the off-time is decreased slightly for each cycle following a cycle in which plunger arrival occurred during a selected "on-time" and increased slightly for each cycle following one in which plunger arrival did not occur during that time. In the gas well mode, the exhaust time is increased slightly for each cycle following a cycle in which plunger arrival occurred before the on-time expired and decreased slightly for each cycle following one in which plunger arrival did not occur. '048, Abstract. In the gas well mode, the off-time can also be modified. '048 patent, col. 11, lines 11-15.

188. In connection with Fig. 1:

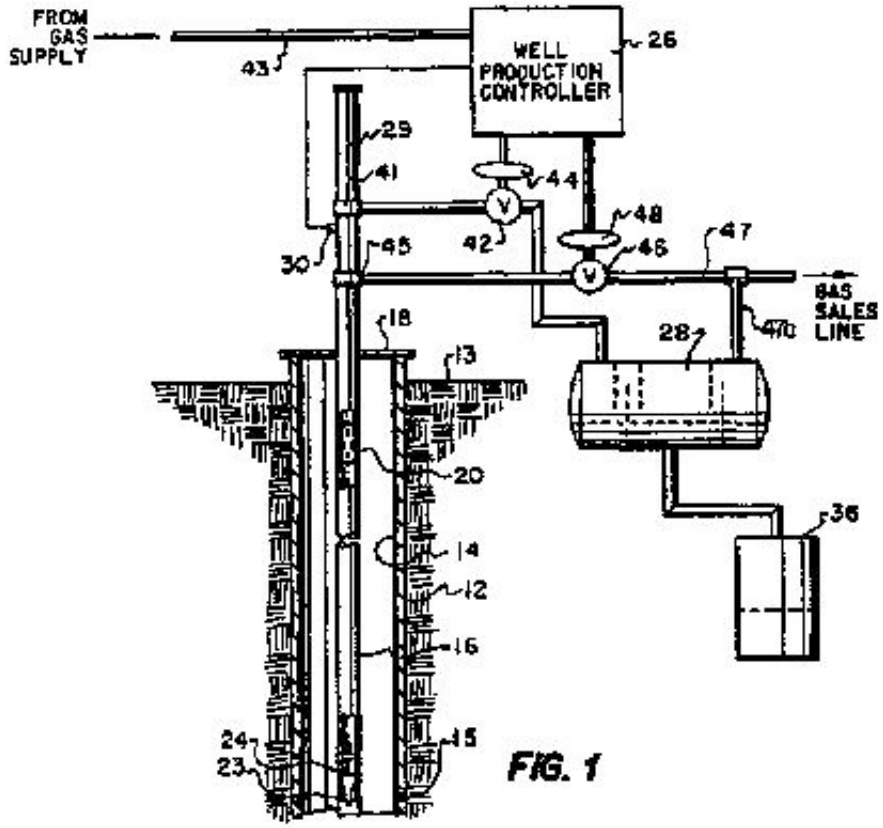


FIG. 1

the '048 patent explains that a borehole 12, extending from the surface to a producing strata, is lined with tubular casing 14 having perforations 15 that allow fluid communication between the strata and the well. A tubing string 16 extends axially down casing 14. A wellhead 18 provides support for the tubing string. A plunger 20 rides within tubing 16. The upper end of the tubing 16 is connected to a T-connector 41 and a motor valve 42 and into a low pressure fluid delivery line leading to a separator 28. Motor valve 42 is actuated by a pair of "on" and "off" solenoids 44 under control of a well production controller 26. Those solenoids control the flow of pressurized air or gas supplied via line 43. The upper end of the tubing 16 is also connected to a T-connector 45 through motor valve 46 to a high pressure gas sales line 47. Motor valve 46 is actuated by "on" and "off" solenoids 48 under control of controller 26. '048 patent, col. 7, line 50-col. 8, line 38.

189. In the "oil well mode," plunger lift completion is "closed in" for a pre-selected time period during which sufficient formation gas pressure is developed within the casing 14 to move the plunger 20, along with the fluids accumulated within the casing 14, to the surface when motor valve 42 in tubing 16 is opened. That time period is described as "off time." The cycle is then begun by opening the motor valve 42. As the plunger 20 rises to the surface in response to the accumulated downhole casing pressure, accumulated fluids, oils and/or water carried by the plunger 20 pass out through T-connector 41, through the low pressure fluid line and into the separator 28. When plunger arrival sensor 30 detects that plunger 20 has reached the surface and is positioned in the lubricator 29, sensor 30 provides a signal to the controller 26 that closes motor valve 42 and ends the cycle. Plunger 20 will then fall down tubing 16 and the cycle continues. If well production controller 26 does not, within a pre-selected "on-time" period, detect a signal from the plunger arrival sensor 30 indicating that the plunger has reached the surface and is positioned in the lubricator 29, the controller recognizes that the downhole casing pressure was insufficient to raise the plunger all the way to the surface and complete a round-trip. After expiration of the selected "on time" period, controller 26 again

closes the motor valve 42 and begins another off-time period for the well of a slightly greater duration than the previous off-time to ensure that the plunger will cycle and reach the surface the next time the motor valve 42 is opened. On the other hand, if controller 26 receives a signal from plunger arrival sensor 30 indicating that plunger 20 has reached the surface, delivered its load of fluid and is positioned in lubricator 29, the controller again closes the motor valve 42 and then begins to time the off-time cycle. But since the well completely cycled during the last time the motor valve 42 was opened, controller 26 changes the length of the off-time period of the well to decrease it by a pre-selected incremental value. Thus, controller 26 attempts to cause the plunger 20 to again complete a round-trip cycle but in response to a downhole pressure that is allowed to build during a slightly shorter off-time than during the previous cycle. Controller 26 continues to decrease the off-time by an incremented value each time the well successfully cycles until, eventually, the plunger 20 does not quite reach the plunger arrival sensor 30 and its fully up position in the lubricator 26. '048 patent, col. 8, line 40-col. 10, line 5.

190. The '048 patent explains that the goal of optimizing well operation comes from decreasing the off-time periods with a resulting increase in the number of round trips that the plunger can make during a selected time period:

Decreasing the off-time period of the well results in a fractional increase in the number of roundtrips which the plunger can make during a given time period. The controller 26 continues to decrease the off-time by an incremented value each time the well successfully cycles until, eventually, the plunger 20 does not quite reach the plunger arrival sensor 30 and its fully up position in the lubricator 26. *In this way, the controller 26 determines the absolute minimum value off-time period which will result in the plunger making a complete round-trip for the particular well conditions existent at that particular point in time*. [Emphasis added.]

'048 patent, col. 9, lines 36-47.FN21

FN21. In the background portion, the '048 patent also explains:
A conservative approach to the intermitting of a well results in substantial waste of potential production capacity of the well. That is, in the case of a plunger completion oil well, the production flow from the well is directly related to the number of trips which the plunger makes from the bottom of the well to the wellhead in a given time period. Each time the plunger cycles and makes a round trip from the bottom, it delivers a slug of fluid as the production output from the well. Thus, it is desirable to allow the plunger to remain at the bottom only long enough to have the bottom hole pressure build to a value sufficient to raise the plunger all the way to the surface and complete a full cycle. * * * *
In the case of a plunger completion gas well, the quantity of production gas from the well is directly related to the length of time that the well can be left in an open and flowing condition without closing it in to cycle the plunger and clear accumulated fluids from the well to allow the free flow of gas from the well. * * *

'048 patent, col. 4, lines 45-57 and col. 5, lines 1-6. However, the '048 patent also explains the dangers of attempting to cycle a well too quickly:
Attempting to cycle the well too quickly results in the bottom hole pressure not building to a value large enough to raise the plunger all the way to the surface and its stopping its travel at some intermediate point and being unable to go further. This condition then requires the well to be again shut in. Failure of the bottom hole pressure to build to a sufficient value to clear the well the second time it is opened for flow runs the risk of loading the well and the required time and expense of swabbing the well before it can be

again placed in production.

* * * * Attempting to not leave the well closed for a sufficiently long period to build sufficient bottom hole pressure to raise the plunger all the way to the surface and fully clear the well of fluid again risks loading of the well and the cessation of production from the well until it has been cleared.

'048 patent, col. 4, lines 58-68 and col. 5, lines 6-12. That was earlier explained in the specification:
A major factor to be considered in well operation is that throughout the intermitting of a well, the operator should guard against having the well "load up". This is a condition in which so much fluid is accumulated in the well bore that the maximum casing pressure of which the well is capable is insufficient to raise the plunger to the surface and purge the well of the accumulated fluids. Once a well loads up, it must be specially treated to remove the fluids from within the well and allow the intermitting process to begin again. Thus, if the well is not periodically "shut in" for a long enough period of time to allow sufficient down-hole casing pressure to accumulate in order to raise the plunger all the way to the surface and completely clear the well when the valve at the wellhead is opened, it will require even greater casing pressure to do so the next time the valve is opened. The value of the accumulated downhole casing pressure is generally a direct function of the length of time during which the well is "shut in" before the surface valve is opened again.

'048 patent, col. 3, line 64-col. 4, line 15.
191. That sequence of gradually attempting to locate the minimum "off-time" is discussed throughout the '048 patent. For example, in connection with Fig. 3 which illustrates a block diagram of controller 26:

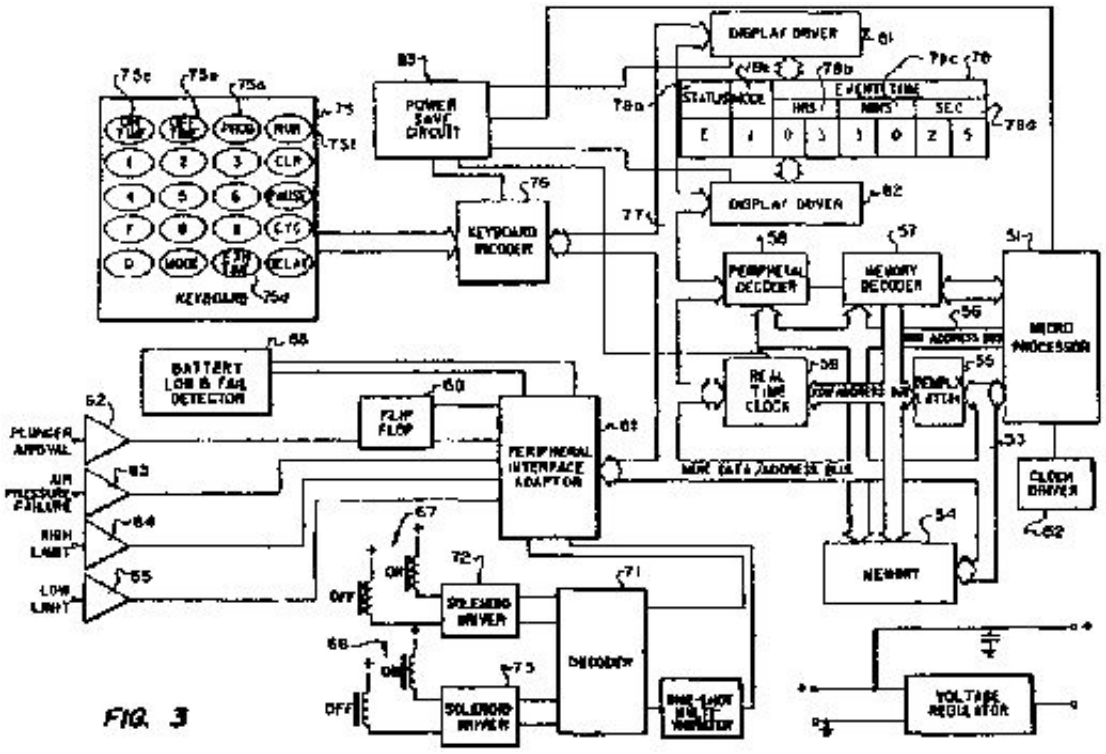
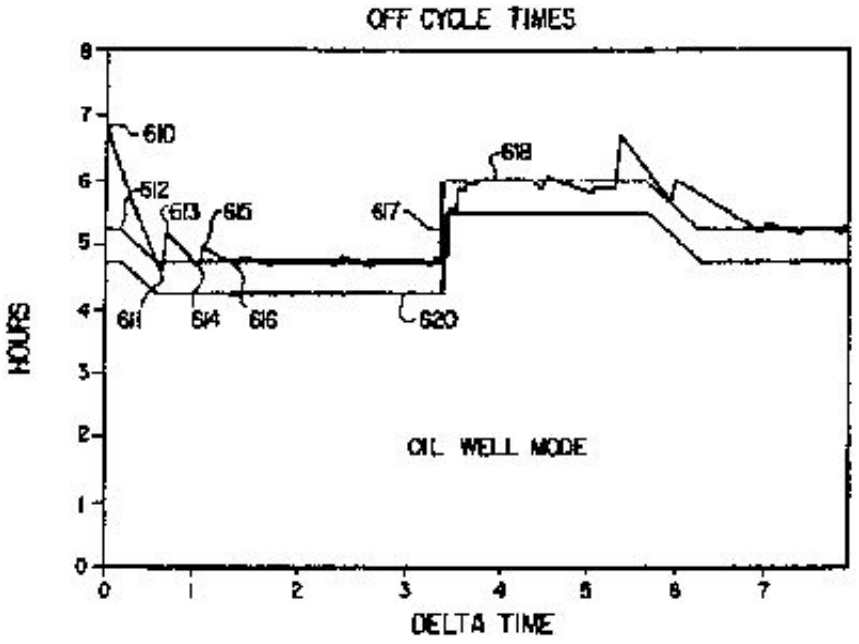


FIG. 3

the '048 patent explains:

Once the controller has successfully cycled the well for the first time with the pre-selected initial off-time, during the next cycle the off-time is decreased by a pre-selected "delta time" to attempt to cycle the well with an off-time of slightly less duration. If this off-time is again successful at accumulating sufficient downhole casing pressure to raise the plunger all the way to the surface, the off-time is again decreased by a "delta time". *This sequence is repeated to gradually locate the minimum off-time for the current operating conditions of the well by achieving the state in which the plunger does not quite reach the plunger arrival detector* and the micro-processor 51 does not receive a signal from the peripheral interface adapter 61, the flip-flop 60 and the operational amplifier 62 indicative of plunger arrival at the surface prior to the expiration of the on-time period initially selected at the maximum time-out period allowed in the event the plunger did not arrive. Once the plunger has failed to arrive before time-out on a particular cycle, the micro-processor 61 then automatically closes the first motor valve and adjusts the off-time period to increase it slightly by a pre-selected value to attempt to again cycle the plunger as a result of the downhole pressure having build-up over a slightly increased off-time period. In the event the system is then successfully cycled and a plunger arrival signal is received from operational amplifier 62 before time-out on the next cycle, the controller again attempts to decrease the off-time period by a delta-time. *In this way the controller functions to maintain a constant balance of continuing to decrease the off-time period to the very minimum allowable for cycling of the plunger*. [Emphasis added.]

'048 patent, col. 14, line 65-col. 15, line 28. Further, in connection with Fig. 8A:



the '048 patent explains "there is shown an illustrative graph of the off times of the system of the present invention operated in the oil well mode. This graph serves to illustrate the manner in which the controller of the present invention continually decreases the length of the off cycle time periods by incremental values

over the period of operation to attempt to achieve optimum fluid production from the well." '048 patent, col. 19, lines 23-30. Curve 612, according to the '048 patent, represents "the upper limit of the length of [the] off time period following which the plunger is sure to reach the surface." '048 patent, col. 19, lines 43-46. Curve 620 "represents the theoretical off-time periods for the well for which the plunger is sure not to cycle." '048 patent, col. 19, line 68-col. 20, line 2. "Off-time periods falling the space between them may or may not cause the plunger to cycle. Thus the controller continually searches for an off-time lying on the ideal upper line 612." '048 patent, col. 20, lines 2-5.FN22

FN22. As background, the '048 patent further explains:
Because of the changing conditions within the well, in the reservoir within which the well is located, and in the external equipment connected to the output from the well, the rate at which the bottom hole pressure builds toward a value which is sufficient to cycle the plunger continues to vary throughout the life of the well. A controller which constantly evaluates the success with which the plunger is being repeatedly cycled and attempts to reduce the off-time while still successfully cycling the plunger would tend toward optimizing production from the well.

'048 patent, col. 5, lines 13-23.
192. The gas well mode is similar. In the gas well mode, after expiration of the off-time, motor valve 42 is opened to start the plunger 20 up tubing 16. When plunger arrival sensor 30 detects that plunger 20 is positioned in the lubricator 29, and the slug of liquid carried by the plunger 20 has been delivered to the separator 28, controller 26 closes motor valve 42 and simultaneously opens motor valve 46 to allow the high pressure formation gases to pass through T-connector 45 and out the high pressure gas sales line 47. After a preselected time period, referred to as "exhaust-time," motor valve 46 is again closed to shut in the well. Controller 26 detects whether plunger 20 was driven up and produced a plunger arrival sensor signal during a pre-selected "on-time" period on each successive cycle. If so, controller 26 increases the length of the exhaust time period. The controller therefore attempts to extend the exhaust time period during which production gas is allowed to flow from the well on each successive cycle. If following an "on-time" period, controller 26 detects that the plunger arrival sensor 30 has not detected arrival of plunger 20 within the pre-selected on time period, the controller recognizes that the downhole casing pressure did not reach a large enough value during the off-time period to fully cycle the plunger when the motor valve was opened. Controller 26 then skips the exhaust time period which would normally follow the on time and re-enters the off time period. The controller also modifies the time periods such that during the next succeeding cycle, the exhaust-time period is decreased slightly to allow the bottom hole pressure to build to fully cycle the plunger the next time the motor valve is opened. '048 patent, col. 10, line 6-col. 11, line 15.

193. Thus, in the gas well mode, the controller continually maximizes the length of the exhaust time periods to optimize well performance. *See* '048 patent, col. 15, lines 47-col. 16, line 28. In connection with Fig. 8B, for example:

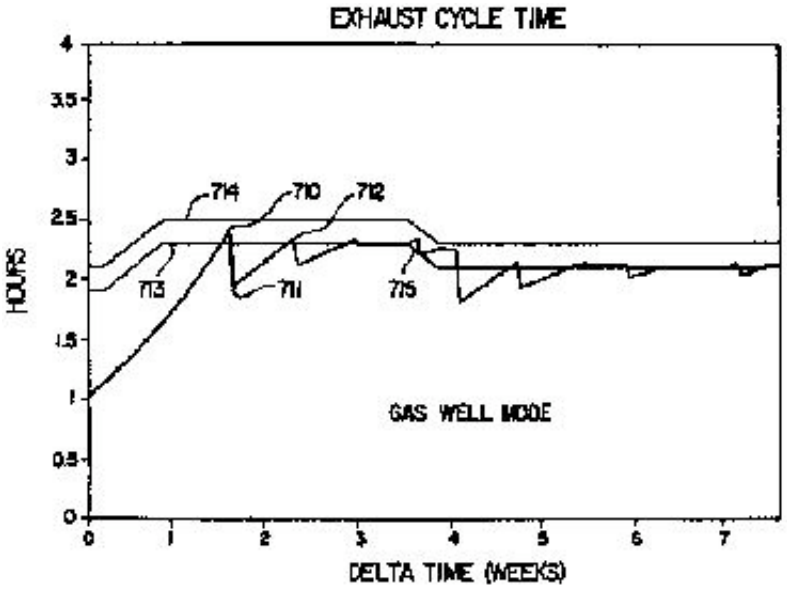


FIG. 8B

the '048 patent explains that "the controller continually tries to maximize the length of the exhaust time periods while ensuring that the well continues to cycle. It does this by incrementally increasing the length of each successive exhaust time period until that value reaches the point where the well will no longer cycle and then backing off and again trying to zero in on the ideal exhaust time for optimum production flow and continuous cycling of the plunger." '048 patent, col. 20, line 65-col. 21, line 5.

C. Claims of the '048 Patent

194. Mega Systems is asserting claims 6 and 35 of the '048 patent, FN23 which provide:

FN23. In its post-trial brief, Mega Systems says that Ferguson Beauregard's "AutoCycle infringes several independent claims of the '048 patent. Below is an analysis of two of them." It is not, of course, incumbent on the Court to ferret out which claims are infringed or not. Accordingly, only claims 6 and 35 will be addressed, and Mega Systems' assertions of infringement *vis-a-vis* any other claims of the '048 patent are deemed withdrawn.

6. A method for controlling the operation of a plunger completion petroleum production well having a motor valve connected between the tubing of the well and a flow sales line comprising:
detecting the arrival of the plunger at the wellhead;

storing in a selectively programmable memory signal indicative of a first time period during which the well is to be shut-in by closing the motor valve and a second time period during which the well is to be allowed to flow by opening the motor valve;

closing the motor valve and beginning the first time period;

opening the motor valve in response to expiration of the first time period and beginning the second time

period;

closing the motor valve in response to detection of the plunger reaching the wellhead;

decreasing the length of the first time period for the next cycle of the well in response to the plunger having reached the wellhead before the expiration of the second time period; and

increasing the length of the first time period in response to the plunger not reaching the wellhead before the expiration of the second time period.

35. A method for optimizing the production from a petroleum producing well having a motor valve connected between the tubing of the well and a flow sales lines and a plunger mounted for movement within the tubing of the well from the bottom thereof to the wellhead to carry liquids from the well to the flow sales line in response to down-hole casing pressure when the motor valve is open, the method comprising:

selecting a value of off-time for the well during which the motor valve is closed and the well is shut-in;

selecting a value of on-time for the well during which the motor valve is open and fluids pass from the well;

selecting a value of exhaust-time for the well during which the motor valve is open and the tubing is connected to the flow sales line;

detecting the arrival of the plunger at the wellhead;

cyclically intermitting the opening and closing of the motor valve in accordance with the sequential expiration of off-time, on-time and exhaust-time;

changing the value of either the off-time or the exhaust-time in response to whether a plunger arrival is detected prior to the expiration of the on-time on each successive cycle of intermitting of the well.

D. Infringement *Vel Non*

1. Mega Systems' Arguments re Claim 6

195. Mega System asserts that Ferguson Beauregard's AutoCycle controller infringes claim 6 of the '048 patent, which Mega Systems construes as being drawn to a method of optimizing a petroleum well in an oil mode because claim 6 does not have an "afterflow" or "exhaust" period, Defendants' Post-Trial Brief at 22, as follows:

a) "detecting the arrival of the plunger at the wellhead"

196. According to Mega Systems, the "AutoCycle detects the plunger's arrival at the well-head." Id.

b) "storing in a selectively programmable memory signal indicative of a first time period during which the well is to be shut-in by closing the motor valve and a second time period during which the well is to be allowed to flow by opening the motor valve"

197. Mega Systems says that in the '991 patent's algorithm, the "operator programs an 'off-cycle' during

which time the motor valve is shut." Thus, Mega Systems says that the "AutoCycle allows the operator to store a 'first time period during which the well is to be shut-in by closing the motor valve." Id. As for the "second time period," Mega Systems says that in the '991 patent algorithm, "the operator programs both an on-cycle time and a normal window. The fast window is the portion of the on-cycle before the beginning of the normal window. In other words, the 'fast window' is the lead edge of the 'on-cycle.' " Id. Mega Systems' theory of infringement is that the "AutoCycle's 'fast window' corresponds to the claimed 'second time period." ' According to Mega Systems, "[t]he plain language of the claim does not require that the 'second time period' coincide with the entirety of the motor valve's on-cycle. It merely requires that the motor valve be open during the 'second time period.' And the motor valve is open during the AutoCycle's 'fast window.' Thus, the AutoCycle's 'fast window' is the 'second time period,' and this element reads on the AutoCycle." Id. at 22-23.

c) "closing the motor valve and beginning the first time period"

198. According to Mega Systems, "[i]n the AutoCycle, the 'off-cycle' corresponds to the period when the motor valve is shut. Thus, the 'off-cycle' corresponds to the 'first time period." ' Id . at 23.

d) "opening the motor valve in response to expiration of the first time period and beginning the second time period"

199. Mega Systems says that the "AutoCycle's motor valve opens in response to the expiration of its [sic.] and the beginning of its 'fast window,' which coincides with the beginning of its 'on-cycle." ' Id.

e) "closing the motor valve in response to detection of the plunger reaching the wellhead"

200. Mega Systems urges that "[w]hen afterflow is set to zero, the AutoCycle closes the motor valve when the plunger reaches the wellhead." Id.

f) "decreasing the length of the first time period for the next cycle of the well in response to the plunger having reached the wellhead before the expiration of the second time period"

201. According to Mega Systems, "[i]f the plunger reaches the wellhead before the end of the 'fast window,' or 'second time period,' [the] AutoCycle decreases the 'off-cycle,' or 'first time period.' Thus this element reads on the AutoCycle." Id.

g) "increasing the length of the first time period in response to the plunger not reaching the wellhead before the expiration of the second time period"

202. Lastly, Mega Systems asserts that "[i]f the plunger reaches the wellhead during the 'slow window,' which is after the end of the 'fast window,' or 'second time period,' [the] AutoCycle increases the 'off-cycle,' or 'first time period.' This element-as well as each of the above elements-reads on the AutoCycle." Id. at 24.

2. Mega Systems' Arguments re Claim 35

203. Mega Systems' arguments regarding claim 35 are similar. Mega Systems construes claim 35 as being drawn to a method of optimizing a petroleum well in a gas mode because it includes an "exhaust" or "afterflow" period. Id. Mega Systems' theory of infringement is as follows:

a) "selecting a value of off-time for the well during which the motor valve is closed and the well is shut-in"

204. According to Mega Systems, "the AutoCycle operator programs an 'off-cycle,' during which time the motor valve is shut. This 'off-cycle' corresponds with the claimed 'off-time." ' Id.

b) "selecting a value of on-time for the well during which the motor valve is open and fluids pass from the well"

205. Mega Systems says that the "AutoCycle algorithm includes a 'fast window,' during which time the motor valve is open. This 'fast window' corresponds to the claimed 'on-time.' And once again, the claim's plain language does not require that the motor valve be open during the *entire* 'on-time' but only that the motor valve be open during the 'on-time.' The motor valve is open during the AutoCycle's 'fast window.' Therefore, this element reads on the AutoCycle." Id.

c) "selecting a value of exhaust-time for the well during which the motor valve is open and the tubing is connected to the flow sales line"

206. According to Mega Systems, the "AutoCycle allows the operator to enter a value for afterflow. The after flow is the period of time after the on-cycle when the motor valve is open, connecting the tubing to the sales flow line. Thus, the AutoCycle's 'afterflow' corresponds to the '048 patent's claimed 'exhaust time." ' Id. at 25.

d) "detecting the arrival of the plunger at the wellhead"

207. Mega Systems says that the "AutoCycle detects the arrival of the plunger at the well-head." Id.

e) "cyclically intermitting the opening and closing of the motor valve in accordance with the sequential expiration of off-time, on-time and exhaust-time"

208. Mega Systems says that the "AutoCycle sequences as follows: off-cycle-fast window-normal window-slow window-afterflow-off, etc. While this sequence includes two windows not claimed in the '048 patent-the normal and slow windows-the AutoCycle's 'off-time' (off-cycle), 'on-time' (fast window), and 'exhaust-time' (afterflow) still cycle as claimed in this element. The claim's plain language does not exclude additional windows; it just requires that the claimed windows sequence in the claimed order. Therefore, this element reads on the AutoCycle." Id.

f) "changing the value of either the off-time or the exhaust-time in response to whether a plunger arrival is detected prior to the expiration of the on-time on each successive cycle of intermitting of the well"

209. According to Mega Systems, "[i]f the plunger arrives at the wellhead before the end of the fast window ('on-time'), then the AutoCycle increases the afterflow ('exhaust time'), decreases the off-cycle ('off-time') or both. If the plunger arrives at the wellhead after the fast window ('on-time'), then the AutoCycle either does nothing (if the plunger arrives during the normal window) or (if the plunger arrives during the slow window) decreases the afterflow ('exhaust-time'), increases the off-cycle ('off-time'), or both. Thus, the AutoCycle changes the value of either (or both of) the off-time or the exhaust-time in response to whether the plunger arrives at the wellhead before the end of the on-time." Id. at 25-26. Therefore, Mega Systems concludes,

"the AutoCycle encompasses this element, as well as each of the others described above." Id. at 26.

3. Ferguson Beauregard's Arguments and Mega Systems' Reply

210. Ferguson Beauregard argues first that equating the "second time period" (claim 6) and the "on-time" (claim 35) to the "fast window" alone (rather than to the entire "on-time" cycle consisting of the fast, normal and slow windows) in the AutoCycle would run contrary to the teachings of the '048 patent. Plaintiffs' Post-Trial Reply at 34-40. Ferguson Beauregard notes that in the '048 patent, at the end of the "second time period" or "on-time," if the plunger has not arrived, the motor valve closes and the off-time begins. Id. at 35. Similarly, in the '991 patent and the AutoCycle, if the plunger has not arrived at the end of the entire on-cycle, *i.e.,* consisting of the fast, normal and good windows, the motor valve also closes and off-time begins. However, if the "second time period" or "on-time" in the '048 claims were construed as only the "fast" window, then, again assuming that the plunger had not arrived, the motor valve would be closed and the off-time would begin at the end of the "fast" window which is not how the AutoCycle works. Id.

211. Additionally, Ferguson Beauregard says, such construction would result in the motor valve closing prior to the "good" or normal window thus running counter to the primary stated objective of the '048 patent, namely optimizing well cycles.

212. Moreover, Ferguson Beauregard argues, such construction ignores the last limitation of the claims. Claim 6, for example, calls for "increasing the length of the first time period in response to the plunger not reaching the wellhead before the expiration of the second time period." FN24

FN24. Ferguson Beauregard argues that "the Defendants' new claim analysis fails because it must ignore the last paragraph of the claims providing for an increase in shut-in time predicated upon plunger arrival failure at the end of the on-time (initially assigned second time period)." Plaintiffs' Post-Trial Reply at 35. In actuality, the last paragraph of claim 35 calls for "changing the value of either the off-time or the exhaust-time in response to whether a plunger arrival is detected prior to the expiration of the on-time on each successive cycle of intermitting of the well."

213. Mega Systems responds that the plain language of the claims "requires only that the motor valve be open during the claimed 'second time period' or 'on-time.' ' Defendants' Post-Trial Reply at 3. The issue before the Court, Mega Systems says, is not what the '048 specification or "algorithm" calls for, but rather what the claims require. Mega Systems argues that there is "nothing in the claim language that requires the controller to shut the motor valve at the end of the claimed 'second time period' or 'on-time,' ' and that it would be error to read such a requirement into the claims from the specification. Id. at 4-5. Mega Systems also argues that the "AutoCycle will increase the motor valve's off time when the plunger arrives during the 'slow window.' The 'slow window' is after the expiration of the claimed 'second time period,' or 'fast window.' Thus, the AutoCycle infringes Claim 6 because it increases motor valve off time when the plunger arrives at the wellhead during the 'slow window.' ' Id. at 7.

214. Ferguson Beauregard secondly argues that each of the independent claims in the '048 patent requires that "the controller drive the well to a point where the plunger fails to arrive at the wellhead" and points to portions of the '048 patent specification that Ferguson Beauregard says compels that conclusion. Plaintiffs' Post-Trial Reply at 40-44.

215. Ferguson Beauregard notes that Mega Systems presented no testimony during trial that each element of the '048 patent claims were infringed by the AutoCycle controller, and urges that the testimony by its expert, Mr. Gibson, established that the AutoCycle controller operated differently than the controller of the '048 patent, *i.e.,* the AutoCycle controller did not control the well based driving the well to a point where the plunger failed to arrive. Plaintiffs' Post-Trial Brief at 35-36. According to Ferguson Beauregard, Special Master Williams did not adopt that construction during the *Markman* hearing because he did not find anything ambiguous about the claim language. Plaintiffs' Post-Trial Reply at 44-45.

216. Mega Systems responds urging that Special Master Williams expressly considered and rejected Ferguson Beauregard's argument. Defendants' Post-Trial Reply at 10-12.

217. With respect to Ferguson Beauregard's observation that Mega Systems did not present any evidence on infringement of the '048 patent during trial, Mega Systems says that "this Court has all the evidence it needs to find infringement," and that the Federal Circuit has "never *required* a party to proffer expert testimony * * * on application of claim language to accused devices," [emphasis in original.], Defendants' Post-Trial Reply at 13, quoting *Moleculon Research Corp. v. CBS, Inc.,* 793 F.3d 1261, 1270 (Fed.Cir.1986). According to Mega Systems, "[t]his Court has before it the operation of the accused devices and the '048 patent claims. All that remains to find infringement is to compare the claims to the AutoCycle's operation." Id.

218. Lastly, Ferguson Beauregard argues that claims 6 and 35 require an adjustment on each cycle based on "whether" the plunger arrived at the wellhead. Mr. Gibson, according to Ferguson Beauregard, explained that the controller of the '048 patent looked to "whether" the plunger arrives as contrasted with the AutoCycle controller that looks to "when" the plunger arrives. Plaintiffs' Post-Trial Brief at 35-36. Specifically, Ferguson Beauregard notes that the last two limitations in claim 6 require a decrease in the off-time if the plunger reaches the wellhead, and an increase in off-time if the plunger does not reach the wellhead. Similarly, Ferguson Beauregard says that claim 35 requires an adjustment on each cycle of the well based on whether the plunger arrived or not. Plaintiffs' Post-Trial Reply at 45-46. According to Ferguson Beauregard, the testimony at trial showed that the "AutoCycle algorithm neither controls the well based upon 'whether' the plunger arrives at the surface nor does it require an adjustment on each and every cycle of the well." Id. at 47.

219. Mega Systems argues in response that "Claims 6 and 35 do not require adjustments to off time or afterflow on each cycle. Even if many repetitions of the steps of Claims 6 and 35 resulted in plunger non-arrival, the Special Master refused to read this additional requirement into the claims." Defendants' Post-Trial Reply at 12. *See also* id. at 8-10. With respect to claim 6, Mega Systems urges that the only question is whether the "AutoCycle will increase the motor valve shut time in response to the plunger not reaching the wellhead before the end of the second time period," and answers the question "Yes, *sometimes,*" asserting that "sometimes" is enough. Id. at 6-7. In particular, Mega Systems reiterates that with afterflow time set to zero, the AutoCycle will decrease off-time if the plunger arrives at the wellhead before the end of the "fast window," and "[i]f the plunger arrives at the well head sufficient after the 'fast window'- *i.e.,* during the 'slow window'-the AutoCycle will increase the motor valve's off time." Id. at 6. With respect to claim 35, Mega Systems says that the last element in the claim "requires that the controller adjust either off-time or exhaust-time in response to the plunger arriving at the wellhead before the end of the claimed 'on-time,' " and that the "AutoCycle adjusts the motor valve's off time or the afterflow time in response to plunger arrival before the end of the 'fast window." ' Id. at 8.

4. Discussion

220. From the foregoing, it is readily evident that the parties do not disagree on the operation of the AutoCycle controller, or on the operation of the controller described in the '048 patent. Rather, the parties disagree, and the issue of infringement turns, on the proper construction of claims 6 and 35. The place to begin, therefore, is with Special Master Williams Report.

a) Special Master Williams' Report

221. Special Master Williams noted that "[i]n claims 1-9 and 22-30, FN25 the phrases 'first time period' and 'second time period' refer to the time intervals during which the motor valve is closed and open (to bring the plunger to the surface), respectively." Special Master Williams' Report at 27. Similarly, Special Master Williams found that "[i]n claims 14-21 and 31-39, the phrases 'off-time' and 'on-time' are used to refer to motor valve closed time and motor valve open time, respectively," and that "Claims 18-21 and 35-39 use the phrase 'exhaust time' to refer to an afterflow period." Id. Special Master Williams noted that while the time period phrases referred to different time intervals in different claims, "the phrases are readily understood by reference to the respective claims, and no issue was raised requiring interpretation of these phrases." Id.

FN25. At the time of the *Markman* hearing, Mega Systems was, apparently, asserting all of the claims in the '048 patent.

222. In addressing the arguments of the parties, Special Master Williams noted that "Ferguson Beauregard contends that each independent claim (and, thus, all claims in the patent) must be interpreted as requiring incremental adjustment of an operating parameter under [sic. until] the plunger fails to arrive at the wellhead, whereupon corrective action is taken." Id. at 28. Special Master Williams also noted, however, that counsel for Ferguson Beauregard was unable to point to any particular word in the claims that was unclear." Id. at 29.

223. Special Master Williams then reviewed the specification, and found that:

The method described in the '048 patent involves an "on-time" interval during which the motor valve is opened and the plunger travels from the lower end of the well tubing toward the wellhead. If the plunger arrives at the wellhead prior to the expiration of this "on-time" interval, an adjustment in a operating parameter is made. For example, the next "off-time" interval may be shortened, or an "exhaust" interval may be lengthened. If the plunger fails to arrive at the wellhead before the "on-time" intervals expires, an adjustment is also made. For example, the next "off-time" interval may be lengthened or a next "exhaust" interval may be shortened. * * * In other words, if the plunger arrives sufficiently quickly, adjustments will be made to allow greater build-up of well pressure.

Id. at 29-30. That is an accurate summary, and none of the parties contends that Special Master Williams misunderstood the method described in the '048 patent. Special Master Williams also noted that:

As the specification indicates, as the plunger arrives within the "on-time" interval and adjustment is made (*e.g.,* to shorten the next "off-time" interval), if this process is repeated enough times, eventually the plunger will fail to arrive before the "on-time" interval expires. Col. 9, lines 39-43.

Id. at 30. On the other hand, Special Master Williams further noted that the specification of the '048 patent suggested that factors other than repeatedly shortening the "off-time" affected plunger speed and that failure of the plunger to arrive at the wellhead may result from any number of such factors:

However, as the specification also suggests, other factors contribute to affect plunger speed, and failure of the plunger to arrive at the wellhead within the "on-time" interval may result from any number of those factors. For example, a decrease in pressure within the downhole formation or an increase in pressure in the output line may prevent the plunger from arriving within the allotted time.

Id. "Hence," Special Master Williams concluded, "the method described in the '048 patent specification makes an adjustment based on whether the plunger arrives at the wellhead within the 'on-time' interval, *regardless of the reason for the arrival. Arrival within the "on-time" [interval] results in one adjustment, and non-arrival within the 'on-time' [interval] results in another adjustment*." [Emphasis added.] Id. In short, adjustments to the "off-time" and "exhaust time" intervals are made regardless of whether the plunger arrives during the "on-time" interval and regardless of the reason therefor.

224. Special Master Williams also apparently viewed Ferguson Beauregard as urging that the claimed method steps were alone responsible for preventing the plunger from arriving during the "on-time" interval. Special Master Williams, for example, comments:

So, for example, if the off-time of the well has been decreased by the controller to a point where the well pressure cannot be built sufficiently to force the plunger to the wellhead, the plunger will fail to arrive during the subsequent on-time period. In that case, the control method will have resulted in plunger non-arrival. But by the same token, an increase in pressure at the output line may also prevent arrival of the plunger within the on-time period, in which case the control method will not have resulted in plunger non-arrival, but the method will nevertheless respond to the non-arrival.

Id. *See also* finding 226.

225. Special Master Williams, in the next succeeding paragraph, found:

The claims of the '048 patent *recite this particular characteristic in clear, and undisputed, language*. Looking at claim 1, for example, the final three paragraphs are as follows:

"decreasing the first time period by a first selected incremental time value in response to the arrival of the plunger prior to expiration of the second time period;

closing the motor valve and beginning the first time period in response to expiration of the second time period; and

increasing the first time period by a second selected incremental time value in response to the failure of the plunger to arrive prior to the expiration of the second time period."

As clearly seen, the first time period (the off-time) is *decreased* by a first time increment *when the plunger arrives* before the second time period (the on-time) expires. The motor valve is closed and the off-time is begun in response to the on-time expiring. And the off-time is *increased* by a second time increment *when the plunger fails to arrive* before the on-time expires. [First emphasis added, other emphasis in original.]

Id. at 30-31. In looking at claim 3, which refers to a "third time period," *i.e.,* the time interval during which "afterflow" (or exhaust time) is allowed, id. at 27, Special Master Williams similarly concluded that "the third time period (the exhaust/afterflow time) is *increased* by a first time increment *when the plunger arrives* before the second time period (the on-time) expires. And the exhaust/afterflow time is *decreased* by a second time increment *when the plunger fails to arrive* before the on-time expires." Id. at 31.

226. From the foregoing, Special Master Williams concluded that "Ferguson Beauregard has not pointed to anything in the specification or the file history to support its position that the subject claim paragraphs require incremental adjustment of an operating parameter *until the claimed method causes the plunger to fail to arrive,* whereupon corrective action is taken." [Emphasis added.] Id. at 32. Special Master Williams also found that the "Reasons for Allowance" that the examiner entered during prosecution of the application maturing into the '048 patent, *i.e.:*

No prior art discloses or renders obvious a method or apparatus for optimizing the production from a well as claimed including the step of (or means for) changing the value of off-time and/or exhaust time in response to whether a plunger arrival is detected prior to the expiration of the on-time on each successive cycle of intermitting of the well.

id. at 29, did not support Ferguson Beauregard's argument, as Special Master Williams understood that argument. "Rather," Special Master Williams concluded, "the Examiner's Statement appears to simply acknowledge the plain meaning of the phrases-the plunger may arrive and it may not arrive (in fact, the plunger either will or will not arrive before expiration of the on-time). The value of a parameter will be changed in response to whether the plunger arrives. The plain meaning of the subject claim elements recited that very characteristic." Id. at 32.

b) Is the Claimed Method Responsible for Driving the Well to Failure?

227. Addressing Ferguson Beauregard's second argument first, if Ferguson Beauregard, in arguing that "the independent claims of the '048 patent all require the controller to drive the well to a point where the plunger fails to arrive at the wellhead," Plaintiffs' Post-Trial Reply at 40, means to say that the claimed method steps are alone responsible for the plunger failing to arrive at the wellhead during an "on-time" interval (*i.e.,* the argument that Special Master Williams believed Ferguson Beauregard was making during the *Markman* hearing), then Mega Systems is correct-Special Master Williams addressed and correctly rejected that argument. The specification of the '048 patent clearly explains that other well parameters affect whether the plunger will arrive during the "on-time" interval. For example, in addition to those portions of the specification that Special Master Williams referred to, the specification explains that "[b]ecause of the changing conditions within the well, in the reservoir within which the well is located, and in the external equipment connected to the output from the well, the rate at which the bottom hole pressure builds toward a value which is sufficient to cycle the plunger continues to vary throughout the life of the well." '048 patent, col. 5, lines 13-18.

c) Adjustments During Each Cycle

228. On the other hand, Special Master Williams also correctly concluded that "as the plunger arrives within the 'on-time' interval and adjustment is made (*e.g.* to shorten the next 'off-time' interval)" that "if this process is repeated enough times, eventually the plunger will fail to arrive before the 'on-time' interval expires." Special Master Williams' Report at 30. Or, as Special Master Williams also correctly observed, "if

the off-time of the well has been decreased by the controller to a point where the well pressure cannot be built sufficiently to force the plunger to the wellhead, the plunger will fail to arrive during the subsequent on-time period. In that case, the control method will have resulted in plunger non-arrival." Id.

229. Special Master Williams also correctly concluded that "[t]he claims of the '048 patent recite this particular characteristic in clear, and undisputed, language." In other words, contrary to Mega Systems' argument, claims 6 and 35 provide for an adjustment on each cycle. Claim 6, once again, calls for:

6. A method for controlling the operation of a plunger completion petroleum production well having a motor valve connected between the tubing of the well and a flow sales line comprising:

detecting the arrival of the plunger at the wellhead;

storing in a selectively programmable memory signal indicative of a first time period during which the well is to be shut-in by closing the motor valve and a second time period during which the well is to be allowed to flow by opening the motor valve;

closing the motor valve and beginning the first time period;

opening the motor valve in response to expiration of the first time period and beginning the second time period;

closing the motor valve in response to detection of the plunger reaching the wellhead;

decreasing the length of the first time period for the next cycle of the well in response to the plunger having reached the wellhead before the expiration of the second time period; and

increasing the length of the first time period in response to the plunger not reaching the wellhead before the expiration of the second time period.

There is no disagreement or doubt that in the "storing" step, the "first time period" is referring to the "off-time" and the "second time period" is referring to the "on-time." Indeed, the claim limitation itself says "a first time period during which the well is to be shut-in by closing the motor valve" and "a second time period during which the well is to be allowed to flow by opening the motor valve."

230. There is also no disagreement or doubt that the claimed method then proceeds by (1) "closing the motor valve and beginning the first time period," (2) "opening the motor valve in response to expiration of the first time period and beginning the second time period," and (3) "closing the motor valve in response to detection of the plunger reaching the wellhead." At that point, as Special Master Williams observed, there are only two alternatives, both of which are addressed in the claim, namely whether the plunger (1) reached, or (2) did not reach the wellhead during the "on-time" interval, *i.e.,* the "first time period." The plunger either did or did not, and the reasons for either are unimportant both in terms of the claims and the specification, as Special Master Williams observed. Claim 6 then unquestionably requires an adjustment to the "off-time" in either scenario. In the first scenario, *i.e.,* when the plunger reaches the wellhead during the "on-time" interval, claim 6 requires "decreasing the length of the first time period *for the next cycle of the well*." Although it is true, as Mega Systems argues, that the phrase "each cycle" does not appear in claim 6, Defendants' Post-Trial Brief at 8, claim 6 nevertheless plainly calls for an adjustment in the off-time "for

the next cycle." FN26 In the context of the claim, that means a cycle-by-cycle adjustment, which is consistent with the only written description of the invention given in the specification. Indeed, the Abstract of the '048 patent explains:

FN26. It might additionally be observed that claim 6 calls for a "method for controlling the operation of a plunger completion petroleum production well." The specification explains that "[i]n the case of a plunger completion oil well, as soon as the plunger has reached the surface a valve in the tubing at the wellhead is closed so that the plunger also falls back down the tubing and is ready to lift another load of production fluids to the surface upon the accumulation of sufficient downhole casing pressure to lift the plunger and its load and the subsequent reopening of the valve."'048 patent, col. 2, lines 12-20. Especially when coupled with the requirement in the body of the claim for an "off-time" adjustment "for the next cycle of the well," it is clear that claim 6 is directed to repetitive cyclical operations. Indeed, such an operation is the only operation taught, disclosed or suggested in the '048 patent.

The controller monitors whether or not a plunger arrival signal is received on each cycle of intermitting the well and changes either the off-time or the exhaust-time for the next cycle in response thereto. *In oil well mode*. [Mega Systems contends that claim 6 is directed to the oil well mode] *the off-time is decreased slightly for each cycle* following a cycle in which plunger arrival occurred and increased slightly for each cycle following one in which it did not. *In gas well mode*. [Mega Systems contends that claim 35 is directed to the gas well mode] *the exhaust-time is increased slightly for each cycle* following a cycle in which plunger arrival occurred before on-time expired and decreased slightly for each cycle following one in which it did not.
See Hill-Rom, 209 F.3d at 1344 n. 1 (the abstract may be used in evaluating the disclosure and claims of a patent).
231. In the second scenario, *i.e.,* when the plunger does not reach the wellhead during the "on-time" interval, claim 6 requires "increasing the length of the first time period." Thus, as Special Master Williams observed, there are but two possibilities: either (1) the plunger arrived during the "on-time" interval in which case the "off-time" is decreased "for the next cycle of the well," or (2) the plunger did not arrive during the "on-time" interval in which case the "off-time" is increased. The claim does not contemplate a "cycle" in which no adjustment is made, and the specification provides neither written description nor enabling support for an embodiment in which no adjustment is made.FN27 Claim 6 is thus viewed as plainly requiring an adjustment in "off-time," or in the words of the claim the "first time period," on each cycle. *See* Netword, LLC v. Centraal Corp., 242 F.3d 1347, 1352 (Fed.Cir.2001)("[t]he claims are directed to the invention that is described in the specification; they do not have meaning removed from the context from which they arose. Thus, the claims are construed to state the legal scope of each patented invention, on examination of the language of the claims, the description in the specification, and the prosecution history," and "[a]lthough the specification need not present every embodiment or permutation of the invention and the claims are not limited to the preferred embodiment of the invention * * *, neither do the claims enlarge what is patented beyond what the inventor has described as the invention.").

FN27. Indeed, as discussed above, the '048 patent is directed toward a system for optimizing well production and explains that "[a] controller which constantly evaluates the success with which the plunger is being repeatedly cycled and attempts to reduce the off-time while still successfully cycling the plunger would tend toward optimizing production from the well." '048 patent, col. 5, lines 19-23.

232. The same is true for claim 35. Claim 35, once again, provides:

35. A method for optimizing the production from a petroleum producing well having a motor valve connected between the tubing of the well and a flow sales lines and a plunger mounted for movement within the tubing of the well from the bottom thereof to the wellhead to carry liquids from the well to the flow sales line in response to downhole casing pressure when the motor valve is open, the method comprising:

selecting a value of off-time for the well during which the motor valve is closed and the well is shut-in;

selecting a value of on-time for the well during which the motor valve is open and fluids pass from the well;

selecting a value of exhaust-time for the well during which the motor valve is open and the tubing is connected to the flow sales line;

detecting the arrival of the plunger at the wellhead;

cyclically intermitting the opening and closing of the motor valve in accordance with the sequential expiration of off-time, on-time and exhaust-time;

changing the value of either the off-time or the exhaust-time in response to whether a plunger arrival is detected prior to the expiration of the on-time on each successive cycle of intermitting of the well.

After "selecting a value of off-time" and "selecting a value of on-time" and "detecting the arrival of the plunger at the wellhead," the claim requires "cyclically *intermitting* FN28 the opening and closing of the motor valve in accordance with the sequential expiration of off-time, on-time and exhaust-time." Claim 35 then requires "changing the value of either the off-time or the exhaust-time in response to whether a plunger arrival is detected prior to the expiration of the on-time *on each successive cycle* of *intermitting* of the well." The clear import of the claim is that "on each successive cycle" of "intermitting" the well, in which the preceding limitation required "cyclically intermitting the opening and closing of the motor valve in accordance with the sequential expiration of off-time, on-time and exhaust-time," the value of either the off-time or the exhaust time is changed depending on whether the plunger arrived during the on-time. Claim 35, like claim 6, addresses the two situations in which the plunger either (1) did, or (2) did not arrive during the on-time interval, and makes adjustments in either event on each cycle. That is also consistent with the method described in the specification, and discussed at length above. Claim 35 plainly does not contemplate or permit a cycle in which no change is made.

FN28. The specification of the '048 patent explains that:
When a well is manually intermitted, a well operator physically visits each well site on a periodic basis and either shuts the well in for a pre-selected period of time or opens the valve at the surface and allows the well to flow for a preselected period of time. In the mechanical timer operated intermitters, a mechanical device replaces the manual opening and closing of the valve by a timed opening and closing thereof. The operator simply selects the time period during which the well is to be shut in and the time period during which the well is to be allowed to flow and the intermitter automatically operates the valve. Experience over many years has shown that with both manual operation and timer controlled intermitters, operators generally select time periods which are relatively conservative with respect to optimizing the production flow from the well but which guard against the possibility of the well "loading up" and necessitating an expensive cleaning in order to place the well back into production again. In addition, operators tend to be distrustful of

sophisticated electronic well optimizing equipment because they know from their experience even though there may be certain monitored parameters upon which intermitting of the well is based, the performance parameters of the well frequently change and thereby eliminate the accuracy with which the well is being operated. These inaccuracies introduce a risk of loading the well and the resultant negative reflection on the job performance by the operator which that brings.

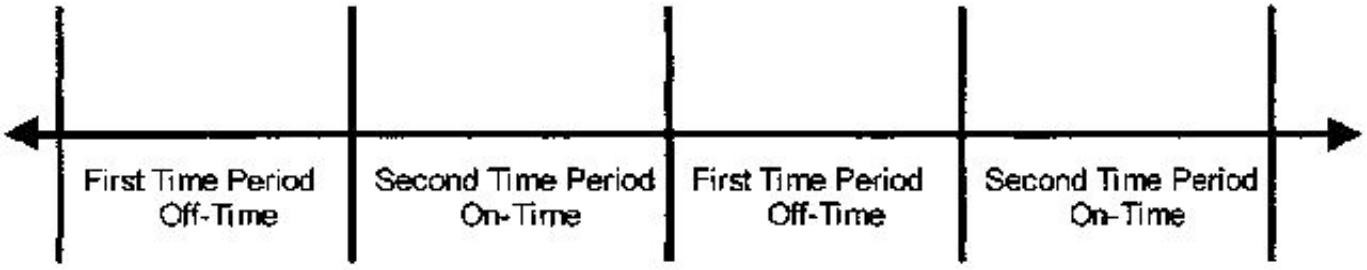
'048 patent, col. 4, lines 16-44. "Intermitting" is itself a cyclical operation.

d) The AutoCycle Controller

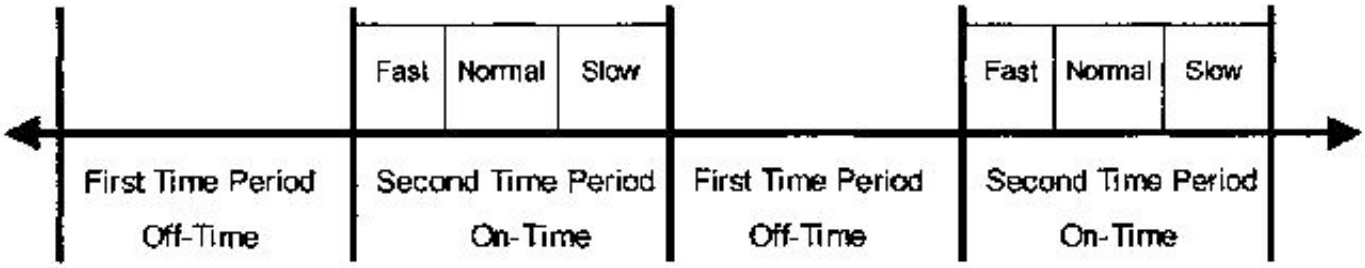
233. It is undisputed that the accused AutoCycle controller does not adjust "off-time" (or any other time interval) on each cycle. As discussed above, Mega Systems acknowledged that "[i]f the plunger [in the AutoCycle controller] arrives at the wellhead after the 'fast window' but during the 'good window,' the AutoCycle will make no adjustments." Defendants' Post-Trial Brief at 6. Mega Systems thus construes the "fast" window in the AutoCycle as the "on-time" or, in the terms of claim 6, the "first time period," in an effort to read those claims on the accused AutoCycle controller. That effort fails.

234. In essence, Mega Systems' infringement argument is the mirror image of a proper infringement argument. Mega Systems starts with its desired conclusion, *i.e.*, that the AutoCycle controller infringes claims 6 and 35 of the '048 patent, and then "construes" or, in this case, attempts to force fit those claims to reach that conclusion. The place to begin, however, is not with the accused infringing device/process, but with the actual words of the claims.

235. Claim 6, once again, calls for "storing" two time periods, namely "a first time period during which the well is to be shut-in by closing the motor valve," and "a second time period during which the well is to be allowed to flow by opening the motor valve." As discussed above, those are cyclical time periods, *i.e.*, each has a beginning and an end, which might be shown as follows:



In the AutoCycle controller, the "on-time," as discussed above, is further divided into "fast," "normal" and "slow" windows:



As also discussed above, Mega Systems' infringement argument rests on a single pillar, namely Mega Systems' assertion that the "AutoCycle's 'fast window' corresponds to the claimed 'second time period.' " Defendants' Post-Trial Brief at 22. To support that assertion, Mega Systems argues that the "plain language of the claim [claim 6] does not require that the 'second time period' coincides with the entirety of the motor valve's on-cycle. It merely requires that the motor valve be open during the 'second time period.' " Id. at 22-23. That argument, however, is a *non sequitur* masked by "merely." If, as Mega Systems says, the claim "requires that the motor valve be open during the 'second time period,' " then the "plain language of the claim" *does* require that the "second time period" coincide with the entirety of the motor valve's on-cycle.

236. Furthermore, claim 6 on its face says what the "second time period" is, *i.e.*, claim 6 calls for "a second time period *during which the well is to be allowed to flow by opening the motor valve*." [Emphasis added.] That clearly equates "second time period" to the motor valve's on-cycle. Any doubt that the claim means precisely that is removed by referring to the specification which explains consistently, for example, that "[a] selectively programmable memory stores signals indicative of a * * * second time period during which the motor valve is to be open and the fluid in the tubing allowed to flow into the sales line," '048 patent, col. 6, lines 48-54, "[a]fter expiration of the selected 'on-time' period, the controller 26 again closes motor valve 42 and begins another off-time period for the well of a slightly greater duration than the previous off-time to ensure that the plunger will cycle and reach the surface the next time the motor valve 42 is opened," '048 patent, col. 9, lines 13-19, "to program a mode A [gas well mode] operation the program key 75 *a* is first depressed followed by the on-time key 75 *c* and then numeral keys to program into the memory 54 a time indicative of the time period during which the motor valve is to be opened in the event that the controller does not receive a signal indicative of plunger arrival," '048 patent, col. 14, lines 14-20, and "[a] mode B gas well operation is similarly programmed with the on-time to open the first motor valve (a 'maximum time' in the event the plunger does not arrive by then), and EXHAUST-TIME during which the second motor valve remains open to allow the free production of gas from the well * * *," '048 patent, col. 14, lines 28-34.

237. That the "second time period" means the time during which the motor valve is open is also clear from the final two limitations of claim 6, namely:

decreasing the length of the first time period for the next cycle of the well in response to the plunger having reached the wellhead before the expiration of the second time period; and

increasing the length of the first time period in response to the plunger not reaching the wellhead before the expiration of the second time period.

The steps of "decreasing" and "increasing" the first time period are performed "in response to" the plunger either (1) reaching, or (2) not reaching the wellhead "before the expiration of the second time period." In

other words, the "second time period" is the maximum time set for the motor valve to be open. If, as claim 6 says, the plunger reaches the wellhead before the "second time period" expires, then the motor valve is closed and the off-time or "first time period" is decreased. However, if the plunger fails to arrive before expiration of the "second time period," the motor valve is closed and the off-time or "first time period" is increased.

238. Mega Systems also argues that "nothing in the claim language * * * requires the controller to shut the motor valve at the end of the claimed "second time period" or "on-time." Defendants' Post-Trial Reply at 4. That, however, is similarly not true. The "storing" step of claim 6 sets two conditions for the motor valve, *i.e.,* it is either (1) closed, or (2) open. According to the claim, the motor valve is closed during the "first time period" and open during the "second time period." The step of "increasing the length of the first time period in response to the plunger not reaching the wellhead before the expiration of the second time period" necessarily means that if the plunger did not reach the wellhead during the time that the motor valve was open, *i.e.,* during the "second time period," the motor valve is closed and the off-time is increased. That construction is confirmed by some of the same portions of the specification quoted above, for example, "[a]fter expiration of the selected 'on-time' period, the controller 26 again closes motor valve 42 and begins another off-time period for the well of a slightly greater duration than the previous off-time to ensure that the plunger will cycle and reach the surface the next time the motor valve 42 is opened, " '048 patent, col. 9, lines 13-19, and "to program a mode A [gas well mode] operation the program key 75 *a* is first depressed followed by the on-time key 75 *c* and then numeral keys to program into the memory 54 a time indicative of the time period during which the motor valve is to be opened in the event that the controller does not receive a signal indicative of plunger arrival, " '048 patent, col. 14, lines 14-20.

239. Claim 35 is similar. The first three steps:

selecting a value of off-time for the well during which the motor valve is closed and the well is shut-in;

selecting a value of on-time for the well during which the motor valve is open and fluids pass from the well;

selecting a value of exhaust-time for the well during which the motor valve is open and the tubing is connected to the flow sales line;

call for selecting "off-time," "on-time" and "exhaust-time." As in claim 6, claim 35 says what the "on-time" is, namely the time "during which the motor valve is open and fluids pass from the well." Mega Systems argues that "the claim's plain language does not require that the motor valve be open during the *entire* 'on-time' but only that the motor valve be open during the 'on-time.' " Defendants' Post-Trial Brief at 24. However, the claim requires "cyclically *intermitting the opening and closing of the motor valve* in accordance *with the sequential expiration of* off-time, on-time and exhaust-time," and "changing the value of either the off-time or the exhaust-time in response to whether a plunger arrival is detected prior to the expiration of the on-time on each successive cycle of intermitting of the well." That necessarily means that the "on-time" is the maximum time during which the motor valve is open, and that is confirmed by the specification, *i.e.,* "[a] mode B gas well operation is similarly programmed with the on-time to open the first motor valve (a 'maximum time' in the event the plunger does not arrive by then) * * *," '048 patent, col. 14, lines 28-31. *See also,* '048 patent, col. 10, line 8-col. 11, line 15.

240. The "on-time" in the AutoCycle controller corresponding to the "second time period" limitation in claim 6 or the "on-time" limitation in claim 35 encompasses all three of the "fast," "normal" and "slow"

windows, not just the "fast" window as Mega Systems argues. For the foregoing reasons, claims 6 and 35 of the '048 patent overall cannot be reasonably construed as covering the AutoCycle controller. Accordingly, for the foregoing reasons, there can be no literal infringement of claims 6 and 35 of the '048 patent. Mega Systems has not argued, and has presented no evidence, during trial or otherwise, on infringement under the doctrine of equivalents. Thus, to the extent that Mega Systems' pre-trial submissions could be construed as asserting infringement under the doctrine of equivalents, such assertions are deemed to have been withdrawn.

5. Revival of the '048 Patent

241. The '048 patent issued on May 1, 1990. Therefore, the 7 1/2 year maintenance fee was due by November 1, 1997, or within the following six-month grace period. 35 U.S.C. s. 41(b). That maintenance fee was not paid, and the '048 patent accordingly lapsed on May 1, 1998. Id. The PTO has the authority to accept payment of maintenance fees up to twenty-four months following the six month grace period "if the delay is shown to the satisfaction of the Director to have been unintentional." s. 41(c)(1). The PTO has the same authority to accept maintenance fees "at any time after the six-month grace period if the delay is shown to the satisfaction of the Director to have been unavoidable." Id. The statute also makes provision for persons "who made, purchased, offered to sell, or used anything protected by the patent * * * after the six-month grace period but prior to acceptance of a maintenance fee * * *." Ferguson Beauregard does not assert the later rights, but rather asserts that the lapse of the '048 patent was not "unintentional" and, therefore, reviving the '048 patent, under the circumstances discussed below, was "improper." Plaintiffs' Post-Trial Reply at 49-54.

242. Ferguson Beauregard also does not allege inequitable conduct. Although the procedure for effecting late payment of a maintenance fee involves a petition, 37 C.F.R. s. 1.378(c), and the Federal Circuit has held that false or misleading affidavits, Refac Int'l, Ltd. v. Lotus Dev. Corp., 81 F.3d 1576 (Fed.Cir.1996), and petitions to make special, General Electro Music v. Samick Music Corp., 19 F.3d 1405 (Fed.Cir.1994), meet the materiality requirement for showing inequitable conduct as a matter of law, according to Mega Systems, this Court has previously stricken all claims and affirmative defenses related to inequitable conduct and has previously ordered Ferguson Beauregard to file an amended complaint having no claims of willfulness or inequitable conduct. Defendants' Post-Trial Reply at 14. Ferguson Beauregard's argument is therefore simply that the revival was "improper."

243. According to Ferguson Beauregard and deposition testimony introduced during trial, Camco International ("Camco") purchased Halliburton Energy Services, Inc.'s ("Halliburton's") artificial-lift division in December 1996 for over $21 million. Tr. May 25, 2001, at 220-21. The '048 patent was sold to Camco as part of that transaction, which also included other patents relating to Halliburton's artificial-lift and control division. Id. at 221. At that point, Camco assumed the responsibility for paying the patent maintenance fees. Id. at 201, 222-23. Apparently Schlumberger (the record, though, does not reflect which of the various Schlumberger entities) acquired Camco on or about September 1, 1998. Id. at 213-14. Thus, the responsibility for paying the 7 1/2 year maintenance fee for the '048 patent both when due and within the six-month grace period fell on Camco. Id. at 222. There was testimony that Scott Brown, Camco's in-house patent counsel, received actual notice at least from Mr. William Imwalle, in-house intellectual property counsel for Halliburton, when the maintenance fee was due. Id. at 222-26. *See also* id. at 202, 212.

244. Camco did not, however, pay the maintenance fee, and apparently undertook no efforts to do so until Mr. Bartley approached Camco offering to purchase the '048 patent. Id. at 208. Mr. Bartley's offer to

purchase the '048 patent, which apparently included $5000 in earnest money, was, however, contingent on reviving the patent. Id. at 75. Apparently, Mr. Wayne Kanak, in-house counsel for Schlumberger, prepared, signed, and filed a petition to revive the '048 patent, id. at 215-16, on August 9, 1999, in which he asserted that the delayed (or non-) payment of the maintenance fee was unintentional. Defendants' Exhibit 201. The PTO granted that petition on or about September 7, 1999, but also advised:

It is not apparent whether the person signing the statement of unintentional delay was in a position to have firsthand or direct knowledge of the facts and circumstances of the delay at issue. Nevertheless, such statement is being treated as having been made as the result of a reasonable inquiry into the facts and circumstances of such delay * * * In the event that such an inquiry has not been made, petitioner must make such an inquiry. If such inquiry results in the discovery that the delay in paying the maintenance fee under 37 C.F.R. s. 1.378(c) was intentional, petitioner must notify the Office.

Id.

245. Ferguson Beauregard asserts that from Mr. Kanak's deposition testimony, introduced during trial, it was clear that he did not have firsthand knowledge of the "facts and circumstances" surrounding Camco's failure to pay the '048 patent maintenance fee.

246. Mr. Kanak was not, of course, with Camco when that maintenance fee became due, and did not become responsible for the '048 patent until after Schlumberger acquired Camco in September 1998 and until Mr. Kanak assumed Mr. Brown's position in March 1999. Plaintiffs' Post-Trial Reply at 51-52. Indeed, the testimony indicated that Mr. Kanak did not begin his inquiry into the '048 patent until sometime after Mr. Bartley made inquiries about obtaining the '048 patent. Tr. May 25, 2001, at 208. The testimony also indicated that Mr. Kanak's inquiry into the '048 patent, and why the maintenance fee had not been paid, was limited, to say the least. Mr. Kanak testified that he did not speak with Mr. Brown, Mr. Tom Hill, the individual responsible at Camco for making sure that maintenance fees were paid, id. at 213, or others at Camco. Id. at 207-08.

247. Rather, Mr. Kanak testified:

Q. Did you find anything in his [Mr. Brown's] files?

A. I found one, that one document there that is signed by Tom Hill, I believe, that has a notice, the expiration notice attached. It's on Camco letterhead. Okay. It's a two-page document.

[Document marked as Kanak Exhibit 2]

Q. Mr. Kanak, I'm handing you what's been marked as Kanak Exhibit 2. Is that the letter that you're referring to that you found in Mr. Brown's file?
A. Yes.

Q. And that's dated September 9th, 1998?

A. That's right.

Q. Tell me what that document is, please.

A. Well, it's a letter from Camco, Tom, from Tom Hill, to a man name David Forville [spelling] of Computer Patent Annuities, which has been mentioned as the firm that Camco used to pay its patent annuities.

Q. And the closing of the acquisition by Camco [of Halliburton] was in December of 1996. Correct?

A. That's when it is.

Q. And is this letter in September of 1998 asking Computer Patent Annuities just to put this on their tickler list, their reminder list?

A. Yes, that's correct.

Q. But that's not dated until September of 1998. Correct?

A. That's correct.

Q. Any idea why it's dated nearly two years later?

A. No, I don't have any idea.

Tr. May 25, 2001, at 202-04. As of September 1998, of course, the '048 patent had already lapsed roughly three months earlier in May 1998. The record does not explain why Mr. Hill would have asked Computer Patent Annuities to put a lapsed patent on their tickler list. The testimony becomes even more curious. Mr. Kanak further testified:
Q. Okay. So based on this Kanak Exhibit 2, Mr. Hill was aware that there was a maintenance fee due on this?

A. Yes.

* * *

A. That's-from what I can see, yes.

Q. Okay. Well-

A. Well, yeah, that's true. I would agree with that statement.

Q. Okay. Okay. Any other documents that you reviewed in your internal research here at Schlumberger?

A. That was it. That was all I could come up with, you know, just what you have.

Id. at 206-07. It is difficult to imagine how Mr. Kanak (or, indeed, anyone) could have reached a reasonable conclusion that Camco had unintentionally failed to pay the 7 1/2 year maintenance fee for the '048 patent based on such a limited investigation and on the document that he actually reviewed.

248. Ferguson Beauregard also points to other testimony that casts doubt on whether the failure to pay the maintenance fee was truly "unintentional." For example, Ferguson Beauregard points to Mr. Imwalle's testimony that Halliburton had transferred all of its patents relating to its artificial lift and control business to Camco, but that Camco was not specifically interested in obtaining patents related to oil or gas controllers. Plaintiffs' Post-Trial Reply at 52-53. Ferguson Beauregard also points to testimony by Mr. Jeff Knierieman, the current director for Camco's former products and a design engineer for Camco since 1978, that Camco and Schlumberger do not make or sell wellhead controllers, and that Camco had not made or sold any oil or gas well controllers since the mid-1980s, which Ferguson Beauregard points out was ten years before Camco acquired the '048 patent. Id. at 53.

249. In light of the testimony produced at trial, it would not be difficult to reach the conclusion that Mr. Kanak's inquiry into whether the failure to pay the 7 1/2 year maintenance fee for the '048 patent fell short of the standards set for making representations to the U.S. Patent and Trademark Office. *See* 37 C.F.R. s. 10.18(b)(1997)("By presenting to the Office (whether by signing, filing, submitting, or later advocating) any paper, the party presenting such paper, whether a practitioner or non-practitioner, is certifying that-* * * (2) To the best of the party's knowledge, information and belief, formed after an inquiry reasonable under the circumstances, that-* * * (iii) The allegations and other factual contentions have evidentiary support or, if specifically so identified, are likely to have evidentiary support after a reasonable opportunity for further investigation or discovery * * * ").FN29 *See also* 1203 OFF. GAZ. PAT. OFFICECE 63, 103 (October 21, 1997). There is scant "evidentiary support" for the assertion that failure to pay the maintenance fee was unintentional even in the current record, and apparently the only "evidence" that Mr. Kanak had, according to his testimony, when he signed and filed the petition to revive, was Kanak Exhibit 2.FN30 Mr. Kanak was also advised in the text of the PTO notice granting his petition of the necessity for making such a reasonable inquiry. Mr. Kanak's failure to follow-up and interview any of the individuals that may have had first-hand knowledge of whether the failure to pay the maintenance fee indicates that his inquiry may have been less than "reasonable under the circumstances."

FN29. That is the form of the rule that was effective during the relevant time period, and is the form of the rule in effect today.

FN30. The only substantive testimony that Mega Systems introduced in response is the following testimony by Mr. Kanak:
Q. When you investigated this patent and found out that the maintenance fee had not been paid, was there anything in your investigation at all that would have indicated that the delay in payment of the maintenance fee was intentional?

A. I found nothing to that effect.

Tr. May 25, 2001, at 217. That, however, is not the issue. The issue is whether Mr. Kanak had any evidence sufficient to support his representation to the PTO that the failure to pay the maintenance fee was unintentional, not whether that failure was intentional. In any event, the evidence that Ferguson Beauregard points to is sufficient to raise at least a reasonable inference that the failure to pay the maintenance fee was

not "unintentional."
250. However, violations of 37 C.F.R. s. 10.18(b)(2) are subject to "sanctions" that are "deemed appropriate" by the PTO, 37 C.F.R. s. 10.18(c), "after notice and reasonable opportunity to respond." The exemplary "sanctions" listed in the rule would seem to broadly permit the PTO to revisit whether the petition to accept the late payment of maintenance fees should have been granted, but neither the rules nor the statute confirm any power on this Court to deem the PTO's grant of that petition "improper" or otherwise reverse the PTO's actions.

251. The alternative of deciding whether such conduct amounts to inequitable conduct rendering the '048 patent unenforceable is unnecessary to reach in light of the prior orders of this Court, although such a conclusion would be relatively easy based on the present record.

252. Accordingly, Ferguson Beauregard's argument that the '048 patent was "improperly" revived is noted, but Ferguson Beauregard points to no statutory or other authority that would permit this Court to take any action as a result.

6. Past Infringement

253. Although Ferguson Beauregard's AutoCycle controller has been found not to infringe claims 6 or 35 of Mega Systems' '048 patent, and Mega Systems is therefore not entitled to any damages for the same, the parties have raised an issue regarding Mega Systems' right to sue for pre-assignment damages that must be addressed.

254. Ferguson Beauregard urged that "based upon the clear and express terms of the agreement transferring the '048 patent to Defendant Mega Systems, Defendants' Exhibit 201, this Court should hold that Defendant Mega Systems is not entitled to recover for acts of infringement of the '048 patent that allegedly occurred prior to Mega Systems' acquisition of that patent." Plaintiffs' Post-Trial Brief at 37.

255. In response, Mega Systems simply asserts that "the assignment transferred Camco's 'entire right, title, and interest in and to' the '048 patent. Thus, Mega has the right to recover pre-assignment damages arising from Ferguson's infringement of the '048 patent." Defendants' Post-Trial Brief at 30.

256. Mega Systems is alleging a right to receive damages extending back to 1993. Id. at 28. The assignment, however, is dated September 14, 1999. Defendants' Exhibit 201. Mega Systems' argument that it is entitled to pre-assignment damages is plainly wrong in view of well-established law that Mega Systems should have brought to the Court's attention.FN31

FN31. That is not to say that Mega Systems could not have presented other arguments. But the argument that Mega Systems did present has no foundation in fact or law, and is utterly frivolous. Moreover, Mega Systems not only failed to advise the Court of contrary controlling legal precedent, but treated Ferguson Beauregard's argument in a dismissive fashion, apparently attempting to divert attention from the substantive issue.

257. An assignment transferring the assignor's "entire right, title, and interest, in and to" a patent is not alone sufficient to give Mega Systems the right to recover for pre-assignment infringement damages. The law is well settled that an assignment from an assignor of "all of its right, title, and interest in and to" a patent, as

Mega Systems argues, is insufficient to confer standing to sue for pre-assignment damages. Arachnid, Inc. v. Merit Indus., Inc., 939 F.2d 1574, 1579 (Fed.Cir.1991) FN32 ("The general rule is that one seeking to recover money damages for infringement of a United States patent (an action 'at law') *must have held the legal title to the patent during the time of the infringement*." [Emphasis added.]). As the court noted, that has been the rule since before the turn of the last century. In *Crown Die & Tool Co. v. Nye Tool & Mach. Works,* 262 U.S. 24 (1923), for example, the Supreme Court wrote:

FN32. The assignment at issue in *Arachnid* also referred to an assignment of "all of its right, title, and interest in and to" a patent which was held insufficient to confer standing for pre-assignment damages.

The law as to who should bring a suit at law for damages by infringement of a patent is clearly and corrected stated in III Robinson on Patents, s. 937 [1890], as follows:
With a single exception the plaintiff in an action at law must be the person or persons in whom the legal title to the patent resided at the time of the infringement.

See also Moore v. Marsh, 74 U.S. (7 Wall) 515, 522, 19 L.Ed. 37 (1868)("[I]t is a great mistake to suppose that the assignment of a patent carries with it the right to damages for an infringement committed before such assignment."). The single exception, the Federal Circuit noted, is "where the assignment of a patent is coupled with an assignment of a right of action for past infringements," and further noted that "[t]he authorities are uniform that the latter assignment must be express, and can not be inferred from an assignment of the patent itself." Arachnid, 939 F.2d at 1579 n. 7.FN33 Here, that exception is not applicable-Mega Systems does not even argue that the assignment includes an express assignment of a right of action for past infringements.
FN33. The Federal Circuit has also held that a *nunc pro tunc* assignment executed after the filing of a lawsuit cannot retroactively cure standing that was deficient at the time of filing. *See* Enz,o Apa & Son, Inc. v. Geapag A.G., 134 F.3d 1090, 1093 (Fed.Cir.1998).

258. Accordingly, even if the '048 patent were found to have been infringed by Ferguson Beauregard's AutoCycle controller, Mega Systems' damages would be limited to those arising after September 14, 1999, the date of the assignment.

259. Mega Systems' current submissions are insufficient to provide any reasonably accurate calculation of what those damages would be. Thus, if the '048 patent is subsequently found to have been infringed by Ferguson Beauregard's AutoCycle controller, and if Mega Systems is permitted to introduce evidence of damages despite its failure to introduce the same during the trial of this cause, an accounting would be required.

7. Damages

260. Mega Systems presented no evidence whatsoever during trial *vis-a-vis* what would have been a reasonable royalty for practicing what is covered by the '048 patent, and presented no evidence to support a claim for lost profits damages under *Panduit* or otherwise.

261. Post-trial, Mega Systems simply asserts that "Ferguson's royalty rates for the '991 patent are evidence of a reasonable royalty for the '048 patent." Defendants' Post-Trial Reply at 15.

262. Contrary to Mega Systems' assertions, the evidence during trial indicated that the '048 patent was not "broader and more valuable" than the '991 patent, but rather represented an approach to well controllers that was neither favored nor adopted in the field. In short, if Mega Systems intended to pursue damages for infringement of the '048 patent, Mega Systems should have presented evidence of the same. Mega Systems did not. The evidence that Ferguson Beauregard introduced *vis-a-vis* the '721, '376 and '991 patents has little, if any, relevance to the '048 patent. From the evidence of record, the '048 patent has never been asserted by any of its owners, and languished even into lapsing until revived at Mega Systems urging under questionable circumstances.

263. Accordingly, in light of Mega Systems' failure of proof (indeed, Mega Systems' utter failure to even attempt to present such proof) of what a reasonable royalty would have been, the only conclusion that can be reached on the current record is that a reasonable royalty would be but nominal.

264. Mega Systems did not present, and does not even argue that it presented, evidence of lost profits damages. Accordingly, Mega Systems is not entitled to lost profits damages.

CONCLUSIONS OF LAW

To the extent that these conclusions of law are findings of fact, they should be so construed.

265. Ferguson Beauregard has standing to enforce the '721, '376, and '991 patents.

266. Defendant Mega Systems' APC 1000 does not infringe claim 1 of the '721 patent.

267. Defendant Mega Systems' APC 1000 does not infringe claim 10 of the '721 patent.

268. Defendant Mega Systems' APC 1000 infringes claim 1 of the '376 patent.

269. Defendant Mega Systems' APC 1000 infringes claim 16 of the '376 patent.

270. Defendant Mega Systems' APC 1000 infringes claim 35 of the '376 patent.

271. Defendant Mega Systems is liable for its infringement of the '376 patent.

272. Defendant Mega Systems' APC 1000 does not infringe claim 1 of the '991 patent.

273. Defendant Mega Systems' APC 1000 does not infringe claim 2 of the '991 patent.

274. Defendant Mega Systems' APC 1000 does not infringe claim 3 of the '991 patent.

275. Defendant Mega Systems' APC 1000 does not infringe claim 5 of the '991 patent.

276. Defendant Mega Systems' APC 1000 does not infringe claim 6 of the '991 patent.

277. Defendant Mega Systems' APC 1000 does not infringe claim 7 of the '991 patent.

278. Defendant Mega Systems' APC 1000 does not infringe claim 8 of the '991 patent.

279. Defendant Mega Systems' APC 1000 does not infringe claim 9 of the '991 patent.

280. Defendant Mega Systems' APC 1000 does not infringe claim 10 of the '991 patent.

281. Defendant Mega Systems' APC 1000 does not infringe claim 11 of the '991 patent.

282. Defendant Mega Systems' APC 1000 does not infringe claim 12 of the '991 patent.

283. Defendant Mega Systems' APC 1000 does not infringe claim 13 of the '991 patent.

284. Defendant Mega Systems' APC 1000 does not infringe claim 14 of the '991 patent.

285. Defendant Mega Systems' APC 1000 does not infringe claim 15 of the '991 patent.

286. Defendant Mega Systems' APC 1000 does not infringe claim 16 of the '991 patent.

287. Defendant Mega Systems' APC 1000 does not infringe claim 17 of the '991 patent.

288. Defendant Mega Systems' APC 1000 does not infringe claim 18 of the '991 patent.

289. Defendants have not presented clear and convincing evidence that one or more of the claims of the '991 patent is invalid under s. 102(b) due to having placed a product embodying all of the limitations if one or more claims of the '991 patent "on sale" more than one year prior to the filing date of the application maturing into the '991 patent.

290. Defendant James Bartley is not liable for inducing infringement by Defendant Mega Systems of any of the '721, '376 or '991 patents..

291. Plaintiff Ferguson Beauregard's AutoCycle controller does not infringe the '048 patent.

292. Defendants have not presented any evidence of a reasonable royalty for the alleged infringement on the '048 patent, and would be entitled to, at best, a nominal royalty, if infringement had been found.

293. Defendants have not shown by a preponderance of the evidence any of the *Panduit* factors, and would not be entitled to lost profits damages, if infringement of the '048 patent had been found.

294. For Defendants' infringement of the '376 patent, Plaintiffs' are entitled to a judgment in their favor against Mega Systems, but not defendant Bartley, for lost profits of $837.00 for each of the APC 1000 controllers made, used or sold prior to October 5, 1999. The total amount to be awarded will be determined in a subsequent accounting.

295. In lieu of lost profits and at a minimum, Plaintiffs are entitled to a judgment in their favor against Mega Systems, but not defendant Bartley, for not less than a reasonable royalty of $100,000.00 for Mega Systems' infringement of the '376 patent from 1996 through the expiration date of such patent.

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing SPECIAL MASTER'S FINDINGS OF FACT AND CONCLUSIONS OF LAW, has been forwarded via Federal Express on August 31, 2001, to the following parties:

The Honorable William M. Steger, Senior Judge

United States District Judge Eastern District of Texas, Tyler Division

221 W. Ferguson, Room 333

Tyler, TX 75702