UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte YOSHITOSHI YAMAGIWA,
TAKAYOSHI SHIOIRI, TAKASHI TERASHIMA,
and EIKI IWASHITA

Appeal 2007-1207
Application 10/703,917
Technology Center 1641

Decided: May 29, 2007

Before RICHARD E. SCHAFER, RICHARD TORCZON, and ROMULO H. DELMENDO, *Administrative Patent Judges*.

TORCZON, *Administrative Patent Judge*.

DECISION ON APPEAL

INTRODUCTION

The claims on appeal generally relate to arithmetic estimation of temperature for a plasticized resin in a heating cylinder or nozzle outlet of an injection machine. All six pending claims stand rejected under 35 U.S.C. §102(b) as having been anticipated. We reverse.

BACKGROUND

The invention

The invention is directed to estimating the temperature of the plastic resin in the heating tube rather than the temperature of the tube itself. To accomplish this goal, Nissei creates an equation that is the sum of selected process variables with unknown coefficients. Nissei next determines the coefficients experimentally. The equation using the now-known coefficients used to estimate the resin temperature.[1] Nissei explains[2] that:

> whereas the conventionally-known technique estimates such a plasticized resin temperature on the basis of a detected temperature of the heating cylinder and can therefore only achieve poor measurement accuracy, the inventive method can estimate, with a much higher accuracy, plasticized resin temperature closely approximate to an actual measurement.

Claim 1 defines the invention as follows:[3]

> 1. A method for estimating a temperature of plasticized resin within a heating cylinder, which comprises:
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> selecting two or more of a heating cylinder temperature, cycle time, metered resin amount, back pressure and number of rotations of a screw to be set as plasticizing conditions, and setting a provisional plasticized-resin temperature estimating mathematical expression indicating that the selected plasticizing conditions are to be multiplied by respective unknown coefficients and summed up;
>
> conducting a given number of experiments equal to or greater than the number of the unknown coefficients in the provisional plasticized-resin temperature estimating mathematical expression, to thereby acquire data indicative of the selected plasticizing conditions;

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[1] Specification at 2:6-3:2.
[2] Specification at 3:12-17.
[3] The claim language comes from the claims appendix of the appeal brief.

converting the unknown coefficients into known coefficients in accordance with the data acquired from the experiments;

converting the provisional plasticized-resin temperature estimating mathematical expression into a complete plasticized-resin temperature estimating mathematical expression using the known coefficients; and

estimating a current temperature of the plasticized resin within the heating cylinder by substituting data for the selected plasticizing conditions into the complete plasticized-resin temperature estimating mathematical expression.

The reference

The examiner rejected claim 1 over a patent to Searle.[4] Searle is concerned with controlling the temperature within the feed assembly of an injection-molding machine, both to bring it up to temperature from a cold start and to tune the temperature in steady-state operation.[5] Searle explains that, in the art, plastic for injection molding enters a feed barrel in granular form, where it is melted in preparation for injection. In this process, temperature control is critical to bring the temperature up to a set point without overshooting. It is also desirable to have the system "autotune" the temperature for steady-state operation.[6]

The examiner points[7] to Searle's discussion of melting plastic in the heating tube[8] to show that Searle estimates the plastic resin temperature. Searle discloses that:

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[4] J.G. Searle et al., "Injection molding machine temperature control system", U.S. Patent 5,397,515 (granted 14 March 1995).
[5] Searle, abstract.
[6] Searle at 1:9-22.
[7] Answer at 9.
[8] Searle at 3:20-34.

> The barrel **16** is heated by different sets of heater bands **24** located around its outer surface that define separate heating zones which may be independently controlled. Temperatures within the barrel **16** are sensed by temperature transducers **26** which are located at the inner surface of the barrel **16** so that they can provide information on the temperature of the plastic materials within the barrel at the different heating zones.

This disclosure states that Searle uses transducers located at the inner surface of the barrel to obtain "information on the temperature of the plastic materials."

The examiner relies[9] on Searle's $Theta_D$ as a cycle time and T_{p1} as (projected) heating cylinder temperature for plasticizing variables. Nissei disagrees with these characterizations. Searle defines $Theta_D$ as the time for process temperature to rise 2° at full heater power.[10] T_{p1} is calculated from $Theta_D$, the current temperature T_{cur}, and the rate of temperature change.[11] Searle does teach that the projected temperature can be forecasted from a mathematical expression, $T_{p1} = (Slope*1.5Theta_D) + T_{cur}$, identified as Equation (3). In Equation (3), $Theta_D$ is multiplied by a variable coefficient "Slope*1.5" but current temperature T_{cur} is multiplied by a *fixed known* coefficient of unity. Hence, even assuming that T_{cur} is a plasticizing condition within the scope of the appealed claims, Searle's disclosure with respect to Equation (3) does not describe "setting a provisional plasticized-resin temperature estimating mathematical expression indicating that the selected plasticizing conditions are to be multiplied by respective *unknown* coefficients and summed up" (emphasis added) and "converting the *unknown* coefficients into known coefficients" (emphasis added).

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[9] Answer at 8.
[10] Searle at 6:25.
[11] Searle at 6:40.

The examiner points[12] to Searle's use of iterative measurements[13] to show that Searle performs repeated experiments to acquire data about heating cylinder temperature and cycle time. The iterative step disclosed, however, appears to be a check on whether the barrel temperature is within a predefined range.

The examiner points[14] to Searle's discussion of phase 6 during steady-state operations [15] as support for converting a provisional formula into a completed resin-temperature estimating formula. Searle explains that if autotuning is requested for steady-state operations, constants for system gain, system time, proportional gain, and integral gain are calculated or recalculated. The relationship of the equations in this discussion to an equation for determining an estimated plasticized resin temperature by summing the separate products of $Theta_D$ and T_{p1} with coefficients is not clear.

Analysis

During examination, a claim must be construed as broadly as it reasonably can be construed in light of the disclosure. Claim 1 defines a method of estimating a resin temperature. Nissei explains that barrel temperature is a poor proxy for resin temperature, so the fact that Searle is directed to controlling barrel temperature is not fatal.

Heating cylinder temperature and cycle time are two of the variables in claim 1. The examiner has identified variables in Searle that qualify as a

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[12] Answer at 9.
[13] Searle at 5:12-30.
[14] Answer at 10.
[15] Specification at 9:10-27 and 49-67.

heating cylinder temperature and a cycle time, but has not successfully related these variables to the sum of products for estimating a resin temperature that claim 1 requires.

Searle and Nissei address closely related problems in the same equipment. Unsurprisingly they employ similar variables. Their goals and methods differ, however.

CONCLUSION

Searle does not anticipate all of the limitations of claim 1. The missing elements are also present in independent claim 2 and in claims 3-6, which all depend from either claim 1 or claim 2. Consequently, the rejection must be—

REVERSED

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