Mackay Radio). It should be noted that in this case, the formula is novel, yet is an abstract idea. Thus, the claim is directed to an exception (*Step 2A: YES*).

Next, the claim as a whole is analyzed to determine whether any element, or combination of elements, is sufficient to ensure that the claim amounts to significantly more than the exception. The claim recites additional elements/steps of determining the value of an unspecified process variable involved in catalytic chemical conversion of hydrocarbons and adjusting the alarm limit to the calculated updated alarm limit value. The preamble specifies the field of use, which is catalytic conversion of hydrocarbons, but in this case imposes no limits on the process of calculating an alarm limit value using the specified equation.

Taken alone, none of the additional elements amounts to significantly more than the exception. Determining the value of an unspecified process variable is mere data gathering and the claimed adjusting the alarm limit to an updated limit is mere post-solution activity that could be attached to almost any formula. By failing to explain how the process variable is selected, integrate the formula into any specified chemical processes at work in the catalytic conversion, or specify the means of setting off an alarm or adjusting the alarm limit, the claim fails to improve the recited technological field. The steps merely calculate a result using a novel equation and do not add any meaningful limits on use of the equation. Taken alone or as an ordered combination, these additional elements do not amount to a claim as a whole that is significantly more than the exception. (*Step 2B: NO*). The claim is not eligible.

For purposes of discussion, it is noted that if the broadest reasonable interpretation of this claim were limited to a computer implementation, adding a generic computer to perform generic functions that are well-understood, routine and conventional, such as gathering data, performing calculations, and outputting a result would not transform the claim into eligible subject matter. Generic computer-implementation of the method is not a meaningful limitation that alone can amount to significantly more than the exception. Moreover, when viewed as a whole with such additional elements considered as an ordered combination, the claim modified by adding a generic computer would be nothing more than a purely conventional computerized implementation of applicant's formula in the general field of industrial chemical processing and would not provide significantly more than the judicial exception itself.

A rejection of claim 1 should identify the exception by pointing to the formula in the claim and explain that the formula is a mathematical relationship similar to those found by the courts to be abstract. The rejection should also identify the additional elements in the claim and explain why they do not amount to significantly more, in this case, because they merely add data gathering and a field of use.

25. Rubber Manufacturing

The following illustrates an exemplary analysis using the 2014 IEG for actual and hypothetical claims modeled after the technology in Diamond v. Diehr, 450 U.S. 175 (1981) (Diehr). As the claims in this example are eligible, no written analysis would be provided in an Office action. The application at issue was granted as U.S. Patent No. 4,344,142. Actual claim

1 recites a method that is directed to a mathematical relationship and steps that could be performed mentally and has additional elements/steps that amount to significantly more than the abstract ideas because as a whole they transform a particular article to a different state or thing and use the abstract ideas to improve another technology/technical field, either of which can show eligibility. Claim 2 is a hypothetical claim in the form of computerized instructions. Claim 2, which also is directed to the mathematical relationship and steps that could be performed mentally, is eligible due to the additional elements/steps that use the abstract ideas to improve another technology/technical field.

Background

Applicant has invented a process of controlling a rubber molding press with a computer to precisely shape uncured material under heat and pressure and then cure the synthetic rubber in the mold to obtain a product that retains its shape. Raw (uncured) synthetic rubber comprises independent polymeric chains, *e.g.,* a mixture of isobutylene and isoprene polymers. Curing cross-links the polymeric chains together, thereby changing the rubber from its raw state into a more durable form that will retain a molded shape. Proper curing depends upon several factors including the thickness of the article to be molded, the temperature of the molding process, and the amount of time that the article is allowed to remain in the press.

At the time of applicant's invention, the usual way of operating rubber-molding presses is for the operator to load and close the press manually. Closure of the press operates a timer that is preset for an estimated cure time. Due to the manual operation, the actual mold temperature may vary, and result in overcured or undercured rubber because the preset time is not equivalent to the actual time required for proper curing.

In the instant application, applicant's process improves upon conventional molding processes by constantly measuring the actual temperature inside the mold using a thermocouple, and automatically feeding these temperature measurements into a standard digital computer that repeatedly recalculates the cure time by use of the Arrhenius equation. The Arrhenius equation has long been used to calculate the cure time in rubber-molding processes, and can be expressed as ln v = CZ+x, where ln is natural logarithm conversion data, v is the total required cure time, C is the activation energy constant unique to each batch of said compound being molded, Z is the temperature of the mold, and x is a constant dependent upon the geometry of the particular mold of the press. When the recalculated time equals the actual time that has elapsed since the press was closed, the computer signals a device to open the press. Applicant's process obtains uniformly accurate cures, which results in substantially reducing the number of defectively cured batches that must be discarded. The improved process also substantially reduces the amount of time in which the presses are closed unnecessarily, thereby resulting in more efficient employment of the mold and operator.

Claims

1. A method of operating a rubber-molding press for precision molded compounds with the aid of a digital computer, comprising:

providing said computer with a data base for said press including at least, natural logarithm conversion data (ln), the activation energy constant (C) unique to each batch of

said compound being molded, and a constant (x) dependent upon the geometry of the particular mold of the press,

initiating an interval timer in said computer upon the closure of the press for monitoring the elapsed time of said closure,

constantly determining the temperature (Z) of the mold at a location closely adjacent to the mold cavity in the press during molding,

constantly providing the computer with the temperature (Z),

repetitively calculating in the computer, at frequent intervals during each cure, the Arrhenius equation for reaction time during the cure, which is ln v = CZ+x, where v is the total required cure time,

repetitively comparing in the computer at said frequent intervals during the cure each said calculation of the total required cure time calculated with the Arrhenius equation and said elapsed time, and

opening the press automatically when a said comparison indicates equivalence.

2. A non-transitory computer readable medium with computer executable instructions stored thereon executed by a processor to perform the method of controlling a rubber-molding press having a mold with a cavity for precision molded compounds, the method comprising:

accessing a data base in the computer including at least, natural logarithm conversion data (ln), the activation energy constant (C) unique to each batch of said compound being molded, and a constant (x) dependent upon the geometry of the particular mold of the press,

initiating an interval timer in the computer upon the closure of the press for monitoring the elapsed time of the closure,

constantly receiving data relating to the temperature (Z) of the mold at a location closely adjacent to the mold cavity in the press during molding,

repetitively calculating in the computer, at frequent intervals during each cure, the Arrhenius equation for reaction time during the cure, which is ln v = CZ + x where v is the total required cure time,

repetitively comparing in the computer at the frequent intervals during the cure each calculation of the total required cure time calculated with the Arrhenius equation and the elapsed time, and

initiating a signal that controls the press to open when the comparison indicates equivalence, meaning that the molded product is cured.

Analysis

Claim 1: Eligible.

The claim recites a series of acts including determining the temperature of the mold and providing that temperature to the computer. Thus, the claim is directed to a process, which is one of the statutory categories of invention (*Step 1: YES*).

The claim is then analyzed to determine whether it is directed to any judicial exception. The claim recites a limitation of repetitively calculating the Arrhenius equation (the mathematical formula: ln v = CZ+x) for reaction time during the cure. This limitation sets forth a judicial exception, because calculating the reaction time using the Arrhenius equation is a mathematical relationship that the courts have held is representative of a law of nature (*e.g.*, the mathematical formula in *Flook*). Mathematical relationships such as this have also been characterized by the courts as abstract ideas. Additionally, the claim limitations of performing repetitive calculations and comparisons between the calculated time and the elapsed time could be performed by a human using mental steps or basic critical thinking, which are types of activities that have also been found by the courts to represent abstract ideas (*e.g.*, the mental comparison in *Ambry Genetics*). Thus, the claim is directed to at least one exception (*Step 2A: YES*).

Next, the claim as a whole is analyzed to determine whether any additional element, or combination of elements, is sufficient to ensure that the claim amounts to significantly more than the exceptions (the mathematical relationship and the critical thinking steps of calculating and comparing). Since there are multiple abstract ideas recited in the claim, the Step 2B analysis needs to be conducted for each abstract idea individually, until the analysis shows ineligibility for one or eligibility for all.

The Step 2B analysis is first conducted for the mathematical relationship. Besides the mathematical relationship, the claim recites additional elements of providing a digital computer with a data base of values, initiating an interval timer, constantly determining the temperature of the mold, constantly providing the computer with the temperature, using the computer to perform the calculations and comparisons, and opening the press automatically when the comparison indicates equivalence. Some of the additional elements/steps, such as accessing a database and using a computer to perform calculations and comparisons, are routine computer activities or generic functions performed by a computer that taken alone do not add significantly more to the process instructions in the claim. By themselves, these limitations are recited at a high level of generality and perform the basic functions of a computer that are well-understood, routine and conventional (*e.g.*, accessing a data base to receive and store data, and performing mathematical operations on a computer). Likewise, initiating a timer and determining a temperature, taken alone, are mere data gathering steps to obtain data necessary to calculate the time using the Arrhenius equation.

However, when viewing the claim as a whole, the combination of all these steps taken together, including the constant determination of the temperature of the mold, the repetitive calculations and comparisons, and the opening of the press based on the calculations, amount to significantly more than simply calculating the mold time using the Arrhenius equation because they add meaningful limits on use of the equation. The claim

does not merely recite the equation in isolation, but integrates these ideas into the molding process. The additional steps specifically relate to the particular variables used, how the variables are gathered, the process by which the rubber is molded and cured, and how the result of the cure time calculation is used. The totality of the steps act in concert to improve another technical field, specifically the field of precision rubber molding, by controlling the operation of the mold. In addition, the claimed steps taken as a combination effect a transformation of the raw, uncured synthetic rubber into a different state or thing, *i.e.*, a cured and molded rubber product. Thus, the claim amounts to significantly more than the mathematical relationship (*i.e.*, the abstract idea of the Arrhenius equation).

Because the claim is eligible with respect to the first abstract idea, it is expected that the additional limitations will amount to significantly more than the second abstract idea (the critical thinking steps of calculating and comparing). This is true in this example. The additional limitations discussed above are significantly more than the critical thinking skills of calculating and comparing results. As previously stated, evaluating the additional limitations both individually and as an ordered combination demonstrates that the claim improves the technical field of precision rubber molding and transforms the raw, uncured synthetic rubber into a different state or thing. Taking all the claim elements both individually and as an ordered combination, the claim as a whole amounts to significantly more than the abstract ideas (*Step 2B: YES*). The claim recites patent eligible subject matter.

If the examiner believes that the record would benefit from clarification, remarks could be added to an Office action or reasons for allowance indicating that the claim recites exceptions including the Arrhenius equation, which is a law of nature or abstract idea. However, the claim is eligible because it recites additional limitations that when considered as an ordered combination provide meaningful limits on the use of the equation and improve the technical field of precision rubber molding.

Claim 2: Eligible.

The claim recites a non-transitory computer-readable medium with stored instructions that are used to control a rubber molding press. The claim is directed to a manufacture (an article produced from materials), which is a statutory category of invention (*Step 1: YES*). Note that the term "non-transitory" ensures the claim does not encompass signals and other non-statutory transitory forms of signal transmission.

The claim recites the same steps of performing repetitive calculations of the reaction time using the Arrhenius equation and comparing the results as claim 1, albeit in the form of computer executable instructions. Therefore, the claim is directed to the same abstract ideas identified in claim 1 (*Step 2A: YES*).

Conducting the Step 2B analysis for the first abstract idea (the Arrhenius equation), the claim recites additional elements including computer instructions to access a database, initiate an interval timer, constantly receive data, and initiate a signal to control the press. The steps also include computer instructions to implement the equation. While some of the elements taken alone are well-understood, routine and conventional use of a computer, or mere data gathering, the combination of the additional elements when the claim is viewed as a whole amounts to significantly more than simply calculating the mold time using the

Arrhenius equation. The totality of the steps governed by the claimed instructions provides software that improves another technical field, specifically the field of precision rubber molding, through controlling the operation of the mold by initiating a signal to control the press to open when the comparison indicates equivalence and the molded product is cured. This software enhances the ability of a specific rubber molding device to open the press at the optimal time for curing the rubber therein. This process does not merely link the Arrhenius equation to a technical field, but adds meaningful limitations on the use of the mathematical relationship by specifying the types of variables used (temperature and time), how they are selected (their relationship to the reaction time), how the process uses the variables in rubber molding, and how the result is employed to improve the operation of the press. For at least these reasons, the elements/steps recited in addition to the mathematical formula, particularly taken in combination, show that claim 2 is not directed to instructions to use the formula in isolation, but rather integrate the concept into an eligible control scheme to improve another technological process.

Similarly, the claim recites additional limitations that when viewed as an ordered combination amount to significantly more than the second abstract idea (the critical thinking steps of calculating and comparing the timing data). As already discussed, these additional limitations demonstrate an improvement in the field of precision rubber molding technology and amount to more than simple instructions to perform the calculating/comparing steps in isolation. Thus, the claim amounts to significantly more than the judicial exceptions (*Step 2B: YES*). The claim recites patent eligible subject matter.

If the examiner believes that the record would benefit from clarification, remarks could be added to an Office action or reasons for allowance indicating that the claim recites exceptions including the Arrhenius equation, which is a law of nature or abstract idea. However, the claim is eligible because it recites additional limitations that when considered as an ordered combination provide meaningful limits on the use of the equation and improve the technical field of precision rubber molding.

26. Internal Combustion Engine

This hypothetical example demonstrates the use of the streamlined analysis. The claim below is based on the technology from U.S. Pat. 5,533,489. As a streamlined analysis would not result in a written rejection, the discussion sets forth exemplary reasoning an examiner might use in drawing a conclusion of eligibility.

Background

Nitrogen oxides are constituents of exhaust gas that are produced during the operation of an internal combustion engine. It is generally understood that nitrogen oxides are harmful to our atmosphere and cause air pollution. The amount of nitrogen oxides produced in the exhaust gas is relative to the temperature that the fuel and air mixture burns in the engine. Therefore, exhaust gas recirculation (EGR) has been developed to recirculate the exhaust gas back to the air intake, which reduces the amount of oxygen in the combustion mixture and causes it to burn at a lower temperature, thereby reducing the amount of nitrogen oxides produced. However, as the amount of EGR increases there may be a resulting decline in engine performance (*e.g.*, a decrease in power output).