COMMISSIONER'S DECISION

Section 2: OPTIMIZING PERFORMANCE of a Multi-Unit Power Plant

Optimizing the performance of a multi-unit power plant which produces steam energy from a plurality of different fuels where the input perturbations to the system affecting its performance cannot be directly and accurately measured is statutory subject matter.

Final Action: Reversed.

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Patent application 273,956 (Class 341-110), was filed on March 15, 1977 for an invention entitled "METHOD OF OPTIMIZING THE PERFORMANCE OF A MULTI-UNIT POWER PLANT". The inventors are Louis S. Adler et al, (assignors to Measurex Corporation). The Examiner in charge of the application took a Final Action refusing to allow it to proceed to patent.

The subject matter of this application relates to optimizing the performance of a multi-unit power plant by determining the incremented efficiency of the boilers and thereafter determining the index of performance and reallocating the sequence of their use in the most optimum manner. It is concerned with power plants in the wood pulp industry where the boilers are fired with a base fuel such as coal or wood chips and a swing fuel such as oil. The steam produced is used for several purposes such as generating electricity, heating reactors and drying pulp. In this application the applicant determines changes in efficiency resulting from small incremental changes in fuel used, and from that, coupled with the cost of the fuels then calculates the most effective allocation of fuels to be used for a particular combination of desired uses.

In the Final Action the examiner rejected the disclosure and claims as being essentially "directed to an algorithm for controlled power plant parameters and therefore unpatentable subject matter under Section 2." That action stated (in part):

> ...
> It is well known in the systems art to employ computers for feedback control ie., sensing flow rates etc. and the applicant states the same on page 6 lines 16-17. The equations as defined in the disclosure are all reiterative and/or differential and there would be considerable difficulty in applying another embodiment instead of a computer. State of the art technology

dictates that real time calculations are biased towards computers and since there is no indication to the contrary in the application to suggest other computational modes, this implies the invention (if any) lies not in the apparatus but rather in computer programming, the latter constituting unpatentable subject matter.

Since the disclosed flow charting and computations are not carried out with specific new fully disclosed apparatus devised to implement a new method of boiler steam control as a function of fuel costs, the disclosure and claims are further rejected as being directed essentially to an algorithm for controlling a turbine.

The applicant implies that the measurement of the primary variables is unique and after computation of the efficiencies, physical changes occur. It is obvious that the feedback network which the applicant utilizes is the most standard and well known in hydraulic flow control (United States Patent 3,676,066, Figure 1), ie, flow transmitters and variable valve actuators. An electrical analogue is the combination of an ammeter with a potentiometer to control current flow.

Actuation of a valve in response to a value derived from a computer cannot be considered novel only because the computer derives a result in a more optimum manner. The embodiments exemplified in Figures 5, 6 and 7 show the novelty lies solely in the flow chart or computations which are realized by programming.

It is conclusive to the examiner that the steps recited in claim 1 and correspondingly claims 2, 3 and 4 (same scope as claim 1) all relate to a computer program function derived from algorithms and flow charts and since the only embodiment disclosed is the computer program generated one, it is concluded the only difference from the cited structure is the software applied.

...

In response to the Final Action the applicant stated (in part):

...

The present invention is directed to a dynamic method of testing the units of a power plant to achieve the lowest cost operation. Specifically, the incremental cost is equal to the incremental efficiency (which is the ratio of incremental input energy to incremental output energy) multiplied by the cost of input energy. This is constantly calculated and, as stated in the disclosure, it must be constantly calculated since conditions change from hour to hour in most power plants of the type considered. Thus, at any one point in time the units with the highest and lowest incremental cost are known. This is believed to be a significant advance in the art.

> Claim 1 defines a combination of process steps. Some of the steps may be known in themselves, but the overall claimed combination of process steps is submitted to be new and unobvious. Furthermore, as actual physical process steps are included in the claim, it is submitted to be improper to characterize it as merely being directed to an algorithm, computer program, or the like. Claim 1 is directed to optimizing the performance of a multi-unit power plant which produces steam energy from a plurality of different fuels. To optimize the performance, one step involves performing "bump" tests and, as explained in the disclosure, this involves varying the fuel supplies to the boilers and measuring the resultant change in steam production, these being real, physical steps. Claim 1 specifically recites these physical steps. Claim 1 does include, as one element of the claim, a step comprising determining the incremental index of performance of each unit by utilizing the incremental efficiency determination and the cost of the fuels, but it is submitted to be incorrect to discard the entire claim because of the inclusion in it of this step which involves mathematical calculations. Note that the particular calculations are not being claimed per se. Finally, claim 1 requires the real, physical step of reallocating the energy outputs of the units by changing the fuel inputs in accordance with calculated indices of performance.
>
> ...

The consideration before the Board is whether or not the application is directed to patentable subject matter. Claim 1 reads as follows:

> A method of optimizing the performance of a multi-unit power plant which produces steam energy from a plurality of different fuels where said steam energy used for independent purposes is a significant fraction of the total energy produced by said power plant and where input perturbations to the system affecting its performance cannot be directly and accurately measured said method comprising the following steps: determining by bump tests the real time incremental efficiency of the units of said power plant including the step of sensing a change in fuel input; determining the incremental index of performance of each of said units by utilizing said incremental efficiency determination and the costs of said fuels; and reallocating the energy outputs of said units by changing the fuel inputs in accordance with said indices of performance.

As we have stated earlier this application is for optimizing the performance of a multi-unit power plant in which the steam is used both to generate electricity and as part of the processing operation. On page 4 of the disclosure the application states at line 4 ff. that:

> The steam energy used for different purposes is a significant fraction of the total energy produced by the power plant. Input perturbations to the system affecting its performance cannot be directly and accurately measured. The real time incremental efficiency of the units of the power plant are determined by bump tests. Change in the energy output of the units in response to change in energy input is sensed. The index of performance of the units is determined by utilizing the incremental efficiency determination. The energy outputs of the units are reallocated in accordance with the index of performance.

The Final Action analyzes claim 1 as having a direct correlation to figures 5, 6 & 7 which show flow charts for understanding the specific features of the invention. It says that the first step of claim 1 is attained by the control computer (fig. 5), the second step is accomplished by the use of equations and the corresponding flow chart (fig. 6) while the third step calls for reallocating the energy outputs as depicted in figures 5 and 7. From this the Examiner concludes that the "flow charts used to develop steps 1, 2 and 3 of claim 1 clearly indicate the presence and exigency for a computer to achieve the integrated result of claim 1".

Applicant's claim 1 specifies optimizing the performance of a multi-unit power plant which produces steam energy from a plurality of different fuels where the input perturbations to the system affecting its performance cannot be directly and accurately measured. Incremental efficiency is determined by bump tests after which the fuel is reallocated for the most efficient operation. However no art is cited to show that "bump tests" for a multi-unit power plant are known. Further the Schlumberger 56 CPR 2d(1981)decision states that "the fact that a computer is or should be used to implement discovery does not change the nature of that discovery." Claim 1 specifies a bump test in combination with a computer and in our view does describe patentable matter in compliance with Section 2 of the Act.

We note that U.S. patent 3,676,066 was initially cited as an applied reference in the Final Action. This patent was cited to show "it is obvious that the feedback network which the applicant utilizes is the most standard and well known in hydraulic flow control". We make the following observations with

respect to this patent which relates to a chemical process such as the production of ammonia where the unreacted feed constituents are recycled. It shows feed components that react in fixed ratios to one another and the conversion per pass is in the order of 25 percent. This patent is also directed to a control procedure which permits the composition of reactor feed "to be regulated in response to an analysis of the feed introduced into the reactor or an analysis of the recycle stream." The application before us does not have any fixed ratio of feed component reaction, and does not recycle unreacted feed components but is concerned with fuel supply for the most efficient operation.

The Final Action states that "it is well known in the systems art to employ computers for feedback control i.e. sensing flow rates" and concludes that since the equations as defined in the disclosure are all reiterative there would be considerable difficulty in applying another embodiment instead of a computer. It adds that the "state of the art technology dictates that real time calculations are biased toward computers and since there is no indication to the contrary in the application to suggest other computational modes, this implies the invention (if any) lies not in the apparatus but rather in computer programming."

We think that the above example referring to sensing flow rate is an area where input perturbations to the system are directly and accurately measured. This is not the condition described in this application where input perturbations to the system affecting its performance cannot be directly and accurately measured. Therefore, in the absence of cited art we do not agree that the invention resides only in computer programming.

In summary, we recommend that refusal of the application and claims be withdrawn, and the application be returned to the examiner. We note in returning the application to the examiner that claims 2 and 4 are identical.

M.G. Brown
Acting Chairman
Patent Appeal Board

S.D. Kot
Member

I have reviewed the prosecution of this application and concur with the reasoning and findings of the Board. Accordingly, I am returning this application to the Examiner.

J.H.A. Gariépy
Commissioner of Patents

Dated at Hull, Quebec

this 24th. day of November, 1983

Agent for Applicant

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