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Our file RX-61/10

Dear Sir/Madam:

Re: Request for reexamination of Patent Number 2,668,777
Patent Title: Optimized Mine Ventilation System
Patentee: SimSmart Technologies Inc.
Requester: J. Gordon Thomson

In accordance with Subsection 48.2(2) of the *Patent Act*, the Reexamination Board has reviewed the request for reexamination of claims 1 to 19 of Canadian Patent number 2,668,777 and has determined that it raises a substantial new question of patentability with regard to claims 1 to 5 and 16 to 19.

In the request for reexamination, the Requester has brought to the attention of the Board the following prior art comprising of 18 references.

For ease of reference, the reference numbers used by the requester have been used by the Board.

Published Non-Patent Literature
D1: Kocsis, C. K., and Hardcastle, S., *"Ventilation system operating cost comparison between a conventional and an automated underground metal mine"*, Mining Engineering, pp. 57-64, October 2003.
D2: Duckworth, I. J., Wallace Jr., K. G., and Wise, R., *"Skyline Mines: Ventilation Planning and Design"*, Coal, pp. 1-6, August 1995.
D3: Widzyk-Capehart, E., and Fawcett, C., *"Life of Mine Ventilation Requirements for Bronzewing Mine Using Ventsim"*, Proceedings of the 7th International Mine Ventilation Congress, chap. 114, pp. 815-822, 2001.
D4: Hardy, R. J., and Heasley, K. A., *"Ventilation simulation programs MineVent and MFIRE: Updates to advance the technology of simulation programming"*, Proceedings of the 11th U. S./ North American Mine Ventilation Symposium 2006, pp. 477-482.
D5: Marx, W., von Glehn, F. H., and Wilson, R. W., *"Design of energy efficient mine ventilation and cooling systems"*, Proceedings of the 11th U. S./ North American Mine Ventilation Symposium 2006, pp. 279-284.

D6: Gillies, A. D. S., Wu, H. W., Tuffs, N., and Sartor, T., *"Development of a Real Time Airflow Monitoring and Control System"*, Proceedings of the Tenth US Mine Ventilation Symposium, Anchorage, Balkema, The Netherlands, Sections 1-5, May 2004.
D9: Hardcastle, S. G., Gangal, M. K., Scheer, M., and Gauthier, P., *"Ventilation-On-Demand - Quantity or Quality - A Pilot Trial at Barrick Gold's Bousquet Mine"*, Proceedings of the 8th US Mine Ventilation Symposium, pp. 31-38, 1999.
D10: Hardcastle, S., Kocsis, C., and O'Connor, D., *"Justifying ventilation-on-demand in a Canadian mine and the need for process based simulations"*, Proceedings of the 11th U. S./ North American Mine Ventilation Symposium 2006, pp. 15-27.
D11: Kocsis, C. K., Hall, R., and Hardcastle, S. G., *"The integration of mine simulation and ventilation simulation to develop a "Life-Cycle" mine ventilation system"*, APCOM 2003, pp. 223-230.

United States Patents

D7: 6,645,066	November 11, 2003	454/229	Gutta et al.
D8: 6,916,239	July 12, 2005	454/256	Siddaramanna et al.
D13: 7,123,149	October 17, 2006	340/572.1	Nowak et al.
D14: 6,512,312	January 28, 2003	307/326	Herkenrath et al.
D15: 5,803,804	September 8, 1998	454/256	Meier et al.
D16: 5,464,369	November 7, 1995	454/256	Federspiel
D17: 6,735,556	May 11, 2004	703/2	Copel

PCT Patent Application

D12: WO2007/107029 A1	27 September 2007	H04L-12/28	Hunziker

E-mail
D18: Mousset-Jones, P., "Simsmart Technologies Patent VOD", pp. 1-2, April 14, 2010.

Brief description of the prior art references

D1 (Kocsis et al.) teaches air flow requirements in stopes and dead-end developments for the tele-remote and automated mining processes based on climatic modelling.
D2 (Duckworth et al.) discloses planning future ventilation needs in a mine using data collected from ventilation surveys and computer modelling.
D3 (Widzyk-Capehart et al.) teaches mine ventilation requirements using Ventsim ventilation software.
D4 (Hardy et al.) teaches mine ventilation software MineVent and MFIRE updates.
D5 (Marx et al.) discloses mine ventilation monitoring to predict mine conditions in different areas.
D6 (Gillies et al.) teaches modelling of airflow in mines based on real time information.
D7 (Gutta et al.) shows camera and imaging processing techniques to detect occupancy for HVAC control in a space.
D8 (Siddaramanna et al.) teaches air quality in a building controlled by a personnel access control system and infrared sensors.
D9 (Hardcastle et al.) discloses an automated demand based ventilation management system in a mine.
D10 (Hardcastle et al.) teaches process based simulation to determine ventilation requirements specific to any point in time in the transient mining process.

D11 (Kocsis et al.) shows discrete event simulation for mine planning with ventilation modelling.
D12 (Hunziker) teaches wireless underground data transmission between multiple mobile stations and a fixed network.
D13 (Nowak et al.) teaches tracking personnel, tools and materials in a work site.
D14 (Herkenrath et al.) discloses a device and method to detect persons in a mine.
D15 (Meier et al.) teaches ventilation on demand from monitored air quality.
D16 (Federspiel) shows an apparatus for controlling environment variables.
D17 (Copel) teaches real time simulation of a model with manipulation of model parameters.

Inapplicable Reference
D18 (Mousset-Jones) constitutes a communication dated April 14, 2010 and discusses the grant of a patent on February 16, 2010 to the present patentee on mine ventilation. **D18** (Mousset-Jones) is not citable for novelty or obviousness under paragraphs 28.2(1)(a) or 28.3(a) of the Patent Act.

The Claims of Canadian Patent 2,668,777

Canadian patent number 2,668,777 contains 19 claims, all of which are the subject of the present request for reexamination.

Claim 1 is independent and defines a method of optimizing mine ventilation, the method comprising:
- calculation of a ventilation demand of a zone of interest; as a function of machinery location and operating status and personnel location monitoring,
- determining an optimal quantity of ventilation required for said zone of interest; and
- remotely controlling a ventilation flow in said zone of interest as a function of said determined optimal quantity of ventilation required.

Claim 2 depends on claim 1 and specifies that said determining an optimal quantity of ventilation comprises: calculation of monitoring data using a ventilation system model adapted to determine an optimal quantity of ventilation required in said zone of interest.

Claim 3 depends on claim 2 and specifies that said monitoring said zone of interest, said determining an optimal quantity of ventilation and said remote controlling of ventilation equipment are carried out in real-time.

Claim 4 depends on claim 3 and adds that said monitoring comprises monitoring presence of operating machinery and personnel inside said zone of interest and said monitoring data comprises machinery-and-personnel related data.

Claim 5 depends on claim 4 and specifies that said monitoring presence of operating machinery and personnel comprises gathering said machinery-and-personnel related data using a monitoring and communication system covering said zone of interest, where said machinery-and-personnel related data comprises an indication of a quantity of operating machinery and personnel present inside said zone of interest.

Claim 6 depends on claim 5, with said machinery-and-personnel related data further comprising, if operating machinery is present in said zone of interest, an indication if said machinery is diesel operated, and if it is the case, an engine or hydraulic-electric operating status of said machinery.

Claim 7 depends on claim 6 and adds that said machinery-and-personnel related data further comprises, if operating machinery is present in said zone of interest and said machinery is diesel operated, engine-characteristics related data allowing for determining a total amount of horse power of said machinery.

Claim 8 depends on claim 7 and specifies that said controlling a ventilation flow in said zone of interest is carried out by modulating speed of fans and/or regulators position.

Claim 9 depends on claim 8, wherein the presence of machinery is detected using a wireless communication system.

Claim 10 depends on claim 8, wherein the presence of personnel is detected using a wireless communication system.

Claim 11 depends on claim 9, wherein the presence of machinery is detected using a radio frequency identification system.

Claim 12 depends on claim 10, wherein the presence of personnel is detected using a radio frequency identification system.

Claim 13 depends on claim 7 and specifies that said controlling a ventilation flow in said zone of interest is optionally manually controlled by an operator.

Claim 14 depends on claim 13 and adds that said manual control is carried out by said operator using a graphical Human-Machine-Interface allowing graphical visualization of a ventilation status as per simulation model calculations of said zone of interest.

Claim 15 depends on claim 14 and specifies that said remotely controlling a ventilation flow in said zone of interest comprises adjusting speed of fans and/or regulators position.

Claim 16 is independent and defines a system for optimizing ventilation equipment, the system comprising:
- a real-time simulation model based control system which calculates air flow data in real-time for a zone of interest;
- a real-time simulation model that calculates flow and pressure as a function of the density and temperature variation which is a function of depth;
- a real-time simulation model that accounts for natural ventilation pressure flows;
- an optimizer for air flow distribution and fan energy consumption connected to said simulation model unit, as a function of an optimal quantity of ventilation required for said zone of interest;
- a real-time simulation model that will correlate physical air flow measurements to modelled air flow calculations and in case of discrepancies will have the capability to automatically calibrate system components k factor resistance to match physical measurements; and
- a ventilation equipment controlling unit connected to said optimal ventilation simulating unit and adapted to be connected to a communication system for remotely controlling performance

of ventilation equipment as a function of said determined optimal quantity of ventilation required.

Claim 17 depends on claim 16 and defines that said remote controlling of ventilation equipment is triggered upon reception, by said ventilation equipment controlling unit, of said determined optimal quantity of ventilation required.

Claim 18 depends on claim 16 and further comprises a graphical image generating module connected to said monitoring unit for generating, as a function of said calculated by modelling and received monitoring data, a graphical image of a current ventilation status of said zone of interest.

Claim 19 depends on claim 18 and specifies that said graphical image generating module is further connected to said optimal ventilation simulating unit for generating, as a function of said determined optimal quantity of ventilation required, a graphical image of an optimal ventilation status of said zone of interest.

Novelty

The Board considers the closest prior art document to independent claim 1 to be **D5**. Marx et al. disclose mine ventilation optimization having the steps of calculating optimum airflow quantities at the design stage (Abstract), determining the optimal air quantity required by zones of interest for example crusher stations and workshop area (p. 281) using a VUMA-network simulation software (p. 282) and altering the system layout to ventilate these areas (p. 281) and alert a central control station whenever conditions do not satisfy minimum requirements (p. 284). The supply-on-demand system responds to change of location of the diesel fleet, when the fleet leaves or enters the zone of interest (p. 284).

Marx et al. fail to disclose determining an optimal quantity of ventilation required for said zone of interest as a function of machinery operating status and personnel location monitoring and remotely controlling a ventilation flow in said zone of interest as a function of said determined optimal quantity of ventilation required.

The Board considers the closest prior art document to independent claim 16 to be **D6**. Gillies et al. disclose a system for optimizing ventilation equipment having a network simulation program linked to real-time information generated by underground mine ventilation air flow monitoring sensors to provide immediate or real-time data on air behaviour within each branch or zone of interest and as a result improve balancing of available air (Abstract, page 1). Gillies et al. disclose "Ventsim" a simulation modelling program that accepts real-time data from sensors to undertake operational changes (p. 4,5). **D6** teaches at page 6 a real-time "Ventsim" model with "live" data to correlate air flow measurements with modelled air flow calculations under "However, during the trial it was found that the system has the ability to update the mine ventilation network model and keep this mine planning tool current. Mine ventilation models are normally static simulation models that are accurate when calibrated after a mine ventilation survey. Even with care in frequent updating, models will tend to lose accuracy. The real time approach allows the model to be seen as a dynamic entity that can be tested for its accuracy at any time without the effort of undertaking a full ventilation survey". As disclosed at page 4, the system measures airflow or air pressure changes in selected ventilation branches and simulates the flows through all other branches.

Gillies et al. do not teach a real-time simulation model that calculates flow and pressure as a function of the density and temperature variation which is a function of depth, or a real-time simulation model that accounts for natural ventilation pressure flows. Gillies et al. teach the simulation / monitoring of a zone of interest with a further operator based decision to control the ventilation system, but fail to teach an automated link between the real-time simulation and the ventilation control system.

No single reference discloses all the features of independent claims 1 or 16.

The Board is of the opinion that claims 1 to 19 are novel under section 28.2(1)(b) of the *Patent Act* with respect to the applicable prior art submitted and that no substantial new question of novelty is raised with respect to all claims when viewed in light of **D5** or **D6**.

<u>Obviousness</u>

Following the approach to obviousness suggested by the Supreme Court of Canada in *Sanofi-Synthelabo Canada Inc. v. Apotex Inc.* 2008 SCC 61, (2008), 69 C.P.R. (4th) 251 the Board considers the skilled person to be a technician skilled in the art of mine ventilation.

The common general knowledge of the skilled person would include air thermodynamics, load calculations, ventilation safety requirements, fan design and operation, conduit layout, environmental parameter monitoring, process and ventilation controls. The skilled person would further be aware of system architecture programs and Human machine interface graphics, including ventilation simulation programs such as VUMA and Ventsim. The Patentee in the section of the description entitled "Background of the Invention" gives an indication of some knowledge that might be commonly known by those skilled in the art. For example, disclosed in this section is a representation of a typical mine ventilation layout with airflow control equipment having one or more ground surface intake fans providing air to the underground infrastructure in downcast shafts, fan control by local controller or by a basic control system including startup and shutdown sequences and interlocks. Downcast shafts to provide fresh air, diesel machinery in production zones, air flow measurement stations and exhaust fans adjacent upcast shafts to exhaust contaminated air are also disclosed as background information.

The alleged inventive concept of independent claim 1 lies in a method of optimizing mine ventilation having a plurality of steps including the step of determining an optimal quantity of ventilation required for a zone of interest as a function of machinery location and operating status and personnel location monitoring. The inventive concept of claim 16 lies in a system for optimizing ventilation equipment comprising a real time simulation model based control system to calculate airflow data for a zone of interest, a real time simulation model to calculate air flow and pressure in relation to depth, a real time simulation of the influence of natural ventilation flows, an optimizer for air flow distribution and fan energy consumption connected to a real-time simulation model, a real time simulation model with the capability to calibrate resistance factors, and a ventilation controlling unit adapted for remotely controlling performance of the ventilation equipment as a function of an optimal quantity of ventilation required in the zone of interest.

Examination of claims

Claim 1

In claim 1, while it is not entirely clear what the difference is between the initial "calculation..." step and the "determining an optimal quantity..." step, the Board has taken the "calculation.." step to be an initial "snapshot" of the ventilation requirements for a zone of interest, which depending on the movement/status of machinery and movement of personnel is then recalculated in order to effect an optimization of the ventilation supply.

D5 (Marx et al.) teach the design of energy efficient ventilation and cooling systems in mines which accounts for, as standard practice in the design stage, individual calculation and the aggregate summation of ventilation demand of various areas of the mine, for example, levels, workshop areas, crusher stations, extraction areas and ore processing areas (p. 280,). **D5** discloses optimization of air quantity of a selected area (p. 281) or the step of determining optimal quantity of ventilation of crusher stations and workshop areas to dilute the heat and diesel concentration. Another example of the claimed step of determining optimal quantity of ventilation is described in page 283 involving the reduction of the supply of normal air in unoccupied production zones. **D5** teaches at page 284 Ventilation-on-demand software programs that operate on a concept of monitoring and control of air pollutants and air temperatures, for example following a diesel fleet, reducing flow when the fleet leaves an area and increases flow where the fleet enters another area. A central control station remotely controlling equipment and sensors is taught in page 284.

The differences between the subject matter of independent claim 1 and that taught by **D5** are the features of monitoring machinery operating status and personnel location.

Rather than operate mine ventilation systems assuming maximum production all the time, **D10** discloses at page 17 Ventilation-on-demand in a mine for providing ventilation in underground mines only to areas requiring air, in the appropriate amount, and then only as long as necessary. For example, a pilot project system is discussed having the ability to recognize and selectively react to mobile equipment, control auxiliary ventilation and an exhaust raise regulator accordingly, and monitor environmental parameters to ensure compliance (p. 17). Another example is discussed on page 26 where VOD is introduced to the mine including vehicle and personnel identification, airflow, carbon monoxide and temperature monitoring, VFD fan control and general fan status/current monitoring. This system was to be installed in 2006. Vehicle and personnel tracking is to provide information on power usage and a global activity map of the mine. Further, on page 26, it is stated that the purpose of the pilot system is to evaluate a higher level control strategy based upon activity tracking and that it will be gathering data to better determine the potential of controlling the mine's primary ventilation system.

As it was already known to provide a VOD system which effected control based on vehicle tracking from **D5**, control based on vehicle status and personnel location would have been obvious in view of **D5** and **D10**, since **D10** suggests control based on activity tracking which includes both vehicle and personnel tracking.

Claim 2

D5 teaches at page 282 a ventilation model identified as "VUMA", a simulation software integrated with a monitoring system to calculate monitored data to predict conditions throughout the mine. **D10** teaches at page 26 a process simulator to model variations in ventilation within mining operations where activity data gathered from monitored temperature and vehicle tracking and fan monitoring will be used to calibrate and validate process modelling. Claim 2 would therefore have been obvious as well.

Claim 3

D5 teaches at page 282 that the VUMA-network incorporates site measurements from the monitoring system having the capabilities of real-time solving and calibration of mine models. Indeed, the system increases the coverage provided by existing instruments through extrapolation of measured values in VUMA-network to provide an expanded real-time view of the mine. At page 283 **D5** discloses that the concept of measuring limited points and prediction of the rest not only gives a real-time view of the complete mine ventilation network but also is a powerful alarm system highlighting abnormal conditions. Claim 3 would therefore have been obvious as well.

Claims 4 and 5

D10 teaches an example on page 26 where VOD is introduced to the mine including vehicle and personnel identification, airflow, carbon monoxide and temperature monitoring. Vehicle and personnel tracking is to provide information on power usage and global activity map of the mine. In view of the fact that VOD based on vehicle and personnel tracking would therefore have been obvious, tracking these values in a zone of interest through a communication system would have been inherent to such a system as would tracking their quantity.

Claims 6-15

The Board considers that, having regard to the features of mine ventilation taught by **D5** and **D10**, it would not have been obvious in view of the combination of **D5** and **D10** to arrive at the method of optimizing mine ventilation claimed by the Patentee in claims 6-15, as there is no suggestion or any evidence of any motivation which would have led a person skilled in the art to track the specific characteristics specified in claim 6 on which claims 7-15 depend. There is no suggestion in **D5** and/or **D10** to vary the ventilation supply based on the particular type of machinery and/or the particular status of specific machine components.

Claim 16

D6 discloses ventilation in underground mines and teaches a system for optimizing ventilation equipment such as in the Abstract at page 1, for example, as stated "The main work activities involved in the main program have involved...site testing and optimizing activities". The system comprises a simulation model linked to real-time information generated from ventilation airflow monitoring sensors to provide immediate or real-time data on air behaviour within each branch of the ventilation network. Real-time mine ventilation simulation is also taught at page 4 under

"The aim of this mine ventilation research was to develop a computerized monitoring system to provide immediate or real-time simulated information on each branch within an underground ventilation network". A ventilation simulation modelling program is taught at page 4 under "Ventsim". At page 5 it is stated that "The aim of this testing was to use the system to monitor changing ventilation conditions, to establish airflow characteristics within the UQEM and to observe the resimulated network results". **D6** teaches a form of optimizer for air flow distribution and fan energy consumption connected to a simulation model. This is evident from the statement at page 9 where it is stated that "One major point of interest in such a system is the setting of the position of each remote controlled regulator at the beginning of each work shift. As the mine is not over-ventilated, it is important to maximize the availability of ventilation air to the active levels..." and in page 7 under "Providing an overall assessment of the fan performance in order to provide recommendations to alter the fan's ventilation capacity to its optimal level, and consequently saving costs." . **D6** teaches at page 6 real-time "Ventsim" model with "live" data to correlate air flow measurements with modelled air flow calculations under "However, during the trial it was found that the system has the ability to update the mine ventilation network model and keep this mine planning tool current. Mine ventilation models are normally static simulation models that are accurate when calibrated after a mine ventilation survey. Even with care in frequent updating, models will tend to lose accuracy. The real time approach allows the model to be seen as a dynamic entity that can be tested for its accuracy at any time without the effort of undertaking a full ventilation survey". As disclosed at page 4, the system measures airflow or air pressure changes in selected ventilation branches and simulates the flows through all other branches.".

D6 discloses at page 9 ventilation equipment performance remote control under "... is the setting of the position of each remote controlled regulator at the beginning of each work shift. As the mine is not over-ventilated, it is important to maximize the availability of ventilation air to the active levels..." and then, "The setting of remote regulator positions is an iterative process...such that close to required quantities of airflow are efficiently delivered to the working levels".

D6 does not suggest a real-time simulation model that calculates flow and pressure as a function of the density and temperature variation which is a function of depth and a real-time simulation model that accounts for natural ventilation pressure flows. Air flows resulting from density and temperature variation which is a function of depth are commonly known as the stack effect. In deep mine vertical shafts, differences in static pressures arise from air temperature variations with depth that create rising air movement. The person skilled in the art would have been aware of the desire to take such effects into account in a simulation model for a mine environment, given the great variation in depth over the mine and the corresponding significance of such effects.

As we discussed under Novelty, **D6** does not disclose a direct control link between the ventilation equipment and the simulation program. **D5** however, does disclose a similar real-time simulation model linked to a ventilation control system to effect ventilation adjustments, as discussed earlier in relation to claims 1-3. From **D5** the person skilled in the art would have been informed of the possibility of ventilation control based on real-time simulation.

Therefore it would have been obvious to the person skilled in the art of ventilation to produce the claimed system for optimizing ventilation equipment in view of the combination of **D6** and **D5**.

Claim 17

As previously discussed in relation to claim 16 and earlier in relation to claim 1, **D5** already disclosed the remote control of ventilation systems based on optimized values derived from a real-time simulation model.

Therefore claim 17 would have been obvious as well in view of **D5** and **D6**.

Claims 18 and 19

D6 teaches real-time monitoring data at page 6 using "Microview" and "Ventsim" and, at Figure 13 a pressure monitoring display or graphic. Fig. 14 and Fig. 16 illustrate as well real time simulation displays.

Therefore claims 18 and 19 would also have been obvious in view of **D5** and **D6**.

The Board has considered the Requester's submissions, and is of the present opinion that claims 1-5 would have been obvious in view of the combination of **D5** and **D10** and that claims 16-19 would have been obvious in view of the combination of **D6** and **D5**.

Proposed Amendments

If the Patentee wishes to propose new or amended claims in response to this letter, then it is requested that they be numbered starting in sequence from the last claim of the issued patent.

Conclusion

The Board is of the opinion that a substantial new question of obviousness has been raised by the request for reexamination with respect to claims 1-5 and 16-19.

Under Subsection 48.2(5) of the *Patent Act*, the Patentee may, within 3 months from the date of this notice, respond with a submission to the Board.

Chairman Stephen MacNeil	Member Mark Janczarski	Member Gilbert Plouffe

cc.

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