# SR&ED Tax Cases

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May 9, 2019

# Webcast - Mac & Mac Case

SREDStakeholder.CA

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# Mac & Mac Hydrodemolition Case

Background :

- This case was finalized at the end of 2017
- The work was performed during 2012 + 2013
- Key factors: SR&ED Documentation
- Outcome: Taxpayer was not successful in appeal

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| | | | |
|---|---|---|---|
| **Project Name:** | Mac & Mac pipe liner removal process | **Start Date:** | 2017-11-06 |
| **Project Number:** | 1801 | **Completion Date:** | 2018-10-06 |

## Project Details:

## Scientific or Technological Objectives:

| Measurement | Current Performance | Objective | Has results? |
|---|---|---|---|
| Remove 2 layers of liner (1=Yes / 0 =No) | 0 | 1 | Yes |
| Remove only inner liner (1=Yes / 0=No) | 0 | 1 | Yes |
| Avoid pipe damage (mm) | 5 | 2 | Yes |

This project example is based on the tax court case of MAC & MAC HYDRODEMOLITION SERVICES INC. vs. THE QUEEN Docket: 2017-1942(IT)I (Oct 27, 2017)

Mac & Mac Hydrodemolition Services Inc. tax credits for two different projects. Both projects involved large metal pipes used to transport bitumen. The inside of the pipes was lined with a quarter inch of rubber and that rubber, in turn, was coated by a one-inch polyurethane coating. Over time, the bitumen travelling through the pipes caused wear to the lining, which meant that eventually the pipe had to be replaced.

For the purpsoes of this example we will consider these 2 projects as separate activites in the same project.

Mac & Mac was approached by a potential client to see if Mac & Mac could develop a method of removing the entire lining without damaging the pipe. The first activity  was to develop a method of removing the entire lining.

After Mac & Mac succeeded in this goal, the second activity was to develop a method of removing only the polyurethane lining while leaving the rubber lining intact.

## Field of Science/Technology:

Mechanical engineering (2.03.01)

## Project Details:

| | |
|---|---|
| Intended Results: | Improve existing processes |
| Work locations: | Lab |
| Key Employees: | |
| Evidence types: | Samples, prototypes, scrap or other artefacts; Records of trial runs |

## Scientific or Technological Advancement:

### *Uncertainty #1: Removing entire lining*

Mac & Mac tried many different techniques to remove the linings. As Mac & Mac's company name indicates, its speciality is hydrodemolition. Thus, all of the techniques that Mac & Mac employed involved the application of high-pressure water.

It tried hydraulicing, cutting and milling. Hydraulicing involves using a water jet to pierce through the material that you are trying to remove in such a way that large pieces of the material are removed when the water rebounds from the hard surface behind the material.

The most significant underlying key variables are:

nozzle size & distance (unresolved), nozzle speed, spin, rotation (unresolved), water pressures & spray angles (unresolved), length of nozzle arms (unresolved)

## Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

| Benchmark Method/Source | Measurement | Explanatory notes |
|---|---|---|

| | | |
|---|---|---|
| Internet searches | 3 Articles | IDEALLY THE CLAIMANT WOULD ILLUSTRATE THE SOURCES USED TO BENCHMARK EXISTING METHODS. |
| Patent searches | 8 patents | PRIOR ART SEARCH EXAMPLE - HOW TO SKIM PATENTS |

### Activity #1-1: Hydraulicing to remove entire lining (Fiscal Year 2017)

**Methods of experimentation:**

Mac & Mac began the first project by trying hydraulicing. The initial approach was to use two nozzles attached to a device that they would drag through the pipe.

Changes that Mac & Mac tried included using different angles of spray, using different water pressures, increasing the number of nozzles, altering the size of the nozzles, adjusting the distance between the nozzles and the linings, making the arms on which the nozzles were mounted rotate, changing the length of the arms, making the nozzle heads themselves spin, altering the speed of the arm rotation, altering the speed of the nozzle spin, adjusting the speed with which the nozzles were moving through the pipe, and adjusting the means by which the apparatus was moved through the pipe. Mac & Mac changed only one of these variables at a time.

**Results:**

- Remove 2 layers of liner: 1 1=Yes / 0 =No (100% of goal) -- SUCCEEDED IN REMOVING 2 LAYERS
- Avoid pipe damage: 3 mm (66% of goal)

**Conclusion:**

### *Uncertainty #2: Removing plastic liner*

Cutting involves using a focused water jet to removing very small slices of material one at a time. Milling involves removing one layer of material at a time until, after multiple passes over the material, it is all gone.

The most significant underlying key variables are:

differing simultaneous water pressures (unresolved), pipe rotation speeds & directions (unresolved), number of passes (unresolved)

## Technology or Knowledge Base Level:

### Activity #2-1: Milling method to remove only plastic lining (Fiscal Year 2017)

**Methods of experimentation:**

| Method | Experimentation Performed |
|---|---|
| | |
| | |
| Analysis / simulation: | 100 alternatives |
| Trials: | 50 runs / samples |
| Physical prototypes: | 8 samples |

Hydraulicing and cutting would not work for the second project so Mac & Mac had to develop a method of milling. This required a different process than that used in the first project.

Changes that Mac & Mac tried included using two different pressures of water at the same time, rotating the pipe itself (both in the same direction as the arms and in the opposite direction), altering the speed of the rotation of the pipe, altering the number of passes that the apparatus made through the pipe, altering the speed of those passes, mounting the apparatus on a long beam instead of wheels, changing nozzle heads between passes, and changing the water pressure between passes. Mac & Mac had to to find a beam construction that was strong enough to withstand the kickback from the water yet light enough to avoid sagging. Again, Mac & Mac changed only one of these variables at a time.

**Results:**

- Remove only inner liner: 1 1=Yes / 0=No (100% of goal) -- SUCCEEDED IN REMOVING SINGLE LINER.
- Avoid pipe damage: 2 mm (100% of goal) -- ABLE TO ACHIEVE MINIMAL DAMAGE TO PIPE INTERIOR.

THE JUDGE COMMENTED:

[8] Mac & Mac kept a set of handwritten notes. The notes were compiled weekly. The notes describe the various parameters that were being tested in only vague terms. The notes do not contain any hypotheses. There is no way of telling what Mac & Mac hoped to achieve from the changes. The notes also contain scant details about the changes being made. For example, the notes indicate that Mac & Mac tried different nozzle sizes and angles but they do not specify what those sizes or angles were. Finally, the notes contain very little information about the results of the tests. Given the large number of parameters described above, I would have expected the notes to have been much more detailed. There is simply no way that someone, even someone very experienced in the industry, could hope to replicate or confirm Mac & Mac's results from these notes.

[9] A spreadsheet was also entered into evidence. It provided more detail than the notes. However, it was prepared after the fact for the purpose of supporting the SR&ED claim and still did not contain the level of detail I would have expected. I have not given the spreadsheet any weight.

**Conclusion:**

BASED ON THE EVIDENCE PROVIDED THE JUDGE RULED:

[10] As noted by Justice Bocock in Highweb & Page Group Inc. v. The Queen:

. . .While evidence of the outcome is important, it is critical to technological advancement that the rigours of adherence to the scientific and experimental method be kept on a detailed and concurrent basis with the conduct of the experiments. Since a negative answer to the hypothesis is a more frequent outcome and frequently as helpful in advancing technological knowledge, detailed step-by-step logging, analysis, and measurement is a mandatory requirement, not an optional addendum. It is the roadmap. If one loses the way and failure results, retracing through these accurate records provides one with the deductive process for developing a different direction, speed or mode to create, locate, size, and arrange the "missing piece in the puzzle". . . .

AUTHOR'S NOTE:

UNLIKE OTHER SR&ED CASES THIS CASE DID NOT PROVIDE DETAILS ON THE TECHNICAL BACKGROUNDS OF THE INVESTIGATORS.

WITH MORE DETAILED RECORDS OF THE EXPERIMENTATION THE CASE WOULD LIKELY HAVE SUCCEEDED. FOCUS WILL BE GIVEN TO CONCURRENT VS. AFTER THE FACT EVIDENCE.

**Documentation:**

- Offline Documents: JUDGE CONCLUDED INADEQUATE DOCUMENTATION

# Mac & Mac Case

- How could this outcome have been different?
- What are the lessons learned from this for SR&ED stakeholders?

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# Mac & Mac Case – What if ???

| 1801 - Mac & Mac pipe liner removal process | | |
|---|---|---|
| **BENCHMARKS** | **ACTIVITIES BY YEAR** | |
| Internet searches: 3 Articles | 2017 | |
| Patent searches: 8 patents | '1-1 | '2-1 |
| | Hydraulicing to remove entire lining | Milling method to remove only plastic lining |
| **OBJECTIVES** | **RESULTS** | |
| Remove 2 layers of liner: 1 1=Yes | 1 | |
| Remove only inner liner: 1 1=Yes | | 1 |
| Avoid pipe damage: 2 mm | 3 | 2 |
| **UNCERTAINTIES & KEY** | **CONCLUSIONS** | |
| 1 - Removing entire lining | | |
| length of nozzle arms | | |
| nozzle size & distance | | |
| nozzle speed, spin, rotation | | |
| water pressures & spray angles | | |
| 2 - Removing plastic liner | | |
| differing simultaneous water | | |
| number of passes | | |
| pipe rotation speeds & directions | | |
| | **METHODS** | |
| Analysis | | 100 |
| Trials | | 50 |
| Prototypes | | 8 |
| Lines of code | | |
| | **COSTS** | |
| Hours | | |
| Materials $ | | |
| Subcontractor $ | | |

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Webcast

May 9, 2019

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# Mac & Mac – What if PRIOR ART SEARCH took place ??

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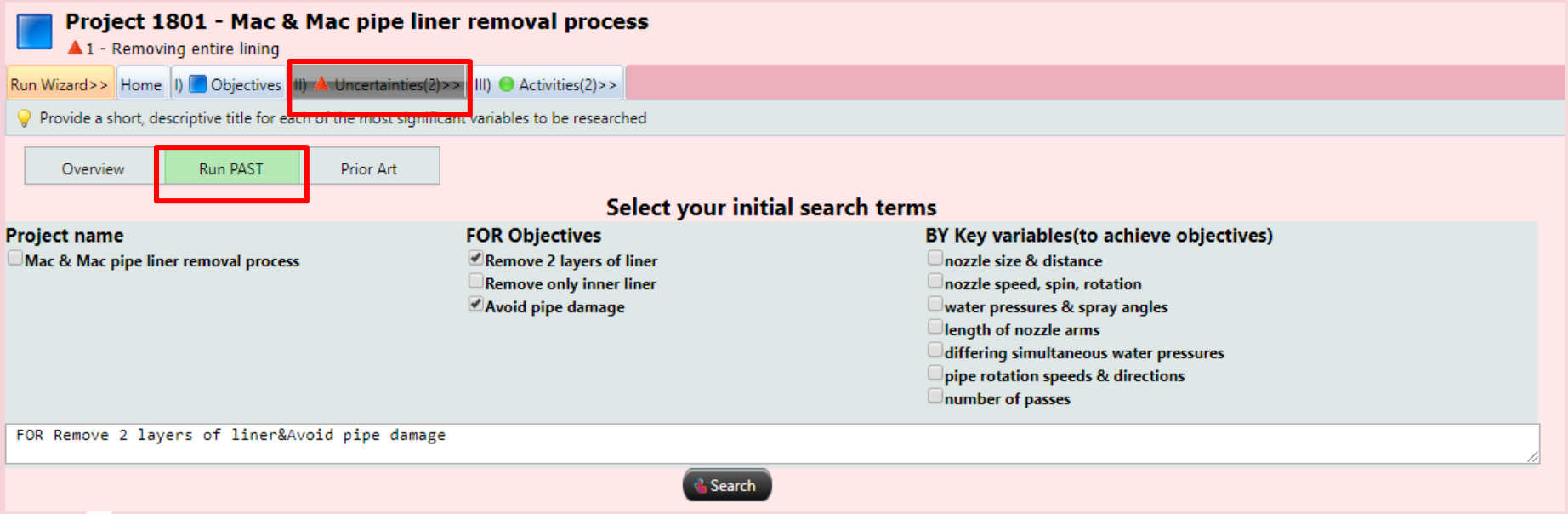
Example of how to benchmark
“standard practice”




1) Select key search terms
   a) objectives or research variables good starting point
   b) run search on Google prior art

https://patents.google.com/?q=Remove+2+layers+of+liner&q=Avoid+pipe+damage&scholar

Google Patents

(Remove 2 layers of liner) (Avoid pipe damage)

SEARCH TERMS

Remove 2 layers of liner × or + Synonym

Avoid pipe damage × or + Synonym

+ Synonym

SEARCH FIELDS

Date · Priority

YYYY-MM-DD – YYYY-MM-DD

+ Inventor

+ Assignee

Patent Office · Language

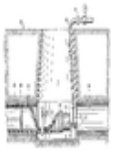
Status · Type

About 25,038 results

Download Side-by-side

Sort by · Relevance · Grouped by · None · Results / page · 10

## Pressurized bladder canister for installation of cured in place pipe



US • US6539979B1 • Franklin Thomas Driver • Insituform (Netherlands) B.V.

Priority 2001-08-10 • Filing 2002-03-14 • Grant 2003-04-01 • Publication 2003-04-01

A process for lining an existing pipeline or conduit with a flexible resin impregnated cured in place liner by pulling in the liner and inflating an eversion bladder with air and curing the liner with flow-through steam without loss of pressure is provided. The bladder is stored in a pressure ...

## Assembly comprising pipe and inner pipe as lining pipe and method of ...

WO EP US ~~GN~~ JP ~~AT~~ ~~AU~~ CA ~~CZ~~ ~~DE~~ ~~EA~~ ~~NO~~ ~~PL~~ • CN1163684C • 西格弗里德 · 施沃特 • 西格弗里德 · 施沃特

Priority 1998-10-26 • Filing 1999-10-22 • Grant 2004-08-25 • Publication 2004-08-25

The present invention relates to a method of manufacturing the tubing assembly and the inner tube to make the tube lining, wherein the assembly directing fluid under high pressure. To prevent the inner tube when the tube failure or when to stop using the damaged tube, the inner tube (1) having an ...

## Cured in place liner with integral inner impermeable layer and continuous ...

WO EP US ~~GN~~ JP ~~KR~~ *AT* AU ~~BR~~ ~~CA~~ DE DK ES ~~HK~~ *HR IL NO NZ PL PT* ~~RU~~ *SG* • AU2004288923B2 • Franklin Thomas Driver • Ina Acquisition Corp.

Priority 2003-11-07 • Filing 2004-11-03 • Grant 2010-05-27 • Publication 2010-05-27

1. A method of continuously preparing a length of a cured in place liner having an integral inner impermeable layer, including the steps of: providing a length of a resin impregnable material having an impermeable 5 layer bonded to one surface; feeding the length of resin impregnable material in a ...

Google Patents

(Remove 2 layers of liner) (Avoid pipe damage)

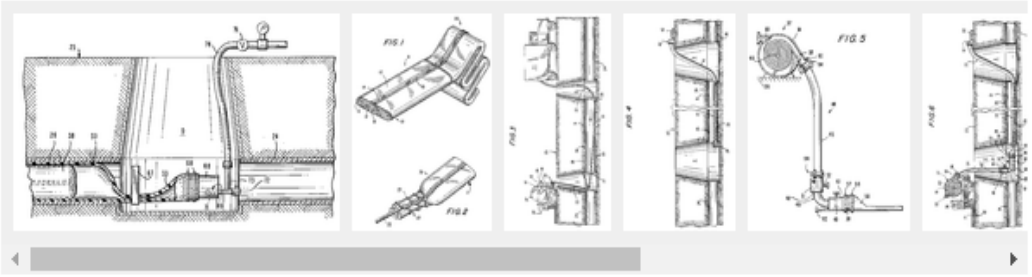
← Back to results  ✎ Remove 2 layers of liner; Avoid pipe damage;

# Pressurized bladder canister for installation of cured in place pipe


## Abstract

A process for lining an existing pipeline or conduit with a flexible resin impregnated cured in place liner by pulling in the liner and inflating an eversion bladder with air and curing the liner with flow-through steam without loss of pressure is provided. The bladder is stored in a pressure bladder canister coupled to a pressurized downtube and eversion elbow. The bladder is everted by introducing pressurized air into the canister As the bladder reaches the distal manhole, it enters a receiving canister where it is punctured while maintaining air pressure within the bladder a pinch valve between the downtube and elbow isolates the inverted bladder so that steam can be introduced into the bladder to cure the resin and exhaust through the receiving canister. The bladder is then removed and lateral service reinstated.


## Images (10)



## Classifications


US6539979B1

United States


Download PDF  Find Prior Art  Similar


**Inventor:** Franklin Thomas Driver

**Current Assignee :** INA Acquisition Corp


**Worldwide applications**

2002 • US  2003 • US  2004 • US  2005 • US  2006 • US

**Application US10/098,974 events**

2001-08-10 • Priority to US92718901A

2002-03-14 • Application filed by Insituform (Netherlands) BV

2003-04-01 • Application granted

2003-04-01 • Publication of US6539979B1

2019-05-01 • Application status is Active

2021-08-10 • Anticipated expiration

https://patents.google.com/patent/US6539979B1/en?q=Remove+2+layers+of+liner&q=Avoid+pipe+damage&scholar

| | | | | |
|---|---|---|---|---|
| US5374174A * | 1993-05-17 | 1994-12-20 | Insituform (Netherlands) B.V. | Apparatus for/installing a liner within a service pipe or the like |
| US5816293A * | 1996-03-27 | 1998-10-06 | Kiest, Jr.; Larry W. | Apparatus for installation of a liner within a pipeline |
| US5736166A * | 1996-06-11 | 1998-04-07 | Insituform (Netherlands) B.V. | Flow-through apparatus for lining of pipelines |
| US5803666A * | 1996-12-19 | 1998-09-08 | Keller; Carl E. | Horizontal drilling method and apparatus |
| DE19852690A1 * | 1998-11-16 | 2000-05-18 | Mueller Umwelttechnik | Method and device for rehabilitating an laid in the ground Altrohrstranges |
| US6390795B1 * | 2000-06-21 | 2002-05-21 | Repipe Holdings, Inc. | Apparatus for everting a tube |
| US6708728B2 * | 2001-07-17 | 2004-03-23 | Insituform (Netherlands) B.V. | Installation of cured in place liners with air and steam and installation apparatus |
| US6539979B1 * | 2001-08-10 | 2003-04-01 | Insituform (Netherlands) B.V. | Pressurized bladder canister for installation of cured in place pipe |

* Cited by examiner, † Cited by third party

Scroll to bottom to find other similar citings – prior & subsequent

## Cited By (68)

| Publication number | Priority date | Publication date | Assignee | Title |
|---|---|---|---|---|
| US20040055072A1 * | 2002-09-20 | 2004-03-25 | Clemie Lee | Nanoclimate clothing and apparel |
| US20040134551A1 * | 2002-10-30 | 2004-07-15 | Daniel Warren | Method of lining a pipeline using a calibration hose |
| US20040149341A1 * | 2001-08-10 | 2004-08-05 | Driver Franklin Thomas | Pressurized bladder canister for installation of cured in place pipe |
| US20040190996A1 * | 2003-02-26 | 2004-09-30 | Pranha 50 Ltda | Method, equipment, and devices for the relining of conduits through the introduction of plastic tubes |
| WO2004113778A2 | 2003-06-13 | 2004-12-29 | Underground Solutions | Bladder system for conduit expansion |

Google Patents

(remove pipe liner) (pipe rotation)(water jets)

← Back to results  (remove pipe liner); (pipe rotation)(water jets);

# Method for removing pipe coatings

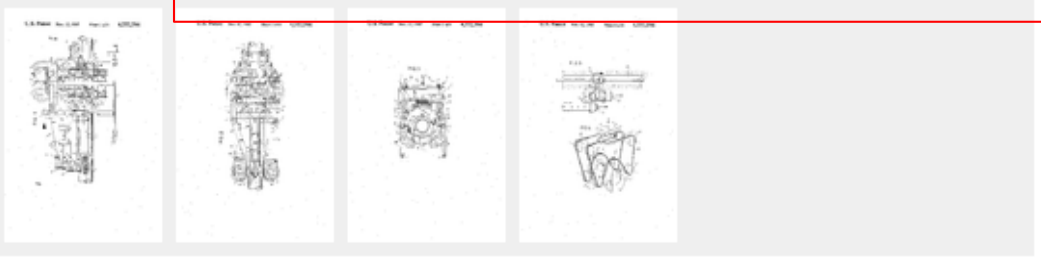
CHANGE SEARCH TERMS TO FOCUS ON RELEVANT AREAS

## Abstract

Bituminous and other coatings are removed from a pipe surface by directing powerful water jets, e.g. under a pressure of 300-600 bars, and preferably under an acute angle of incidence, against such pipe surface. The apparatus has one or more nozzles, each provided with water supply means, in a frame that can be mounted around the pipe to be treated. In a preferred embodiment, the nozzles are arranged in groups on rotatable annular discs which surround the pipe with some clearance and which receive a reciprocating rotary movement during operation, while the frame carrying such discs is adapted for travelling in longitudinal direction of the pipe. If both movements are coordinated, i.e. effected simultaneously then, each nozzle will follow a zigzag path along the pipe surface, thereby covering a vast area and removing bituminous or other coatings in a fast and efficient way.

CITE:
- SIMILARTIES (E.G. REMOVING PIPE COATING) &
- DIFFERENCES (EG. OUTSIDE VS INSIDE OF PIPE)

## Images (4)



US4552594A
United States

Download PDF  Find Prior Art  Similar

**Inventor:** Dirk F. van Voskuilen, Frans van Voskuilen

**Current Assignee :** VOSKUILEN DIRK F VAN , VOSKUILEN FRANS VAN

**Worldwide applications**

1982 • ~~NL~~ 1983 • ~~US~~ ~~EP~~ ~~DE~~ ~~JP~~ ~~DE~~ 1985 • ~~US~~

**Application US06/529,752 events**

**1982-09-08** • Priority to NL8203501A

1982-09-08 • Priority to NL8203501

**1983-09-06** • Application filed by Voskuilen Dirk F Van, Voskuilen Frans Van

**1985-11-12** • Application granted

# Mac & Mac Case – What if ???

| 1801 - Mac & Mac pipe liner removal process | | |
|---|---|---|
| **BENCHMARKS** | **ACTIVITIES BY YEAR** | |
| Internet searches: 3 Articles<br>Patent searches: 8 patents | 2017 | |
| | '1-1 | '2-1 |
| | Hydraulicing to remove entire lining | Milling method to remove only plastic lining |
| **OBJECTIVES** | **RESULTS** | |
| Remove 2 layers of liner: 1 1=Yes | 1 | |
| Remove only inner liner: 1 1=Yes | | 1 |
| Avoid pipe damage: 2 mm | 3 | 2 |
| **UNCERTAINTIES & KEY** | **CONCLUSIONS** | |
| 1 - Removing entire lining | | |
| length of nozzle arms | | |
| nozzle size & distance | | |
| nozzle speed, spin, rotation | | |
| water pressures & spray angles | | |
| 2 - Removing plastic liner | | |
| differing simultaneous water | | |
| number of passes | | |
| pipe rotation speeds & directions | | |
| | **METHODS** | |
| Analysis | | 100 |
| Trials | | 50 |
| Prototypes | | 8 |
| Lines of code | | |
| | **COSTS** | |
| Hours | | |
| Materials $ | | |
| Subcontractor $ | | |

# Mac & Mac Case – What if ???

| 1801 - Mac & Mac pipe liner removal process | | |
|---|---|---|
| **BENCHMARKS** | **ACTIVITIES BY YEAR** | |
| Internet searches: 3 Articles | 2017 | |
| Patent searches: 8 patents | '1-1 | '2-1 |
| | Hydraulicing to remove entire lining | Milling method to remove only plastic lining |
| **OBJECTIVES** | **RESULTS** | |
| Remove 2 layers of liner: 1 1=Yes | 1 | |
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| **UNCERTAINTIES & KEY** | **CONCLUSIONS** | |
| 1 - Removing entire lining | | |
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| nozzle size & distance | | |
| nozzle speed, spin, rotation | | |
| water pressures & spray angles | | |
| 2 - Removing plastic liner | | |
| differing simultaneous water | | |
| number of passes | | |
| pipe rotation speeds & directions | | |
| | **METHODS** | |
| Analysis | | 100 |
| Trials | | 50 |
| Prototypes | | 8 |
| Lines of code | | |
| | **COSTS** | |
| Hours | | |
| Materials $ | | |
| Subcontractor $ | | |

# Formadrain Overview

| 1705 - Formadrain liner development | |
|---|---|
| **BENCHMARKS** | **ACTIVITIES BY YEAR** |
| | 2017 |
| | '1-1 |
| Internet searches: 3 Articles | Activity 1 |
| **OBJECTIVES** | **RESULTS** |
| Thickness: 4 mm | |
| Steaming time to activate: 60 min | 70 |
| Open time : 60 days | 62 |
| Cost : 65 $/m | 70 |
| Diameter range: 15 cm | 15 |
| Weight: 2.6 kg/m | 3.1 |
| Stress resistance: 11 kg/mm | 9 |
| Disposable mandrel: 1 yes = 1 / no = 0 | 1 |
| Access points for mandrel: 1 number | 1 |
| **UNCERTAINTIES & KEY VARIABLES** | **CONCLUSIONS** |
| 1 - Technological uncertainty | |
| chuck design | Y |
| composition of form | Y |
| mandrel configurations & composition | Y |
| push vs pull deployment | Y |
| resin formulation | |
| | **METHODS** |
| Analysis | 460 |
| Trials | 23 |
| Prototypes | 8 |
| Lines of code | |
| | **COSTS** |
| Hours | 1072 |
| Materials $ | 38800 |
| Subcontractor $ | 23500 |

# “Mac & Mac” Case Comparison?

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<u>Comparing to Formadrain Inc. case specifics:</u>

- Formadrain also **tested a number of parameters** just like Mac&Mac (both piping cases)
- Some Formadrain tests documented in ***lab book & recorded*** *descriptions / photos*
- “Avg of 20” Formadrain tests carried out in year
- Formadrain had ***successfully licenced*** their technology to other companies
- Expert witnesses may have influenced outcome
- Formadrain was successful in its appeal

# Mac & Mac Case

- Concluding remarks:
  - Would better documentation have resulted in a successful appeal like “Formadrain Inc.”?
  - Focus will be given to contemporaneous documentation vs. after the fact evidence

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| 1802 - Lehigh (alt fuels - S 58 shortcut) | |
|---|---|
| **BENCHMARKS** | **ACTIVITIES BY YEAR** |
| | 2019 |
| | '1-1 |
| (none) | Activity 1 |
| **OBJECTIVES** | **RESULTS** |
| (none) | |
| **UNCERTAINTIES & KEY VARIABLES** | **CONCLUSIONS** |
| 1 - Technological uncertainty | |
| | **METHODS** |
| Analysis<br>Trials<br>Prototypes<br>Lines of code | |
| | **COSTS** |
| Hours<br>Materials $<br>Subcontractor $ | |

| | | | |
|---|---|---|---|
| **Project Name:** | Lehigh (alt fuels - S 58 shortcut) | **Start Date:** | 2018-04-01 |
| **Project Number:** | 1802 | **Completion Date:** | 2019-04-30 |

## Project Details:

## Scientific or Technological Objectives:

This project example is based on the Tax Court of Canada case of LEHIGH HANSON MATERIALS LIMITED,v THE QUEEN, Docket: 2015-2735(IT)G

[2] Lehigh seeks an order for a determination hearing under Rule 58 where the Court may grant an order if it appears that the determination of the question before the hearing may dispose of all or part of the proceeding or result in a substantially shorter hearing or a substantial saving of costs.

The following conditions must be met:
1. The question proposed must be a question of law, fact or mixed law and fact or be a question as to the admissibility of any evidence;4
2. The question must be raised in a pleading; and
3. It appears that the determination of the question before the hearing may dispose of all or part of the proceeding, result in a substantially shorter hearing or result in a substantial saving of costs.

[28] Paragraph 113 of its pleading describes the overall issue as “Did the activities undertaken by the Appellant in the conduct of its experimental trials with alternative fuels at its Delta cement plant constitute “SR&ED” as that term is defined in subsection 248(1) of the Act?”

[7] In each of the taxation years ending December 31, 2009, December 31, 2010 and December 31, 2011 (“relevant years”), Lehigh conducted operations in Canada. Its principal businesses were cement, ready-mixed concrete, aggregates and pipe and cement products. Lehigh’s registered office is located in Calgary, Alberta, and it has an office in Vancouver, British Columbia.

[8] Cement production operations were conducted by Lehigh’s Cement division with two cement plants located in Canada. One plant is located in Delta, British Columbia (“Delta plant”).

[9] Lehigh used alternative fuels in the cement kiln operation at its Delta plant in its Delta Alternative Fuels Project (the “Project”).11 The alternative fuels included construction and demolition waste and mixed plastic and paper. Lehigh experienced issues and obstacles working on the Project and sought to understand and overcome those concerns. During the relevant years, it claimed input tax credits (“Credits”) arising from expenditures used in the Project that it alleges constitutes Scientific Research and Experimental Development (“SR&ED”).

## Field of Science/Technology:

Chemical process engineering (2.04.02)

## Project Details:

| | |
|---|---|
| Intended Results: | Improve existing processes |
| Work locations: | Commercial Facility |
| Key Employees: | |
| Evidence types: | |

## Scientific or Technological Advancement:

### *Uncertainty #1: Technological uncertainty*

[10] The Minister of National Revenue reassessed and denied the federal SR&ED Credits, totaling $782,576, claimed by Lehigh in the relevant years on the basis it is common practice for cement kilns to use alternative fuels, thus there were no technological uncertainties nor technological advancements.12 Any issues that arose while using alternative fuels could be resolved by applying known practices, techniques and methodologies.

## Technology or Knowledge Base Level:

| | | | |
|---|---|---|---|
| **Project Name:** | Lehigh (alt fuels - S 58 shortcut) | **Start Date:** | 2018-04-01 |
| **Project Number:** | 1802 | **Completion Date:** | 2019-04-30 |

## Activity #1-1: Activity 1 (Fiscal Year 2019)

**Methods of experimentation:**

[14] No examinations for discoveries have been held.

**Results:**

**Conclusion:**

THE JUDGE RULED:

[51] In the present case, the pleadings reveal a complex case. Material facts are disputed by both parties, a substantial number of facts pled by Lehigh have been denied by the respondent and no discovery has taken place. Extensive findings of fact will need to be made. Determining the relevance and weight to be given to the practices of other industry participants is best left to the trial judge tasked with determining the overall issue so as to consider the evidence in the context of the overall SR&ED analysis. In my view, such circumstances warrant a trial with the benefit of the evidentiary protections afforded to both sides at a trial to obtain a fair hearing.

[52] For these reasons, I am of the view that the proposed Question was not properly raised in the pleadings thus fails to satisfy the condition in subsection 58.

| 1901 - A&D Precision "Full spectrum versatile horizontal lathes" | | | |
|---|---|---|---|
| **BENCHMARKS** | **ACTIVITIES BY YEAR** | | |
| Internet searches: 1 Articles | 2006 | 2007 | 2008 |
| Patent searches: 5 patents | '1-1 | '1-2 | '1-3 |
| | Adapt Tachi lathes | Design 80 ton lathe | lathes |
| **OBJECTIVES** | **RESULTS** | | |
| supported workpiece max.: 100 tons<br>unsupported workpiece max. : 80 tons<br>length of workpiece: 13 m<br>precison of finish : 2 thou./in | | | |
| **UNCERTAINTIES & KEY VARIABLES** | **CONCLUSIONS** | | |
| 1 - Technological uncertainty | | | |
| methods to control inertia & deflection | | Y | Y |
| welded vs cast iron structure | | Y | Y |
| | **METHODS** | | |
| Analysis<br>Trials<br>Prototypes<br>Lines of code | | | |
| | **COSTS** | | |
| Hours<br>Materials $<br>Subcontractor $ | | | |

| | | | |
|---|---|---|---|
| **Project Name:** | A&D Precision “Full spectrum versatile horizontal lathes” | **Start Date:** | 2006-01-15 |
| **Project Number:** | 1901 | **Completion Date:** | 2009-01-07 |

## Project Details:

## Scientific or Technological Objectives:

| Measurement | Current Performance | Objective | Has results? |
|---|---|---|---|
| supported workpiece max. (tons) | 50 | 100 | No |
| unsupported workpiece max. (tons) | 40 | 80 | No |
| length of workpiece (m) | 10 | 13 | No |
| precison of finish (thou./in) | 4 | 2 | No |

This project example is based on the Tax Court of Canada case of A & D PRECISION LIMITED vs. THE QUEEN Citation: 2019TCC48

The claimed SR&ED current expenditures are for the 2006, 2007 and 2008 fiscal periods with total federal ITCs of $1,212,213 across 2 projects.

Background of key investigators

Antranik Derbedrosian testified as one of A&D’s two main fact witnesses. He is the founding owner, president, sole shareholder and director of A&D. Mr. Derbedrosian has little formal education, but considerable experience since childhood in machine shops and at 13 started a five year machinist apprenticeship. He came to Canada in 1969 at age 22 and started A&D in 1974 as a one-man shop. At the time of the hearing of this appeal, A&D employed over 30 persons. Mr. Derbedrosian does not hold any engineering designation.

George Predoiu testified also, as A&D’s other main fact witness. Sadly, Mr. Predoiu has since passed away. During much of the subject time period he was, through a personal corporation, a subcontractor of A&D. Mr. Predoiu was an Ontario registered professional engineer. He had formal training at the University of Bucharest in Romania as a mechanical engineer before coming to North America. He had a distinguished 47 year career in the design and assembly of machine tools, including work with Northstar Aerospace in Milton, Ontario, General Dynamics in Marion, Virginia and the U.S. Air Force.

Objectives & background:
Prior to 2000, A&D had used horizontal lathes purchased from an Italian manufacturer - Safop. Upon GE becoming more demanding in its specifications for turbine components that A&D sought to manufacture, these lathes no longer were sufficiently precise for GE work. After engaging in some due diligence enquiries, A&D decided to purchase three new large horizontal lathes from another Italian company, Tacch which was considered an international leader in the building of CNC (computer numerical control) heavy duty lathes.

However, performance issues soon developed, including headstock vibration, imprecise z-axis carriage movement and overnight sliding of the tailstock. The one year warranty period for the Tacchis passed, allowing A&D itself, not solely Tacchi, to try to fix or improve these lathes, but without success.

Consequently A&D per Mr. Derbedrosian concluded that the Tacchi lathes should be sold, and that A&D should build its own lathes to be able to continue manufacturing large turbine components for GE with heightened tolerance requirements.

Mr. Derbedrosian came up with the original concept for the 80 ton horizontal lathe. That concept was that that lathe, known as the 80 ton Matteo, would be capable of turning an unsupported workpiece of 80 tons weight (or 100 tons with use of a steady rest to support the workpiece) and 13 metres in length, while meeting rigorous tolerance specifications in machining the workpiece.

## Field of Science/Technology:

Mechanical engineering (2.03.01)

## Project Details:

Intended Results: Improve existing processes

| | | | |
|---|---|---|---|
| **Project Name:** | A&D Precision “Full spectrum versatile horizontal lathes” | **Start Date:** | 2006-01-15 |
| **Project Number:** | 1901 | **Completion Date:** | 2009-01-07 |
| Work locations: | Commercial Facility | | |
| Key Employees: | George Predoiu (mechanical - BASc. (1970) / PEng.), Tony Derbedrosian (Metal forming - Machinist (1974) / President) | | |
| Evidence types: | Test protocols, test data, analysis of test results, conclusions; Records of resources allocated to the project, time sheets; Samples, prototypes, scrap or other artefacts; Design, system architecture and source code; Photographs and videos; Records of trial runs; Contracts | | |

## Scientific or Technological Advancement:

### *Uncertainty #1: Technological uncertainty*

[61] The CRA’s submission was that if the welded (rather than cast iron) structure of the 80 ton Matteo, and inertia and deflection due to the unprecedented weight and length of an 80 ton and 13 metre workpiece gave rise to technological uncertainties, the uncertainty was overcome by A&D using known solutions.

Steps to define prior art:

Use of expert witnesess:

As well, two experts were called A&D – Drs. Stephen Veldhuis and Eu-Gene Ng. The CRA in turn called Dr. Yusuf Altintas as its expert. All are university affiliated and have advanced expertise in machine tool design and testing. The judges stated, "Their evidence was of general assistance to me in my reaching the conclusions noted herein."

[59] The Respondent’s expert, Dr. Altintas, acknowledged in testimony that system uncertainty could constitute a technological uncertainty:
When you put the machine - all the parts together, all this uncertainty is now merged, accumulated. Now, the system has uncertainty. I call that - this is my definition - people may say - I call this technological uncertainty, now, because you have a technology, now. The whole machine together. (transcript, p. 2349)

The most significant underlying key variables are:

methods to control inertia & deflection, welded vs cast iron structure

## Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

| Benchmark Method/Source | Measurement | Explanatory notes |
|---|---|---|
| Internet searches | 1 Articles | IDEALLY THE CLAIMANT WOULD HAVE CITED THE MAJOR DOCUMENTS USED TO BENCHMARK THE METHODS & PERFORMANCE OF EXISTING TECHNOLOGY. |
| Patent searches | 5 patents | EXAMPLE OF PRIOR ART SEARCH USING GOOGLE PATENTS |

### Activity #1-1: Adapt Tachi lathes (Fiscal Year 2006)

**Methods of experimentation:**

[13] Prior to 2000, A&D had used horizontal lathes purchased from an Italian manufacturer - Safop. Upon GE becoming more demanding in its specifications for turbine components that A&D sought to manufacture, these lathes no longer were sufficiently precise for GE work. After engaging in some due diligence enquiries, A&D decided to purchase three new large horizontal lathes from another Italian company, Tacchi Giacomo e Figli SpA (Tacchi). A&D anticipated that these three Tacchi lathes would enable it to achieve GE’s more demanding specifications. Tacchi was considered an international leader in the building of CNC (computer numerical control) heavy duty lathes.

[15] However, performance issues soon developed, including headstock vibration, imprecise z-axis carriage movement and overnight sliding of the tailstock. The one year warranty period for the Tacchis passed, allowing A&D itself, not solely Tacchi, to try to fix or improve these lathes, but without success.

# Lathe design
# prior art search example

Sample prior art search for A&D Precision tax case example

Google Patents

((lathe)) ((length of workpiece)) ((precision of finish )) ((methods to contrc

SEARCH TERMS

(lathe) × or + Synonym

(length of workpiece) × or + Synonym

(precision of finish ) × or + Synonym

(methods to control inertia & deflection) ×

or + Synonym

+ Synonym

SEARCH FIELDS

Date · Priority

YYYY-MM-DD – YYYY-MM-DD

+ Inventor

+ Assignee

Patent Office · Language

Status · Type

About 859 results

Download Side-by-side

Sort by · Relevance · Grouped by · None · Results / page · 10

## Tool touch probe system and method of precision machining

EP ~~US~~ JP ~~DE~~ · US4428055A · John R. Zurbrick · General Electric Company

Priority 1981-08-18 · Filing 1981-08-18 · Grant 1984-01-24 · Publication 1984-01-24

A system and method are disclosed for automatically machining a work piece to precise selectively determined dimensions under computer numerical control in which the cutting tool is set automatically and automatic on-machine inspection is performed of the machined work piece surfaces. Using ...

## System and method of precision machining

~~US~~ · US4382215A · Allan R. Barlow · General Electric Company

Priority 1981-07-16 · Filing 1981-07-16 · Grant 1983-05-03 · Publication 1983-05-03

A system and method are disclosed for automatically machining a work piece to precise selectively determined dimensions under computer numerical control. A movable probe is calibrated against position reference surfaces and is then used to calibrate the position of a fixed probe. The latter serves ...

## Prediction of workpiece elastic deflections under cutting forces in turning

Google Scholar · www.researchgate.net · Benardos P · Robotics and Computer-Integrated Manufacturing

Publication 2006

... The verification of the numerical method and the development of the ANN model were based on data gathered from turning experiments conducted on a CNC **lathe**. The results support the proposed cutting mechanism ... Fig. 4. Workpiece supported from the **lathe's** chuck ...

## Principles and techniques for designing precision machines

Google Scholar · www.osti.gov · Hale L

Publication 1999

... 334 9.5.5 The Assembly Model ..... 338 9.5.6 Tool-to-**Work** Compliance ..... 339 ... 258 Figure 8-15 A Type 2 preloaded gear train for a C-axis on a **lathe**. ..... 260 ...

## A review of chatter vibration research in turning

Google Scholar · www.sciencedirect.com · Siddhpura M · International Journal of Machine tools and manufacture

Publication 2012

... The objective of this review **work** is to compare different chatter stability prediction, chatter detection and chatter control techniques to find out ... 2] examined numerous influences to which a tool is subjected during cutting analytically as well as experimentally for **lathes** and other ...

Google Patents

( horizontal lathes) (length of workpiece) (methods to control inertia &amp

← Back to results ( horizontal lathes); (length of workpiece); (methods to control inertia & deflection);

# A review of chatter vibration research in turning

## Snippet

Chatter vibrations are present in almost all cutting operations and they are major obstacles in achieving desired productivity. Regenerative chatter is the most detrimental to any process as it creates excessive vibration between the tool and the workpiece, resulting in a ...

Continue reading at www.sciencedirect.com (other versions)

## Classifications

machine-classified

G05B19/406 Numerical control [NC], i.e. automatically operating machines, in particular machine tools, e.g. in a manufacturing environment, so as to execute positioning, movement or co-ordinated operations by means of programme data in numerical form characterised by monitoring or safety

*View 20 more classifications*

**Siddhpura et al., 2012**
From Google Scholar

**Author:** Siddhpura M, Paurobally R

**Publication year:** 2012

**Publication venue:** International Journal of Machine tools and manufacture

**External links:** Cited by

**Info:** Similar documents

## Similar Documents

Example of documents citing current metal forming design issues & technology

| Publication | Publication Date | Title |
|---|---|---|
| Rehorn et al. | 2005 | State-of-the-art methods and results in tool condition monitoring: a review |
| Faassen et al. | 2003 | Prediction of regenerative chatter by modelling and analysis of high-speed milling |
| Kuljanic et al. | 2009 | Development of an intelligent multisensor chatter detection system in milling |

| | | |
|---|---|---|
| Liang et al. | 2002 | Machining process monitoring and control: the state–of–the–art |
| Bravo et al. | 2005 | Stability limits of milling considering the flexibility of the workpiece and the machine |
| Rao et al. | 1999 | A comprehensive dynamic cutting force model for chatter prediction in turning |
| Budak | 2006 | Analytical models for high performance milling. Part II: process dynamics and stability |
| Wang et al. | 2010 | A theoretical and experimental investigation of the tool-tip vibration and its influence upon surface generation in single-point diamond turning |
| Haber et al. | 2004 | An investigation of tool-wear monitoring in a high-speed machining process |
| Budak et al. | 2010 | Identification and modeling of process damping in turning and milling using a new approach |
| Altintas | 2000 | Modeling approaches and software for predicting the performance of milling operations at MAL-UBC |
| Altintas et al. | 2004 | Chatter stability of metal cutting and grinding |
| Biermann et al. | 2010 | A general approach to simulating workpiece vibrations during five-axis milling of turbine blades |
| Cheng | 2008 | Machining dynamics: fundamentals, applications and practices |
| Khorasani et al. | 2016 | An improved static model for tool deflection in machining of Ti–6Al–4V acetabular shell produced by selective laser melting |
| Zhongqun et al. | 2008 | Solution and analysis of chatter stability for end milling in the time-domain |
| Arnaud et al. | 2011 | Simulation of low rigidity part machining applied to thin-walled structures |
| Campa et al. | 2011 | Chatter avoidance in the milling of thin floors with bull-nose end mills: model and stability diagrams |
| Ahmadi et al. | 2011 | Analytical stability lobes including nonlinear process damping effect on machining chatter |

Includes articles written by CRA expert witness

# Comment by CRA expert witness

[59] The Respondent's expert, Dr. Altintas, acknowledged in testimony that system uncertainty could constitute a technological uncertainty:

> When you put the machine - all the parts together, all this uncertainty is now merged, accumulated. Now, the system has uncertainty. I call that - this is my definition - people may say - I call this technological uncertainty, now, because you have a technology, now. The whole machine together. (transcript, p. 2349)

Google Patents

inventor:(Altintas Y)

← Back to results  Inventor: **Altintas Y;**

# Virtual process systems for part machining operations

Example of current SR&ED issues in machining

## Snippet

This paper presents an overview of recent developments in simulating machining and grinding processes along the NC tool path in virtual environments. The evaluations of cutter– part-geometry intersection algorithms are reviewed, and are used to predict cutting forces ...

Continue reading at www.sciencedirect.com (other versions)

## Classifications

machine-classified

G05B19/4097 Numerical control [NC], i.e. automatically operating machines, in particular machine tools, e.g. in a manufacturing environment, so as to execute positioning, movement or co-ordinated operations by means of programme data in numerical form characterised by using design data to control NC machines, e.g. CAD/CAM

*View 24 more classifications*

## Altintas et al., 2014

From Google Scholar

**Author:** Altintas Y, Kersting P, Biermann D, Budak E, Denkena B, Lazoglu I

**Publication year:** 2014

**Publication venue:** CIRP Annals

**External links:** Cited by

**Info:** Similar documents

## Similar Documents

| Publication | Publication Date | Title |
|---|---|---|
| Bedi et al. | 2003 | Flank milling with flat end milling cutters |
| Ozturk et al. | 2009 | Investigation of lead and tilt angle effects in 5-axis ball-end milling processes |
| Lazoglu | 2003 | Sculpture surface machining: a generalized model of ball-end milling force system |

**Results:**

[16] Mr. Predoiu had been engaged by both A&D and Tacchi to provide a neutral view as to deficiencies respecting the three Tacchi lathes. He had concluded they were unfixable, so as to be able to meet the demandingly tight tolerance requirements of A&D’s major customer, GE. Consequently A&D per Mr. Derbedrosian concluded that the Tacchi lathes should be sold, and that A&D should build its own lathes to be able to continue manufacturing large turbine components for GE with heightened tolerance requirements.

**Conclusion:**

THE JUDGE RULED: INELIGIBLE

[52] A&D in its written submissions made no obvious effort to identify that Tacchi expenditures were included as part of its Project #4 SR&ED claims, or to explain why expenditures respecting the three Tacchi lathes would qualify for SR&ED tax benefits. In A&D’s written submissions, under the heading “ISSUES”, para. 408 reads: “The only issue is whether A&D’s design, development and assembly of the Matteos and Grinding machine constitutes SR&ED…”. Para. 409’s beginning sentence reads basically the same - “Only the Matteos and Grinding machine are at issue.” There is no mention of the Tacchi lathes.

[53] Accordingly, A&D’s SR&ED claim for its 2006 fiscal period pertaining to the three Tacchi lathes (subsumed within A&D’s Project #4), is denied.

## Activity #1-2: Design 80 ton lathe (Fiscal Year 2007)

**Methods of experimentation:**

[19] A&D asserts that the 80 ton Matteo is made up of various systems and subsystems that all had to work together. A&D further submits (written submissions, para. 145) that the major subsystems of the Matteos are the headstock, tailstock, chuck, the cutting tool post on the cross slide (x-axis), the carriage on the longitudinal slide (z-axis) and the tailstock sensor control.

[20] My understanding is that these are usual components of a horizontal lathe.

[21] In more detail, the 80 ton Matteo’s workpiece positioning and driving system included the following elements which A&D describes (written submissions, para. 149) as subsystems - said to be the main spindle and bearings (which holds the workpiece), the main spindle drive system (which provides torqueand speed to the main spindle), the headstock (which supports the main spindle drive system), the tailstock mechanism (which holds the other end of the workpiece in place while allowing for rotation), the tailstock structure (which supports the tailstock mechanism), the hydraulic system (which releases the tailstock locking mechanism), the workpiece bed-ways (which particularly includes the longitudinal guide along which the tailstock moves), the chuck (which holds the workpiece and allows it to rotate with the spindle) and steady rests (providing supplementary support to heavy parts).

[22] A further claimed system of the 80 ton Matteo is the tool positioning and driving system, also said to be comprised of subsystems; such subsystems including the longitudinal carriage guide (which guides the cutting tool carriage as it moves along the z-axis), the longitudinal feed mechanism (which moves the cutting tool carriage along the z-axis), the transversal carriage and guide (which guides and drives the tool carriage along the x-axis), the tool positioning system (which allows multiple tools to be used on the workpiece), the carriage bed (which supports the wheel spindle) and the lubrications system (which lubricates housings for the linear guideways and ball screws).

[23] The third of the three identified systems for the horizontal lathe is the CNC/PLC system. CNC means, as noted, “computer numerical control” and PLC means “programmable logic controller”. This system provides computer control in the operation of the lathe - which system A&D submits includes electronics, Siemens computer and software (A&D written submissions, heading of para. 248).

[24] Mr. Predoiu made calculations and closely directed and oversaw the assembly of the parts, largely purchased “off-the-shelf”, comprising the 80 ton Matteo. A testing start-up regimen for new machines such as this was closely followed, starting and proving one component at a time (an inadequate summary of the start-up regimen).

**Results:**

REGARDING THE DOCUMENTATION THE JUDGE COMMENTED:

[65] The third of the five Northwest Hydraulic criteria is, did the procedure adopted in each project accord with the total discipline of the scientific method including the formulation, testing and modification of hypotheses? In this matter we have in evidence many drawings made under Mr. Predoiu’s direction of many significant parts of the 80 ton Matteo. We do have fewer items of evidence exhibiting the engineering calculations Mr. Predoiu would have carried out in designing the 80 ton Matteo. What we have - in large part the drawings - helps to corroborate Mr. Predoiu’s testimony that the procedure in developing this machine did accord with the total discipline of the scientific method.

[68] In the case of the 80 ton Matteo records were kept, as noted above largely in the form of drawings of many if not most significant parts of this machine. The parts were in large part designed in the basis of engineering calculations carried out by Mr. Predoiu. Testing only occurred relatively at the end of the building process but that is an aspect of the financial unfeasibility of constructing and utilizing prototypes as above noted. It is acknowledged that not many records pertaining to the carrying out of the testing protocol itself were made, let alone retained.

**Conclusion:**

THE JUDGE RULED: 100% ELIGIBLE

[62] In my view, considering the evidence as a whole and as well the submissions of the respective parties and experts, A&D in determining to manufacture the 80 ton Matteo did face a technological uncertainty, being system uncertainty. Here A&D, with the specific guidance and expertise of Mr. Predoiu, took known technologies for the manufacture of horizontal lathes and combined with these technologies other known technologies pertaining to using welded structuring rather than cast iron, and other technological innovations as noted above to address inertia and deflection. These adaptations were made necessary by, and made in the unique context of, the intended great size and weight of the workpieces that would be tooled on this lathe, while seeking also the ability to machine very large workpieces with notably extreme accuracy.

[69] In sum, I am persuaded that the Northwest Hydraulic criteria have been sufficiently met that I can conclude that the work that went into design and build of the 80 ton Matteo was SR&ED qualified work. Thus the SR&ED ITCs claimed in respect of this work for Project #4 for the 2007 fiscal period should be entirely allowed A&D.

Significant variables addressed: methods to control inertia & deflection, welded vs cast iron structure

**Documentation:**

Offline Documents: Docs

## Activity #1-3: Design 80, 60 & 40 ton lathes (Fiscal Year 2008)

**Methods of experimentation:**

[25] Subsequently the 60 and 40 ton Matteos were built. As suggested by the names, they were intended respectively to be able to handle workpieces of up to 60 tons and 40 tons. Unlike the 80 ton Matteo they were constructed of cast iron rather than welded steel. A&D had discovered a foundry in China that could do the iron castings of the carriage bed, workpiece bed, headstock and tailstock. Other differences were use of a different type of off-the-shelf spindle bearings, and use of a ball screw instead of rack and pinion for movement along the z-axis, as the length of that axis was shorter than that for the 80 ton Matteo. Additional calculations were required of Mr. Perdoiu to aid in ensuring these changes were workable. Ultimately the 60 and 40 ton Matteo lathes were successfully commissioned and put to work fashioning smaller workpieces for GE and other A&D customers.

[26] At para. 276 of its written submissions A&D asserts that the 80 ton Matteo was a new machine not available from traditional machine tool suppliers. The same claim is not asserted regarding the 60 and 40 ton Matteos.

**Results:**

COST ALLOCATIONS BY COURTS : 1/3 EACH MACHINE

[72] In the absence of any allocation from A&D respecting the three Matteos for A&D’s 2008 fiscal period, I will allocate for each of the three Matteos a share of one-third of the total SR&ED

[73] As for the 60 ton and 40 ton Matteos, to my mind the evidence shows that there was little originality factored into their designs and manufacture as distinguished from the case of the 80 ton Matteo. One difference the two smaller lathes had with the 80 ton Matteo was that they were made from cast iron rather than, in the case of the 80 ton Matteo, welded steel. But, as A&D acknowledges in its written submissions at para. 207, in describing notable differences of the 80 ton Matteo, "most machine manufacturers use cast iron for the main components, as cast iron has density that lessens vibration while steel does not."

[75] Another difference cited by A&D in written submissions between the 60 and 40 ton Matteos on the one hand the 80 ton Matteo on the other is that the latter used SKF main spindle bearings while the two smaller machines each used Timken bearings, being “more economical and off the shelf”. (A&D written submissions para. 266). This does not seem revolutionary either.

[76] The third and final difference between the 80 ton and the 60 and 40 ton Matteos cited in A&D’s written submissions (paras. 269ff) is the use of a ball screw drive for the for the z-axis of the two smaller machines rather than, as in the case of the 80 ton Matteo, use of a rack and pinion for movement along the z-axis.

[77] Again, A&D appears to acknowledge that a ball screw drive was already conventional.

| | | | |
|---|---|---|---|
| **Project Name:** | A&D Precision “Full spectrum versatile horizontal lathes” | **Start Date:** | 2006-01-15 |
| **Project Number:** | 1901 | **Completion Date:** | 2009-01-07 |

**Conclusion:**

THE JUDGE RULED: 1/3 ELIGIBLE

[80] Thus, I conclude that the work in developing the 60 and 40 ton Matteos did not constitute SR&ED. Consequently, the claim for two-thirds of the ITCs claimed for Project #4 for the 2008 fiscal period, is dismissed. The one-third share of claimed ITCs allocated to work on the 80 ton Matteo in the 2008 fiscal period will be allowed, as previously noted.

Significant variables addressed: methods to control inertia & deflection, welded vs cast iron structure

| 1902 - A&D precision - Double wheel roll grinding machine | |
|---|---|
| **BENCHMARKS** | **ACTIVITIES BY YEAR** |
| Internet searches: 20 Articles | 2006 |
| Queries to experts: 1 responses | '1-1 |
| | development |
| **OBJECTIVES** | **RESULTS** |
| Cost: $ | |
| Accuracy: thou | |
| **UNCERTAINTIES & KEY VARIABLES** | **CONCLUSIONS** |
| 1 - Technological uncertainty | |
| method to move wheel | Y |
| preventing spindle overheating | Y |
| vibration control methods | Y |
| | **METHODS** |
| Analysis | |
| Trials | |
| Prototypes | |
| Lines of code | |
| | **COSTS** |
| Hours | |
| Materials $ | |
| Subcontractor $ | |

| | | | |
|---|---|---|---|
| **Project Name:** | A&D precision - Double wheel roll grinding machine | **Start Date:** | 2006-01-31 |
| **Project Number:** | 1902 | **Completion Date:** | 2008-02-29 |

## Project Details:

## Scientific or Technological Objectives:

| Measurement | Current Performance | Objective | Has results? |
|---|---|---|---|
| Cost ($) | (not set) | (not set) | No |
| Accuracy (thou) | (not set) | (not set) | No |

This project example is based on the Tax Court of Canada case of A & D PRECISION LIMITED vs. THE QUEEN Citation: 2019TCC48

The claimed SR&ED current expenditures are for the 2006, 2007 and 2008 fiscal periods with total federal ITCs of $1,212,213 across 2 projects.

[30] All of the Project #6 work claimed by A&D for each of its 2006, 2007 and 2008 fiscal periods relates to design and ultimately abandoned development of this one machine, called a “double wheel roll grinding machine” (Exhibit R-15).

[31] The novel concept, advanced by Mr. Derbedrosian, was to have the grinding head capable of being moved to either side of the middle of the workpiece for grinding. Removing and repositioning the workpiece could take 16 to 18 hours and realignment could occur. A&D knew of no other grinding machine in the world that could do this. The machine would not grind the workpiece on opposite sides of the middle of the workpiece simultaneously. But there were covers on opposite sides of what would be the middle of the particular workpiece for the two positions the grinding wheel could be moved to.

## Field of Science/Technology:

Mechanical engineering (2.03.01)

## Project Details:

| | |
|---|---|
| Intended Results: | Improve existing processes |
| Work locations: | Commercial Facility |
| Key Employees: | George Predoiu (mechanical - BASc. (1970) / PEng.), Tony Derbedrosian (Metal forming - Machinist (1974) / President) |
| Evidence types: | Records of resources allocated to the project, time sheets; Samples, prototypes, scrap or other artefacts; Design, system architecture and source code; Records of trial runs; Contracts |

## Scientific or Technological Advancement:

### *Uncertainty #1: Technological uncertainty*

[83] A&D submits that the technical risk or uncertainty in respect of the double wheel grinding machine was whether - with this novel design of having the grinding wheel capable of being repositioned from one side of the machine to the other, rather than requiring the workpiece itself to be moved - fine grinding tolerances still could be achieved. System uncertainty is also cited.

Steps to define prior art:

[33] Before deciding that A&D would build this, Mr. Derbedrosian consulted with Toshiba in Japan about whether it could build such a machine. Toshiba ultimately responded with a $6 million quote to produce such a machine but without guarantee that it could meet the required tolerances.

THE JUDGE COMMENTED:

[84] There was no knowledge, within Canada or internationally, of any grinding machine having this fundamentally novel design feature.

[85] In considering the evidence as a whole, I Conclude that there was not reasonable expectation that routine engineering

or standard procedures would establish that such a design still could achieve required grinding tolerances, defeating risks or uncertainties pertaining to excessive vibration or “chatter”.

The most significant underlying key variables are:

method to move wheel, preventing spindle overheating, vibration control methods

## Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

| Benchmark Method/Source | Measurement | Explanatory notes |
|---|---|---|
| Internet searches | 20 Articles | search performed - ideally would be detailed |
| Queries to experts | 1 responses | Toshiba Japan quoted $6 million but would not guarantee performance |

### Activity #1-1: 2006 to 2008 development (Fiscal Year 2006)

**Methods of experimentation:**

[35] Messrs. Predoiu and Derbedrosian developed specifications for the contemplated machine, including respecting headstock, carriage, wheel head and grinding performance. Again A&D views this complete machine as an assembly of systems and subsystems. And of course to meet GE specified tolerances all systems and subsystems had to well work together (A&D’s written representations, para. 302).

[36] The machine itself was built in part from re-furbishment of an older grinding machine located in Romania. Because the grinding wheel could be repositioned at either end, the traditional set-up of a grinder - wheel at one end and a pulley at the other could not be utilized. A&D envisaged driving the wheel (which could be moved to either side of the middle) from the middle of the machine using a Siemens motor. From the middle of the machine between the two wheel locations, the motor would drive the drive shaft, and the drive shaft would drive the main spindle (A&D’s written representations, para. 303).

[37] There were some novel aspects in the preparation of this machine. To help the spindle not overheat A&D used angular contact bearings that were ceramic which does not overheat, and used Kluber grease, also because ceramic does not overheat (representations, para. 306).

[38] A&D chose to fabricate rather than cast the wheel-bed of the grinding machine. A&D fabricated rather than cast the parts because this was more economical (representations, para. 307).

[39] To help minimize vibration the z-axis carriage traveled on linear guideways like the 80 ton Matteo. This was not typical and may have been the first grinder to use linear guideways. Also the foundation of the grinding machine was stiffened, again seek to minimize vibration.

[40] Further, a steady rest was designed by Mr. Derbedrosian for the grinder, to aid in eliminating or minimizing vibration.

[41] Nevertheless, there was excessive vibration when the machine was tested. Further attempts to minimize vibration (through use of optimizing software to try to isolate the vibration source, and use of vibration measuring equipment, and referral to a vibration analysis company which provided a report) were not sufficiently successful to make the machine acceptable for use. Mr. Derbedrosian decided A&D would not continue development of this machine because of the financial costs that would continue to be incurred.

**Results:**

THE JUDGE COMMENTED:

[88] Again, Mr. Predoiu’s testimony satisfied me that his highly knowledgeable and experienced input in his position as chief engineer in the design and manufacture of the double wheel grinder was quite focused on reducing risks. That is, he in combination with Mr. Derbedrosian did formulate theories and or plans seeking to minimize anticipated risks pertaining to vibration.

**Conclusion:**

THE JUDGE RULED: ELIGIBLE

[85] In considering the evidence as a whole, I conclude that there was not reasonable expectation that routine engineering or standard procedures would establish that such a design still could achieve required grinding tolerances, defeating risks or uncertainties pertaining to excessive vibration or “chatter”.

[86] Thus I find that there was technical uncertainty associated with the development and potential implementation of this

radical design concept.

[94] .. I conclude that the work that went into design and build of the grinding machine was SR&ED qualified during each of the subject three fiscal periods.

Significant variables addressed: method to move wheel, preventing spindle overheating, vibration control methods

**Documentation:**

- Offline Documents: Doc

| 1903 - Concept Danat process integration | |
|---|---|
| **BENCHMARKS** | **ACTIVITIES BY YEAR** |
| Internet searches: 50 Articles | 2019 |
| Potential components: 15 products | '1-1 |
| | Activity 1 |
| **OBJECTIVES** | **RESULTS** |
| (none) | |
| **UNCERTAINTIES & KEY VARIABLES** | **CONCLUSIONS** |
| 1 - Technological uncertainty | |
| fabric thickness | Y |
| laser power | Y |
| laser speed of displacement | Y |
| | **METHODS** |
| Analysis<br>Trials<br>Prototypes<br>Lines of code | |
| | **COSTS** |
| Hours<br>Materials $<br>Subcontractor $ | |

| | | | |
|---|---|---|---|
| **Project Name:** | Concept Danat process integration | **Start Date:** | 2019-02-01 |
| **Project Number:** | 1903 | **Completion Date:** | 2020-01-24 |

## Project Details:

## Scientific or Technological Objectives:

This project is based on the tax court ruling in CONCEPT DANAT INC., v. HER MAJESTY THE QUEEN, File: 2017-3790 (IT) I

[2] Danat, a company with approximately 24 employees in manufacture and distribution of clothing including clothing decoration for advertising purposes by various methods, namely embroidery, silkscreening, digital printing, laser and transfer, and clothing manufacturing.

Mr. Daniel Bourgault, President of Danat, testified on its behalf. The case did not provide any details on technical background or training.

For it's 2015 taxation year it claim SR&ED expenses of $ 32,056 witha resulting federal ITC of $ 13,862.

3 projects:

1) Laser clothing printing
2) Improved embroidery techniques
3) Sublimation technique on elastic necks and printing on 210 denier nylon.

We will use the first project (laser clothing printing) for this project example.

[10] Under Project 1, the goal was to burn laser, while burning fiber very lightly to decorate clothes, clothes made of cotton, polyester or polar. This printing technique was starting to appear on the market in 2014-2015. Mr. Bourgault testified that on the date of the first

## Field of Science/Technology:

## Project Details:

Intended Results:
Work locations:
Key Employees:
Evidence types:

## Scientific or Technological Advancement:

### *Uncertainty #1: Technological uncertainty*

[11] After extensive research on the Internet and release with several suppliers to find a machine to engrave by laser technology, Mr. Bourgault has acquired a machine, the LaserPro MG380 Hybrid (the "LaserPro machine"), designed to cut or engrave hard materials, such as glass, plastic, metal or wood, but can also laser cut a fabric called "poly-twill" as well as the vinyl, for the purpose of laser printing on fabrics.
Suppliers of laser machines had told Bourgault that laser machines were too powerful to engrave the tissues.

The most significant underlying key variables are:

laser speed of displacement, laser power, fabric thickness

## Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

| Benchmark Method/Source | Measurement | Explanatory notes |
|---|---|---|

| | | | |
|---|---|---|---|
| **Project Name:** | Concept Danat process integration | **Start Date:** | 2019-02-01 |
| **Project Number:** | 1903 | **Completion Date:** | 2020-01-24 |

| | |
|---|---|
| Internet searches | 50 Articles |
| Potential components | 15 products |

## Activity #1-1: Activity 1 (Fiscal Year 2019)

**Methods of experimentation:**

[12] Mr. Bourgault testified that the LaserPro machine functions as a printer: a drawing prepared on the computer is sent to the machine LaserPro, which subsequently launches a laser jet to cut or engrave the
desired material. The controllable parameters of the LaserPro machine are the speed of displacement and the power of the laser. Adjustments were only made units of one percent, or 1% to 100%. Mr. Bourgault had to find the power parameters allowing the decoration and not the cutting of the tissues and regulating the laser, since no data existed on the tissues.

[13] Realizing that the software offered with the LaserPro machine was not working to decorate the fabrics, Mr. Bourgault did some research to find a commercial software allowing him to control the parameters of the machine but without success. He then turned to the Adobe Illustrator software, a drawing already used by two employees of Danat and compatible with the machine LaserPro, being recommended by the designer of this machine. The software of drawing can pre-establish the pattern and tone of the color in a way compatible with the printer driver of the LaserPro machine.

[14] Mr. Bourgault did not modify the LaserPro machine except by installation of a tray or additional support. He did not change thelaser as such. Instead, he worked on the process, using the parameters of the machines: either air (which has an influence on the power of the laser) and the speed of the laser. The first tests were performed using parameters random; thereafter, the parameters were corrected: either the speed and thelaser power. There were 10,000 possibilities. Mr. Bourgault testified that he always had to start over with the different tissues since every tissue has a thickness, a density, a fiber and a stability of its own.

**Results:**

THE JUDGE COMMENTED:

[4] At the hearing, no party invited an expert to testify.

THE CRA RTA COMMENTED:

[41] As for Mr. Sylla, he is of the opinion that the problem of Danat consisted, for a given fabric, in matching the intensity and laser speed on the one hand and the tone of the print color on the other hand, using commercial software. According to him, there was no technological uncertainty since there was no technological incompatibility between the different engraving / cutting parameters and the printer driver setting of the LaserPro machine.

The adjustments of the laser parameters remained in the limits offered by it; the printer driver has not been modified. The correlation was done using Adobe Illustrator software, commercial software
recommended by the manufacturer of the LaserPro machine.

.... not investigation or systematic search, but rather process by trial and error: indeed, for each fabric, Danat had to repeat the tests.

**Conclusion:**

THE JUDGE COMMENTED & QUOTED PRIOR PRECEDENCE:

It is important to recognize that this issue is not just about identify that we do not know how to achieve the objectives. We must be inable to specifically identify what is missing from the knowledge base
science or technology and that generates this uncertainty.

In Formadrain Inc. v. The Queen ,

"... it is necessary to show that the missing knowledge is really nonexistent in the database of scientific or technological knowledge and not just unknown to the applicant."

[54] For all these reasons, I am of the opinion that Danat failed to demonstrate on the balance of probabilities that the work done in the context ofthree projects were SR & ED.

Significant variables addressed: fabric thickness, laser power, laser speed of displacement