Date: 20071123

Docket: T-1707-03

Citation: 2007 FC 1233

BETWEEN:

JOHN RUSSELL MCKAY

Plaintiff
Defendant by Counterclaim

and

WEATHERFORD CANADA LTD.

Defendants
Plaintiffs by Counterclaim

REASONS FOR JUDGMENT AND JUDGMENT

CAMPBELL J.:

[1] Rubber bonded to metal by an adhesive capable of withstanding tremendous pressures is a feature of equipment used in the oilfield industry in Canada, the United States, and around the world. In such equipment where the rubber is worn, and must renewed, an economic and environmentally safe method is required to break the adhesive bond in order to remove the worn rubber from the metal without harming the metal. The present action concerns a patent issued to the Plaintiff (McKay) which claims such a method of breaking the adhesive bond by the use of refrigeration, and makes an allegation that the Defendants (Weatherford) have taken the invention in their large scale renewal operations.

[2] McKay's Canadian Patent 2,371,155 (the Patent), granted on June 10, 2003, is attached in its issued form as Appendix A to these reasons, and denoted in these reasons as ('*155 Patent*). The Patent is directed at a particular style of pump. In essence, the pump is composed of a metal pipe (the stator housing) into which a hollow rubber sleeve called a stator or elastomer (the elastomer) is inserted and affixed to the inside of the pipe by adhesive, and a shaft which turns inside the elastomer thereby forcing liquid through the elastomer. Over time the elastomer wears by the action of the shaft and must be removed so that a new elastomer can be inserted and bonded to the stator housing.

[3] The Patent claims a method for removing the worn elastomer by the use of a certain refrigeration technique which causes the elastomer to shrink and pull away from the stator housing. In the "Detailed Description of the Preferred Embodiment" section of the specifications of the Patent the statement is made that, after the refrigeration is applied, it is an "extremely simple matter" to remove the elastomer which has pulled away from the pipe; indeed, it can be accomplished by exerting a force upon the stator to have it "slide out" of the stator housing, or by tipping the stator housing so that the elastomer "slides from" the stator housing by the force of gravity ('*155 Patent, p.3*).

[4] Weatherford uses refrigeration to remove elastomers from stator housings, but states that the temperatures applied are not those claimed in the Patent and that, in any event, its process does not depend on the elastomer shrinking and pulling away from the stator housing, but involves having the elastomer only reach its "glass transition temperature" at which point the elastomer

becomes brittle and can be removed by a mechanical shattering process. In addition to denying McKay's infringement allegation on this and other grounds, Weatherford alleges that the Patent is invalid for obviousness; that is, the techniques claimed in the Patent were well known to the public prior to the Patent being filed for approval (the claim date).

[5] For the reasons which follow, I find that the Weatherford process does not infringe the Patent, but I also find the Patent is not invalid for obviousness.

I. *The Construction of the Patent Claims*

A. *The law*

[6] The law with respect to the approach to patent construction is well understood and is concisely stated in *Bourgault Industries Ltd. v. Flexi Coil Ltd.* [1998] F.C.J. No. 264 (F.C.) at paragraphs 109-110:

> Construction of a claim must be done before and independent of assessing whether a defence of invalidity is sustainable. The task of construing a claim lies within the exclusive domain of the trial judge. The role of the expert witness, those skilled in the art, is to provide the judge with the technical knowledge necessary to construe a patent as though he/she were so skilled. Where experts disagree, the Trial Judge is to make a binding determination.
> *Dableh v. Ontario Hydro* (1996), 68 CPR (3d) 129 per Robertson, J.A. at 143-145 (F.C.A.)[70]
>
> A patent specification is addressed to those skilled in the particular art. The Court must look at the whole of the disclosure and claims to ascertain the nature of the invention, being neither benevolent or harsh, but seeking a construction which is reasonable and fair to both the patentee and the public.
> *Consolboard v. Macmillan Blodel (Sask) Ltd.* [1981] 1 SCR 504 per Dickson, J. at 520-521.

> If the claims are expressed in plain and unambiguous language, the courts are not to restrict or expand or qualify the scope by reference to the body of the specification; this does not mean that the Court is not to look at the specification, but means that resort is limited to assisting in comprehension. Terms must be read in context, as what is "plain and unambiguous" may not be a safe conclusion.
> *Nekoosa Packing Corp. v. AMCA International Inc.* (1994), 56 CPR (3d) 470 per Robertson, J.A. at 481-482 (F.C.A.)
>
> A Court must interpret the claims, it cannot redraft them. When an inventor has clearly stated in the claims that he considered a requirement as essential to the invention, the Court cannot decide otherwise for the sole reason that he was mistaken. The Court cannot conclude that strict compliance with a word or phrase used in a claim is not essential unless it is obvious that the inventor knew that failure to comply would have no material effect upon the way that the invention worked.
> *Eli Lilly & Co. v. O'Hara* (1989), 26 CPR (3d) per Pratte J.A. at 7(F.C.A.)

[7] Justice Binnie in *Free World Trust v. Électro Santé Inc.*[2000] 2 S.C.R. 1024 (S.C.C.) at paragraphs 14 and 15 expresses the need to clearly define the essential elements of a patent claim:

> Patent claims are frequently analogized to “fences” and “boundaries”, giving the “fields” of the monopoly a comfortable pretence of bright line demarcation. Thus, in *Minerals Separation North American Corp. v. Noranda Mines, Ltd.*, [1947] Ex. C.R. 306, Thorson P. put the matter as follows, at p. 352:
>
> By his claims the inventor puts fences around the fields of his monopoly and warns the public against trespassing on his property. His fences must be clearly placed in order to give the necessary warning and he must not fence in any property that is not his own. The terms of a claim must be free from avoidable ambiguity or obscurity and must not be flexible; they must be clear and precise so that the public will be able to know not only where it must not trespass but also where it may safely go.
>
> In reality, the “fences” often consist of complex layers of definitions of different elements (or “components” or “features” or

> "integers") of differing complexity, substitutability and ingenuity. A matrix of descriptive words and phrases defines the monopoly, warns the public and ensnares the infringer. In some instances, the precise elements of the "fence" may be crucial or "essential" to the working of the invention as claimed; in others the inventor may contemplate, and the reader skilled in the art appreciate, that variants could easily be used or substituted without making any material difference to the working of the invention. The interpretative task of the court in claims construction is to separate the one from the other, to distinguish the essential from the inessential, and to give to the "field" framed by the former the legal protection to which the holder of a valid patent is entitled.

B. *The construction of the claims in issue*

[8] There are three claims in the Patent; however, it is agreed that only Claims 1 and 2 are in issue (*'155 Patent pp.5-6*). A principal point of contention concerns the "cryogenic refrigeration" aspect of Claims 1 and 2.

[9] During the course of the trial, it was agreed that the following words in Claim 1 constitute a statement of fact and should be disregarded in deciding the construction of the claim: "in order to have the tubular metal stator housing and elastomer stator shrink at substantially the same rate" and, as a result, the word "and" following the words to be disregarded should read as "to".

[10] Therefore, the words of Claim 1 state that patent protection is afforded to three essential features of the invention:

> (1) subjecting a stator housing having an interior surface to which a worn elastomer is adhered by adhesive to cryogenic refrigeration <u>until</u> the elastomer shrinks and pulls away from the interior surface of the stator housing [emphasis added],
>
> and

> to avoid thermal shock,
> (2) the temperature of the stator housing being gradually lowered to cryogenic levels,
> and
> (3) then gradually raised to ambient temperature.
>
> (Emphasis added)

[11] Claim 2 is a dependent claim since it specifies, as essential, "the method as defined in Claim 1" and, thereby, includes all the essential features of Claim 1. However, Claim 2 limits the protection of the temperature to which the stator housing is to be subjected. Therefore, a reasonable and fair construction of Claim 2 is as follows:

> (a) subjecting a stator housing having an interior surface to which a worn elastomer is adhered by adhesive to cryogenic refrigeration of between minus 150 degrees Celsius and minus 200 degrees Celsius until the elastomer shrinks and pulls away from the interior surface of the stator housing;
>
> and
>
> (b) the temperature of the stator housing being gradually lowered to the cryogenic levels of between minus 150 degrees Celsius and minus 200 degrees Celsius and then gradually raised to ambient temperature to avoid thermal shock.
>
> (Emphasis added)

[12] The approach that McKay has taken to the development of its construction argument in advancing the present action is based on a much different construction of the "cryogenic refrigeration" aspect of Claims 1 and 2. This construction is clarified in the following passage from McKay's written argument:

> Claim 2 contains all of the essential elements of claim 1 and adds one further essential element, that being that the housing is to be subjected to temperatures between -150 degrees Celsius and -200 degrees Celsius. This clearly does not mean that the temperature of

> the housing itself must be between those temperatures. Claim 1 specifies that the housing is to be "subjected to" cryogenic refrigeration and then goes on to say that the temperature of the housing is to be reduced to cryogenic levels. Claim 1 clearly differentiates between the temperature to which the housing is subjected, and the temperature to which the housing is to be reduced. Claim 2 uses the phrase "subjected to" and refers to the housing. The temperature range added by Claim 2 therefore can only be directed to the temperature of the environment and not the temperature of the housing itself.
>
> [Emphasis added]
>
> (Written Argument of the Plaintiff, p.11)

[13] I do not agree with McKay's argument because the premise upon which it is based does not appear in the words of the claims concerned. That is, Claim 1 does not specify that the stator housing is to be subjected to cryogenic refrigeration "and then goes on to say that the temperature of the housing is to be reduced to cryogenic levels". Claim 1 specifies that the stator housing is to be subjected to "cryogenic refrigeration until" an event occurs; the event being the elastomer shrinks and pulls away from the stator housing.

[14] If McKay's argument raises an ambiguity it is resolved to my satisfaction by the following passage from the "Detailed Description of the Preferred Embodiment" feature of the specifications ('*155 Patent, p.3*):

> The cryogenic temperature range starts at approximately minus 50 degrees celsius. It will be understood that the method works on a combination of temperature and time. As the temperature is made colder within the cryogenic temperature range, the less time it takes for the worn stator to shrink sufficiently to pull away from interior surface 14. In tests proving the concept of a temperature range of between minus 150 degrees celsius and minus 200 degrees celsius was used.

On this basis, I find that the meaning of the term “cryogenic refrigeration” in Claim 1 is found within the Patent; it means a range of temperatures beginning at -50 C and below. The specification also makes it clear that the meaning to be put to the terms “subjecting a tubular metal stator housing” in Claim 1, and “the tubular metal stator housing being subjected to” in Claim 2 is that patent protection is given to a process in which a temperature, below – 50 C, is applied to a stator housing until a certain event occurs, being that the elastomer shrinks and pulls away from the stator housing.

[15] As a result, I find that the construction of Claims 1 and 2 is that which I have set out above.

II. The Evidence at Trial

A. *The admissibility of evidence of the history of the Patent*

[16] The original filing date of the ‘155 Patent was February 8, 2002 (Exhibit P1, Tab 1) and the Patent was granted and issued on June 10, 2003 (Exhibit P1, Tab 2). After the filing date, McKay filed an amendment to the original filing. It is uncontested that an amendment was required by the patent examiner to deal with prior art disclosed by two existent patents, and, accordingly, a response was provided by McKay. During the course of the trial, Counsel for Weatherford argued

that the response (Exhibit A), which constitutes revised claims, should be admitted as evidence on the trial record. Counsel for McKay objected on the basis of that Mr. McKay's conduct before the patent examiner is not relevant because it is not identified in Weatherford's pleadings as relevant.

[17] McKay's argument for admission is connected to the allegation that, after the filing date of the Patent, the Plaintiff, Mr. Russell McKay, learned the details of the Weatherford process, and, thereby, on the assertion that the Weatherford process is prior art, became aware of that prior art, and also knew of other prior art, which was not disclosed to the patent examiner in filing the revised claims. While Mr. McKay's intentions were initially raised as relevant, in the end result the argument for admission is not made on the basis that the Patent should be vitiated for Mr. McKay's failure to disclose known prior art, but is made on the basis that the response is relevant to prove the prior art before the examiner which, if admitted, can be compared to evidence of prior art produced at trial. Counsel agree that the prior art before the patent examiner may be relevant in a trial, and, accordingly, the patent prosecution documents relating to this issue may be found to be relevant (*Foreco Trading A.G. v. Canadian Ferro Hot Metal Specialties Ltd.* (1991) 36 C.P.R. (3rd) 35, 46 F.T.R. 81 (F.C).

[18] Given that the existent patents before the examiner prompting the response are known, and, given that the contents of the patent as filed and the Patent as amended and granted are known, and given that Mr. McKay's conduct and intentions in making the amendment is not plead as an issue, I find that the response has not been shown to be relevant. As a result, Exhibit A is not admitted as evidence on the trial record.

B. ***The experts***

[19] For McKay, Dr. Glen E. McIntosh testified as an expert qualified to give an opinion on heat transfer and thermodynamics and, in particular, the behaviour of materials at low temperatures. Dr. McIntosh is a registered Professional Engineer in Colorado State and holds a bachelor's degree in mechanical engineering from North Dakota State University and a Ph.D. from Purdue University in Indiana, where he majored in heat transfer and thermodynamics. He is a designer of cryogenic equipment and specialized products for scientific applications, which requires the study of the behaviour of metals at very low temperatures. Dr. McIntosh has worked in the field since 1953 when he joined the National Bureau Standards Cryogenic Laboratory in Boulder, Colorado. He is currently employed at Cryogenic Technical Services, a division of Eden Cryogenics.

[20] For Weatherford, Dr. Michael C. Williams testified as an expert qualified to give an opinion on polymers, elastomers, and heat transfer. Dr. Williams holds a B.Sc., an M.S. and a Ph.D. in chemical engineering with a minor in physical chemistry from the University of Wisconsin-Madison; he has substantial academic experience in the field, having worked as a professor at the University of Berkeley, California from 1965 until 1989, when he moved to take a position at the University of Alberta. Dr. Williams has worked at the University of Alberta from 1990 until retirement in 2002, and since that time he has continued to work there as a professor emeritus of chemical engineering. His specialty is polymer materials, and he has published numerous academic articles and been an expert witness in several court proceedings on the topic.

C. *The demonstrations*

[21] In preparation for trial, by a Court direction dated March 1, 2007, McKay and Weatherford were required to "have their experts analyze the processes being used". As a result, a major portion of the evidence at trial centered on demonstrations of the preferred embodiment of the Patent, and the Weatherford process. Each of McKay and Weatherford engaged their experts to witness the demonstrations and to give opinions based on their observations. McKay's construction of the Patent, and his argument on the essential features of the invention claimed has been a driving force behind the very intensive scrutiny of the demonstration evidence.

[22] As described above, I reject McKay's construction of the Patent and, therefore, a great deal of the evidence arising from the demonstrations is of little value. However, certain features of the demonstration evidence, and the expert evidence base thereon, are relevant to infringement, and, therefore, the demonstrations do require some analysis.

[23] McKay's evidence includes videos which record two demonstrations carried out by Dr. McIntosh from April 4 to 6, 2006. Each demonstration involves a cooler with liquid nitrogen flowing into it via a tube. Inside the cooler is a short piece of stator pipe, being approximately 2 feet long, with two temperature probes, called thermocouples, attached to it. One of the thermocouples measures the temperature at the bond line between the elastomer and the stator housing and one measures the temperature in the cooler. The results of these measurements are displayed on a computer. Inside the cooler, the stator segment is placed on a wooden block so as to ensure that the

stator does not sit in the liquid nitrogen, and there is a metal shield above it to prevent the nitrogen directly impinging the stator.

[24] The first test done by Dr. McIntosh (Exhibit P1, Tab 6, Disc One) shows the gradual cooling of the air in the cooler to -196 C, and, at the bond line, -184 C. After this temperature is reached, the pipe is taken out of the cooler and the elastomer is removed by hitting it several times with a hammer. The elastomer comes out of the stator housing easily; it is in one piece with only a few minor cracks.

[25] The second test (Exhibit P1, Tab 6, Disc Three) is similar to the first, except that after the elastomer is taken out of the cooler it is allowed to warm up to ambient temperature; the warming was done overnight so it is not pictured on the video. After it has reached room temperature the elastomer is again removed from the stator housing, this time using a winching device with a metal plate and washer. As was the case in the first test, the elastomer is removed substantially whole with only a few minor cracks.

[26] Weatherford's evidence includes videos of demonstrations carried out at its plant on February 15, May 9, and May 14, 2007. In addition, on May 18, 2007 both of the parties' experts went to the Weatherford plant and observed its elastomer removal process.

[27] The February 15th video (Exhibit P1, Tab 5) shows the Weatherford stator delining equipment which includes a long cylindrical metal tank with a lid running its full length; the tank

can hold several full length stator pipes. In this demonstration several stators are in the tank and liquid nitrogen is introduced through nozzles which are connected to a large outdoor bulk liquid nitrogen storage unit. The stators are cooled for a period and then the temperature on one stator is tested with a hand held temperature probe. Its temperature is displayed as -47 C. This stator is then taken out of the tank by a hoist and lowered onto an apparatus, which allows the pipe to be positioned opposite a rotating rod with a metal drill-like bit at the end. This bit is known as the "mangler" by Weatherford technicians. It was agreed at trial that the mangler is not exactly a drill but rather works to machine or break up the elastomer; however, it was often referred to as a drill by all parties.

[28] The February 15th video continues with the mangler being advanced towards the pipe. In this first attempt the pipe begins to spin and the elastomer does not come out; the video then cuts and resumes with another pipe on the apparatus. The temperature on this pipe is measured at -66 C and, this time, the mangler is successful in fracturing the elastomer. Most of the elastomer comes out of the pipe in small chunks, except for a loose round piece, the diameter of the pipe and several inches long with its circular edges intact, which is lifted out of the end opposite to where the mangler was inserted.

[29] The May 9th video (Exhibit P1, Tab 12) shows a Weatherford demonstration intended to replicate Dr. McIntosh's tests, except using Weatherford's temperatures and conditions. The video of the attempt to replicate the first test shows thermocouples attached to a small section of stator (Exhibit D20), which is placed in the Weatherford tank on top of two full length stator pieces. The

short pipe length is removed from the tank after a period of cooling. On removal, the temperature of the stator housing is measured as -55.6 C, and the elastomer as - 28 C. A Weatherford worker tries to remove the elastomer lining with a hammer, but is unsuccessful. The elastomer simply chips and fractures but does not come out of the stator housing. A temperature log, which records the cooling time and temperatures, was kept for this demonstration (Exhibit D15).

[30] The May 14th video (Exhibit P1, Tab 7) shows the attempt to replicate Dr. McIntosh's second test using the same piece of pipe that was shown in the May 9th video. This pipe has now warmed up to ambient temperatures and the video shows Weatherford technicians trying to replicate the warm removal of the stator that is shown in the McKay demonstration, with a similar winch device with a washer and a metal plate. Unlike Dr. McIntosh's elastomer, the one in this video does not come out of the stator housing and the metal plate that was part of the winch device deforms and begins to buckle (Exhibit D21).

[31] Although not videotaped, on May 18, 2007 there was another demonstration that was attended by the experts. A temperature log was kept from this demonstration and was entered into evidence at trial (Exhibit D12). The set-up for this demonstration was agreed to be the same as the one in the February video, except that the bulk nitrogen tank was undergoing repairs and the liquid nitrogen was introduced using two portable tanks called dewars. There were three elastomer pipes in the tank in this demonstration and the lining on the all the pipes were successfully removed.

III. The Allegation of Infringement

[32] It is agreed that infringement is a trespass which takes each essential element of a particular patent claim.

[33] As mentioned, Weatherford maintains that its process for removing an elastomer from stator housing does not depend on having the elastomer shrink and pull away from the stator housing. Instead, Weatherford maintains that its process depends on subjecting a stator housing to a temperature cold enough to have the elastomer reach its glass transition temperature, and once this has been achieved, the elastomer becomes brittle and can be broken away from the stator housing by mechanical means. It is agreed that the glass transition temperature of the elastomers in question is - 21.8 C. As a result, Weatherford argues that, as its process depends on a different principle for removal of a stator than that protected by the Patent, it does not offend the Patent.

[34] While Weatherford relies on a different principle for removing elastomers from that protected in the Patent, nevertheless, the primary infringement issue is whether, in the exercise of the principle, it takes each essential of the Patent.

[35] McKay has made the choice to rely on observations in the course of the demonstrations conducted, and expert opinion based thereon, to prove infringement of each of the three essentials of the Patent.

A. *Claim 1: The cryogenic refrigeration essential*

[36] To prove the taking of this essential, McKay must prove that Weatherford has applied a temperature, below -50 C, to a certain stator housing until a certain event occurs, being that the elastomer shrinks and pulls away from the stator housing.

1. *The McKay demonstrations*

[37] I find that Dr. McIntosh's evidence proves that, by applying a temperature to a stator housing with an adhered elastomer at the very low end of the cryogenic range described in the Patent, being approximately - 196 C, the result is achieved that the elastomer shrinks and pulls away from the stator housing. However, Dr. McIntosh's demonstrations do not prove the exact temperature at which the shrinkage and pulling away occurs in the circumstances of either of the April 2006 demonstrations; all Dr. McIntosh is able to say is that "at some very low temperature, differential shrinkage between the stator pipe and liner is sufficient to break the bond" (McIntosh Expert Report, Ex. P1, Tab 8, p.3). Indeed, his best guess given in evidence during his oral testimony is that the temperature at which the bond is broken was "probably very close" to the glass transition temperature. On further questioning he said it was "maybe very close". However, Dr. McIntosh said that this was not something that he had measured and that he did not know at what temperature the bond would break. He also did not offer any reason as to why he thought that the shrinking and pulling away and glass transition temperatures would be similar (Transcript, pp. 300-301).

[38] Dr. William's opinion diverges from Dr. McIntosh's on this point. He stated that, in relation to the Weatherford process, it is possible to go below the glass transition temperature of the

elastomer but still not have the elastomer shrink away from the stator housing. He says that in the Weatherford process, which is done below the glass transition temperature, it is only with the application of force that the elastomer becomes separated from the stator housing (Transcript, pp. 717-718).

[39] Neither expert has a verifiable rationale to support the opinions offered. Therefore, I do not accord them sufficient weight to prove, on a balance of probabilities, the temperature at which the elastomer shrinks and pulls away from the stator housing.

2. *The Weatherford demonstrations*

[40] Without direct evidence as to when the elastomer shrinks and pulls away from the stator housing, McKay depends on the evidence of six observations stemming from the demonstrations to prove the taking of the cryogenic refrigeration essential by Weatherford.

a. *Dr. William's opinion*

[41] McKay's construction position throughout the trial and argument with respect to "cryogenic refrigeration" is that Weatherford's application of any temperature below - 50 C, in and of itself, constitutes the taking of an essential element of the Patent. Under cross-examination by Counsel for McKay on this position, Dr. Williams essentially agreed that, if McKay is correct in its

position, and Weatherford uses temperatures below -50 C, then Weatherford's process takes the cryogenic refrigeration essential of the Patent (Transcript p.704). In argument, McKay offers this statement as conclusive proof of infringement entitling McKay to judgment in its favour. I dismiss this argument for two reasons: Dr. Williams's opinion addresses a legal question which is outside of his expertise rather than a factual question within his expertise, and, therefore, his answer is inadmissible; and, as I have found, I do not agree with McKay's construction argument on the cryogenic refrigeration issue.

b. ***Use of the "grappler"***

[42] McKay attempts to use email exchanges between Weatherford employees to prove that Weatherford has had some success in removing elastomers in long pieces with a "grappler", being a device with hooks on the end of a rod, and, thus, is evidence that Weatherford had applied a temperature that resulted in the elastomers concerned to shrink and pull away from their stator housings (Exhibit 13, Tab 64). However, since the email exchanges are only admitted into evidence as proof that the email exchanges took place, and not for the truth of their contents, I find that they are not admissible evidence for McKay's purpose. Therefore, I dismiss the grappler argument.

3. ***The short piece of elastomer***

[43] McKay also relies on the evidence from the February 15th video of the Weatherford process as described above, which shows a loose round piece, the diameter of the pipe and several inches long with its circular edges intact being lifted out of the pipe (Exhibit P1, Tab 5). Counsel for McKay argues that the only way that this piece could come out with such smooth edges is

because the elastomer had shrunk and pulled away from the stator housing prior to the drilling, and only the force of friction prevented the entire elastomer from coming out as smoothly. He also argues that this drill is the application of a centrifugal force, such as the type that is mentioned in the Patent specifications.

[44] I find that this argument fails for two reasons. First, the argument is not supported by expert opinion; in fact there exists a contrary compelling opinion offered by Dr. Williams to the effect that the Weatherford process relies on the brittleness of the elastomer once it has gone below its glass transition temperature, and this brittleness will cause the elastomer to come out of the pipe in chunks as a result of the drilling action. That is, the existence of the loose round piece of elastomer was not necessarily the result of the elastomer shrinking and pulling away from the stator housing before the drilling took place. Indeed, in Dr. Williams' opinion, the elastomer would still be bonded to the inside of the stator before the force of the drill was applied (Transcript, pp. 694, 727). And second, with respect to the friction feature of the argument, as there is no expert opinion substantiating the quality and effect of the friction involved in the procedure demonstrated, I find that the stated influence of friction is pure conjecture.

[45] As to the centrifugal force element of the argument advanced, it is irrelevant to the issue of infringement because Claims 1 and 2 do not speak of the means for extracting the elastomer.

4. *Failure of the drill*

[46] Another argument advanced by McKay to prove that Weatherford does not rely on the glass transition temperature in its process, but rather the process protected by the Patent, comes from the February 15th demonstration. In the February 15th demonstration, the first stator removed from the tank was not able to have its elastomer drilled out despite the fact that the temperature of the pipe was - 47 C, which is well below its glass transition temperature. As the argument goes, since it could not be drilled out at well below the glass transition temperature of -21.8 C, in fact, Weatherford is relying on having the elastomer shrink and pull away from the stator housing.

[47] I find that this argument fails on the evidence of Dr. Williams who offers the opinion that the temperature of - 47 C is only taken at the end of the stator and, therefore, this would not necessarily mean that the elastomer was at a uniform temperature through its whole length (Transcript, pp. 1050-1052). Therefore, the fact that the first elastomer could not be drilled out is not proof, on a balance of probabilities, that the Weatherford process relies on the process protected by the Patent

5. *The clean pipe*

[48] Another aspect of the demonstrations which is argued by McKay to prove infringement is the evidence given by Dr. McIntosh that the pipe was "clean" after the elastomer had been removed by the Weatherford process during the May 18th demonstration. The point of this argument is that, if the pipe can be said to be clean in the sense of being free of elastomer, it is evidence that the elastomer shrunk and pulled away from the stator housing.

[49] With respect to his statement, Dr. McIntosh was asked whether this degree of cleanness would have been possible without the bond being broken, to which he replied “No, I don’t think so” (Transcript p. 303). McKay argues that this is the only evidence before the Court as to what the inside of that pipe looked like and, since Dr. McIntosh is an expert witness, his answer should be given substantial weight.

[50] I cannot agree with this submission. Although it is true that Dr. McIntosh was not challenged on his observation, it is not clear what he meant when he said the pipe was clean. For example, referring to the pipe in the tests he conducted in April 2006, after the elastomer was removed, he said that pipe was clean, but when asked for details about this statement, Dr. McIntosh said that he did not make a scraping and “we just looked at it and there were no particles sticking out” (Transcript p. 287). In addition, when asked if there was evidence of an adhesive on his test pipe he said that “I don’t think we saw anything that we could say one way or the other whether it was on the rubber or left behind stuck on the wall. I don’t know the answer to that” (Transcript. p. 288).

[51] The point here is that, apart from visual observation, Dr. McIntosh has no physical or chemical evidence to offer about the condition of the interior of the pipe in his tests after the elastomer was removed. Therefore, Dr. McIntosh’s evidence cannot be said to establish that the interior of the pipe in the May 18th demonstration was in the same condition as that in his April 2006 test. As a result, I find that his simple observation evidence does not establish, on a balance of

probabilities, that the elastomer in the May 18th demonstration had shrunk and pulled away from the stator housing.

6. *The deformed plate*

[52] An observation made from the May 9th video is also relied on by McKay as evidence that the Weatherford process infringes the cryogenic essential of the Patent. This observation is that when Weatherford attempted to replicate the removal of the stator at ambient temperatures, as taught in Dr. McIntosh's experiment, the plate that was used as part of the winching apparatus (Exhibit D22) collapsed in one place. As a result, McKay argues that the collapse is an indication that the elastomer at the point of collapse had begun to pull away from the stator housing and was only prevented from doing so completely because the temperatures during this demonstration were warmer than the normal temperatures used by Weatherford.

[53] In my opinion, the observation relied upon by McKay proves nothing with respect to the question of infringement. As stated above in Section III A, to prove the taking of the cryogenic refrigeration essential, McKay must prove that Weatherford has applied a temperature, below -50 C, to a certain stator housing until a certain event occurs, being that the elastomer shrinks and pulls away from the stator housing. Therefore, it is not enough to suggest that if this stator had been subjected to a certain temperature an infringement would have occurred. Rather, there must be evidence that it actually did occur in a specific instance on the application of a temperature, below -50 C, to a certain stator until the certain event occurs. For this reason, I find that the deformed plate argument fails.

B. ***Claim 1: The thermal shock essentials***

[54] As found, the second and third essentials of Claim 1 are:

> to avoid thermal shock,
> (b) the temperature of the stator housing being gradually lowered to cryogenic levels,
> and
> (c) then gradually raised to ambient temperature.

While no precise definition of "thermal shock" has been given in the evidence at trial, it is common ground that changing the temperature of metal can cause damage to it. It is also common ground that it is preferable to eliminate this effect while changing the temperature of stator housings.

[55] In this part of the analysis there are two critical questions which require an answer.

1. ***What is the meaning of the term "cryogenic levels"?***

[56] Since the term "cryogenic refrigeration" in Claim 1 is found within the Patent, and means a range of temperatures beginning at - 50 C and below, I find that, with respect to the cooling and warming essentials of Claim 1, the term "cryogenic levels" means any temperature below - 50 C. Therefore, if the Weatherford process gradually lowers the temperature of a stator housing to below - 50 C, and then from the temperature so reached, gradually raises the temperature of the stator housing to ambient temperature, Weatherford takes this aspect of the essential of Claim 1.

[57] It is not disputed that the Weatherford process does lower the temperature of stator housings to below - 50 C. As a result, "cryogenic levels" are reached.

2. *What is the meaning of the terms "gradually lowered" and "gradually raised"?*

[58] With respect to "gradually lowered", McKay relies on Dr. McIntosh's opinion that the Weatherford process was gradual enough to avoid damaging their pipes (Transcript, p. 186), and argues that this fact, combined with the evidence that Weatherford does not drop its stators into liquid nitrogen, is enough to demonstrate infringement of this essential.

[59] I do not accept this argument. The Patent protects a specific method of avoiding pipe damage. The question is not whether Weatherford has avoided pipe damage; it is whether the method protected by the Patent has been taken in avoiding pipe damage.

[60] I find that the terms "gradually lowered" and "gradually raised" are ambiguous. There is no expert opinion as to what a person skilled in the art would understand by their use. I find that the only aid to the interpretation of the term "gradually" is the "Detailed Description of the Preferred Embodiment" portion of the Patent. That is, a stator housing "must be gradually brought down into the cryogenic range and then gradually brought back up" at the defined rate of 2.5 C per minute (Appendix 1, p.3). I find that this statement expresses that "gradually" means the temperature is to be lowered and raised at a constant maximum temperature change of 2.5 C per minute.

[61] Counsel for Weatherford argues that the demonstration evidence establishes that the Weatherford process gradually lowers temperature at a greater rate than 2.5 degrees. For example,

the temperature log from the May 18th demonstration (Exhibit D12) proves the cooling rate to be 3.5 C per minute, a full degree faster than that taught in the Patent (Transcript, pp.1120-1121). There is no evidence that Weatherford raises the temperature to ambient temperature at a constant maximum temperature change of 2.5 C per minute.

[62] Therefore, I find that Weatherford does not take the "gradually lowered" and "gradually raised" essentials of the Patent.

C. *Claim 2*

[63] Since I have found that the Weatherford process does not take any of the essentials of Claim 1, and Claim 2 is dependent on Claim 1, I find that the Weatherford process does not infringe Claim 2.

D. *Conclusion*

[64] I find that McKay has failed to prove that the Weatherford process takes each essential of the Patent, and, therefore, I dismiss its infringement claim.

IV. The Defence of Invalidity

A. *The law*

[65] Section 43(2) of the *Patent Act* RSC 1985, C. P-4 (the *Act*) creates a presumption that the Patent is valid. Therefore, in the present action, Weatherford has the onus to prove, on a balance of probabilities, that the Patent is invalid.

[66] In the Counterclaim, Weatherford alleges that the Patent is subject to prior art and obviousness. The situations in which a patent is invalid for obviousness is codified in s.28.3 of the *Act*:

28.3 The subject-matter defined by a claim in an application for a patent in Canada must be subject-matter that would not have been obvious on the claim date to a person skilled in the art or science to which it pertains, having regard to	28.3 L'objet que définit la revendication d'une demande de brevet ne doit pas, à la date de la revendication, être évident pour une personne versée dans l'art ou la science dont relève l'objet, eu égard à toute communication :
(a) information disclosed more than one year before the filing date by the applicant, or by a person who obtained knowledge, directly or indirectly, from the applicant in such a manner that the information became available to the public in Canada or elsewhere; and	a) qui a été faite, plus d'un an avant la date de dépôt de la demande, par le demandeur ou un tiers ayant obtenu de lui l'information à cet égard de façon directe ou autrement, de manière telle qu'elle est devenue accessible au public au Canada ou ailleurs;
(b) information disclosed before the claim date by a person not mentioned in paragraph (a) in such a manner that the information became available to the public in Canada or elsewhere.	b) qui a été faite par toute autre personne avant la date de la revendication de manière telle qu'elle est devenue accessible au public au Canada ou ailleurs

[67] In the present case it is common ground that the information referred to in s.28.3(a) did not originate from Mr. McKay; therefore, the issue is whether Weatherford can demonstrate, on a balance of probabilities, that the Patent would have been obvious on the claim date to a person

skilled in the art having regard to the information that was available to the public in Canada or elsewhere.

[68] To demonstrate obviousness it is not necessary to have the prior art contained in one publication, rather, several sources can be looked at as a "mosaic" to see if they constitute prior art for the purpose of obviousness (*Beloit Canada Ltd. et al. v. Valmet OY* (1986), 8 C.P.R. (3d) 289 (F.C.A.) at 294). This determination is one of fact (*Rothmans, Benson & Hedges Inc. v. Imperial Tobacco Ltd.* (1993), 47 C.P.R. (3d) 188 per Desjardins J.A. at 198 (F.C.A.). Simply because something points towards an invention or there is art demonstrating components of the invention, does not necessarily make the invention as a whole obvious. A novel combination of elements can be viewed as an inventive step (*Shell Oil Co. v. Commissioner of Patents* (1982), 67 C.P.R. (2d) 1 (S.C.C.).

[69] In order to conclude that something would have been obvious to a person skilled in the art, the Court must consider the issue from the perspective of the unimaginative skilled technician as described by Justice Hugessen in *Beloit*, *supra* at 294:

> ...The classical touchstone for obviousness is the technician skilled in the art but having no scintilla of inventiveness or imagination; a paragon of deduction and dexterity, wholly devoid of intuition; a triumph of the left hemisphere over the right. The question to be asked is whether this mythical creature (the man in the Clapham omnibus of patent law) would, in light of the state of the art and of common general knowledge as at the claimed date of invention, have come directly and without difficulty to the solution taught by the patent. It is a very difficult test to satisfy.

B. *Persons skilled in the art in the present action*

[70] A person skilled in the art is the skilled addressee of the Patent's specification (*General Tire & Rubber Co. v. Firestone Tyre and Rubber Co.*, [1972] R.P.C. 457 at 482 (C.A.)). The Patent is clearly directed at those working in the area of removing elastomers from stator housings. Therefore, a person skilled in the art would be someone who works in the petroleum industry as the elastomers in question are an integral part of a pump used extensively in this industry. A person skilled in the art would also have experience with the cryogenic reclamation of metal from rubber adhered to metal; according to several witnesses from both parties, this type of process is often used in the industry for reducing expenses and reusing equipment. However, on the evidence, skill in the art of cryogenics is not required. As held by the Federal Court of Appeal in *Nutron Manufacturing Ltd. v. Almecon Industries Ltd.* ([1997] F.C.J. No 239, 72 C.P.R. (3d) 379 at 401): "[w]hat is important is that he be a person who understands, as a practical matter, the problem to be overcome, how different remedial devices might work, and the likely effect of using them".

[71] Prior to the claim date of the Patent, while the members of the technical team at Weatherford Edmonton were skilled in engineering, and had experience in the oilfield, I find that they are not persons skilled in the art as defined because they had very little experience with stator delining. In fact, it was their search for information to develop these capabilities that led them to contact other people in the industry for advice (Transcript, pp. 427-428).

[72] However, I find that two of Weatherford's witnesses meet the qualifications of a person skilled in the art in the subject matter of the Patent prior to its claim date: Ms. Debbie Banta, a Chemical Engineer now employed by Weatherford Texas, who was employed by the Texas firms of

Murray Rubber from 1981 to 1990 and Hydril from 1995-1997; and Mr. Vince Howard, a current employee of Hydril who has worked with that firm since 1980. Before the Patent claim date, both Ms. Banta and Mr. Howard had been involved in the reclamation of metal from rubber, and had experience with different processes of stator delining. Ms. Banta and Mr. Howard have no expertise in cryogenics, but this is not the worker to whom the Patent is addressed. Rather, they were workers in the industry who had gained significance experience delining stators through formal education and practical experimentation.

C. *The effect of the Murray Rubber and Hydril processes as prior art*

[73] In order to assess obviousness from the point of view of a person skilled in the art, an assessment of the state of the art available to him or her at the claim date is necessary. There is no dispute that two features of the prior art were known by the Patent Commissioner prior to the issuance of the Patent: the 1934 Allen Patent (US Patent No. 1,955,728), and the 1973 Laussermair Patent (US Patent No. 3,731,367). However, Weatherford does not argue that this prior art was enough to lead a person skilled in the art to the process described in the Patent; Weatherford argues that other prior art existed that would accomplish this result and, thus, render the Patent invalid for obviousness. Weatherford argues that this prior art is found in the processes used by Murray Rubber and Hydril.

[74] With respect to the process employed by Murray Rubber, there were many differences between it and the one claimed in the Patent. Ms. Banta gave evidence that Murray Rubber had, for several years predating the claim date, used liquid nitrogen in a process designed to thermally separate rubber from metal in order to reuse or reclaim metal components of oil drilling equipment (Transcript. pp 321-322). The Murray Rubber process was not applied specifically to stators, but rather was used on “packers” which is a component, used in oil well drilling, in which rubber is sandwiched between two metal plates. This process did not rely on the rubber shrinking and pulling away as a result of the application of cryogenic temperatures. Instead, it involved lowering packers into liquid nitrogen to have the rubber reach its glass transition temperature and then, by applying a significant force, fracturing the rubber so it could be removed from the metal.

[75] Ms. Banta testified that the Murray Rubber process did result in occasional debonding of the rubber from the metal along the edges of the packers, but it was clear that this was not an element on which the process depended. In addition, the gradual lowering and raising of the temperature of the stators was not an element of the process; the parts to be separated were put into a basket and lowered into liquid nitrogen, and upon removal were only allowed to sit for a few minutes before the metal and rubber were separated (Transcript, pp.329-330).

[76] Ms. Banta and Mr. Howard gave evidence that the process used by Hydril to remove elastomer linings from stators resembles that claimed in the Patent; Weatherford states that this process was used as a model for developing their stator removal operations.

[77] The Hydril process made use of a tank filled with liquid nitrogen, described as a nitrogen bath, into which stators were put to cool. The stators were originally completely immersed in liquid nitrogen and would remain there for a dwell time ranging from between 30 minutes to one hour depending on the size of the stator. The stators were then removed and allowed to sit for approximately 5 minutes before the elastomer would be chipped out. Over time, this process was refined for maximum economic and time efficiency. In this refined process the stators were no longer completely submerged in the nitrogen bath, and the dwell time was shortened; however, there was always nitrogen already present in the tank when the stators were put into it. Hydril also developed a hydraulic ramming method that was more effective in removing the stators. Mr. Howard described that, eventually, the chipping method was abandoned and replaced with the hydraulic ram, and by using this method, the lining ceased to come out of the pipe in shards but would come out in bigger chunks, sometimes as long as 10 to 12 feet (Transcript, p. 370). However, in this method it is clear that the element relied upon to remove the elastomer from a stator is the 1500 pounds per square inch force of the ram and the brittle nature of the chilled elastomer (Transcript, pp. 345-346, 365).

[78] Another difference between the Hydril process and the process protected by the Patent is that the Hydril process did not use gradual cooling and heating to avoid thermal shock. Hydril did not gradually cool the stators; instead, they were placed into a nitrogen bath for rapid cooling. On removal, the practice was to let a stator sit for approximately five minutes after it was removed from the liquid nitrogen. Without this short warming period, Mr. Howard testified that the process often

resulted in the fracturing of the pipes. By allowing the stators to briefly warm, the Hydril process was able to minimize the number of pipes that it broke (Transcript, pp. 364-365).

[79] Given the foregoing analysis, in my opinion, Weatherford has established that there were cryogenic delining processes in use before the claim date of the Patent. However, I find that there is an important distinction between these and the essential elements of the Patent which involves the elastomer shrinking and pulling away from the stator lining; the Murray Rubber and Hydril processes were based on the idea that an elastomer will become brittle when it is cooled to below its glass transition temperature and can then be removed by exerting force. In addition, these processes did not teach that, in order to avoid thermal shock, the elastomer should have its temperature gradually lowered and then gradually raised.

[80] As a result, I find that the prior art of the Murray Rubber and Hydril processes do not teach the Patent.

D. *Conclusion*

[81] As Weatherford has not proved, on a balance of probabilities, that the unimaginative skilled technician would be lead directly to the patented process, I find that the Patent is not invalid for obviousness.

V. Costs

[82] Costs are usually awarded in favour of the successful party, which might mean that in a case where success is divided the costs should be apportioned on that basis. However, in a patent case such as the present one, with a claim of infringement and a counterclaim of invalidity that are both dismissed, the Federal Court of Appeal has held that it should not be considered a case of divided success and, absent special circumstances, costs should be awarded to the defendant (*Illinois tool Works Inc. v. Cobra Anchors Co. (*2003). 312 N.R. 184; *Gorse v. Upwardor Corp. (F.C.A.)* [1992] F.C.J. No. 116).

[83] I find it is only fair to give McKay an opportunity to argue whether special circumstances exist. Therefore, judgment on the action is delivered, but the issue of awarding costs is reserved for further argument.

JUDGMENT

THIS COURT ORDERS AND ADJUDGES that:

The Plaintiff's Claim is dismissed, and the Defendant's Counterclaim is dismissed.

The issue of awarding costs is reserved for further argument.

"Douglas R. Campbell"

Judge

APPENDIX A

Office de la propriété intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An Agency of Industry Canada

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...dien / Canadian Patent

une demande
vention.
de la *Loi sur*
: l'invention
ont une

une période expirant
vingt ans à compter de la date du dépôt de la demande au Canada, le droit, la faculté et le privilège exclusif de fabriquer, construire, exploiter et vendre à d'autres, pour qu'ils l'exploitent, l'objet de l'invention, sauf jugement en l'espèce rendu par un tribunal compétent, et sous réserve du paiement des taxes périodiques.

The Commissioner of Patents has received a petition for the grant of a patent for an invention. The requirements of the *Patent Act* have been complied with. The title and a description of the invention are contained in the specification, a copy of which forms an integral part of this document.

The present patent grants to its owner and to the legal representatives of its owner, for a term which expires twenty years from the filing date of the application in Canada, the exclusive right, privilege and liberty of making, constructing and using the invention and selling it to others to be used, subject to adjudication before any court of competent jurisdiction, and subject to the payment of maintenance fees.

BREVET CANADIEN **2,371,155** CANADIAN PATENT

Date à laquelle le brevet a été accordé et délivré	2003/05/13	Date on which the patent was granted and issued
Date du dépôt de la demande	2002/02/08	Filing date of the application
Date à laquelle la demande est devenue accessible au public pour consultation	2002/08/14	Date on which the application was made available for public inspection

Commissaire aux brevets / Commissioner of Patents

Canada

3056 (CIPO 91) 9702

OPIC CIPO

Office de la Propriété Intellectuelle du Canada
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An agency of Industry Canada

CA 2371155 C 2003/06/10

(11)(21) 2 371 155

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CANADIAN PATENT

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(45) Date de délivrance/Issue Date: 2003/06/10

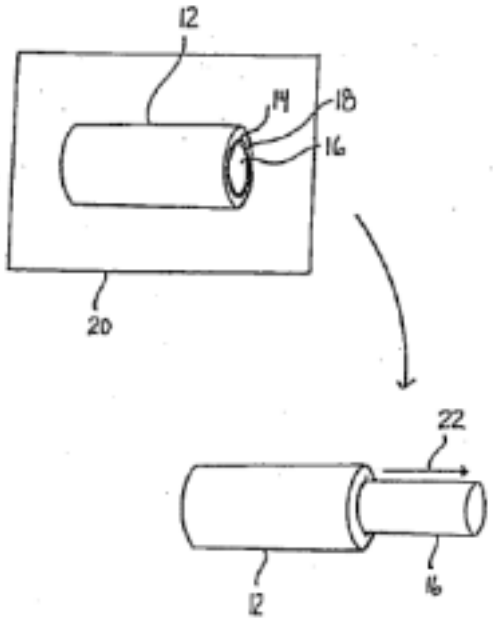
(51) Cl.Int.^{7}/Int.Cl.^{7} F04B 53/22, F04C 2/107, F16D 1/06, F16B 4/00

(72) Inventeur/Inventor:
MCKAY, JOHN RUSSELL, CA

(73) Propriétaire/Owner:
MCKAY, JOHN RUSSELL, CA

(74) Agent: THOMPSON LAMBERT LLP

(54) Titre : METHODE DE DEPOSE DE STATORS DE BOITIERS TUBULAIRES
(54) Title: METHOD OF REMOVING STATORS FROM TUBULAR STATOR HOUSINGS



(57) Abrégé/Abstract:
A method of removing stators from tubular stator housings involving subjecting a tubular stator housing having an interior surface to which a worn stator is adhered by adhesive to cryogenic refrigeration until the stator shrinks and pulls away from the interior surface of the tubular stator housing.

CA 02371155 2002-02-08

TITLE OF THE INVENTION:

Method Of Removing Staters From Tubular Stator Housings

FIELD OF THE INVENTION

The present invention relates to a method of removing stators of moineau style pumps from tubular stator housings.

BACKGROUND OF THE INVENTION

In the petroleum industry extensive use is made of moineau style pumps, so named after the french aviator who invented them. These pumps utilize metal rotors and polymer plastic rotors. The stator are secured with adhesive within a tubular stator housing. When a moineau style pump is new, there is a tight sealing engagement between the tubular stator housing and the stator. Upon rotation of the rotor, liquids are moved sequentially through a series of cavities formed between the tubular stator housing and the stator. After prolonged use the polymer plastic stator begins to wear and the rotor and stator are no longer able to move liquids efficiently due to inadequate sealing.

In order to service the moineau pump, the worn polymer plastic stator must be removed from the tubular stator housing and replaced with a new stator. At the present time the removal of the worn stator represents approximately one half of the cost of replacing the stator. Hydraulic or mechanical rams are used to break the bond of the adhesive and push the worn stator out of the stator housing. The tubular stator housing then must be reamed out to remove any residue of polymer plastic which remains.

SUMMARY OF THE INVENTION

What is required is a method of removing stators from tubular stator housings which will simplify removal and lower

the cost of removal.

According to the present invention there is provided a method of removing stators from tubular stator housings, involving subjecting a tubular stator housing having an interior surface to which a worn stator is adhered by adhesive to cryogenic refrigeration until the stator shrinks and pulls away from the interior surface of the tubular stator housing.

The method, as described above, provides an alternative to the use of rams. More importantly, it removes the worn stator is a comparatively clean fashion thereby reducing the reaming and post reaming preparation of the interior surface of the tubular stator housing. Reducing reaming and post reaming preparation provides a substantial savings.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features of the invention will become more apparent from the following description in which reference is made to the appended drawings, the drawings are for the purpose of illustration only and are not intended to in any way limit the scope of the invention to the particular embodiment or embodiments shown, wherein:

FIGURE 1 is a flow diagram representation of the removal of a stator from a tubular stator housing in accordance with the teachings of the present method.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The preferred method of removing stators from tubular stator housings will now be described with reference to FIGURE 1.

Referring to FIGURE 1, the preferred method involves subjecting a tubular stator housing 12 having an interior surface 14 to which a worn stator 16 is adhered by adhesive 18 to cryogenic refrigeration in a cryogenic refrigeration unit 20 until worn stator 16 shrinks and pulls away from interior

surface 14 of tubular stator housing 12.

The cryogenic temperature range starts at approximately minus 50 degrees celsius. It will be understood that the method works on a combination of temperature and time. As the temperature is made colder within the cryogenic temperature range, the less time it takes for the worn stator to shrink sufficiently to pull away from interior surface 14. In tests proving the concept a temperature range of between minus 150 degrees celsius and minus 200 degrees celsius was used.

In order to avoid thermal shock, the temperature of tubular stator housing 12 must be gradually brought down into the cryogenic range and then gradually brought back up. In tests proving the concept the temperature was brought down by 2.5 degrees celsius per minute until minus 196 degrees celsius, the temperature of liquid nitrogen, was reached. Once worn stator 16 separated from tubular stator housing 12, the temperature was brought back up at the rate of 2.5 degrees celsius per minute. There was minimal dwell time required at minus 196 degrees celsius. The time consuming part of the process was in gradually bringing down and then bringing up the temperature, which took approximately 3 to 24 hours. Although the preferred range of between minus 150 degrees celcius to minus 200 celcius was used in tests, lower cryogenic temperatures may be used. Some experimentation would be required to determine the optimal temperature and dwell time.

Once worn stator 16 has shrunk and pulled away from interior surface 14, removal of worn stator 16 from tubular stator housing 12 becomes an extremely simple matter. Worn stator 16 is removed simply by exerting a force upon worn stator 16 to slide worn stator 16 out of tubular stator housing 12 as indicated by arrow 22. It will be understood that this can be done in any number of ways. It can be done by pushing or pulling upon worn stator 16. It can also be done by tipping tubular stator housing 12, so that stator 16 slides from

tubular stator housing 12 by force of gravity. It can also be done by utilizing centrifugal force or other principles of physics.

Cautionary Note:

In most cases the cryogenic treatment will actually enhance the mechanical properties of tubular stator housing 12. Cryogenic treatments are used on metal to increase abrasion resistance, toughness, dimensional stability and tensile strength. However, there is a danger that ostentite will be transformed to martensite in some metals. In such cases, the virgin martensite will have to be tempered through a subsequent heat treatment.

It will be apparent to one skilled in the art that modifications may be made to the illustrated embodiment without departing from the spirit and scope of the invention as hereinafter defined in the Claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A method of removing stators from tubular stator housings, comprising:

subjecting a tubular metal stator housing having an interior surface to which a worn elastomer stator is adhered by adhesive to cryogenic refrigeration until the elastomer stator shrinks and pulls away from the interior surface of the tubular metal stator housing, the temperature of the tubular metal stator housing being gradually lowered to cryogenic levels and then gradually raised to ambient temperature in order to have the tubular metal stator housing and elastomer stator shrink at substantially the same rate and avoid thermal shock.

2. The method as defined in Claim 1, the tubular metal stator housing being subjected to temperatures between minus 150 degrees celsius and minus 200 degrees celsius.

3. A method of removing stators from tubular stator housings, comprising:

placing a tubular metal stator housing having an interior surface to which a worn elastomer stator is adhered by adhesive into a cryogenic refrigeration unit;

lowering the temperature in the cryogenic refrigeration unit gradually to cryogenic levels in order to have the tubular metal stator housing and elastomer stator shrink at substantially the same rate and avoid thermal shock, the temperature in the cryogenic refrigeration unit reaching temperatures of between minus 150 degrees celsius and minus 200 degrees celsius;

raising the temperature in the cryogenic refrigeration unit gradually to ambient temperatures in order to avoid thermal shock, the elastomer stator shrinking and pulling away from the interior surface of the tubular stator housing as the temperature is gradually lowered and then gradually raised; and

exerting a force upon the worn stator to slide the worn stator out of the tubular stator housing.

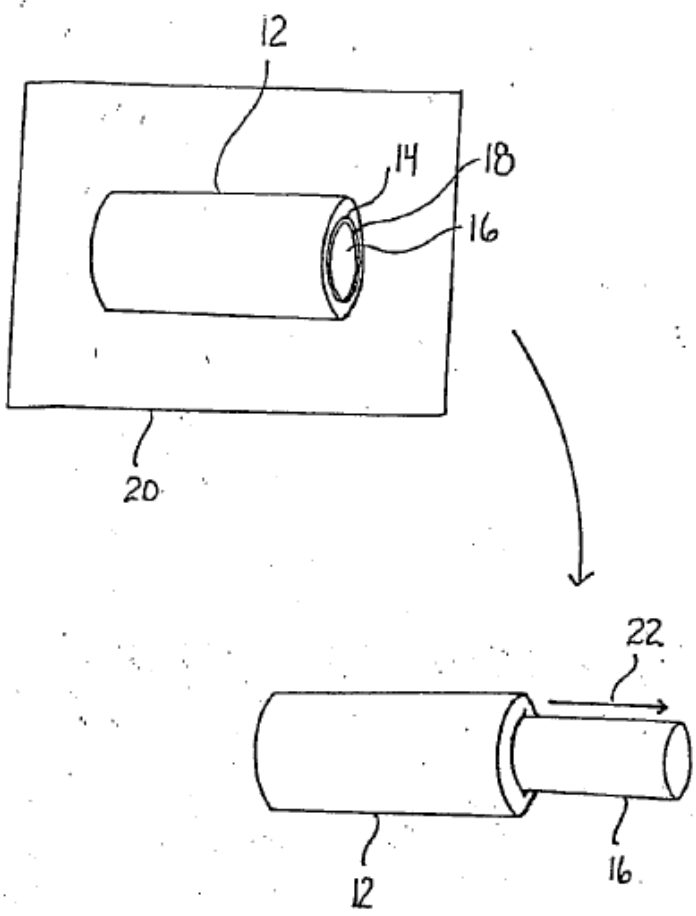


FIGURE 1

FEDERAL COURT

SOLICITORS OF RECORD

DOCKET:	T-1707-03
STYLE OF CAUSE:	**John Russell McKay v. Weatherford Canada Ltd., Weatherford Artificial Lift Systems Inc., Weatherford Canada Partnership**
PLACE OF HEARING:	Edmonton, Alberta
DATE OF HEARING:	September 24, 2007
REASONS FOR JUDGMENT AND JUDGMENT:	CAMPBELL J.
DATED:	November 23, 2007

APPEARANCES:

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K. D. Wakefield, Q.C. Dennis Schmidt	FOR THE DEFENDANTS (Plaintiffs by Counterclaim)

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