
1944

Nov. 13-17, 20-24, 27-30, Dec. 1-2.

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1947

May 28

BETWEEN:

MINERALS SEPARATION NORTH AMERICAN CORPORATION .... PLAINTIFF;

AND

NORANDA MINES, LIMITED ..... DEFENDANT.

Patents—Infringement—Use of xanthates in froth flotation concentration of ores—The Patent Act, 1923, ss. 7(1), 14(1), 43(1)—The Patent Act, 1935, ss. 37(1), 61(1)(a)—Specification should be construed fairly—Disclosures required in specification—Correct and full description of invention—Specification must not contain misleading statements—Inventor must disclose all necessary information and all useful information within his knowledge—Claim must be free from avoidable ambiguity or obscurity—Inventor must not claim what is useless—Specification the dictionary for the claims—Maxim ut res magis valeat *quam pereat—Selection patent—Nonpayment of application fees not a defence in infringement action—Anticipation—Unsuccessful experimentation not prior invention—Test of anticipation—Delay in bringing action for infringement not laches or acquiescence.*

Plaintiff sued for infringement of its patent covering invention relating to new and useful improvements in froth flotation concentration of ores. Defendant attacked validity of patent.

Held: That a specification should be construed "fairly, with a judicial anxiety to support a really useful invention if it can be supported on a reasonable construction of the patent". *Hinks & Son* v. *Safety Lighting Co.* (1876) 4 Ch. D. 607 at 612 followed.

2. That the inventor has correctly and fully described his invention in its various aspects so that any person skilled in the froth flotation art would know precisely what the inventor has found to be new and useful.

3. That the inventor has fulfilled the duty of full disclosure required of him by section 14(1) of the patent Act, 1923.

4. That claim 6 is invalid for avoidable obscurity and ambiguity.

5. That the construction of a specification is a matter of law for the Court.

6. That the interpretation of the word xanthate in claim 9 comes within the application of the principle that "the specification itself provides the dictionary by which the scope and effect of the terms in the claims is to be ascertained", and the word should be read in the light of the inventor's definition in paragraph 4 of the specification. *Western Electric Co.* v. *Baldwin International Radio of Canada* (1934) S.C.R. 570 followed.

7. That it would be erroneous to construe the word xanthate in claim 9 as including a useless xanthate, such as cellulose xanthate, and declaring the claim invalid on that account, when the word is fairly capable of another meaning which will exclude cellulose xanthate and support the patent, particularly when such meaning is in accord with the common dictionary meaning of the word and clearly the meaning with which the inventor himself has used the term in the specification and that it is sound in principle and consistent with authority under the circumstances to resort to the maxim *ut res magis valeat quam pereat* and give effect to the construction that will validate the patent.

8. That the patent is not a selection patent.

9. That the patent contains a recital that the petitioner has complied with the requirements of the Patent Act, and it is not open to the defendant in an infringement action to deny the validity of the patent on the ground that the fees payable on the application for it have not been paid, even if such has been the case.

10. That the defendant has failed to discharge the onus of proving that the invention was previously known by Martin or that he had disclosed it in such manner that the invention had become available to the public.

11. That delay in bringing an action for infringement until just before the patent has expired is not laches or acquiesence on the part of the plaintiff.

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Action for infringement of patent.

The action was tried before the Honourable Mr. Justice Thorson, President of the Court, at Ottawa.

W. L. Scott, K.C. and *E. G. Gowling, K.C.* for plaintiff.

O. M. Biggar, K.C., P. C. Finlay and *Christopher Robinson* for defendant.

The facts and questions of law raised are stated in the reasons for judgment.

The President now (May 28, 1947) delivered the following judgment:

This is an action for the infringement of letters patent 247,576, dated March 10, 1925, issued by the Commissioner of Patents to the plaintiff. The petition for the grant was made by Cornelius H. Keller, who assigned all his right, title and interest in and to his invention to the plaintiff.

The invention relates to "froth flotation concentration of ores" and is an improvement in the existing process. This requires description.

Ore, as extracted from the ground, is a mixture of minerals, some being valuable as containing the metals sought to be recovered and others being worthless material, such as silica or rock or as containing metals whose recovery is not desired. The worthless material is known as gangue and the purpose of any concentration of ores process is to separate the valuable minerals from the gangue. The ore is a physical mixture of minerals rather than a chemical compound, which means that the minerals can be separated by physical means and not by chemical reaction.

The valuable metals in the ore could be recovered at a smelter but there was always waste expense in transporting and treating worthless gangue. Efforts were continuously made to eliminate or lessen such expense by finding some process whereby the separation of the valuable minerals from the gangue could be done at the mine and only the valuable minerals sent to the smelter. Prior to the invention of the froth flotation process there were two ways in which this could be done. In some cases, where the ore was rich, the valuable minerals could be picked out by hand. The other method was the use of the gravity concentration process. This was based on the difference in the specific gravities of the valuable minerals and the gangue. The ore was crushed and the crushed ore put in a tray and shaken in water either up or down or from side to side causing the valuable minerals, being heavier, to fall to the bottom leaving the gangue at the top. There were, however, many ores which did not lend themselves to picking the valuable minerals out by hand or to the gravity concentration process.

A great advance took place when the froth flotation process was invented in 1905. In this process the ore was first crushed to a certain size. The crushed ore then went into a series of mills in which it was ground to the desired degree of fineness; some ores had to be ground more finely than others. The final grinding was invariably carried on in the presence of water. The finely ground ore included particles of the consistency of sand, called the sands, and also some very fine substances of the consistency of powder or fine mud, known as the slimes. When the final grinding was completed, the mixture of the sands, the slimes and the water was known as ore pulp. This was placed in a vat and more water was added to the mixture so that it flowed freely, about four parts of water to one of finely ground ore. There was added either to the ore in its final grinding stage or to the freely flowing ore pulp a substance known as a mineral frothing agent or reagent, the terms agent or reagent each being used, and the whole mixture was then violently agitated with air introduced into it. The purpose of the agitation was to mix the ingredients thoroughly and also to promote the formation of air bubbles with their resulting froth.

The secret of the success of the process lay in finding that some frothing agents, when added to the ore pulp, had the remarkable properties, when the mixture was violently agitated and air was introduced into it, not only of creating air bubbles in the mixture which rose to the top in the form of a froth, but also of causing the valuable minerals in the mixture to attach themselves to the bubbles and float to the top of the mixture in the froth that formed there. Such frothing agents were known as mineral frothing agents. The particles of gangue did not attach themselves to the bubbles but sank to the bottom of the mixture when the agitation had ceased. The froth into which the valuable minerals had been concentrated by the rising bubbles then overflowed or was otherwise removed from the top of the mixture. This froth with its valuable minerals was known as the concentrate. What was left in the mixture after the froth was removed was called the tailings. The tailings included the worthless gangue but also some valuable minerals which had not risen with the froth. The tailings were then run through a series of further processes of the same kind with a view to concentrating in the fresh froth such valuable minerals as had not floated to the top in the previous process until it was no longer economical to do so. When no more valuable minerals could be economically recovered the remaining tailings, consisting mostly of gangue but still containing some valuable minerals, were run off to a dump.

The success of the froth flotation process depended upon the use of an effective mineral frothing agent. Many different kinds were referred to during the course of the trial, a very good one being steam distilled pine oil. The mineral frothing agents varied in effectiveness with different types of ores, and metallurgists and others engaged in the process used the kind of mineral frothing agent that gave the best results when applied to the particular type of ore with which they were working; sometimes a combination of mineral frothing agents was required.

Ore pulps might be acid, alkaline or neutral and it was found that with some mineral frothing agents and some kinds of ores the froth flotation worked best in an acid pulp or circuit. If that was so sulphuric acid was added to the pulp to make it acid. Sulphuric acid by itself was not a mineral frothing agent. Sometimes, on the other hand, the best results were obtainable in an alkaline pulp or circuit in which case an alkali, such as caustic soda, was added to the pulp to make it alkaline. Similarly, if a neutral pulp produced the best results the necessary steps were taken to make it such.

Just as there were some valuable minerals left with the gangue that was run out with the final tailings, so there was some gangue in the concentrate. Where the concentrate was of insufficient grade to send to a smelter because of too much gangue it was run through another flotation to eliminate the gangue as far as possible. The tailings from the concentrate were called middlings, and these were also run through flotation processes to recover the valuable minerals in them until it was no longer economical to do so. Sometimes, further grinding of the minerals in the concentrate was needed.

The concentrate always had to be cleaned and dried before it could be sent to the smelter and filtration of it was always necessary. Some of the water could be siphoned off but the thick pulp had to be run through a filter and the water squeezed out by suction, leaving a cake almost dry.

The froth flotation process did not entirely supersede the gravity one, for at some mines both processes were used. The gravity process was used to the extent that was possible and then the tailings from the gravity concentrator went to the flotation plant for further treatment by the froth flotation process.

An improvement was made in the froth flotation process about 1910 when it was found that certain minerals could be selected from the others by froth flotation. This was known as selective froth flotation and was most usually applied to lead zinc ores. By the use of certain mineral frothing agents the lead bearing minerals could first be floated off, the resulting froth being a concentration of the lead and some other metals, such as silver, which tended to go with it. The lead concentrate thus formed went separately to the smelter. The tailings left after the lead concentrate was removed, containing the gangue and the zinc and other metals, were then treated with some other suitable mineral frothing agent that would float off the zinc separately.

When the concentrate was cleaned and dried it was sent to the smelter which completed the work of recovering the valuable metals in it. Even with the selective flotation process it was not yet possible to take out of the lead concentrate such metals as gold and silver as might be combined with the lead or which tended to go into the concentrate with it. The necessary separation had to be done at the smelter. The same was true with regard to the metals that might be combined with the zinc in the zinc concentrate or which tended to go into the concentrate with it.

While the froth flotation process was a remarkable one and made possible the development of mines with low grade ore bodies, it did not produce complete recoveries of the valuable minerals in the ore, for some still remained in the tailings and, on the other hand, there was still room for improvement in the grade of the concentrate which was measured by the ratio of the valuable metals in it to its total volume. To the extent that there was worthless material in the concentrate there was still a waste of transportation and smelter charges, since they were applicable to the volume of the concentrate and the smelter paid only for the valuable metals contained in it.

Moreover, although great success attended the froth flotation process in respect of the kind of ores on which it would work, it did not work at all on oxide ores and, indeed, on oxidized ores it did not work unless the oxidized ores were first sulphidized.

This was the state of the art known as froth flotation concentration of ores prior to the improvement proposed by Keller. Keller was an assayer on the staff of the plaintiff working at San Francisco, and it appears that he was seeking a sulphidizing agent that would enable the valuable minerals in oxide ores to be concentrated by the froth flotation process, when he hit upon an improvement in the froth flotation process itself late in 1922. His proposals were embodied in the specification of an application for a United States patent filed October 23, 1923. The patent issued as No. 1,554,216 and was dated September 22, 1925. The patent in suit corresponds exactly with the United States patent.

The essence of the Keller invention, which may be called the Keller process, was that he proposed the use of certain new agents, which were not themselves frothing agents, in addition to the mineral frothing agents already in use. The basic new agents whose additional use in the froth flotation process was proposed were certain defined substances known as xanthates. Analogous substances were also found to be useful under specified circumstances.

Claims were not made to any xanthates or analogous substances as new substances, but only to their use along with mineral frothing agents.

So far as the Keller process relates to the use of potassium or sodium xanthate it has proved very useful. The efficiency of the former froth flotation process has been substantially increased. In some cases the improved process makes better recoveries of the desired valuable minerals; in others it makes the same recoveries with less quantities of mineral frothing agent; sometimes the increased efficiency is seen in reducing the time required for agitation; the time required for filtration of the concentrate has been reduced by as much as one-half; and the selective froth flotation is made more effective. When the Keller process was adopted at the big Anaconda mine after a competitive test it created a great stir. It has been very extensively used all over the world and many millions of tons of ore have been treated by it. Many of the biggest mining companies in Canada have licences under the patent and use the process at their mines, for example, International Nickel Company, Consolidated Mining and Smelting Company, Hudson Bay Mining and Smelting Company, Britannia Mining and Smelting Company and others (Exhibit G 14). The invention made by Keller was, in my opinion, a very meritorious one.

The defendant is one of twenty Canadian mining companies that have refused to take out licences under the patent and this action is brought to enforce the plaintiff's rights. The defence consists of attacks on the validity of the patent.

Consideration of these attacks will involve examination of the terms of the specification. The paragraphs have been numbered for convenience of reference. Paragraphs 1 to 8, around which controversy revolves, read as follows:

1. Be it known, that I, Cornelius H. Keller, a citizen of the United States of America, and a resident of San Francisco, County of San Francisco, State of California, Chemist, have invented certain new and useful improvements in Froth Flotation Concentration of Ores and do declare that the following is a clear, full, and exact description of the same.

2. This invention relates to the froth-flotation concentration of ores, and is herein described as applied to the concentration of certain ores with mineral-frothing agents in the presence of certain organic compounds containing sulphur.

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3. It has been found that certain sulphur derivatives of carbonic acid greatly increase the efficiency of the froth-flotation process when used in connection with mineral-frothing agents. The increased efficiency shows itself sometimes in markedly better recoveries, sometimes in effecting the usual recoveries with greatly reduced quantities of the usual mineral-frothing agents, and sometimes in greatly reducing the time needed for agitation to produce the desired recoveries.

4. The invention is herein disclosed in some detail as carried out with salts of the sulphur derivatives or carbonic acid containing an organic radical, such as an alkyl radical and known as xanthates, as the new substance. These form anions and cations in solution. Excellent results were also obtained by agitating ore pulps with the complex mixture produced when 33⅓ per cent of pine oil was incorporated with an alcoholic solution of potassium hydrate, and xanthates or analogous substances were produced by adding carbon disulphide to this mixture.

5. The galena-bearing froth obtained with xanthates or analogous substances used at the rate of 0·2 pounds per ton of ore had a characteristic bright sheen, like a plumbago-bearing froth, and seemed to make a more coherent froth than when other materials were used on the same ore.

6. In general the substances referred to are not mineral-frothing agents,—producing only a slight scum, and some evanescent frothy bubbles, when subjected to agitation which would produce mineral-bearing froth on an ore pulp in the presence of a mineral-frothing agent. The substances are effective in enabling a selective flotation of lead and zinc; and cause uncombined silver, if present, to tend to go into the lead concentrate rather than with the zinc, where these are separated in separate concentrates: Usually pre-agitation is unnecessary, the brightening and other effects seeming to be practically instantaneous. The pulps may be either acid, alkaline or neutral according to circumstances.

7. Two sticks of caustic potash weighing perhaps 15 grams were partly immersed in about 80 cc. of commercial carbon disulphide and kept for about ten days in a closed bottle containing some air in the warm region of the laboratory where were the hot plates used for drying. These eventually yielded a yellow or orange salt which was used with pine oil at the rate of approximately half a pound to a ton of ore in concentrating Hibernia ore from Timber Butte Mining Company. The test was with a neutral pulp, and the concentrates were seen to be clean with brightened lead sulphide particles.

8. For laboratory purposes pototassium xanthate was prepared as follows: 198·4 grams of 88·5 per cent caustic potash was dissolved in 524 grams ethyl alcohol (denatured No. 5 formula) at a temperature of 124° F., in a reflux condenser. The solution was cooled at 58° F. It contained a large excess of alcohol over the theoretical amount needed for the subsequent reactions. To this was added, while stirring, and in a cooling bath, the theoretical amount of carbon disulphide. The reaction was substantially instantaneous, producing a thick pulp of potassium xanthate. The pulp was cooled and centrifuged in a laboratory machine, yielding crystals containing about 20 per cent moisture. The yield thus obtained was 74·7 per cent. Another 17·5 per cent was obtained by evaporation of the mother liquor. Both the centrifuged crystals and the residue from the mother liquor gave excellent results in flotation. It was found in cases where sulphuric acid was used that the centrifuged material yielded better results than the uncentrifuged.

Then follow paragraphs 9 to 19 which describe experiments and tests, several of them on a large scale, made on various types of ores, with their results. These need not, I think, be set out. There are 11 claims in the patent but the only ones in suit are claims 6, 7, 8 and 9, which read as follows:

> 6. The process of concentrating ores which consists in agitating a suitable pulp of an ore with a mineral-frothing agent and an alkaline xanthate adapted to co-operate with the mineral-frothing agent to produce by the action of both a mineral-bearing froth containing a large proportion of a mineral of the ore, said agitation being so conducted as to form such a froth, and separating the froth.
>
> 7. The improvement in the concentration of minerals by flotation which comprises subjecting the mineral in the form of a non-acid pulp to a flotation operation in the presence of a xanthate.
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> 8. The improvement in the concentration of minerals by flotation which comprises subjecting the mineral in the form of a non-acid pulp to a flotation operation in the presence of potassium xanthate.
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> 9. The improvement in the concentration of minerals by flotation which comprises subjecting the mineral in the form of a non-acid pulp to a flotation operation in the presence of a xanthate and a frothing agent.

The main attacks upon the validity of the patent are directed against the specification, both in respect of the disclosures and against the claims in suit. The attacks upon the disclosures consist of a main general attack and four specific charges; those against the claims are of a specific nature. In view of the final conclusion I have reached, it will be necessary for me to deal with each of the attacks made. There are so many of them that these reasons for judgment, if they are to deal properly with the issues raised, some of which involve questions of considerable difficulty, cannot be otherwise than lengthy.

The requirements of a valid patent specification have in Canada been reduced to statutory form. Section 14 of The Patent Act, Statutes of Canada, 1923, chap. 23, which governs the interpretation of the present specification, provides in part as follows:

> 14. (1) The specification shall correctly and fully describe the invention and its operation or use as contemplated by the inventor. It shall set forth clearly the various steps in a process, or the method of constructing, making or compounding, a machine, manufacture, or composition of matter. It shall end with a claim or claims stating distinctly the things or combinations which the applicant regards as new and in which he claims an exclusive property and privilege.

The Act speaks of the specification as ending with a claim or claims, which indicates that it has two parts, the first dealing with what leads up to the claims, which may be called the disclosures, and the claims themselves. At the same time it should be borne in mind, in considering the cases, that the term specification in Canada includes both the disclosures and the claims.

The requirements of a specification generally were well stated by the former President of this Court in *De Forest Phonofilm of Canada Limited* v. *Famous Players Canadian Corporation, Limited* (1), but he did not attempt to separate the requirements into those that relate only to the disclosures and those that relate only to the claims. This is not easy to do for some requirements, such as freedom from avoidable obscurity or ambiguity, are applicable to both; nevertheless, the requirements relating to the disclosures are not the same as those relating to the claims; and both sets of requirements must be complied with. In view of the attacks upon the disclosures it is, I think, desirable to set out, with more particularity than section 14 (1) of the Act does, the duties of disclosure required of an inventor in consideration of the grant of a valid monopoly in respect of his invention.

Two things must be described in the disclosures of a specification, one being the invention, and the other the operation or use of the invention as contemplated by the inventor, and with respect to each the description must be correct and full. The purpose underlying this requirement is that when the period of monopoly has expired the public will be able, having only the specification, to make the same successful use of the invention as the inventor could at the time of his application. The description must be correct; this means that it must be both clear and accurate. It must be free from avoidable obscurity or ambiguity and be as simple and distinct as the difficulty of description permits. It must not contain erroneous or misleading statements calculated to deceive or mislead the persons to whom the specification is addressed and render it difficult for them without trial and experiment to comprehend in what manner the invention is to be performed. It must not, for example, direct the use of alternative methods of putting it into effect if only one is practicable, even if persons skilled in the art would be likely to choose the practicable method. The description of the invention must

(1) (1931) Ex. C.R. 27 at 42

also be full; this means that its ambit must be defined, for nothing that has not been described may be validly claimed. The description must also give all information that is necessary for successful operation or use of the invention, without leaving such result to the chance of successful experiment, and if warnings are required in order to avert failure such warnings must be given. Moreover, the inventor must act *uberrima fide* and give all information known to him that will enable the invention to be carried out to its best effect as contemplated by him. This statement of the extent to which the disclosures must go in describing the invention and its operation or use as contemplated by the inventor, if the patent is not to fail for either the ambiguity or insufficiency of such description, is abstracted from a number of cases cited by counsel for the defendant: *Smith Incubator Co.* v. *Seiling* (1); *French's Complex Ore Reduction Co.* v. *Electrolytic Zinc Process Co.* (2); *The British Ore Concentration Syndicate Limited* v. *Minerals Separation Limited* (3); *Simpson* v. *Holliday* (4); *Natural Colour Kinematograph Co. Ltd.* v. *Bioschemes Ld.* (*re G. A. Smith's Patent*) (5); *Badische Anilin und Soda Fabrik* v. *La Société Chimique des Usines du Rhone and Wilson* (6); *Gold Ore Treatment Company of Western Australia Ld.* v. *Golden Horseshoe Estates Co. Ld.* (7); *Vidal Dyes Syndicate Ld.* v. *Levinstein Ld.* (8); *The Franc-Strohmenger and Cowan Inc.* v. *Peter Robinson Ld.* (9). Section 14. (1) does not, in my opinion, alter the requirements of the law, as laid down in the cases; it merely puts them into statutory form. If they are not complied with, then the patent fails, not for ambiguity or insufficiency of description, as the cases put it, for the Act does not refer to these terms, but for non-compliance with statutory conditions. The result is the same.

When it is said that a specification should be so written that after the period of monopoly has expired the public will be able, with only the specification, to put the invention to the same successful use as the inventor himself could do, it must be remembered that the public means persons

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(1) (1937) S.C.R. 251.
(2) (1930) S.C.R. 462.
(3) (1909) 26 R.P.C. 33 at 47.
(4) (1866) 1 E & I. App. 315.
(5) (1915) 32 R.P.C. 256.
(6) (1897) 14 R.P.C. 875 at 888.
(7) (1919) 36 R.P.C. 95 at 132.
(8) (1912) 29 R.P.C. 245 at 269, 273.
(9) (1930) 47 R.P.C. 493 at 501.

skilled in the art to which the invention relates, for a patent specification is addressed to such persons. In the present case, the specification is addressed to such persons as skilled metallurgists and chemists engaged in the art of froth flotation concentration of ores. It should, therefore, be looked at through their eyes and read in the light of the common knowledge which they should possess. But it is important to note that such common knowledge must be limited to that which existed at the date of the specification.

The main general attack on the disclosures was that it fails to describe the invention at all. The words of each paragraph were minutely scrutinized. It was contended that paragraph 2 indicated that the invention was really wider than "herein described" and might be applied to something altogether different from the concentration of ores, and that the references to "certain ores" and "certain organic compounds" left the reader in the dark as to the kind of ores and the kind of organic compounds; that paragraph 3 did not advance the definition since it did not indicate which sulphur derivatives of carbonic acid were meant: that in the first part of paragraph 4 the words "herein disclosed in some detail as carried out with" the salts mentioned showed that the inventor was careful not to say that the invention consisted in the use of such salts leaving him free to say that such use was not restrictive but merely a particular example of his invention, that the words "an organic radical" meant "any organic radical", that the phrase "such as an alkyl radical" means "for example, an alkyl radical", that two possible interpretations could be given to the word "alkyl", that the word "also" in the third paragraph indicated that something that was not "xanthates" was meant, that the first and second sentences added nothing to what the invention was and the third presented a problem in construction and that up to the end of this paragraph the boundaries of the class of sulphur derivatives recommended for use remained undefined; that paragraphs 5 and 6 gave no help; that paragraph 7 lead into new territory and dealt with a compound that was not xanthates and had no organic radical in it and thus was a considerable extension of the scope of the invention; that there is a description of certain reagents which are recommended, that the invention as described is an invention of the use of certain sulphur derivatives of carbonic acid in the most general terms; that paragraph 8 is confined to a description of how potassium xanthate is made "for laboratory purposes" only, that the term "theoretical" is another indication of the carelessness and vagueness and unsatisfactory character of the specification, which might have been made clear, simple and definite; that the inventor approached the question of describing the invention but was careful to sheer off so that he could, according to the circumstances, contend that his invention was a narrow or broad one; that nobody can tell what sulphur derivatives are recommended but that all that can be gathered is that there are certain sulphur derivatives of carbonic acid which, with certain ores, the inventor thinks will be useful.

There is no doubt that the specification is not well drawn, but there is a vital difference between imperfection of draughtsmanship and non-compliance with statutory requirements. There may be faults of expression that do not affect the vaildity of the patent. A patent specification is not an exercise in composition, and the Court should not concern itself with faults of language that do not amount to breach of the statutory conditions for the grant of the patent. The proper attitude of mind of the Court in construing a specification was well described by Sir George Jessell, M.R. in *Hinks & Son* v. *Safety Lighting Co.* (1) when he said that it should be construed "fairly, with a judicial anxiety to support a really useful invention if it can be supported on a reasonable construction of the patent." This statement has received full acceptance. The need for fair construction was stated by Lord Parmoor in the House of Lords in the *Natural Colour* v. *Bioschemes* case (*supra*), at page 270. The Supreme Court of Canada has also shown the same attitude. In *French's Complex Ore Reduction Co.* v. *Electrolytic Zinc Process Co.* (2) Rinfret J., as he then was, in delivering the judgment of the Court, approved Sir George Jessel's statement and said that the specification "should not be construed astutely". And in *Baldwin International Radio Co. of Canada Ltd.* v. *Western Electric Co. Inc. et al.* (3) Rinfret J., again speak-

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(1) (1876) 4 Ch. D. 607 at 612.
(2) (1930) S.C.R 462 at 470.
(3) (1934) S.C.R. 94 at 106.

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ing for the Court, said that the respondents were entitled to have the claims interpreted "by a mind willing to understand, not by a mind desirous of misunderstanding", thus approving the remarks of Chitty J. in *Lister* v. *Norton Brothers and Co.* (1). And in *Western Electric Co.* v. *Baldwin International Radio of Canada* (2) Duff C. J., giving the judgment of the Court, pointed out that where the Courts have been satisfied that there was a meritorious invention they have resorted to the maxim *ut res magis valeat quam pereat,* and said:

> And, where the language of the specification, upon a reasonable view of it, can be so read as to afford the inventor protection for that which he has actually in good faith invented, the Court, as a rule, will endeavour to give effect to that construction.

The test of whether a specification complies with the requirements of the first sentence in section 14.(1) is whether persons skilled in the art, on reading the specification in the light of the common knowledge existing at its date and being willing to understand it, would be unerringly led to the invention and be enabled to put it to full use.

The first criticism in the attack on the disclosures for failure to describe the invention, namely, that paragraph 2 indicates that the invention may be applicable to something quite different from the concentration of ores may be dismissed offhand as hypercritical; paragraph 1 makes it clear that the invention is one of new and useful improvements in froth-flotation concentration of ores; nothing else is contemplated or could reasonably be inferred. The next comment is that the definition of an invention need not appear in a single sentence or paragraph, so long as it appears in the disclosures as a whole. This is particularly true in the case of inventions that are difficult of description. Descriptions of inventions involving the use of chemical substances are frequently difficult by reason of the nomenclatures of chemistry and the limits of their application. The description of the invention under review is of such a nature. All that need be said further with regard to paragraph 2 is that the terms "certain ores" and "certain organic compounds containing sulphur" are not yet defined. The description of the invention is advanced in the first sentence of paragraph 3 by the reference to

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(1) (1886) 3 R.P.C. 199 at 203.

(2) (1934) S.C.R. 570 at 574.

"certain sulphur derivatives of carbonic acid". There is no statement yet as to which of these are meant, but the class of "organic compounds containing sulphur" referred to in paragraph 2 has been limited to those that are sulphur derivatives of carbonic acid.

The suggestion of counsel for the defendant that the description of the invention stops at the end of paragraph 3 is without merit and should be rejected, for it is clear, notwithstanding the clumsiness of the phraseology used, that the class of sulphur derivatives of carbonic acid whose use in froth flotation is proposed is limited by paragraph 4 to the salts of such derivatives that come within the definition contained in the first two sentences of the paragraph and the specific xanthates or analogous substances referred to in the third sentence. Paragraph 4 is, in my opinion, a vital part of the description of the invention. The first sentence refers to certain defined salts of the sulphur derivatives of carbonic acid as the new substance. To come within the class of such defined salts, the salts must satisfy two conditions, namely, they must contain an organic radical, such as an alkyl radical, and they must be known as xanthates. This definition of the salts is, conversely, a definition of the xanthates whose use is proposed. The inventor does not propose the use of all or any xanthates, but only that of those that contain a radical of the alkyl type. Moreover, the second sentence in the paragraph must be read with the first, for the statement "these form anions and cations in solution" is clearly restrictive of the xanthates referred to in the first sentence and is part of their definition. Thus, when the two sentences are read together it is, I think, clear that so far as the invention relates to the use of xanthates as a new substance in froth flotation, the only xanthates whose use is contempted by the inventor are those that come within the class defined as "containing an organic radical, such as an alkyl radical", and also comply with the requirement that "they form anions and cations in solution".

Most of the expert evidence at the trial related to the meaning and extent of the chemistry terms in this definition. They require most careful attention for it is upon their interpretation that the issue largely depends. The experts called by the parties, Mr. A. H. Higgins for the plaintiff, and Dr. C. B. Purves and Mr. R. L. Bennett for the defendant, were all men of standing and experience and the Court has had the benefit of their explanations and opinions as to the meaning of the chemistry terms used in the specification and the extent of their application. Mr. Higgins has been retained by the plaintiff as its chief consulting metallurgist since 1925 and is outstanding in his experience and knowledge of the froth flotation art. Dr. Purves is a professor of industrial and cellulose chemistry at McGill University and has carried out extensive research on the chemistry of carbohydrates and cellulose. Mr. Bennett has been employed by the defendant as a metallurgist on froth flotation since 1942, and before that had varied practical experience including that of an assayer and chemist.

The basic compound to be considered is carbonic acid. It is represented by the formula H_2CO_3 which means that each molecule of it consists of two atoms of hydrogen, one of carbon and three of oxygen. The central atom is carbon. It has four bonds or affinities, each equivalent in its properties, by which it can be linked with another carbon atom or an atom of another element. Each oxygen atom has two bonds but each hydrogen atom has only one. The bonds are in the nature of arms or hooks to grasp or unite with other atoms. It is essential to the stability of a compound that all the bonds of all the atoms in it should be mutually satisfied or, to put it in descriptive terms, that all the arms of all the atoms in it should be full. The links between the atoms need not necessarily be single, except, of course, in the case of single bond atoms. A description of the structural formation of carbonic acid will illustrate what is meant. The central carbon atom is bonded on one side with an oxygen atom by double links, and on the other with two separate groups of atoms, known as hydroxyl groups, in each case by a single link. Each hydroxyl group consists of an atom of oxygen and one of hydrogen, the hydrogen atom in each case being bonded with the oxygen atom by a single link. Thus all the bonds of all the atoms in the molecule are mutually satisfied; or, in other words, all the arms of all the atoms in it are full.

The next thing to be considered is what is meant by "sulphur derivatives of carbonic acid". Theoretically, and only by indirect means, the atoms of oxygen in carbonic acid may be replaced by atoms of sulphur. If only one oxygen atom is replaced by a sulphur atom the resulting compound is known as monothiocarbonic acid of which there are two forms; in one the sulphur, which has two bonds like the oxygen, is substituted for the oxygen that is bonded with the carbon by the double links, in which case it may be called sulphocarbonic acid, and in the other the sulphur is substituted for the oxygen in one of the hydroxyl groups bonded with the carbon by a single link. If two oxygen atoms are replaced by two sulphur atoms the result is dithiocarbonic acid, which likewise may take two forms; in one case a sulphur atom is substituted for the oxygen atom bonded with the carbon by the double links and another sulphur atom is substituted for the oxygen in one or other of the hydroxyl groups bonded with the carbon by a single link, in which case it may be called sulphothiocarbonic acid, and in the other case a sulphur atom is substituted for the oxygen atom in each of the singly linked hydroxyl groups. Thio indicates sulphur and the prefix sulpho indicates the substitution by sulphur of the doubly linked oxygen. Finally, where all three oxygen atoms are replaced by sulphur atoms, the result is trithiocarbonic acid, of which there can be only one form. There are thus five, and only five, acids that are sulphur derivatives of carbonic acid, where the only change made is the substitution of sulphur for oxygen, the other elements in the compound remaining the same. These acids are known generally as thiocarbonic acids. There is also a form of dithiocarbonic acid, of the kind called sulphothiocarbonic, where the hydrogen in the hydroxyl group, in which sulphur has not been substituted for the oxygen, is replaced by an ethyl or other alkyl radical. The acid thus derived is known as xanthic acid. These sulphur derivatives all appear on the chart, Exhibit P 54, prepared by Mr. Higgins, which shows both their formulae and their structural formations.

The term "salts of the sulphur derivatives of carbonic acid" is next to be considered. Salts are the result of the union of an acid and a metal. Since the acids that are sulphur derivatives of carbonic acid are the thiocarbonic acids, including xanthic acid, above referred to, the salts resulting from a union between them and a metal are known generally as thiocarbonates. There will, therefore, to correspond with the acids, be as many forms of thiocarbonates as there are of thiocarbonic acid, namely, two forms of monothiocarbonate, two of dithiocarbonate and one of trithiocarbonate. These substances may all be called analogous, since the acids from which they result are analogous. Since xanthic acid is a form of dithiocarbonic acid, as already shown, its resulting salt, which is known as xanthate, is a form of dithiocarbonate. It was part of the scheme of the general attack upon the disclosures to show, if possible, that the limits of the classes of substances referred to in the specification were undefined, and counsel for the defendant contended that this was so in respect of the compounds referred to as sulphur derivatives of carbonic acid. He relied upon the opinion expressed by Dr. Purves who considered that the class should be extended to include compounds, in which in addition to the substitution of sulphur for oxygen, other elements or groups in the compound are replaced by elements or groups other than sulphur and not containing sulphur. These are shown on the chart, Exhibit D 57, with its explanatory notes, prepared by Dr. Purves. He adopts as being sulphur derivatives of carbonic acid the thiocarbonic acids, including xanthic acid, together with the salts resulting from them, including xanthates, and then proceeds to add to the list. In respect of one of the monothio derivatives, where sulphur has been substituted for the oxygen in one of the hydroxyl groups, he adds two other compounds in which nitrogen or chlorine has been substituted for the other hydroxyl group; and in respect of the other monothio derivative, where sulphur has been substituted for the doubly-linked oxygen, he adds four other compounds in two of which nitrogen replaces either one or both of the singly-linked hydroxyl groups and in the other two the replacement is by chlorine. Similarly, in respect of the dithio derivatives, he adds two compounds in which nitrogen or chlorine has been substituted for the hydroxyl group in which sulphur has not been substituted for the oxygen.

He cannot, of course, make any similar addition to the trithio derivatives. There is also added to his chart a note to the effect that the list might be extended to include four additional compounds in which the chlorine was replaced by bromine and four more in which it was replaced by iodine. Dr. Purves went even farther. He said that he could have included more substances on his chart but had stopped at an arbitrary point. He went so far as to say that if one of the oxygen atoms were replaced by sulphur, the other oxygen atoms could be replaced by other elements and the resulting compounds would all be sulphur derivatives of carbonic acid, but he was unable to say what elements other than nitrogen, chlorine, bromine or iodine might be substituted.

Mr. Higgins thought that the expression "sulphur derivatives" was properly applicable only to derivatives in which sulphur was the only substitution for oxygen; that it was not proper to include the compounds referred to by Dr. Purves in which the oxygen atoms were replaced by sulphur and some other element such as nitrogen or chlorine; and that such a compound should be described, not as a sulphur derivative, but as a sulphur nitrogen or sulphur chlorine derivative. I agree with Mr. Higgins. The inclusion of the compounds in dispute could be justified only by reading the word "sulphur" in the expression "sulphur derivatives" as though it meant "sulphur containing", but such an extension of meaning is not permissible. Dr. Purves freely admitted that he could not be dogmatic as to what can be included under the head of sulphur derivatives of carbonic acid and that the additional compounds shown on his chart can be described accurately as sulphur nitrogen or sulphur chlorine derivatives of carbonic acid. He said that he had included them because they are closely related to carbonic acid and thiocarbonic acids and contended that everything on his chart was included in Richter's chapter on derivatives of carbonic acid. The reference is to Richter's treatise on Organic Chemistry, recognized as the best text book on the subject in English (Exhibit P 88). In my opinion, Richter supports the position taken by Mr. Higgins rather than that of Dr. Purves. On page 431, he shows only the five acids referred to by Mr. Higgins as the acid sulphur derivatives of carbonic acid and then states that "the free acids are not known, or are very unstable, but numerous derivatives such as salts, esters, and amides are known" and, on page 434, he refers to the chlorides of the sulphocarbonic acids. This indicates, I think, that Richter regards the compounds, which Dr. Purves added to his chart, as derivatives of the thiocarbonic or sulphocarbonic acids he referred to as free acids. My conclusion is that the nitrogen or chlorine containing compounds referred to by Dr. Purves ought to be described either as sulphur nitrogen or sulphur chlorine derivatives of carbonic acid or, alternatively, as nitrogen or chlorine derivatives of thiocarbonic acid and that the expression sulphur derivatives of carbonic acid should be restricted to compounds in which the only substitution for oxygen is by sulphur. The reference by Dr. Purves to Watts' Dictionary of Chemistry further confirms my opinion. This leaves the limits of the class of substances that can be described as sulphur derivatives of carbonic acid clearly and precisely defined. They are the thiocarbonic acids shown on Exhibit P 54, including xanthic acid, and the thiocarbonates resulting from them, including xanthates. The extent of the class of xanthates depends upon what is meant by an alkyl radical and what metal may be used in their production.

The term "alkyl radical" in the first sentence of paragraph 4 is of vital importance and much of the defendant's attack was concentrated on it. Its meaning and significance in the specification must, therefore, be precisely ascertained. Mr. Higgins defined a radical as part of a chemical compound and Dr. Purves explained that in chemistry it was found convenient to assume that certain groupings of atoms pass through chemical changes without altering their relative position. Such a grouping is a radical; it is not a complete molecule but a grouping of atoms. Radicals may be organic or inorganic depending on whether they contain atoms or carbon or not. We are here concerned only with organic radicals and only those that are alkyl radicals. Counsel for the defendant, in line with the general scheme of attack sought to construe the words "containing an organic radical, such as an alkyl radical" as expansive.

In support of such construction he referred to the amendment made in the United States patent office prior to the issue of the United States patent. Originally the first sentence of paragraph 4 read:

> The invention is herein disclosed in some detail as carried out with salts of the alkyl sulphur derivatives of carbonic acid known as xanthates, as the new substance.

By the amendment the word "alkyl" before the word sulphur was struck out and after the word acid the expression "containing an organic radical, such as an alkyl radical and" was inserted. Counsel for the defendant contended that by the amendment there was a deliberate extension of the class of salts whose use was proposed; that the term "organic radical" meant "any organic radical" and that the expression "such as an alkyl radical" was in no sense restrictive but merely illustrative. It was argued that the whole expression "an organic radical, such as an alkyl radical" meant "any organic radical, for example, an alkyl radical". This would have been a convenient construction for the defendant; indeed, it would have ended the plaintiff's case for there are certain kinds of organic radicals, such as aryl radicals, with which xanthates cannot be made at all, and there are some xanthates containing certain other organic radicals, such as the cellulose radical, that are useless in froth flotation. The expression cannot have the meaning suggested. The amendment was clearly corrective of an erroneous placing of the word alkyl and at the same time restrictive and definitive of the substances referred to. If the term "an organic radical" meant "any organic radical" there would be no need at all for the expression that follows. The expression "such as an alkyl radical" is a qualifying one and has a clear and precise meaning; it is referable to the term "an organic radical" which precedes it and is clearly restrictive and definitive of it. I have carefully consulted the New English Dictionary and Webster's New International Dictionary. Both make it perfectly clear that the expression "such as", referring back as it does to "an organic radical", means an organic radical of the kind or type that is subsequently stated. The whole expression means, therefore, that the only organic radical that is to be considered is an organic

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radical of the kind or type known as alkyl. The expression is an integral part of the definition of the class of salts, or xanthates, whose use in froth flotation is proposed. No xanthate which does not contain an alkyl radical is contemplated by the inventor, for it would fall outside the defined meaning of xanthates inserted in the specification.

Mr. Higgins defined an alkyl radical as the residue of a saturated hydrocarbon. The first in the series of saturated hydrocarbons is called methane CH_4, consisting of a carbon atom with each of its four bonds or affinities satisfied with a hydrogen atom, that is, each of its four arms has grasped a hydrogen atom so that all its arms are full. The residue of this saturated hydrocarbon, that is, the grouping of atoms that would remain if one of the hydrogen atoms were removed, is an alkyl radical called methyl CH_3. This is the first in the series of alkyl radicals. Methyl is what would be left of methane if one of its hydrogen atoms were removed. The hydrogen atom is only theoretically removable since the remaining compound would be unstable, so that methyl cannot exist by itself. It has been isolated but only in a very transitory way. It can, however, enter into chemical composition or reaction in various ways. Since one of the bonds of the carbon atom in methyl is unsatisfied, that is, one of its arms is not full, it is said to have a free valence, that is, one bond or arm free to unite with or grasp another atom or group of atoms. Valence is the extent to which an atom can combine with another atom or group of atoms. Where an atom has only one free valence it is called monovalent. If there are two or three free valences it is said to be divalent or trivalent. And if it were possible to have an isolated carbon atom it would have four free valences and be called tetravalent. If all the bonds are satisfied there are no free valences and the atom is nonvalent. In this sense methyl is a monovalent radical. The next hydrocarbon is called ethane C_2H_6, consisting of two carbon atoms, each having three of its bonds satisfied with hydrogen atoms and the remaining fourth bond satisfied by being linked with the other carbon atom by a single link. It is of the essence of a saturated hydrocarbon containing more carbon atoms than one that such atoms should be bonded with one another by a single link. Ethane is, therefore, a saturated hydrocarbon and its radical, called ethyl C_2H_5, being the residue of a saturated hydrocarbon, that is, the grouping of atoms that would remain if one hydrogen atom were removed, is an alkyl radical. Having only one free valence it is monovalent. The addition of each carbon atom to a hydrocarbon requires the addition of two hydrogen atoms to complete its saturation, and in each case, when one hydrogen atom is removed, the residue or grouping of atoms that remains is an alkyl radical. The alkyl radicals are shown on Mr. Higgins' chart, Exhibit P54, as methyl CH_3, ethyl C_2H_5, both already dealt with, propyl C_3H_7, butyl C_4H_9, amyl C_5H_{11} and hexyl C_6H_{13}. This does not exhaust the list of alkyl radicals for it continues as the number of carbon atoms in the hydrocarbons of the saturated hydrocarbon series increases. It will be seen that in every alkyl radical there are twice as many plus one hydrogen atoms as there are carbon atoms, so that the general formula for all alkyl radicals may be stated as C_nH_{2n+1}. It follows that if the formula for any particular radical does not fall within this general one, such radical is not an alkyl radical. Every alkyl radical is the residue of a saturated hydrocarbon and answers to the same formula C_nH_{2n+1}; and every such radical is monovalent in the sense that, regardless of the number of carbon atoms in it, it has only one bond or arm free to unite with or grasp another atom or group of atoms. The definition of the particular class of organic radicals, known as alkyl radicals, given by Mr. Higgins is thus shown to be a clear and precise one.

The precision of this definition did not suit the defendant. It was necessary to attempt to enlarge its scope in order to include xanthates that would not work in froth flotation or to show that the term "alkyl" was ambiguous. Counsel for the defendant relied upon evidence given by Dr. Purves. He explained that the great division of organic radicals was into aryl and aliphatic radicals. The aryl radicals are those derived from compounds of the benzene class. The formula for benzene is C_6H_6, that is, six carbon atoms and six hydrogen atoms. Its structural formation is distinctive. The carbon atoms are not joined in a chain but in a symmetrical ring with each carbon atom bonded to a carbon atom on one side by a single link and to a carbon atom on the other by a double link. This satisfies three of the bonds of each atom, the remaining bond being satisfied by a hydrogen atom, so that there are six hydrogen atoms in a circle each attached to a carbon atom in the central ring, which is called a benzene ring. If one hydrogen atom is removed, the residue or group of atoms that remains is the radical called phenyl C_6H_5. It is the simplest in the series of aryl radicals. All the aryl radicals are derived by the removal of a hydrogen atom directly from a benzene ring. They differ in chemical behaviour from other radicals, one aspect of such behaviour being that they cannot be used in making xanthates. All organic radicals, whatever their kind or type, that are not aryl radicals, are called aliphatic radicals. The term aliphatic is thus one of the broadest terms in organic chemistry. Dr. Purves then divided the aliphatic radicals into those that are monovalent and those that are not. The importance of this subdivision lies in the fact that only monovalent aliphatic radicals can be used in making xanthates. Dr. Purves defined a monovalent aliphatic radical as one in which there is only one bond per carbon atom free to unite with another atom or group. This is not the same monovalency as that of the alkyl radical as defined by Mr. Higgins which has only one free valence, not per carbon atom, but in the whole radical, regardless of the number of carbon atoms in it.

Dr. Purves said that, according to Mr. Higgins' definition, alkyl radicals form a precise subsection of aliphatic radicals. He did not challenge the accuracy of the definition and agreed that it was a good, clear cut definition and the most precise one used in the text-books and that it was widely and commonly used. But he also said that in chemistry the term alkyl radical was sometimes used in a wider sense and sometimes in a different one. There was, however, one limit to the territory it takes in, namely, that it never covers a wider territory than that of aliphatic radicals. In its narrowest sense, he said, the term has the meaning given by Mr. Higgins, which is its most precise meaning; in its widest sense it is used in contrast with aryl radical; but it never includes an aryl radical.

While Dr. Purves said that in books of reference the term alkyl had a different meaning from that given by Mr. Higgins, the only chemistry reference book he mentioned was Watt's Dictionary of Chemistry in which, he said, alkyl was defined simply as an alcoholic radical. By these statements and the reference to Watts' the suggestion was left with the Court that in organic chemistry the terms "alkyl radical" and "alcoholic radical" are used synonymously. Such a suggestion is, in my opinion, unwarranted. Dr. Purves explained that the term "alcoholic radical" means that the radical must be such as to give an alcohol where a hydroxyl group has been added to its free valence. According to this explanation, alcohol has two radicals, one the "alcohol radical" and the other the hydroxyl group. When a hydroxyl group is added to an aryl radical the resulting compound is a phenol which, according to Dr. Purves, is not an alcohol. It is obvious, with this explanation of its meaning, that the term "alcoholic radical" is as wide in extent as the term "alcohol" itself, which, according to Watts', was originally limited to one substance, namely, spirit of wine, but is now applied to a large number of compounds which in their external characteristics show little or no resemblance to common alcohol. It is easy to see how the terms alkyl and aryl may be used in contrast to one another, for the simplest alcohol is produced from a hydroxyl group attached to the simplest alkyl radical, methyl CH_3, making methyl alcohol CH_3OH, and the simplest phenol is produced from a hydroxyl group attached to the simplest aryl radical phenyl C_6H_5, making the phenol C_6H_5OH known as carbolic acid. Nor can there be any quarrel with the description of an alkyl radical as an alcoholic radical so far as the substances commonly called alcohol are concerned for they are all derived from saturated hydrocarbons C_nH_{2n+2} by the substitution of an hydroxyl group for one of the hydrogen atoms so that such alcohols consist of the radical C_nH_{2n+1} and a hydroxyl group, and in respect of such alcohols the terms "alkyl" and "alcoholic" as applied to their radicals would have exactly the same meaning and there would be no confusion with regard to them. But when it comes to alcohols in the wide sense of the term, meaning for the scientific chemist a range of compounds that extends from potable liquids to substances used for making rayon silk, with the radicals for each class or series of such compounds conforming to a specific formula, it becomes obvious, I think, that the statement that each radical of such compounds, meaning thereby the residue or group of atoms remaining after the removal of one or more hydroxyl groups, is an alcoholic radical, no matter what the formula for it may be, is a descriptive statement and not a chemical definition. A study of Watts' supports this view.

It is interesting to note that in the 1882 edition of Watts' the term "alkyl" does not appear. In the 1888 edition, reprinted 1911, it appears simply as follows: "Alkyl. An alcohol radicle". Under the article "Alcohols" Watts', after describing the composition of alcohols and their derivation from hydrocarbons containing even numbers of hydrogen atoms by the substitution of one or more hydroxyl groups for an equal number of hydrogen atoms, classifies alcohols as monohydric, dihydric, trihydric, etc., according to the number of hydroxyl groups they contain. He then divides the monohydric alcohols into five series. Each series is described by a formula to which all the alcohols in that series answer. If a hydroxyl group is subtracted from the general formula of the series the general formula of the radical of such alcohols appears. For example, the first series is described as series $C_nH_{2n+2}O$ or $C_nH_{2n+1}OH$, the latter description being written to show the alcoholic radical and the hydroxyl group in that series. Each alcohol in this series is derived from the paraffin C_nH_{2n+2} by the substitution of a hydroxyl group for a hydrogen atom and the alcohols in the series are described as methyl alcohol, ethyl alcohol, propyl alcohol, butyl alcohol, amyl alcohol, hexyl alcohol, etc. Paraffin is merely another word for saturated hydrocarbon, being derived from *parum* and *affinis,* indicating paucity and affinity, namely saturation. The alcoholic radical in this series is identical with the alkyl radical as defined by Mr. Higgins. The only other series that need be mentioned is the fourth. It is interest-

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ing because of Dr. Purves' statement that the term "alkyl radical" is never broad enough to include the aryl radical. Watts describes this series of monohydric alcohols by the formula $C_nH_{2n-6}O$, which equals $C_nH_{2n-7}OH$, and says that these alcohols are derived from the aromatic hydrocarbons C_nH_{2n-6} in the same manner as the fatty alcohols from the paraffins (or saturated hydrocarbons) C_nH_{2n+2}. The lowest member of this series is phenol C_6H_6O or C_6H_5OH, the radical of which C_6H_5 is described by Dr. Purves on his chart of organic radicals (Exhibit D 86) as phenyl, an aryl radical. The inclusion of phenols in the series of monohydric alcohols implies also the inclusion in the term "alcohol radicle" of the radicals of such phenols, all of which, according to Dr. Purves, are aryl radicals. If Watts' is relied upon as authority for the suggestion that an "alkyl radical" means the same thing as an "alcohol radicle", it must follow, according to Watts', that the term "alkyl radical" includes such aryl radicals as phenyl. Yet Dr. Purves was quite emphatic in saying that the term "alkyl radical" could never include an aryl radical. Dr. Purves might have pointed out that Watts' classification of monohydric alcohols as including phenols is broader than is now accepted, from which it follows that if the statement in Watts' that "alkyl" is "an alcohol radicle" is to be taken as meaning that "alkyl radical" and "alcohol radicle" are synonymous terms, as Dr. Purves suggests, then it must, on Dr. Purves' own evidence, be considered as being now erroneous. Dr. Purves should have made this clear. The fact is that when the statement was made in Watts' the term "alkyl" was a comparatively new term in chemistry, the precise limits of which had not been defined. I have already mentioned that it does not appear at all in the 1882 edition. It is also significant that it does not appear in the first volume of the New English Dictionary published in 1888. If the statement in Watts' is to be taken as a definition it must be rejected as taking in too much territory according to modern classifications of radicals. It must be remembered that the classification of radicals had not proceeded as far in 1888 as at the time of the Keller specification. This is shown by the fact that the 1888 edition of Watts' does not give any definition

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for either aryl or aliphatic radicals, although Dr. Purves said that this was the broad classification of radicals and that aliphatic was one of the broadest terms in organic chemistry. It was, therefore, in my opinion, unfair of Dr. Purves to refer to Watts' as an authority showing that in organic chemistry the term alkyl was used in a different sense from that in which Mr. Higgins used it. The only chemistry reference given by him showing a different use was Watts'. No up to date reference book was cited. In Webster's New International Dictionary "alkyl" is defined as meaning "any radical of the methane series, such as methyl, ethyl, propyl, etc." This is the same meaning as that given by Mr. Higgins. It is defined in the same way in the Century Dictionary and Encyclopedia— "A generic name applied to any alcohol radical, such as methyl (CH_3), ethyl (C_2H_5), propyl (C_3H_7), etc." Other reference books are to the same effect, for example, Kingzett, Chemical Encyclopaedia (1928) — "Alkyl (Radicals) — The monovalent groupings (C_nH_{2n+1}), such as methyl and ethyl, which form the radicals of the monovalent alcohols", and Hutchinson's Technical and Scientific Encyclopaedia — "Alkyl (Chem.) — A name given to the group remaining when one atom of hydrogen is removed from the molecule of a hydrocarbon of the paraffin series. The names of the individual alkyls are obtained from those of the hydrocarbons by changing —ane to —yl. e.g. Methane CH_4 methyl CH_3 etc." and Hackh, Chemical Dictionary (1930) — "Alkyl — Alphyl, Aphyl. A monovalent radical derived from an aliphatic hydrocarbon by removal of one hydrogen atom, as methyl — ethyl or propyl. Their general formula is C_nH_{2n+1}." and Bennett's Standard Chemical and Technical Dictionary (1939) — "Alkyl. Denoting a non-cyclic saturated hydrocarbon radical of general formula C_nH_{2n+1}." There can be no doubt as to the generality of the definition given by Mr. Higgins, and there is no room in my opinion for the suggestion of ambiguity or wider meaning left by Dr. Purves. There was another suggestion left by Dr. Purves which, in my opinion, was also unfair. When asked whether metallurgists would know the varieties of definitions he had referred to he replied that he could only speculate on that question, that it would depend on where the metallurgist got his training and the work of reference he looked up and said "if he looked up Watts' under Alkyl to see what alkyl meant, he would see it meant an alcohol radical". There is suggested in this reply that a metallurgist engaged in froth flotation on seeing the term "alkyl radical" in paragraph 4 might on looking up Watts' conclude that the term alkyl radical covered as wide a territory as the term "an alcohol radicle". It must be remembered that the specification is addressed to persons skilled in the art, metallurgists and chemists working on froth flotation, having the knowledge of the art as of the date of the specification and not of 1888. Such a person would not be confused by looking up Watts'. He would see the description of alkyl as "an alcohol radicle" and would conclude that this was a description rather than a definition of the term. On looking up "alcohols" he would be confirmed in this view, for he would see the wide range of substances covered. He would see that the monohydric alcohols were classified in series according to given formulae from which he could find the formula of the radical they contained. He would see that there were included together such extremes as the radicals of the paraffin series and the aryl radicals of the phenol series. He would know, as Dr. Purves did, that "alkyl" could not include "aryl" and this would lead him elsewhere than to Watts' for an accurate definition of "alkyl". Indeed, it is altogether inconceivable that a person skilled in the art of froth flotation as of the date of the specification who wished to ascertain the limits of the meaning of such a comparatively new term in organic chemistry as "alkyl radical" would confine his enquiries to Watts', for he would know that since 1888 there had been a great advance in the knowledge of radicals and an increased clarification in their classification and definition. He would, therefore, without question consult more recent text books than Watts'. If he did so he would see the generality of the use of the term alkyl in the sense given by Mr. Higgins. In my opinion, the term "alkyl radical" has the exact, precise meaning that was given to it by Mr. Higgins and I do not think that any skilled metallurgist or chemist engaged in froth flotation could have failed to understand the term according to such meaning or would have been misled into thinking it had the wider meaning suggested as possible by Dr. Purves.

But if there is any doubt in the matter, which I for my part do not see, the doubt should be resolved in favour of the patentee. In his definition, which is a difficult one, the inventor has chosen a term which has a precise and exact meaning which, if applied, will hold his invention. He should not lose it merely because someone has been astute enough to find another possible meaning which, if applied, will destroy the patent. In such circumstances, there has been no avoidable obscurity or ambiguity on the part of the inventor and, no lack of good faith being shown on his part and the definition being a difficult one, that meaning should be adopted which will support the patent. That principle is supported by the decision of the House of Lords in *Natural Colour* v. *Bioschemes* (*supra*), to which further reference will be made when the claims are considered.

The xanthates referred to in paragraph 4 are the result of the union of xanthic acid and a metal. If the alkyl radical is ethyl and the metal is potassium the resulting xanthate is potassium ethyl xanthate. Xanthic acid has already been described as a form of dithiocarbonic acid, called sulphothiocarbonic, consisting of a central carbon atom bonded on the one side with a sulphur atom by double links and on the other side with a sulphur hydrogen group by a single link and a group consisting of oxygen and an alkyl radical, in this case ethyl, also by a single link. Potassium ethyl xanthate results when the hydrogen in the sulphur hydrogen group is replaced by potassium K. The resulting formula is $SCSKOC_2H_5$ showing the structural arrangement already described. Any alkyl radical may replace ethyl and any metal permitted by the definition may replace potassium, so that if M is used to designate the metal and R the radical the general formula becomes MCS_2RO, the metal, carbon disulphide, the radical and oxygen. When it is known what M and R respectively represent, the calculation of the quantities of the elements required for the formation of the xanthate is fixed by inflexible chemical laws based upon the atomic weights of the atoms. Exhibit P 55 shows the way in which two of the commonest xanthates, namely, potassium xanthate and sodium xanthate are made. In the case of potassium xanthate the ingredients are caustic potash, which is potassium hydroxide KOH, ethyl alcohol C_2H_5OH, and carbon disulphide CS_2, each having the molecular weight that is the total of the atomic weights of the atoms in it. The formula for this mixture with all the elements included is $KCS_2C_2H_5O$, which represents potassium ethyl xanthate, plus H_2O, which is water. The significant fact is that in the production of potassium ethyl xanthate with the ingredients mentioned some water is always also formed because of the hydroxyl groups in both the caustic potash and the ethyl alcohol. When the water is removed, pure potassium xanthate results. The theoretic amount of any ingredient required for the production of a given quantity of potassium xanthate is a matter of chemical certainty. Exhibit P 55 shows that to produce 160 grams of potassium ethyl xanthate there will be required 56 grams of potassium hydroxide, 46 of alcohol and 76 of carbon disulphide, which in addition to the desired quantity of xanthate will also produce 18 grams of water. The result will be 89·9 per cent potassium ethyl xanthate and 10·1 per cent water. It is useless to vary the proportions of the ingredients or to increase the quantities of any of them, but frequently an excess of alcohol over the theoretic amount required is used to enable easier control of the reaction and the excess may then be driven off with the water in various ways. The figures given above are the theoretic ones and are based upon the use of pure ethyl alcohol, but if 10 per cent water is used less xanthate would result, for reasons that will be amplified later, but there would not be enough to stop the reaction.

A brief reference may be made to the list of xanthates filed by the defendant (Exhibit D 61). An attempt was made to show the number of xanthates to be enormously large. Indeed, it was suggested by counsel for the defendant that it might run into hundreds of thousands. Yet the number included in the list was only 91, classified in 16 groups according to the radical contained. The list was filed subject to the agreement between the parties that it constitutes all the references to xanthate prior to 1923 which could be found by the defendant in the scientific literature; that none of the references are to metallurgical publications but all are in the chemical field; that all the references are to laboratory experiments (with the exception of cellulose xanthate in rayon) and are reports either of success in preparing the type of xanthate disclosed, or of laboratory exploration of one or more of its properties; and that none of the references are to preparation or use outside the laboratory. Of the 16 groups listed, 10 are excluded from the definition of xanthates in paragraph 4 by the requirement of the first sentence that the radical contained must be of the alkyl type. Which of the xanthates in the remaining 6 groups may be included depends upon the metals used in their production. There are fifty metallic elements but xanthates made with some metals are excluded from the inventor's definition by the requirement of the second sentence that the xanthates must "form anions and cations in solution". This sentence was brought into the paragraph by way of amendment at the same time as the amendments to the first sentence and its restrictive effect was properly admitted. Only such xanthates as form anions and cations in solution are contemplated by the inventor. When a salt is dissolved in water a physical splitting of the molecules takes place through the fact that they carry a charge of electricity and can be separated by the influence of an electric current, the anion from the acid side to the anode and the cation from the metal side to the cathode. For the purposes of the definition the word "solution" in the sentence is the important one, for if a xanthate is to be capable of forming anions and cations in solution it must first of all be soluble. The solubility of a substance is related to the solvent that is to be used and the term "solubility" or "solution" must always be considered according to its context. Its meaning is relative to the circumstances under which it is used. When a substance is stated to be soluble without mention of the solvent, it is generally implied that it is soluble in water. This means that it is all capable of being dissolved in water. I understood Dr. Purves to say that for practical operating reasons in organic chemistry a substance could be regarded as soluble in water if it took 500 parts of water or less to dissolve it completely. A very much smaller degree of solubility is required to enable a substance to form anions and cations for that takes the word soluble out of the working range of the practical organic chemist into that of the physicist. To the physicist, for example, even glass might be soluble, but its order of solubility is so low that it would not be considered soluble by an organic chemist. On the other hand, a much higher degree of solubility would be expected by the chemist or metallurgist engaged in froth flotation for he would think of solubility in relation to the quantity of water used in froth flotation, and if a large amount of water, judged by such a standard, is required to dissolve a substance it would be regarded by him as substantially insoluble. This becomes of importance when the classification of xanthates according to whether they are made with heavy or light metals is considered. Mr. Higgins classified among the heavy metals lead, zinc, copper, mercury, tin, nickel, cobalt and so forth, and described as light metals the alkali group of metals, and also magnesium and aluminum. Mr. Higgins stated, and there was no contradiction of his evidence on this point, that xanthates formed with the heavy metals were not soluble in the sense in which a metallurgist would use them. Copper xanthate, for instance, is one of the most insoluble compounds known to the chemist and some of the other xanthates might give a very slight solution but certainly not enough for them to be of any use in the flotation process. All the xanthates shown on Exhibit D 61 which are formed with heavy metals are, therefore, excluded from the definition of the class of xanthates whose use in froth flotation is proposed, on the ground that they are not soluble in water in the sense in which a chemist or metallurgist engaged in froth flotation would regard that term. This leaves the xanthates formed with the light metals including mainly the alkali metals of which the main ones are potassium and sodium. The xanthates formed from such metals are readily soluble in water. The other metals in the alkali group are cæsium, lithium and rubidium. The number of xanthates contemplated by the inventor, instead of running into the hundreds of thousands, is thus shown to be comparatively small.

This concludes the analysis of the description of the invention so far as it relates to the use of xanthates. I have come to the conclusion that it is precise and as reasonably clear from avoidable obscurity or ambiguity as the difficulty of the description permits. A person skilled in the froth flotation art would, in my opinion, have no doubt as to the class of xanthates whose use was proposed by the inventor.

The description of the invention does not, however, stop with the definition of the class of xanthates although it might well have done so, since the use of such xanthates could in itself be the subject matter of a patent. The inventor goes on to describe the rest of his invention. In the third sentence of paragraph 4 he discloses that excellent results were also obtained by agitating ore pulps with a certain complex mixture the nature of which he then describes. The sentence is a clumsy one but its meaning is clear to any one desirous of understanding it. The complex mixture with which the ore pulps are agitated is produced as follows; the pine oil is incorporated with an alcoholic solution of potassium hydrate and carbon disulphide is added to the mixture. There will be potassium xanthate in the mixture, but there will also be other substances that are analogous to it, because of the water in the alcohol. The inventor thus covers substances analogous to xanthates. These are the various thiocarbonates already described. The thiocarbonates are salts, just as xanthate is, resulting from the union of a metal with the thiocarbonic acid from which they are derived. Xanthate is itself a dithiocarbonate derived from xanthic acid as already explained. If the same metal, for example, potassium, is used in the thiocarbonates as in the xanthate the resulting salts are analogous substances, the only difference being that the thiocarbonates are monothiocarbonates, dithiocarbonates or trithiocarbonates depending upon whether one, two or three atoms of oxygen have been replaced by sulphur in the thiocarbonic acid from which they are derived, and that xanthate is the only one that contains an alkyl radical. The class of analogous substances is as defined as the class of xanthates.

In paragraph 5 the inventor refers to the galena-bearing froth obtained with xanthates or analogous substances, which is merely a reference to their beneficial effect on a lead zinc ore.

In paragraph 6 the inventor discloses that the substances referred to, whether xanthates or analogous substances, are not mineral frothing agents but when used in the presence of a mineral frothing agent are effective in enabling a selective flotation of lead and zinc and cause uncombined silver to tend to go into the lead concentrate rather than with the zinc. There is no attack on this paragraph, except with regard to the last sentence, which will be dealt with separately.

Then paragraph 7, which was inserted by way of amendment, discloses that the invention goes further than already described and covers the use of the substance described in the paragraph to the extent mentioned in it. This substance is neither a xanthate nor exclusively an analogous substance. The salt described as yellow or orange results from the union of caustic potash and carbon disulphide. The evidence is that this substance was a mixture of which about two-thirds was potassium trithiocarbonate, the remainder being potassium carbonate. Potassium trithiocarbonate is a substance analogous to potassium xanthate, but potassium carbonate is not. To this extent, therefore, the invention extends to a substance which is neither a xanthate nor an analogous substance. Potassium trithiocarbonate is derived from trithiocarbonic acid by the substitution of an atom of potassium for the atom of hydrogen in each of the sulphur hydrogen groups. It differs from potassium xanthate in having all three atoms of oxygen substituted by sulphur instead of two and in not having an alkyl radical, its place being taken by another potassium atom. Both are sulphur derivatives of carbonic acid. Potassium carbonate is not a sulphur derivative of carbonic acid but a direct derivative, the hydrogen atom in each of the hydroxyl groups in carbonic acid being replaced by an atom of potassium. The test with this substance was carried out with Hibernia ore, a lead zinc ore, with a neutral pulp.

Then paragraph 8 describes how the inventor made potassium xanthate for laboratory purposes, which he need not have done since no claim is made to xanthate as a new substance.

The remainder of the disclosures deals with experiments and tests made by the inventor on various types of ores and may be regarded as part of the description of the operation and use of the invention as contemplated by the inventor. The description of the invention itself is contained in the first eight paragraphs. It has been described by the inventor in respect of its various aspects in the manner indicated. He has disclosed that his primary and best invention is the use of certain xanthates and has defined the class of such xanthates in the first two sentences of paragraph 4; he has also disclosed that the complex mixture referred to in the third sentence of paragraph 4, consisting of xanthates or analogous substances, produced excellent results; then in paragraphs 5 and 6 he has disclosed that in dealing with lead zinc ores he found good results with xanthates or analogous substances; and, finally, in paragraph 7 he discloses that, on a particular type of ore and with a neutral circuit, he found useful results with the particular substance described in the paragraph. He could, I think, have applied for one patent in respect to the use of xanthates and another in respect of the use of the other substances and it may well be that under The Patent Act, 1935, Statutes of Canada 1935, chap. 32, his application would be divided, but it is also clear from section 37(1) of such Act that his patent is not invalid by reason only that more than one invention is included. In my opinion, the inventor has correctly and fully described his invention in its various aspects so that any person skilled in the froth flotation art would know precisely what the inventor has found to be new and useful, primarily as his best invention the use of the xanthates he defined, and also, on the ores specified and within the limits stated, the use of the other substances specified. He put into the specification everything that he found useful and has, I think, in this respect fully complied with the requirement of the Act.

In addition to the main general attack on the specification for failure to describe the invention, which fails for the reasons given, four specific charges were made, two of which related to statements that were said to be misleading.

The first of such statements is the implied one that useful results can be obtained with a compound prepared in accordance with paragraph 7. Counsel contended at first that this is positively misleading in that the compound does not lead to the useful results promised, and later that it is inferentially misleading in that it recommends the use of useless material. He argued that the paragraph misleads the person who is trying to put the invention into operation, puts him off the track and directs him away from obtaining successful results. The argument has no merit. The inventor does not propose the use of the substance referred to in paragraph 7 as an alternative to the use of xanthate, nor does he suggest anywhere that it is equal in value to xanthate. The disclosures show that potassium or sodium xanthate is the best substance to use, and many proofs of its value are given. Then in paragraph 7, the inventor also shows that on a particular kind of ore, namely, a lead-zinc ore, and with a particular kind of pulp, namely, a neutral one, useful results were accomplished with the substance referred to, namely, that the concentrates were seen to be clear with brightened lead sulphide particles. There is nothing more in the paragraph. The inventor does not hold out the substance as having special value, but merely states what he found when he was working out his invention, namely that this was one of the substances he found useful in its specified and limited sphere. There is no statement in the paragraph, either express or implied, that can be considered misleading. As for the contention that the substance is useless, the evidence proves the contrary. It was tested at Noranda by Mr. Bennett, the defendant's metallurgist, who said that the tests indicated that it was substantially inert as a flotation collecting agent. He could not say that it was useless for the tests showed a higher percentage of copper recovery than was possible without it, although the grades in the concentrates were somewhat lower. The value of this evidence is lost by the fact that the tests were with a copper ore in which there was no lead or zinc and with a very alkaline pulp, whereas paragraph 7 shows useful results in a test made with a neutral pulp on Hibernia ore, which was a lead-zinc ore. On the other hand, Mr. Higgins gave evidence that he had made an experiment similar to that set out in paragraph 7 and that it was successful, that while the concentrate was not as good as with potassium xanthate it showed a distinct selection of lead from zinc. He made his experiment with a lead-zinc ore called Orphan Girl, which was the nearest in kind to Hibernia ore which he could find, the Hibernia mine having closed down. In my opinion the evidence of Mr. Higgins proves that the substance referred to, far from being useless, is useful on a lead-zinc ore like Hibernia ore with a neutral pulp. This attack on the disclosures fails.

The second statement said to be misleading is the final sentence in paragraph 6, namely, "The pulps may be either acid, alkaline or neutral according to circumstances". As it stands, it is merely a statement of fact, for all three kinds of circuits were in use "according to circumstances", depending upon the type of ore and the kind of mineral frothing agent that was used. Some ores and some mineral frothing agents worked best in an acid circuit, others in an alkaline one and others in a neutral one. Although the trend was away from the use of acid circuits, a few large mines, including Anaconda, still used an acid circuit. Counsel for the defendant did not quarrel with the statement as a statement of fact but read a misleading implication into it. He contended that its inclusion in the specification is meaningless unless the inference is drawn that it means that the invention is of equal value and operates in the same way whether the circuit used is acid, alkaline or neutral, and that with such an inference the statement is misleading, since there were differences in behaviour of the reagents, known to the inventor, which he did not disclose. This attack is not well founded. So far as the use of xanthate is concerned there is no evidence that it does not work successfully in all kinds of circuits. As for the other substances the specification indicates that there are differences and points them out. The evidence showed that in the large scale tests at Anaconda in which an acid circuit was used pure xanthate worked better than xanthate mixed with other substances. This fact was known to the inventor and was, no doubt, the reason for the last sentence in paragraph 8 that "it was found in cases where sulphuric acid was used that the centrifuged material yielded better results than the uncentrifuged." This is a warning to any person reading the specification that if he is dealing with an acid circuit he should use xanthate by itself rather than xanthate mixed with analogous or other substances. As to the use of xanthates or analogous substances in alkaline or neutral circuits there is no evidence of any difference in effect. As to the use of the substance referred to in paragraph 7 the only statement as to its effect is that on Hibernia ore, a lead-zinc ore, useful results were obtained in a test made with a neutral pulp. There is no statement or suggestion that the same result would follow with a different ore or with a different circuit. I find nothing misleading in the last sentence of paragraph 6.

The next charge is that the inventor knew that his proposed reagents did not work on oxide ores but had failed to disclose this necessary information. Ores are sulphide or oxide depending upon whether the metalliferous minerals they contain are mainly sulphide or mainly oxide. The metalliferous minerals referred to are those that are chemical combinations of metals and other elements. If the combination contains sulphur it is sulphide, but if it contains oxygen it is oxide. Sulphide ores tend to reaction by oxygen when exposed to the air and are then said to be oxidized. There was controversy during the trial as to the position of oxide ores with regard to froth flotation. Mr. Bennett gave evidence that froth flotation worked particularly well only on sulphide ores. He knew that oxide ores were difficult to treat but was not able to say whether they could be treated at all. When counsel for the plaintiff called Mr. Higgins to give evidence in rebuttal on this question objection was taken by counsel for the defendant on the ground that Keller on his commission evidence had testified that certain oxides were relatively easily floated and others were floated with more difficulty and that another witness, Wilkinson, also giving evidence on commission, showed that oxide ores were the subject of flotation, and that counsel for the plaintiff could not give evidence to contradict his own witnesses. I allowed Mr. Higgins to be examined on the question reserving consideration of the objection. While there is some support for the objection, it is not clear whether oxide ores could be

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treated in froth flotation without some sulphidizing agent. In view of this, and also in view of Mr. Bennett's uncertainty, I think that Mr. Higgins could properly be asked what the situation was. His evidence settled the matter beyond dispute. He stated categorically that in 1923 it was not possible to separate oxide ores by the froth flotation process without first subjecting them to the action of a sulphidizing agent, and that this was a matter of common knowledge in 1923 to persons skilled in the art. This evidence, which I accept, is in accord with the general tenor of Keller's evidence. He was really searching for a sulphidizing agent to treat oxide ores so that they could be separated by froth flotation when he fell upon the use of xanthate. He discovered that it worked well with sulphide ores but did not work at all with oxide ores, from which he concluded that xanthate was not a sulphidizing agent. If the use of xanthate had enabled the flotation of oxide ores Keller should have said so, for that would have been a new and startling development in froth flotation, but he was under no duty to say that it did not work with such ores, since it was already known in the art that the froth flotation process did not work at all with oxide ores so long as they remained oxide and the particles were not discovered by a sulphide film. This attack on the disclosures was, in my opinion, an unreasonable one.

One other attack on the disclosures was made. It was contended that in the course of the tests at Anaconda, in which an acid circuit was used, the inventor had learned a better method of preparing xanthate for use in an acid circuit than that described in paragraph 8 but had failed to disclose this useful knowledge. This contention requires careful consideration by reason of the chemistry questions involved, but there are, I think, two answers to it. The first is that the inventor did not have to describe any method of preparing xanthate at all, since xanthate itself as a new substance is not the subject of his invention. The second answer is that there was no real chemical difference, having regard to the ingredients used, between the method described in paragraph 8 and that used in the successful test at Anaconda. This requires a clear statement of what happened at Anaconda and a careful analysis of the various methods of preparing the xanthate. The method described in paragraph 8 may be called the Keller method. There were several distinct steps in it. First, the caustic potash was dissolved in the alcohol at a given temperature in a reflux condenser to retain what might otherwise be lost through the mixture being volatile, and the solution was then cooled. The second step was that while this solution was stirring in a cooling bath the carbon disulphide was added, the resulting reaction being substantially instantaneous and producing the potassium xanthate. A third step was then taken; the thick pulp was cooled and centrifuged, that is, the solid substance was thrown out from the liquid, yielding xanthate crystals containing about 20 per cent moisture. Then there was a fourth step; the liquid remaining after the solid substance was thrown out by the centrifuging, called the mother liquor, also contained some xanthate and this was recovered by evaporation of the liquid. Keller had conceived his invention in September, 1922, and made his first formal demonstration in the plaintiff's San Francisco laboratory in March, 1923. Anaconda ore was a problen and the Anaconda slimes were particularly difficult. In May, 1923, arrangements were made for large scale tests of the Keller process at Anaconda. Two samples of xanthate were taken to Anaconda, one being that used in the laboratory, and the other, consisting of 250 pounds each of potassium xanthate and sodium xanthate having been made by Great Western Electric Chemical Company. The plaintiff's staff went out to supervise the demonstration. The tests took place in June, 1923. Counsel for the defendant refers to them as encouraging but not conclusive, but the evidence is that they were successful and created quite a furore in the Anaconda Mill. This was the first Anaconda test. Then Anaconda arranged for a further test on a full section of the mill, and an order was placed with Great Western Chemical Company for 1,000 pounds of potassium xanthate. The second test was run during July and August, 1923. While the results were successful they were disappointing in that they were not as good as anticipated, and the tests were stopped. The xanthate had been prepared by the Company according to the method given by their chemist, Dr. Rosenstein. Keller felt certain that the lack of anticipated results was due to the inferior quality of the xanthate and there were acrimonious discussions with Rosenstein. The method used by Rosenstein, which may be called the Rosenstein method, differed from the Keller one in two important particulars. The first difference was that instead of the caustic potash being dissolved in alcohol, it was dissolved in water because it is more soluble in water than in alcohol, and the alcohol and carbon disulphide were added to such solution. The second major difference was that the resulting mixture was not centrifuged at all, but merely dried by evaporation. A third test at Anaconda was then arranged. This was to be a competitive test between xanthate and another flotation agent called thiocarbonalid. Two sections of the mill were to run side by side, one using xanthate and the other thiocarbonalid. An order for 1,500 pounds of xanthate was placed with the Great Western Chemical Company and special instructions were given to prepare it according to what counsel for the defendant called the Nutter method. The steps in this method were as follows. First, the caustic potash was dissolved in an excess of alcohol and the mixture allowed to settle; the water in the mixture went to the bottom in what was called the aqueous layer, leaving the alcohol, called the supernatant liquid, at the top. The next step was to get rid of the water, either by decanting the alcohol solution off the top or draining or siphoning the water layer away from the bottom. Then the carbon disulphide was added to the solution containing the alcohol, which was the only part of the original mixture that was used for the reaction. Finally, the resulting compound was centrifuged and only the centrifuged material was used in the test, the mother liquid being "dumped down the sewer". The only difference between this method and the Keller one was that the water was removed from the first solution before the carbon disulphide was added to produce the reaction and only the centrifuged material was used in the test. The result was that xanthate won the competitive test and Anaconda adopted the Keller process. Counsel for the defendant said that this proved that the Nutter method was the best one and contended that Keller should have disclosed it to the public so that it should be in the same position as he was to make the most effective use of the invention in an acid circuit. The criticism requires consideration of the chemical reactions involved.

I have already discussed the manner in which potassium xanthate is produced through the reaction resulting when carbon disulphide is added to a mixture of caustic potash and alcohol, but some reference should be made to the effect of the presence of water in the mixture during the reaction. Its effect is peculiar. Water has hydroxyl groups similar to those in alcohol so that when alcohol and water are present the sets of hydroxyl groups compete against one another for the other reagents in the mixture. The presence of water in the mixture thus tends to reduce the yield of xanthate and also to increase that of other salts that are not xanthate. Moreover, impurities form in the reaction if the ingredients used are not pure and these will be in the mixture and in the solution if an excess of alcohol is used. Centrifuging throws the solids out of the solution leaving the mother liquid with whatever it contains. If there are impurities they tend to remain with it rather than to adhere to the solids thrown out by the centrifuging. The centrifuging does not squeeze all the liquid out of the centrifuged material for some remains in the form of moisture. And the mother liquor will have some xanthate still in it which the centrifuging has not been able to throw out, and it will also contain whatever impurities there were in the ingredients and whatever other substances the water in the mother liquor was able to attract in its competition with the alcohol less what went with the solids. The result is that while the centrifuged material still contains some liquid and, therefore, some impurities and substances other than xanthate there is no doubt that it is more nearly a pure xanthate than the product of the mother liquor when evaporated or the product without centrifuging would be. It is, therefore, apparent why there was a different result with the xanthate prepared by the Nutter method from that prepared by the Rosenstein one. The use of water in the latter method in dissolving the caustic potash would accentuate the formation of substances other than xanthate and the failure to centrifuge would leave all such substances, as well as any impurities in the solids when the mixture was dried by evaporation, so that the resulting product was not pure xanthate but included other substances and impurities as well. The success in the third test proved the superior value of pure xanthate in an acid circuit. But that is all, in my opinion, that it did prove. While the tests at Anaconda did show that the product prepared by the Nutter method was more nearly pure xanthate and worked better than that prepared according to the Rosenstein one, there is no proof that there would not have been the same success with xanthate prepared according to the Keller method if only the centrifuged material had been used. There would be some moisture in the Nutter method xanthate just as there was in the centrifuged material referred to in paragraph 8 and some of it would have been water, with its accompanying impurities and substances other than xanthate, for there would still have been some water in the supernatant liquid even after the aqueous layer had been removed, and there is no evidence that it was more free from impurities and substances other than xanthate than the centrifuged material of the Keller method xanthate was. Mr. Higgins described the Keller method as quite a good one and Dr. Purves agreed that it would give a good yield. He did not like the use of denatured alcohol for this meant that there would be a little methyl alcohol mixed with the ethyl alcohol so that there would be some methyl xanthate mixed with the ethyl xanthate and there would also be some water. He said that the less water there was the greater the yield of xanthate would be, but he agreed that the small amount of methyl and water present in the Keller method would not be a matter of any practical consequence. He also agreed that the Keller method could be applied to commercial production. When Dr. Purves was asked to compare the Keller method with the Nutter one he said that the latter showed the presence of water and that he could not really compare the two methods without knowing how much water there was. This indicates that the quantity of water that is present is important. Dr. Purves' view was that the results of the two methods were substantially the same and that the Nutter method was basically simply a device for using an inexpensive grade of alcohol containing water. He could see no chemical difference between the two methods. The use of pure alcohol would yield more xanthate but would cost more; the use of a cheaper alcohol containing water would yield less xanthate but would cost less. The only difference between the Keller method and the Nutter one was that in the latter after the caustic potash was dissolved in the alcohol the water in the mixture was removed by draining or siphoning it away or by decanting the alcohol before the carbon disulphide was added to the solution. Dr. Purves' evidence that he could see no chemical difference between the two methods supports the contention of counsel for the plaintiff that the only difference between the two methods was purely a mechanical one made necessary by the fact that a cheap alcohol in which there was more water than was desirable was being used and that it was merely a process of removing the excess water. Even when pure alcohol is used some water is produced in the reaction for, as we have seen, potassium hydrate KOH, ethyl alcohol C_2H_5OH and carbon disulphide CS_2 produce potassium ethyl xanthate $KCS_2C_2H_5O$ plus water H_2O. The small amount of additional water involved in the use of the denatured alcohol referred to in paragraph 8 would make no real difference, either as to the yield or purity of the xanthate produced. These are all facts that a chemist would know and are matters relating to the manufacture of xanthate. Consequently, if instead of using pure alcohol or the denatured alcohol referred to in paragraph 8 the chemist wished to use a cheaper alcohol containing an excessive amount of water, he would know that if he wanted to get the same results as he would get with pure alcohol, he would have to take steps to drive off the excess water, and that it would be desirable to do so before the carbon disulphide was added and the reaction took place. In my opinion the defendant has not been able to prove the grounds upon which his last attack on the disclosures of the specification was based.

The defendant thus fails in all its attacks upon the disclosures portion of the specification. In my view, any person skilled in the froth flotation art on reading the specification would know what the invention related to and what it was. He could have no doubt as to its ambit or scope. Moreover, he could with the specification and his knowledge of the art put the invention into effect as successfully as the inventor could do himself. He is directed to the use of the best substance without any need for experimentation and can then deal with the other substances found to be useful as he chooses under the conditions mentioned. There are no misleading statements to put him off the track. He has been given the necessary warning if he is dealing with an acid circuit. The inventor has, I think, fulfilled the duty of full disclosure required of him by section 14.(1) of the Act.

Section 14.(1) also requires that the specification shall end with a claim or claims stating distinctly the things or combinations which the applicant regards as new and in which he claims an exclusive property and privilege. 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. If a claim does not satisfy these requirements it cannot stand. The need for freedom from avoidable ambiguity or obscurity cannot be better expressed than it was by Lord Loreburn in the House of Lords in *Natural Colour* v. *Bioschemes* (*supra*) (1) where he said:

> It is the duty of a patentee to state clearly and distinctly, either in direct words or by clear and distinct reference, the nature and limits of what he claims. If he uses language which, when fairly read, is avoidably obscure or ambiguous, the Patent is invalid, whether the defect be due to design, or to carelessness or to want of skill. Where the invention is difficult to explain, due allowance will, of course, be made, for any resulting difficulty in the language. But nothing can excuse the use of ambiguous language when simple language can easily be employed, and the only safe way is for the patentee to do his best to be clear and intelligible.

And in the same case Lord Parker said, at page 269:

> It is open to the Court to conclude that the terms of a Specification are so ambiguous that its proper construction must always remain a matter of doubt, and in such a case, even if the Specification had been prepared in perfect good faith, the duty of the Court would be to declare the Patent void.

Vide also *General Railway Signal Co., Ld.* v. *Westinghouse* (2); *Whatmough* v. *Morris Motors, Ld.* (3)

(1) (1915) 32 R.P.C. 256 at 266.
(2) (1939) 56 R.P.C. 295 at 382.
(3) (1940) 57 R.P.C. 177 at 198.

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The inventor may make his claims as narrow as he pleases within the limits of his invention but he must not make them too broad. He must not claim what he has not invented for thereby he would be fencing off property which does not belong to him. It follows that a claim must fail if, in addition to claiming what is new and useful, it also claims something that is old or something that is unless: *Vidal Dyes* v. *Levinstein* (*supra*) (1); *Natural Colour* v. *Bioschemes* (*supra*) (2).

The attacks upon the claims may now be considered. Objection was taken to claim 6 on the ground of ambiguity. It reads as follows:

> The process of concentrating ores which consists in agitating a suitable pulp of an ore with a mineral-frothing agent and an alkaline xanthate adapted to co-operate with the mineral-frothing agent to produce by the action of both a mineral-bearing froth containing a large proportion of a mineral of the ore, said agitation being so conducted as to form such a froth, and separating the froth.

Three expressions were said to be ambiguous, namely, "suitable pulp of an ore", "alkaline xanthate" and "adapted to co-operate". "Suitable pulp of an ore" may mean that the suitability is related either to the fineness of the ore and the amount of water required for the pulp or to the nature and kind of the ore and whether it can be treated by froth flotation. This means no more than that the pulp should be suitable for froth flotation; this would be known to a practical metallurgist or chemist. I see no objection to the expression. Nor was the expression "adapted to co-operate" seriously challenged, although it was said to be ambiguous. The strongest exception was taken to the term "alkaline xanthate". Xanthate is a neutral salt and the term alkaline xanthate appears as a contradiction. By itself it does not make sense. Mr. Higgins considered it a slip of the tongue but did not think any metallurgist would misunderstand it. He regarded it as synonymous with alkali xanthate or alkali metal xanthate. Dr. Purves stated that the expression did not make sense to a chemist since xanthates are neutral substances. It struck him as a conundrum. His first impression was that it meant a xanthate in an alkaline solution, but it might mean a xanthate made with an alkali or an alkali metal. Mr.

(1) (1912) 29 R.P.C. 245 at 268, 270.

(2) (1915) 32 R.P.C. 256 at 266, 268.

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Bennett thought the expression a contradiction in terms, but considered that it was possible to regard alkaline as meaning alkali metal and that such a meaning was a reasonable one. The inventor made several clarifying and important amendments during the course of prosecuting his patent application but this term remained untouched. He could have avoided ambiguity if he had used more care. As the expression stands it is either contradictory or incomplete. Counsel for the plaintiff contended that if it meant alkali metal xanthate to a metallurgist or chemist the claim should be upheld, but this means interpretation of the claim by experts. The construction of a specification is for the Court and not for the experts. Moreover, to read the word "alkaline" which has a well known meaning as if it were "alkali metal" is not construction of the claim but amendment of it, which is not the function of the Court or within its powers. I find obscurity and ambiguity, whch the inventor could have avoided. Claim 6 must, therefore, fail.

Of the remaining claims in suit claim 9 is the significant one. It reads as follows:

> 9. The improvement in the concentration of minerals by flotation which comprises subjecting the mineral in the form of a non-acid pulp to a flotation operation in the presence of a xanthate and a frothing agent.

Two attacks upon this claim were made; one, that it extends to some xanthates that will not work in froth flotation and that it is bad because it claims something that is useless, and the other, that there is nothing in the disclosures to warrant confining the claim to a non-acid circuit.

As to the first objection it is said that the claim covers all xanthates and that there are two classes of xanthate that will not work in froth flotation, one being cellulose xanthate and the other copper, cobalt and calcium xanthates. The main attack on claim 9 centred on cellulose xanthate. The evidence that it will not work successfully in froth flotation is conclusive. Mr. Bennett prepared it in accordance with instructions from Dr. Purves and tested it at Noranda. The tests proved that the recoveries made with it were very low, that the purer the xanthate was and the more of it that was used the worse the results were. Far from having any use in froth flotation, it had a positively depressing effect on copper minerals and seemed to prevent them from coming into the froth. Counsel for the defendant contended that notwithstanding the fact that the inventor had tried it and discarded its use he had included its use in claim 9 and that the claim was accordingly bad. A great deal of evidence was given at the trial on this subject and much argument was devoted to it.

Cellulose xanthate was originated as early as 1893. Its discovery was the foundation for the viscose industry and the rayon silk industry and in 1923 it was known chiefly for its value in the latter connection.

The cellulose xanthate was prepared for the tests as follows. The first ingredient was cellulose to which was added a caustic soda solution, that is, caustic soda dissolved in water. This was agitated and stirred for two hours. The compound was then filtered, the excess solution discarded and the residue pressed between blotters. The resulting swollen gelatinous mass was shredded with scissors to get it into small particles or crumbs. These were aged or ripened for 46 hours and then carbon disulphide was added. This mixture was agitated and stirred for 3 hours and any excess carbon disulphide was removed. What was left was a highly swollen, yellow, somewhat crumbly material. This was crude cellulose xanthate, really a mixture of cellulose xanthate with some caustic soda in it. This compound was known as viscose. The obtaining of pure cellulose xanthate required further processes. To the yellow crumbly material a caustic soda solution and water were added until all the crumbs were dissolved, forming a viscous clear solution. While this was being stirred methyl alcohol was added causing the cellulose xanthate to coagulate. All excess alcohol was decanted and the coagulated material was further treated with alcohol to wash out all excess caustic soda, leaving only the pure cellulose xanthate.

The essential chemical difference between sodium cellulose xanthate and sodium ethyl xanthate is that in the former sodium is mixed with cellulose, whereas in the latter it is mixed with ethyl alcohol. The cellulose takes the place of the ethyl alcohol, with the result that the cellulose xanthate contains the cellulose radical whereas the sodium ethyl xanthate contains the ethyl radical. There are other differences which are perhaps of a physical rather than a chemical nature. The ethyl xanthate is a crystalline substance, the cellulose xanthate a fibrous one. The ethyl xanthate dissolves easily in water, whereas the cellulose xanthate to the extent that it does dissolve forms only what is called a colloidal solution.

The evidence shows a number of practical differences between sodium cellulose xanthate and sodium or potassium ethyl xanthate. Cellulose xanthate is more difficult and takes longer to make; more care has to be taken of temperatures and times. Cellulose xanthate is not readily purchasable on the market for in the rayon industry the material that is used is viscose; the xanthate itself is not a commercial product. Consequently, if xanthate were to be purchased it would be in the form of viscose, which does not lend itself to shipment or storage except for very short periods, for the xanthate in it quickly decomposes. Sodium or potassium ethyl xanthate, on the other hand, is easily and quickly made, the ingredients for its production are readily procured, the xanthate is sold on the market, is easily shipped and can be stored in large quantities at the mine. Moreover, the cost of cellulose xanthate was greater than that of ethyl xanthate. So far as froth flotation was concerned there were obvious disadvantages in using cellulose xanthate as compared with ethyl xanthate, even if their use was equally efficacious.

Counsel for the plaintiff had several replies to the defendant's criticism that claim 9 was invalid because it covered cellulose xanthate which was useless in froth flotation. Mr. Bennett admitted that as a practical metallurgist and chemist he would, after reading the specification, first try potassium or sodium xanthate. I think any person skilled in the art would do the same thing. He would be led immediately and directly to that kind of xanthate, and no other, as the best substance to use and he would be able to achieve the same best success as the inventor could without any experimentation on his part. The situation is quite different from that in the *Natural Colours* v. *Bioschemes* case (*supra*), on which the defendant relied, for there the reader of the specification was given no indication as to which red and green he would have to use to succeed and his success with the invention depended on his finding the right colours himself by his own experiments. Mr. Bennett also admitted that in view of the disadvantages in the use of cellulose xanthate, as compared with potassium or sodium xanthate, he would not, as a practical man, use it in froth flotation even if it did work. Under the circumstances, counsel for the plaintiff contended that the claim should not be held invalid. His argument was that cellulose xanthate was a different kind of xanthate from the kind whose use was proposed in the specification; that no practical metallurgist or chemist engaged in froth flotation, having been directed by the specification to use potassium or sodium xanthate would think of using cellulose xanthate; that it was not necessary to consider whether the word xanthate was wide enough to include cellulose xanthate or not, since no practical person skilled in the art would think that the claim extended to it; and that if there was any doubt whether the word did or did not include cellulose xanthate it should be resolved in favour of the patentee since no person would be led to use it. Counsel relied on *Thermit Ld.* v. *Weldite Ld.* (1). In that case the proposal in the specification was to combine powdered aluminium and the powdered oxide of a metal with the idea that the aluminium would join with the oxygen in the metal and leave the metal. The purpose was to get a metal free from oxygen for welding purposes. Aluminium has a particular affinity for oxygen. It was stated in the specification that all metals or their alloys could be gained in this way. The patent was attacked on the ground that in the case of some metals this process did not work—that the aluminium would not combine with the oxygen in the metal. It was held that since it was known to chemists that there were certain metals with which aluminium would not react at all, that the statement in the specification that all metals or their alloys could be gained by the process should be read as referring only to those metallic compounds which are capable of reduction by aluminium under the conditions described in the specification. It was contended that a similar principle should be applied in the present case, and that the claim should be read as referring only to a xanthate of the kind which a person skilled in the art would regard as practical and

(1) (1907) 24 R.P.C. 441.

adequately described in the specification. This suggested construction of a claim in the light of the knowledge of practical persons skilled in the art is an interesting one, but the weakness of the contention that it should be applied in the present case lies in the fact that at the time of the specification there was no knowledge in the art of the use or efficiency of any xanthate in the froth flotation process. It was the discovery of the value of the use of certain xanthates of a defined class as a new substance in froth flotation that was the very subject matter of the invention. The situation is not similar to that existing in the *Thermit* case (*supra*), where there was chemical knowledge as to what metals would react with aluminium, and it cannot be considered applicable, even if otherwise acceptable as an authority.

The plaintiff has, however, a complete answer to the defendant's contention. It is clear from the correspondence that the inventor was not concerned with cellulose xanthate and was not afraid of infringement through its use. He was anxious, however, about trithiocarbonate. It was for these reasons that the amendments were made. Paragraph 4 was amended, as already noted, to make sure that only such xanthates were included as contained an organic radical of the alkyl type and formed anions and cations in solution; and all other xanthates were excluded from consideration. Then by the inclusion of paragraph 7 the inventor protected himself from infringement from the trithiocarbonate side. By his definition of the kind of xanthate whose use he proposed and his exclusion of other xanthates thereby the inventor was entitled to have the word xanthate, which was not a common word, interpreted to mean what he intended it to mean, namely, only the kind of xanthate he had specifically defined in the first two sentences of paragraph 4. The word xanthate is thus used with the meaning which the inventor has given to it. If it is so read, then cellulose xanthate must be excluded from its ambit on two grounds, as will be shown later.

The construction of a specification, both as to the disclosures and as to the claims, is a matter of law for the Court, and it is well established that there are cases in which the terms in a claim may, and should, be interpreted in the sense in which the inventor has used them in the specification. In such cases, the specification is the dictionary of the claims and serves a purpose similar to that of the definition section of a statute. The basic case for the statement of this principle is *Needham and Kite* v. *Johnson and Co.* (1). In that case there were two possible constructions of the word "conduit" in one of the claims, but the Court adopted that which would validate the patent, and Lindley L. J., at page 58, laid down the following rule:

> The expression "conduit" requires explanation, and one must look for it, and see what it does mean. Of course it does mean that which the patentees have said it means. You are not to look into the dictionary to see what "conduit" means, but you are to look at the specification in order to see the sense in which the patentees have used it.

The same principle was stated by the House of Lords in *British Thomson-Houston Company Ld.* v. *Corona Lamp Works Ld.* (2). There one of the claims was for an incandescent electric lamp having a filament "of large diameter", and one of the attacks on the patent was that the ambit of the claim had not been sufficiently defined. Sargent J. gave effect to this objection and the Court of Appeal affirmed his judgment, but it was unanimously reversed by the House of Lords. At page 67, Viscount Haldane, after stating that the specification must be read as a whole, said:

> The Claiming Clauses, for example, are not to be taken as standing in complete isolation. For if the Patentee has used in these clauses expressions which he has already adequately interpreted in the body of his Specification, he is entitled to refer to the Specification as a dictionary in which the meaning of the words he uses has been defined.

The principle has also been recognized in Canada, the leading authority being the decision of the Supreme Court of Canada in *Western Electric Co.* v. *Baldwin International Radio of Canada* (3). Duff C. J., speaking for the Court, there applied the principle "that the specification itself provides the dictionary by which the scope and effect of the terms in the claims is to be ascertained" to one of the claims before the Court. The claim related to the use of a combination of sound amplifiers. It was disclosed in the specification that the combination would work "without transformers" and that the absence of transformers was a characteristic and essential feature of the invention, but there was no statement in the claim that the combination should be "without transformers". The judgment contains

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(1) (1884) 1 R.P.C. 49.
(2) (1922) 39 R.P.C. 49.
(3) (1934) S.C.R. 570.

a number of illuminating statements. At page 580, Duff C. J., agreed with the holding of the President of this Court that the language of this claim must be construed by reference to the disclosure of the nature of the invention in the body of the specification, and also said:

> This is especially one of those cases in which it is the document itself which affords the most valuable assistance possible for ascertaining the scope and signification of the phrases employed to limit the claim.

Later, he found it impossible to separate the claim from a passage in the specification in which it was clear that the discovery was of a combination that would operate "without transformers" and said, at page 583:

> I have no doubt whatever that, on a proper construction of the specification as a whole, the combination mentioned in the second claim is the combination described in the passage just quoted; or that the "thermionic" repeaters mentioned in the claim must be taken to be thermionic repeaters having the characteristics ascribed by definition to those which the inventor has succeeded in securing the results which he says are secured by his invention.

In the result, the claim was held to be limited to a combination that worked "without transformers" even although no such limitation was expressed in the claim itself. The two cases last cited were further referred to by the Supreme Court of Canada in *Smith Incubator Co.* v. *Seiling* (1). There Duff C. J. said, at page 256:

> Lord Haldane's judgment in *British Thomson-Houston Co. Ld.* v. *Corona Lamp Works Ld. (supra)* at page 67, affords an illustration of the manner in which expressions used in the claim may be interpreted by reference to the body of the specification. *Western Electric Co. Inc.* v. *Baldwin International Radio of Canada (supra)* is another case in which the description in the body of the specification of the invention provided a lexicon interpreting the phrases in the claim.

and Rinfret J. (all other members of the Court concurring) said, at page 259:

> The rule is that the claims must be regarded as definitely determining the scope of the monopoly having regard to the due and proper construction of the expressions they contain.

and, at page 260:

> The claims must be construed in the light of the rest of the specification; and that is to say, that the specification must be considered in order to assist in comprehending and construing the meaning— and possibly the special meaning—in which the words or the expressions in the claims are used.

(1) (1937) S.C.R. 251.

These authorities were relied upon by counsel for the plaintiff in support of his submission that the word xanthate in claim 9 should be read as meaning only the kind of xanthate which the inventor had defined in paragraph 4 of the specification.

Counsel for the defendant, however, contended that the meaning of the word could not be limited by importing any qualification from the specification and relied upon two cases in support of his contention. The first was the judgment of Davis J., speaking for the Supreme Court of Canada, in *B.V.D. Company Ltd.* v. *Canadian Celanese Ltd.* (1). There the validity of claims in a patent in respect of fabrics containing a thermoplastic derivative of cellulose was under attack. They could be saved from invalidity on the ground of anticipation by previous patents only if they could be limited to the use of the cellulose derivative in the form of yarns, filaments and fibres and such limitation appeared in the disclosures of the specification. Yet Davis J. held that the claims could not be so limited. At page 237, he said:

> We are invited to read through the lengthy specification and import into the wide and general language of the claims that which is said to be the real inventive step disclosed. But the claims are unequivocal and complete upon their face. It is not necessary to resort to the context and as a matter of construction the claims do not import the context. In no proper sense can it be said that though the essential feature of the invention is not mentioned in the claims the process defined in the claims necessarily possesses that essential feature. The Court cannot limit the claims by simply saying that the inventor must have meant that which he has described. The claims in fact go far beyond the invention. Upon that ground the patent is invalid.

It is difficult to read the judgment in this case without feeling that the Court was to some extent influenced by the fact that the inventor had limited his claims in his British and United States patent applications but had omitted any limitation in his Canadian one. The other case relied upon was that of the English Court of Appeal in *Molins and Molins Machine Co. Ltd.* v. *Industrial Machinery Co. Ltd.* (2). There a claim was made to a "cigarette making machine on the continuous rod type". It was contended that the claim ought to be read as being limited to high

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(1) (1937) S.C.R. 221. (2) (1938) 55 R.P.C. 31.

speed machines in order to give effect to the object of the invention but this contention was rejected. Greene M. R., as he then was, said, at page 39:

> It is sufficient for me to say that in my opinion there is no justification whatever for importing into the claim, drawn as it is in simple and direct language, a limitation extracted either from the language of the body of the specification or from the purpose at which the invention is aiming. It has been laid down over and over again that this method of construing a Patent Specification is inadmissible.

These cases do not deny the principle that the specification is the dictionary by which the scope and effect of the terms in the claims is to be ascertained but merely indicate that it is not of general application and ought not to be applied in cases where a claim is expressed in simple and direct language or in wide or general terms whose meaning is plain and unequivocal. Some of the authorities cited by Davis J. in the *B.V.D. Company* case (*supra*) make this clear. For example, in Terrell on Patents, 8th Edition, at page 134 it is said.

> If the words of the claim are plain and unambiguous it will not be possible to expand or limit their scope by reference to the body of the specification.

And in *Ingersoll Sergeant Drill Company* v. *Consolidated Pneumatic Tool Company Ld.* (1) Lord Loreburn said:

> The idea of allowing a patentee to use perfectly general language in the Claim, and subsequently to restrict, or expand, or qualify what is therein expressed by borrowing this or that gloss from other parts of the Specification, is wholly inadmissable

And in *British Hartford-Fairmont Syndicate, Ld* v. *Jackson Bros. (Knottingley), Ld.* (2) Romer L. J. said:

> But where the construction of a Claim when read by itself is plain, it is not in my opinion legitimate to diminish the ambit of the monopoly claimed merely because in the body of the Specification the Patentee has described his invention in more restricted terms than in the Claim itself.

In my opinion, this case is quite a different kind of case from those relied upon for the defendant. Xanthate is not a common word at all, nor is it a word whose meaning is so plain and unequivocal that it necessarily includes cellulose xanthate, for authority can be found in the dictionaries for two meanings of the word, the commonest one of which completely excludes cellulose xanthate and the other only possibly includes it. The New English Dictionary (1928) defines xanthate as "A salt of xanthic (sulphocarbethylic) acid" and xanthic acid as "a complex acid containing sul-

(1) (1908) 25 R.P.C. 61 at 83. (2) (1943) 49 R.P.C. 495 at 556.

phur and carbon, also called sulphocarbethylic or ethyldisulphocarbonic acid ($C_3H_6OS_2$), many of whose salts (*xanthates*) are yellow." When this formula is rewritten to show the structural formation of the acid it is $SCSHOC_2H_5$, being that form of dithiocarbonic acid in which the alkyl radical, ethyl, has replaced the hydrogen in the hydroxyl group in which sulphur has not been substituted for the oxygen. This definition is exactly the same as that contained in the first sentence of paragraph 4. If this meaning is given to the word "xanthate" in claim 9, it cannot include cellulose xanthate, for its radical is quite different from the ethyl one. The definition of xanthate in Watts' Dictionary of Chemistry is the same. All that would be found there would be "Xanthates. The salts RS.CS.OEt where R is a metal; v. Ethyl Dithiocarbonate" and "xanthic acid v. Ethyl Dithiocarbonate". Then Mono-ethyl Dithiocarbonate is given as "EtO.CS.SH. anthogenic acid. Xanthic acid". Et is the symbol for ethyl C_2H_5. This definition would not fit cellulose xanthate. It should be noted, however, that this definition antedates the discovery of cellulose xanthate. The most recent dictionary meaning is to be found in Webster's New International Dictionary (Second Edition) (1942). It defines xanthate as "a salt or ester of xanthic acid" and one of the meanings of xanthic as "Pertaining to or designating any of a series of thio acids having the general formula ROCSSH, obtained in their salts (xanthates) by treating alcoholates with carbon disulphide; specif., ethylxanthic acid, C_2H_5OCSSH, a colourless unstable oil. Alkalimetal xanthates form yellow precipitates with copper salts". The specific illustration in this definition would also exclude cellulose xanthate but the general formula might include it if R is read as being broad enough to include the cellulose radical and if the word alcoholates is read as including a solution of a metal hydroxide, water and cellulose. The definition might convey such a meaning to a scientific chemist of Dr. Purves' standing who might classify cellulose as an alcohol. It is interesting to note that in the earlier edition of this dictionary, published in 1910, a less extensive meaning of xanthic acid is given, with the same formula as that in the New English Dictionary. Of the chemical dictionaries to which reference was made for the meaning of the word "alkyl", the only one that mentions cellulose xanthate is Hutchinson's Technical and Scientific Encyclopædia. The others all give a meaning to xanthate which would exclude cellulose xanthate. For example, Hackh's Chemical Dictionary (1930) gives the following, namely "xanthate. xanthogenate. A salt of xanthic acid of the general type, MO.CS.SEt, or MO.CSSR, where M is a metal and R an alkyl radical". This is the same definition as that in the first sentence of paragraph 4 and excludes cellulose xanthate. On the evidence of the experts a wider meaning than the common dictionary one was given which did include cellulose xanthate. The list of xanthates (Exhibit D 61) shows 16 groups of substances called xanthates in 10 of which the radical is not of the alkyl type, one of these being cellulose xanthate. Dr. Purves explained that, while the nomenclatures of chemistry accurately describe compounds according to their constituent elements, they are not as accurate and precise in the matter of description of classifications of substances. The classifications are being revised from time to time as knowledge grows. Indeed, when substances such as potassium ethyl xanthate and cellulose xanthate, which differ so greatly both in chemical composition and in behaviour, are classified under the same term, it would not be strange if one were to question the correctness of the classification or the aptness of the term. It should also be remembered that none of the references to the xanthates listed in Exhibit D 61 were to publications in the metallurgical field. And counsel for the defendant strongly urged that there was no common knowledge of xanthates in the froth flotation art at the time of the invention by which the meaning of the word xanthate could be ascertained. Certainly, to borrow an expression from Duff C. J. in *Western* v. *Baldwin* (*supra*), at page 582, the word xanthate was not a term of art having "a generally understood signification in the art at the date of the patent". The term is a technical chemistry term, the meaning of which might not be known to the persons to whom the specification is addressed. Under the circumstances, it seems to me that it would be proper and reasonable for a reader unfamiliar with the term to look at the specification to see whether the inventor has used it with a defined special meaning. If he did so he would find a definition of xanthates in paragraph 4 that is in accord with the common dictionary meaning but is more restricted by reason of the requirement of the second sentence in it. In my opinion, this case falls fairly within the proper application of the principle stated by Duff C. J. in *Western* v. *Baldwin* (*supra*) that "the specification itself provides the dictionary by which the scope and effect of the terms in the claims is to be ascertained". The word xanthate in claim 9 should, therefore, be read in the light of the inventor's definition in paragraph 4 of the kind of xanthate whose use in froth flotation he found useful. That is the only kind of xanthate he had in mind.

Counsel for the defendant is under the onus not only to prove that cellulose xanthate is useless in froth flotation but also to show that it comes within the definition given in paragraph 4. The first part of the onus is discharged, but the second is not. There are two grounds for holding that he has not succeeded in bringing cellulose xanthate within the definition. In the first place, the evidence as to whether cellulose xanthate can form anions and cations in solution is not free from doubt. Dr. Purves stated that it would form anions and cations if it were soluble, but he was not at all sure whether it was soluble in water. He had no definite knowledge about the matter but admitted that its solubility was not very large. Dr. Purves is an outstanding expert on cellulose and his doubt on the subject is important. Mr. Bennett stated that he had added 1 gram of carefully purified potassium cellulose xanthate to 100 grams of distilled water and that substantially all of the gram was dissolved, from which he concluded that it was soluble in water to the extent of approximately one per cent. Solubility must in this case be looked at from the point of view of the froth flotation process and it is far from clear that this degree of solubility is enough. Moreover, Mr. Bennett admitted that the solution was a colloidal solution and Mr. Higgins stated that in 1923 colloids were not used in froth flotation but were avoided like poison. On cross-examination it was brought out that in some cases sodium silicate was used in froth flotation and that it would form a colloid if used in an acid, but Mr. Higgins said that he did not know a single case where it was used except in an alkaline circuit. I conclude that cellulose xanthate was not soluble in the sense in which a froth flotation metallurgist or chemist would use the term. There is a second ground upon which the defendant completely fails. Cellulose xanthate is a different kind of xanthate from the xanthates whose use is proposed in the specification. The cellulose radical is not an alkyl radical. It is a radical of a carbohydrate, which means that it has oxygen in it, the formula of the radical being $C_6H_7O_2$ taken X times, whereas an alkyl radical is a radical of a being $C_nH_{2n}+_1$. Dr. Purves admitted that the cellulose saturated hydrocarbon and has no oxygen in it, the formula radical was not like methyl or ethyl etc. If the term alkyl radical is to receive the precise meaning given by Mr. Higgins and in the dictionaries referred to, as I think it should, then it is clear beyond any possible dispute that the radical in cellulose xanthate is not an alkyl radical. The result is that cellulose xanthate is completely excluded from the definition of xanthates given in paragraph 4 and consequently from the word xanthate in claim 9.

Moreover, since the onus is on the defendant to bring cellulose xanthate within the ambit of claim 9, I am of the view that if there is any doubt in the matter it should, under the circumstances of the case, be resolved in favour of the patentee. There is support for this opinion in *Natural Colour* v. *Bioschemes* (*supra*). In that case, there is an illuminating discussion on the subject of ambiguity in a specification, and how it should be dealt with in its various aspects. I have already quoted the language of Lord Loreburn and Lord Parker, in connection with the attack on claim 6. In the same case Lord Parmoor points out that the word ambiguity is itself ambiguous and may denote several things. In the first place, it may denote that the language used is not sufficiently explicit in describing the nature and ambit of the invention to ensure to the public the benefit of the discovery. Secondly, it may denote language that is designedly capable of alternative constructions; this is a studied and affected ambiguity that is inconsistent with the good faith required of a patentee. There is a third sense which is quite different. At page 272, Lord Parmoor says:

> In a third sense there is ambiguity which arises from the difficulty of accuracy in expression, there being no suspicion of the want of good faith, and where the language used, if capable of being construed in the sense

> claimed, would give a sufficient description of a new and useful invention. I apprehend that in this case the same principles apply to the construction of a Patent grant as to other documents which determine public rights or obligations, as distinct from documents which define the contractual relationship between the contracting parties, and that, if, applying these principles, the grant is fairly capable of being construed in the sense claimed, it is a valid grant and supports the claims of the inventor to his monopoly right.

The principle involved in this statement is properly applicable in the present case. The inventor has taken care in the specification to define the kind of xanthate whose use in froth flotation he proposes. It is part of the definition that the xanhtate must contain an organic radical of the alkyl type. In the most precise sense of that term, which is consistent with its use in modern chemistry reference books, cellulose xanthate would be excluded from the definition because its radical is not of the alkyl type. It is only by importing into the word alkyl a meaning as wide as that of aliphatic that cellulose xanthate could possibly be included in the inventor's definition. Then, with regard to the meaning of the word xanthate in the claim itself we find that the common dictionary meaning of the word is similar to that which the inventor has used in his definition and will by itself exclude cellulose xanthate and that it is only by giving an extended meaning to the term that cellulose xanthate could be included. Moreover, while the word xanthate cannot be interpreted according to any common knowledge in the art, for the reason that it was a new term in the art, the specification itself is full of references to the kind of xanthate the inventor contemplated. Under the circumstances, I think it would be erroneous to construe the word xanthate in claim 9 as including a useless xanthate, such as cellulose xanthate, and declaring the claim invalid on that account, when the word is fairly capable of another meaning which will exclude cellulose xanthate and support the patent, particularly when such meaning is in accord with the common dictionary meaning of the word and clearly the meaning with which the inventor himself has used the term in the specification. It is, I think, sound in principle and consistent with authority under the circumstances to resort to the maxim *ut res magis valeat quam pereat* and give effect to the construction that will validate the patent. This, in my opinion, would be fair construction and consistent with a "reasonable and judicial anxiety to support a really useful invention". I, therefore, come to the conclusion that the word xanthate in claim 9 was not intended to include and does not include cellulose xanthate.

Neither does the claim include calcium, copper or cobalt xanthate. There is no evidence that xanthates made with these substances, if they can be made at all, will not work. All that the defendant has to rely on is a statement in Keller's notebook (Exhibit K 12, page 70) to the effect that he had told Mr. Nutter that copper xanthate, cobalt xanthate and calcium xanthate were not useful "as they are insoluble". If these xanthates are insoluble they are excluded from the definition. Mr. Higgins spoke of copper xanthate as one of the most insoluble compounds in chemistry. Cobalt is also one of the heavy metals whose use in making xanthates is excluded. Calcium is an alkaline earth rather than a metal and while there is no evidence that calcium xanthate is insoluble, except the statement by Keller in his notebook, Mr. Higgins says that calcium hydrate is only very slightly soluble in water and it would follow, I think, that the same is true of the xanthate.

There was also some controversy as to ammonium xanthate. In the first place, the evidence is quite clear that xanthate cannot be made with ammonium directly but must be made indirectly by making sodium or potassium xanthate first, then acidifying such xanthate and then neutralizing it with ammonia. Tri-methyl-phenyl ammonium and tetra-methyl-ammonium will make xanthates but these are not the same substances as ammonium. As I read the evidence relating to ammonium I think it quite irrelevant in considering claim 9 because there is no evidence that ammonium xanthate will not work. The defendant relies upon a statement by Keller to Mr. Nutter on August 2, 1923, (Exhibit K 38) that he had made ammonium xanthate and that the substance was not very stable. He gave the formula he used which showed that he tried to make it directly, substituting only NH_4 (ammonia), which is really a radical, for either sodium or potassium. Dr. Purves says that with this substitution the inventor would wind up with the ammonium salt of thiocarbamic acid which is not a xanthate at all. If this substance is not a xanthate there is not a tittle of evidence that ammonium xanthate, which can be made only indirectly, is useless in froth flotation. And even if the substance referred to by Keller is ammonium xanthate, there is proof that it has usefulness for Keller says that it gives a good selection between lead and zinc, although its action on copper is not as favourable as potassium or sodium xanthate. Whichever way it is regarded there is no evidence of its uselessness.

One other objection to claim 9 remains for consideration. It will be remembered that the claim is limited to a non-acid pulp. It was contended by counsel for the defendant that no foundation for such a limitation was laid in the disclosures in view of the statement in paragraph 6 that the pulp may be either acid, alkaline or neutral according to circumstances. It was also contended that in confining his claim to a non-acid pulp, Keller was claiming an invention that really belonged to Lewis who had been allowed to take out a patent for the use of xanthate in an alkaline circuit. We are not concerned with why Lewis was allowed to do this or with the Lewis patent. Moreover, it seems to me that the last sentence in paragraph 6 provides a sufficient basis for enabling the inventor to make a claim in respect of any kind of a circuit. That being so, I see no reason why he should not restrict his claim to a non-acid circuit if he desires to do so. I find no substance in this objection. I find, therefore, that claim 9 in the patent is valid.

Under the circumstances, I find it unnecessary to pass on the validity of claims 7 and 8, or to deal with the contention that if claim 8 is valid then sodium xanthate is the chemical equivalent of potassium xanthate.

In addition to the attacks upon the disclosures and the claims, the validity of the patent was challenged on a number of other grounds. The contention that it was a selection patent and was invalid because it did not satisfy the requirements of such a patent may be dealt with briefly. Terrell on Patents, 8th Edition, refers to selection patents at pp. 81-82. In the case of chemical patents the invention may reside in the selection of a particular substance or group of substances out of a class for a particular purpose.

The general principles governing the validity of selection patents were stated in *In re I. G. Farbenindustrie A.G's Patents* (1) by Maugham J.:

> First, a selection patent to be valid must be based on some substantial advantage to be secured by the use of the selected members (The phrase will be understood to include the case of a substantial disadvantage to be thereby avoided) Secondly, the whole of the selected members must possess the advantage in question. Thirdly, the selection must be in respect of a quality of a special character which can fairly be said to be peculiar to the selected group.

A selection patent appears to presuppose an originating patent. In this case the originating patent was said to be the Perkins United States Patent No. 1,364,304, dated January 4, 1921, said to cover the invention of the use in froth flotation of "certain non-obaginous solid organic compounds, which themselves have substantially no frothing properties, but which have valuable properties as collecting agents for the mineral". It was contended that this general description covered xanthates and the other substances referred to in the patent in suit, such as trithiocarbonate and monothiocarbonates, and that this made the patent in suit stand in relation to the Perkins patent as a selection patent. Then it was contended that the second requirement for the validity of a selection patent, namely, that all the selected members must possess the advantages claimed for them, could not be complied with since xanthates and the other two substances, trithiocarbonate and monothiocarbonates, were of unequal advantage and that, in consequence, the whole patent was invalid. In my view, the plain answer is that the patent in suit is not a selection patent in relation to the Perkin's one. A study of the Perkin's patent shows that it would be quite unreasonable to regard the substances referred to in the patent in suit as selected members of the class of substances dealt with in the Perkin's patent. They are not so at all. For example it is said in the Perkin's patent that the collecting agents are substantially insoluble, and are commonly referred to as insoluble, but are soluble to a very small degree, whereas it is of the essence of the xanthates covered by the patent in suit that they should be soluble. Furthermore, the specific compounds referred to in the Perkin's patent, for example, diazo-amino-benzene, are not of the same class

(1) (1930) 47 R.P.C. 289 at 322.

as the substances covered by the patent in suit. Under the circumstances, it cannot, in my opinion, properly be said that the patent in suit is a selection patent covering the use of members of the class of substances, if there is any, whose use is covered by the Perkin's patent. This contention as to the invalidity of the patent is quite untenable.

The next attack on the patent was that it was void because there was no authority in the Commissioner of Patents to issue it. The facts on which this argument is based are as follows. On October 23, 1924, a letter was sent by Messrs. Caron & Caron on behalf of the inventor to the Commissioner of Patents enclosing a petition, oath and specification together with the fee of $15. The letter also stated that a new specification, which might be amended to correspond with the case filed in the United States, would be substituted as soon as completed. The specification indicated that the invention related to a method for which the inventor had applied for a patent in the United States of America under serial number 670,242 on October 23, 1923. It was, to say the least, a very informal specification and was obviously filed with the intention of getting the benefit of a convention filing date. Then, on the following day, October 24, 1924, Messrs Caron & Caron filed a new petition signed by the inventor and an oath, as well as the specification in duplicate and a third copy of the claims, "to be substituted for those filed yesterday." An assignment from the inventor to the plaintiff and an assignment fee of $2 was also inclosed, but no further fee of $15 was paid. The specification filed on October 24, 1924, is the one included in the patent subsequently issued on March 10, 1925. Counsel for the defendant took the position that the two applications were in respect of different inventions; that the $15 fee had been paid and received in respect of the application of October 23; that no fee had been paid in respect of the application of October 24; and that since the statutory requirement of payment of the proper fees had not been complied with, the Commissioner had no jurisdiction to receive or deal with the application or to issue a patent based upon it and that the patent was, therefore, void. The section relied upon is section 43 of the 1923 Act which provides:

> 43. (1) The following fees shall be payable before an application for any of the purposes herein mentioned shall be received by the Commissioner, that is to say:—
>
> On filing an application for patent . . . . 15.00.

It would be strange if a person could justify what would otherwise be an infringement by such a defence as this. There are two answers. The argument disappears altogether if there were not two different applications. There was certainly no intent to make two applications: the letters from Caron and Caron make this clear. Moreover, the file wrapper (Exhibit D 83) shows that the Commissioner dealt with the matter as though only one application were involved, under one serial number and with one filing date. In my opinion, he did so correctly, for all that happened was that on October 24th, a new set of documents relating to the application made on October 23rd, was filed. The most that can happen, if the papers filed on October 23rd are not complete, is that the plaintiff is not entitled to October 23rd as its filing date, but should have it only as of October 24th. That still leaves one application. As it is, nothing turns on the date and I see no reason for disturbing it. The next answer to the defence is *Fada Radio Limited* v. *Canadian General Electric Company Limited* (1). There the defendant sought to attack the validity of a re-issued patent because of the absence of an affidavit. There was some question as to whether it was required, but in any event, Anglin C. J., delivering the judgment of the Supreme Court of Canada, said; at page 523:

> We are satisfied that any insufficiency in the material on which the Commissioner acts, the entire absence of an affidavit or any defect in the form or substance of that which is put forward as an affidavit in support of the claim, cannot, in the absence of fraud, ... avail an alleged infringer as a ground of attack on a new patent issued under s. 24.

And, at page 524:

> The recital of the patent that the applicant . . . "has complied with the requirements of the *Patent Act*" is conclusive against the appellant in the absence of fraud.

And then a number of United States cases are referred to. This statement of principle is applicable in the present case.

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(1) (1927) S.C.R. 520.

1947
MINERALS SEPARATION NORTH AMERICAN CORPORATION
v.
NORANDA MINES, LIMITED

Thorson P.

The patent in suit contains a recital that the petitioner has complied with the requirements of The Patent Act, and it is not open to the defendant in an infringement action to deny the validity of the patent on the ground that the fees payable on the application for it have not been paid, even if such has been the case.

Finally, the defence of anticipation of the invention was set up. Counsel for the defendant contended that there was nothing in the way of information contained in the specification of the patent in suit which was not contained in a document eight years earlier and made available to the public at that time. The document relied upon is called Bulletin No. 2 (Exhibit G-3), dated August 15, 1915, and compiled by one R. B. Martin under the circumstances hereinafter set forth. It is headed "Preparation of Flotation Reagents" and deals with a number of substances called Kotrix, Mimola, Cinol, Grabanol, Stanol. We are concerned only with that portion which deals with Stanol, reading as follows:

STANOL

PREPARATION OF STANOL

Measure out 100 c c of Denatured alcohol
" " 10 c c " Carbon sulphides
Weigh " 1 gram of Caustic soda

Shake until dissolved and digest under a reflux condenser until the caustic soda has disappeared.

Several Stanols have been made up varying the proportion of carbon disulphides and caustic soda to meet the condition of the ore under treatment. The following proportion will serve as a guidance:

A Stanol

Denatured Alcohol	100 c c
Carbon Disulphide	10 c c
Caustic Soda (NaoH)	1 gram

B Stanol

Denatured Alcohol	90 c c
Carbon Disulphide	20 c c
Caustic Soda (NaoH)	1 gram

C

Denatured Alcohol	80 c c
Carbon Disulphide	30 c c
Caustic Soda	1 gram

D

Denatured Alcohol	100 c c
Carbon Disulphide	10 c c
Caustic Soda	5 grams

E

Denatured Alcohol	90 c c
Carbon Disulphide	20 c c
Caustic Soda	5 grams

F

Denatured Alcohol	100 c c
Carbon disulphide	10 c c
Resin	10 grams
Caustic Soda	1 gram

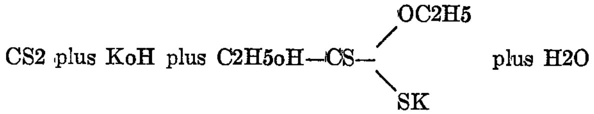
G

Denatured Alcohol	90 c c
Carbon Disulphide	20 c c
Caustic Soda	5 grams
Resin	20 grams

Boil under reflux condenser until the resin is saponified. Dilute with 500 c c of water.

These formulas illustrate that in preparing Stanol variation can be practised by the addition of resin, the alcohol can be diminished and the caustic soda should always be governed as to only have present sufficient quantity to produce the reaction sought for. With some ores an excess of caustic soda to neutralize the acidity seems to impart specific results over the neutral Stanol.

The theory of forming flotation compounds from alcoholic caustic Potash and carbon disulphide may be expressed as follows:



$$CS_2 \text{ plus } KoH \text{ plus } C_2H_5oH\text{—}CS\text{—}\genfrac{}{}{0pt}{}{\diagup OC_2H_5}{\diagdown SK} \quad \text{plus } H_2O$$

Potassium Ethyl — Xanthate

The equation illustrates that if we digest under reflux condenser

Carbon Disulphide	57·6%
Caustic Potash	26·8
Denatured Alcohol	15·6
	100·0

we should upon the completion of the reaction obtained crystaline Potassium xanthate which, however, is soluble in alcohol and can be employed at any strength to effect flotation of copper salts.

Potassium xanthate is not a frothing agent and therefore it must be mixed with some appropriate agents that will give a voluminous froth. Alcohol, resin and pine oil seem to be the most suitable agents for this purpose.

It might be conjectured that some arrangements of combining Potassium xanthate with alcohol and resin and then mixing this compound with mineral oil, would be the initial step of using such a commercial mixture for the flotation of copper carbonates.

A substituted product may be formed by using caustic soda

Carbon Disulphide	70·8%
Caustic Soda	10·0
Denatured Alcohol	19·2
	100·0

> The soda compound does not seem to produce the correspondent good results as is produced with the potasium xanthate. The high cost of potassium salt will prevent this compound from entering as a competitor of the much cheaper sodium salt.
>
> All the experiments conducted so far have been by the use of sodium hydrate and denatured alcohol.
>
> A very good compound is made up for alkali ores by using 20 per cent sodium ethyl xanthate and 80 per cent denatured alcohol.

At the time of Bulletin No. 2 Martin was in the employment of Minerals Separation American Syndicate (1913) Limited, the predecessor of the plaintiff, as a metallurgist and engineer under an employment agreement dated March 6, 1915, one of the terms of which was that he was to disclose and assign to his employer all inventions made by him during his employment relating to the treatment of ores or tailings, flotation concentration or reagents. On the same date Martin also entered into an option agreement with Minerals Separation, Limited, a British Company related to the plaintiff's predecessor, whereby he agreed to disclose all inventions theretofore made by him relating to the treatment of ores or tailings or flotation concentration or reagents to such company for its benefit and to Mr. H. D. Williams for patent application purposes, and to give the company an exclusive option to purchase such inventions for $5,000. The agreement also provided that if in the company's opinion any of his reagents could be successfully and profitably manufactured as a patented flotation oil or reagent the Company would do its best to exploit its manufacture and pay him 25 per cent of the net profits therefrom. Bulletin No. 2 was one of a number of reports made by Martin both in the course of his employment and pursuant to the option agreement.

Counsel's attack on the patent based on Bulletin No. 2 is a twofold one, namely, that before Keller made the invention for which the patent in suit was issued it was known by Martin in 1915, and that the Bulletin was a publication that anticipated the invention in that it had been disclosed or used in such a manner that it had become available to the public. He argued that he was not barred from this defence by anything contained in section 61. (1) (*a*) of The Patent Act, 1935, which provides as follows:

> 61. (1) No patent or claim in a patent shall be declared invalid or void on the ground that, before the invention therein defined was made

by the inventor by whom the patent was applied for it had already been known or used by some other inventor, unless it is established either that,

(a) before the date of the application for the patent such other inventor had disclosed or used the invention in such manner that it had become available to the public; or that

This was introduced as section 37A of the Patent Act, R.S.C. 1927, chap. 150 by An Act to amend the Patent Act, Statutes of Canada, 1932, chap. 21, section 4. Counsel argued that section 61. (1) (*a*) could not be retroactive in effect and that, in any event, there had been a disclosure of the invention such as to meet the conditions of the section. It was agreed that a disclosure made to persons under a duty of confidence is not a disclosure at all, but it was argued that when Martin delivered the bulletin to his employer and to the British Company he made a disclosure to persons who were under no obligation of confidence and that such disclosure made the contents of the bulletin available to the public. Counsel contended that this put these companies in the dilemma of being in one or other of two relations so far as Martin was concerned, namely, either they were in the same position as the inventor or they were in the position of being the public. Consequently, when the Keller invention was used at Anaconda in 1923, the plaintiff, as the successor of Martin's employer, could not say that such use was that of an invention made only in 1923 by Keller, when they knew of it as an invention made by Martin in 1915. Accordingly, so the involved argument goes, either Martin made his invention available to the public in 1915 when he disclosed Bulletin No. 2 to his employer and the British Company or, alternatively, the plaintiff made it available to the public in 1923 by its use at Anaconda. It is clear that counsel, although relying only on Bulletin No. 2 and its disclosure to the persons receiving it, could not abandon the defence alleged in the statement of defence that Martin was a prior inventor, for the defence of anticipation based on Bulletin No. 2 depends upon the assumption that when Martin compiled it in 1915 he knew the invention covered by the patent in suit. Whether he did so cannot be determined by a consideration of Bulletin No. 2 by itself. It is a matter of inference to be drawn not only from the document but also from the facts and circumstances leading up to and surrounding its compilation. The onus of proof of the fact of Martin's prior knowledge of the invention lies on the defendant.

The evidence of Mr. Higgins is important. He first met Martin late in February or early in March, 1915, at the office of the British Company in New York. He was its chief metallurgist and had instructions to examine Martin's inventions to see whether they had any value. Soon afterwards he and Mr. H. D. Williams, the patent attorney for the British Company and the plaintiff's predecessor, had a further meeting with Martin at which Martin disclosed all the inventions later referred to in Bulletin No. 2 except grabanol. At that time the substance later named stanol was called natrola or nitrola. Both Mr. Williams and Mr. Higgins took notes of the disclosures made. It was important that Martin should demonstrate his inventions. In order that he should be able to do so the British Company made a laboratory available to him and supplied him with the apparatus and chemicals he requested. In the laboratory there were the necessary testing machines for flotation tests and in the basement the necessary apparatus to crush ore. Martin also had chemistry reference books at his disposal. Subsequently, early in June, 1915, Mr. Higgins discussed with Martin certain draft specifications for certain substances, including stanol, which Martin had prepared for patent application purposes. Martin had been making tests with his various substances including stanol. Mr. Higgins and his assistant, Mr. Waling, supervised the making of these tests. Mr. Higgins saw how Martin made stanol. This was about the end of July or the middle of August. Moreover, he saw Martin make tests with stanol and he made some tests himself. When asked what was the result of these tests Mr. Higgins' reply was "They were perfectly negative. Neither Martin nor Waling nor I found the least use in stanol." Some use was found in kotrix, which was a sulphidizing agent, and in reconstructed oil, called mimola, which was a mineral frothing agent. Bulletin No. 2 was received directly from Martin by Mr. Higgins on September 14, 1915. Mr. Higgins stated that there were so many formulae in the Bulletin that he requested Martin to put the best of each one into a book; this was subsequently done and the book handed to Mr.

Higgins on October 21, 1915. On September 28, 1915, Mr. Higgins received from Martin Bulletin No. 3 in which no mention of stanol was made. He then instructed Martin to furnish a further report and to make a test on Anaconda Copper Company's ore. Then he received Bulletin No. 4 from Martin in which Martin stated that stanol was not satisfactory for the Anaconda ore. This was the last Mr. Higgins heard of stanol until sometime in 1923, for although Martin compiled 88 bulletins altogether the last one in which he mentioned stanol was Bulletin No. 4. Patent applications were filed for kotrix and re-constructed oils, but not for stanol. Mr. Higgins stated that patents were secured for everything which Martin and he regarded as of any value. Stanol was never patented.

The evidence given by Mr. Higgins, together with the documents, including Bulletin No. 2, prepared by Martin is, I think, quite relevant to the issue whether Martin on August 15, 1915, knew the inventions covered by the patent in suit, and is, in my judgment, against the contention that he did so. The very first disclosure by Martin to Mr. Higgins and Mr. Williams of the substance called natrola or nitrola, which was the same as stanol, showed that he was thinking of something different from the use of xanthate. He was looking for new flotation reagents that would be patentable and entitle him to the chance of a share of the profits from their exploitation, which would not happen in the case of a known substance such as xanthate which would not be patentable. Then we come to the draft specifications to which Mr. Higgins referred. These were sent with a covering letter, dated March 19, 1915, to Dr. S. Gregory, the managing director of both the plaintiff's predecessor and the British Company and referred to Mr. Higgins. The reference to stanol is as follows:

> *Stanol,* an alkaline organic sulphide containing a great many complex organic compounds produced from organic sulphides and an alkali. This solution should be of vital importance to the flotation industry, especially so should your Company decide to manufacture it as a patent flotation agent.

This was a description of something other than xanthate, for xanthate is not a complex compound at all and being already known could not be patented as a flotation agent. The draft specifications were discussed with Martin by

Mr. Higgins and carry the latter's notes made at the time. The specification relating to stanol is quite inconsistent with the suggestion that Martin had the use of xanthate in mind. Of this fact there are many indications. Martin describes stanol as an "organic alkali sulphide salt". Mr. Higgins' note of the formula after his discussion with Martin is "$(C_2H_5)_2S$", which is ethyl sulphide a substance not related to xanthate and Mr. Higgins was not sure that it was a compound. Then reference is made to the substance

> obtained by the action of an alkali upon the numerous organic compounds, such as the hydrocarbon and carbohydrates, including the more specific groups of alcohols, carbon disulphide, carbon titrachloride, and other carbon compounds, such as methanes, carbon monoxide, etc in the presence of an organic sulphide, or an alkali sulphide.

Xanthate cannot be made with such substances as carbon tetrachloride, methanes, or carbon monoxide. Later Martin says that

> variation may be practiced in the process of manufacturing the alkali organic sulphide by varying and selecting the raw organic material.

That is not true of xanthate whose composition is fixed by non-variable chemical laws. Then there is another very significant statement, namely,

> The presence of water and other impurities are essential in promoting the formation of the desired compound. The reaction that takes place is complicated and many compounds that may be classed as impurities are formed, of which the mercaptans, alkynes, and esters, are hereby classed as beneficial to the reaction and necessary in the application of compounding the alkali organic sulphide and the ultimate employment of this agent in promoting flotation.

This statement is proof that Martin did not know the use of xanthate as Keller did. Xanthate is not a complex compound but the result of a very simple chemical reaction. And, far from being essential in the formation of xanthate, the presence of water and other impurities is quite the reverse. Then Martin went on to say,

> In preparing the alkali organic sulphide, I prefer the employment of sodium hydrate, as the alkali, and alcohol and water as the organic base, and carbon disulphide as the organic sulphide, though in practice it is feasible to employ other analygeous combination to effect the same results.

The most that can be said for this statement is that some of the ingredients of stanol also enter into the composition of xanthate, but this does not mean that stanol was xanthate and there is no suggestion that Martin knew the value of the use of xanthate as such. The claims in the draft specification also suggest something other than the use of xanthate for some of them assert that stanol replaces oil in flotations or is used in preference to oil. That could not be said of xanthate. Mr. Higgins stated that he could not understand most of the specification and suggested to Martin that it did not disclose what he had to sell and that he had better make some and show how the substance worked. Mr. Higgins said that after that he saw Martin work in the laboratory up to about the end of July or the middle of August. He described the way in which Martin made stanol as follows: first he put in the alcohol and then the carbon disulphide and shook them up; then he put in the caustic soda and water; this was all in a flask that was put on a wire gauze over a bunsen burner; the flask was fitted with a reflux condenser and the substance was thoroughly boiled, sometimes for as long a period as three days. The mixture was then brown muddy liquid. If Martin had known the use of xanthate he would not have made it in such a manner, for he would have known not only that water should not be added but also that prolonged heating would cause decomposition. Whatever may be the cause one thing is certain, namely, that neither Martin nor Mr. Higgins nor his assistant Waling found the least use in stanol. There is no contradiction of this evidence. It seems to me that up to the date of Bulletin No. 2 the evidence is conclusive against the defendant's contention that Martin knew the value of the use of xanthate in froth flotation.

Then came Bulletin No. 2, which counsel for the appellant relies upon as proof that Martin knew the invention covered by the patent in suit. The document as a whole is inconsistent with any such contention and its contents require comment. The first formula would be a very strange one if Martin were thinking of xanthate as his active reagent for the ingredients used would produce very little xanthate. This is Stanol A which could produce only 3·9 per cent xanthate, the balance being mostly alcohol and some carbon disulphide. Then the instructions are given "shake until dissolved and digest under a reflux condenser until the caustic soda has disappeared". These are indefinite, but there is nothing to indicate that Martin had a different method in mind from that which he used in the manner described by Mr. Higgins. Then the statement is made that "several stanols have been made up varying the proportion of carbon disulphides and caustic soda to meet the condition of the ore under treatment". Martin could not have been thinking of xanthate, for the proportion of the ingredients entering into its composition is not variable. Then 7 different formulae for stanol are given with varying compositions, Stanol D being the one that will produce the most xanthate, approximately 19 per cent. These are all called stanol which is not xanthate; nowhere is there any indication that xanthate is the product being sought. Then Martin suggests that the stanols should be diluted with water, which is quite inconsistent with his really knowing the value of the use of xanthate. Then come the references to potassium ethyl xanthate in the bulletin. Counsel argues that these show that Martin really proposes the use of xanthate as his active reagent. This is quite inaccurate. He does no such thing. Nowhere in Bulletin No. 2 does Martin propose the use of xanthate. The only reagent whose use he proposes is stanol, compounded in different proportions of ingredients and then he expresses the theory of forming his compounds from alcoholic caustic potash and carbon disulphide in terms of a chemical formula which represents potassium ethyl xanthate, and then, after setting out certain proportions, he states that "we should upon the completion of the reaction obtained crystalline Potassium xanthate which, however, is soluble in alcohol and can be employed at any strength to effect flotation of copper salts". I think it is clear that Martin is here travelling in the field of conjecture. He expresses a theory in terms of a chemistry formula which means potassium ethyl xanthate together with an expectation of potassium ethyl xanthate being effective in flotation for which there is no foundation of experimentation or knowledge at all, but is founded solely on speculation and conjecture. No crystalline potassium xanthate was ever obtained. Indeed, there is an admission that there were no experiments at all with caustic potash. And there is no evidence of any tests or experiments with any xanthate. The reference to the effectiveness of potassium xanthate is pure speculation. So far as any tests with stanol go they were failures. Moreover, the formula of the ingredients is wrong. The correct formula as per exhibit P 55, is carbon disulphide 42·7 per cent instead of 57·6 per cent, caustic potash 31·5 per cent instead of 26·8 per cent and denatured alcohol 25·8 per cent instead of 15·6 per cent. This is, I think, evidence that Martin was not thinking of xanthate. The proportion suggested where caustic soda is used instead of caustic potash is even more out of line. Then with regard to the soda compound he says that it "does not seem to produce the corresponding good results as is produced with the potassium xanthate". How could he know whether this is so since no experiments were conducted with the latter? Nowhere in the document is there any statement or suggestion that xanthate is his reagent or any direction that xanthate should be used. Martin is thinking of stanol and the most that can be said for Bulletin No. 2 is that it contains a statement that in theory there is some xanthate in stanol and a speculation that it should be effective in flotations. But speculation and conjecture are not knowledge. I can find no justification in Bulletin No. 2 for saying that Martin knew the invention that Keller later made.

Furthermore, what happened subsequently bears out that Keller was not thinking of xanthate and had no knowledge of its value in froth flotation. Mr. Higgins, knowing that stanol was a failure and seeing so many formulae in Bulletin No. 2, instructed Martin to put the best of them in a book. This Martin did and in Exhibit G 4 the following entry is made under the heading Stanol: "Denatured alcohol 100 c c., Carbon Disulphide 100 c c., Caustic Soda (NaCH) 100 grs. Digest under reflux condenser". This is further proof that Martin had no thought of xanthate, for these are not the proper proportions; not only is there an excess of alcohol, but there is also a great excess of caustic soda, which would tend to cause the decomposition of any xanthate produced. Moreover, the heating of the mixture would also hasten the decomposition. If Martin had known the value of xanthate, it is inconceivable that he would have put this down as the best of his formulae.

Coupled with this fact is his further statement in Bulletin No. 4 that stanol was not satisfactory with the Anaconda ore. This was the very kind of ore with which Keller made such a success with xanthate as to create a furore at Anaconda. Then after the admission of this failure in Bulletin No. 4 there is no further record of stanol and no suggestion that Martin was thinking of xanthate was made until after Keller discovered its value in 1923. It is established beyond dispute that Keller knew nothing of Martin's work or of Bulletin No. 2 when in 1923 he was looking for a sulphidizing agent for oxidized ores and fell upon his important invention of the use of xanthate. Even if it could be said that Martin had made experiments and had failed and that he had abandoned his experiment, it has been long settled that unsuccessful experimentation is not prior invention. In *Galloway* v. *Bleaden* (1) Tindal C.J. said:

> a mere experiment, or a mere course of experiments, for the purpose of producing a result which is not brought to its completion, but begins and ends in uncertain experiments—that is not such an invention as should prevent another person, who is more successful, or pursues with greater industry the claim in the line that has been laid out for him by the preceding inventor, from availing himself of it, and having the benefit of it;

And even if it could be said that Martin had some idea of the use of xanthate in froth flotation that would not be enough to make him a prior inventor, for it was said in *The Permutit Company* v. *Borrowman* (2) by Viscount Cave L.C.:

> It is not enough for a man to say that an idea floated through his brain; he must at least have reduced it to a definite and practical shape before he can be said to have invented a process.

On the evidence before me I have no hesitation in finding that the defendant has failed to discharge the onus of proving that when Martin compiled Bulletin No. 2 he knew the invention covered by the patent in suit.

And I find no assistance for the defendant in the tests carried on by Mr. Bennett at Noranda in 1944. He used Stanol D prepared in two ways, namely, one by simply mixing the ingredients shown in Bulletin No. 2 and the other by boiling them for only 15 minutes. He then ran

(1) (1839) 1 Webster's P.C. 520 at 525.
(2) (1926) 43 R.P.C. 356 at 359.

tests with sodium ethyl xanthate and Stanol D. The amounts used are significant. Of sodium ethyl xanthate he used only ·08 pounds per ton of pulp, but of Stanol D he used ·45 pounds. It is clear that he worked from the amount of xanthate that was necessary to success and then used the necessary amount of Stanol D that would produce the same amount of xanthate. Stanol D would yield 18·74 per cent of xanthate while Stanol A would yield only 3·91 per cent. It follows that if Mr. Bennett had used Stanol A he would have had to use 2·25 pounds per ton. He, therefore, used the Stanol that had the largest potential xanthate content. Under these circumstances his evidence was that Stanol D gives as good results in flotation as sodium ethyl xanthate. But this must be considered also in the light of the fact that to accomplish equal results almost 6 times as much Stanol D would be required as would be needed in the case of sodium ethyl xanthate. This is an important cost factor and is important in respect of an invention of an improvement in a process by the reduction of cost. At first sight it seems strange that Stanol D worked in the tests as made by Mr. Bennett in 1944 but failed to show any usefulness in the tests made by Martin in 1915. The answer is plain. The tests were made under different circumstances. Mr. Bennett did not have only Bulletin No. 2 to work with. He had the 1944 knowledge of the use of xanthate derived from the Keller specification. He knew how much xanthate was required for success and worked from that as a starting point, using whatever quantity of Stanol D was necessary to give him the same amount of xanthate. It may be assumed, I think, that if he had used less than ·45 pounds of Stanol D per ton the results would not have been as satisfactory. Without the knowledge of the use of xanthate he could not have known from Bulletin No. 2 what amount of stanol was necessary for success for it gave no information on the subject. If Martin had had the same knowledge of the use of xanthate in 1915 as Mr. Bennett had in 1944 he would not have failed in his tests with stanol. The fact that he did fail and that Mr. Bennett succeeded is, in my opinion, clear evidence that Martin did not have the knowledge of the use of xanthate that Mr. Bennett had, namely, the use that was the subject matter of the Keller invention. The suggestion implied in the defendant's suggestion that stanol is the same thing as xanthate is absurd.

The finding that when Martin compiled Bulletin No. 2 he did not know the invention covered by the patent in suit really disposes of the defendant's plea of anticipation. Counsel for the defendant relied upon Bulletin No. 2 as having shown that Martin had the same information in 1915 as Keller had in 1923 and that its disclosure to the British Company and the plaintiff's predecessor was a disclosure to the public of as good information as is contained in the specification of the patent in suit. There was also reliance upon an alleged public use of the invention at Anaconda in 1923. There are several answers to the appellant's argument on this branch. Bulletin No. 2 was received by Mr. Higgins directly from Martin at a time when Mr. Higgins was acting for the British Company to see whether Martin had any inventions worth purchasing. If there was any invention the disclosure to Mr. Higgins was in confidence and both he and his principal were under a duty of confidence with regard to it and it cannot be considered as a disclosure to the public. Thereafter, there was no disclosure by the alleged inventor. Then when the inventions were paid for in 1917 there was no further disclosure by any one for Bulletin No. 2 was never again referred to. The public use at Anaconda in 1923 can have importance only if Martin made the same invention as Keller did. If, as has been found, Martin was not a prior inventor, then the public use at Anaconda in 1923 was of an invention quite different from Martin's and has no bearing on the present question.

Moreover, even if it were assumed that Martin knew the Keller invention, it does not follow that Bulletin No. 2 can be regarded as anticipation of the Keller invention. The only possible resemblance to anticipation in Bulletin No. 2 consists in the references to xanthate and a resemblance can be seen only if the document is looked at in the light of the knowledge imparted by the Keller patent. That is not anticipation. It might be said that there was a clue to the Keller invention but this is not enough. In order that a document should anticipate an invention, it must give the same information as the specification in the patent covering the invention. The test of anticipation was carefully discussed by the Judicial Committee of the Privy Council in *Pope Appliance Corporation* v. *Spanish River Pulp and Paper Mills Ld.* (1). There Lord Dunedin, at page 54, referred to the statement of Lord Moulton in *British Ore Concentration Syndicate* v. *Minerals Separation* (2):

> It cannot be too carefully kept in mind in patent law that, in order to render a document a prior publication of an invention, it must be shown that it publishes to the world the whole invention, i.e., all that is material to instruct the public how to put the invention in practice. It is not enough that there should be suggestions which, taken with suggestions derived from other and independent documents, may be shown to foreshadow the inventions or important steps in it.

And, at page 52, after referring to the cases he expressed the test of anticipation as follows:

> Would a man who was grappling with the problem solved by the Patent attacked, and having no knowledge of that Patent, if he had had the alleged anticipation in his hand, have said, "That gives me what I wish"?

It is obvious that Bulletin No. 2 does not begin to meet these tests. No one having only Bulletin No. 2 could put the Keller invention of the use of xanthate in froth flotation into practice. It gave no instructions as to the amount of stanol to use and it is obvious from Mr. Bennett's evidence that the amount required would depend upon which stanol was used. Then the instructions as to its preparation namely "shake until dissolved and digest under a reflux condenser until the caustic soda has disappeared" are indefinite. Mr. Bennett found ambiguity in the words "and digest"; then, acting upon the assumption that "digest" meant boil, he boiled the ingredients, but only for fifteen minutes, and not for three days as Martin did. The conclusion is, in my opinion, inescapable that if any one had had only Bulletin No. 2 he would have met with the same failure as Martin did. I have no hesitation in finding that there was no anticipation of the invention in Bulletin No. 2. Counsel for the defendant admitted that it was not a printed publication within the meaning of section 7 of the Act. This means that it could have importance only if it came within section 61 (1) (*a*), assuming its retroactivity. This it cannot do for the con-

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(1) (1929) 46 R P C 23.

(2) (1909) 26 R.P.C. at 147.

ditions of the section, namely, of prior invention, of disclosure by the inventor, and of disclosure in such manner that the invention had become available to the public, have not been satisfied. Under the circumstances it is not necessary to consider whether section 61 (1) (*a*) of the 1935 Act is retroactive or not. The defence of anticipation of the invention, in my opinion, fails completely.

In its statement of defence the defendant alleged that the plaintiff was not entitled to the relief claimed because of its laches and acquiescence in that it postponed the bringing of this action and nineteen other infringement actions until a few days before the expiry of the patent in order to avoid the risk of provoking an attack on its validity and the loss of benefits that would result from a successful attack. The facts may be stated briefly. In August, 1930, the plaintiff requested the defendant to sign a licence agreement for the use of amyl xanthate which the defendant had been using at its mill at Noranda and, subsequently, there was further correspondence between the parties on the subject. Then on February 12, 1936, Mr. J. Y. Murdock, the defendant's president, notified Mr. J. A. Boyd, the plaintiff's representative, to the effect that he had concluded that the defendant was not liable for and should not pay any royalty to the plaintiff. Then there was further correspondence without any change of result. The defendant persisted in its refusal to pay royalty and no steps were taken by the plaintiff to enforce payment until this action was taken some 10 days before the expiry of the patent. Dr. S. Gregory, the plaintiff's president, on his examination for discovery, explained that he had recommended to the board of directors that no action should be taken until the patent expired or was about to expire and that he had given two reasons for this, namely, that the tonnage the plaintiff would gain by fighting with Mr. Murdock's corporation, the defendant, was a small fraction of what was coming from other directions; and that he thought a fight with the defendant would disturb the relationship with the licensees that were paying royalties. Acting on his advice the plaintiff refrained from taking action. It was this inaction that was relied upon as laches and acquiescence. But counsel for the defendant admitted that he could not, in this Court, maintain this defence in view of the statement by Fletcher Moulton L.J. in *Vidal Dyes Syndicate* v. *Levinstein Ld.* (1) that it is settled law that a patentee need not attempt to stop an infringement when he first learns of it and that his right of action against an infringer is not affected by the circumstance that he did not take action until just before the expiry of the patent. While counsel admitted that he could not urge the defence of laches and acquiescence in this Court he did not abandon it. I adopt the statement of Fletcher Moulton L.J. as applicable in the present case. The plaintiff's delay in bringing action was not laches or acquiescence on its part.

This leaves only the question of infringement. If the plaintiff's patent is valid there is no doubt that it was infringed by the defendant. The process used by the defendant at Noranda is described in Exhibit M 1; there is no difference between it and that disclosed in the Keller specification. Then Exhibit M 2 sets out the list of reagents used by the defendant in its four circuits. It shows that during the years for which the plaintiff may claim damages, the defendant used potassium amyl xanthate in its copper circuit, sodium ethyl xanthate in its pyrite flotation circuit, potassium amyl xanthate in its pyrite regrinding circuit, and also during the years 1940, 1941 and 1942 potassium hexyl xanthate in the same circuit, and potassium amyl xanthate in its pyrrhotite retreatment circuit. The type of circuit used by the defendant was an alkaline one.

Under the circumstances there will be judgment for the plaintiff declaring that claim 9 is valid, that it has been infringed by the defendant and that the plaintiff is entitled to damages in such amount as may be found on an inquiry as to damages by the Registrar if the parties cannot agree as to the amount. The plaintiff is also entitled to costs.

Judgment accordingly.

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(1) (1912) 29 R.P.C. 245 at 259.