S. No. 514.
F. & D. No. 1389.

Issued February 8, 1911.

United States Department of Agriculture,

OFFICE OF THE SECRETARY.

NOTICE OF JUDGMENT NO. 722, FOOD AND DRUGS ACT.

ADULTERATION AND MISBRANDING OF BLEACHED FLOUR.

On or about April 1, 1910, the Lexington Mill and Elevator Company shipped from Lexington, Nebr., to Castle, Mo., a consignment of 625 sacks of flour, each labeled "L 48—1 lbs. Lexington Cream XXXXX Fancy Patent. This flour is made of the finest quality hard wheat. Lexington Cream—Lexington, Neb.—Lexington Mill & Elevator Co."

Analysis of samples of this product made by the Bureau of Chemistry, United States Department of Agriculture, showed it to be adulterated and misbranded within the meaning of the Food and Drugs Act of June 30, 1906. As it appeared from the findings of the analyst and report made that said shipment was liable to seizure under section 10 of the act, the Secretary of Agriculture reported the facts to the United States attorney for the Western District of Missouri.

In due course libel was filed against the said 625 sacks of flour charging the above shipment and alleging that the product was adulterated as therein set forth and praying seizure and condemnation of said flour and process of the court against the claimants thereto. Pursuant to the process of said court, the above-described flour was seized by the United States marshal of said district; whereupon the Lexington Mill and Elevator Company appeared as claimant thereto and filed its answer. Thereafter the libelant, by leave of court, filed the following amended libel, alleging adulteration and misbranding of said flour:

IN THE DISTRICT COURT OF THE UNITED STATES FOR THE WESTERN DIVISION OF THE WESTERN DISTRICT OF MISSOURI.

UNITED STATES OF AMERICA
vs.
SIX HUNDRED AND TWENTY-FIVE (625) SACKS OF FLOUR.

AMENDED LIBEL.

The United States of America, by Arba S. Van Valkenburgh, United States attorney for the Western District of Missouri, who prosecutes for and on behalf of the United States of America, hereby gives the court to understand and be informed that there are now in the possession of and held by B. O. Terry, of Castle, Sullivan County, Missouri, certain original unbroken packages and sacks each containing forty-eight (48) pounds more or less of flour; that said flour

so contained in said packages and sacks is adulterated within the meaning of the act approved June 30, 1906, entitled "An act for preventing the manufacture, sale, or transportation of adulterated or misbranded or poisonous or deleterious foods, drugs, medicines, and liquors, and for regulating traffic therein, and for other purposes."

And the United States attorney aforesaid further gives the court to understand and be informed that said packages and sacks of flour consist of six hundred and twenty-five (625) sacks or packages, each containing forty-eight (48) pounds more or less of flour, branded and labeled as follows, to wit: "L 48 Pounds Lexington Cream XXXXX Fancy Patent. This Flour is Made of Finest Quality Hard Wheat. Lexington Cream. Lexington, Nebraska, Lexington Mill and Elevator Company," and were received by the said B. O. Terry, as aforesaid, on or about the 7th day of April, A. D. 1910, from the Lexington Mill and Elevator Company, a corporation duly organized and existing under and by virtue of law, and engaged in the manufacture and sale of flour and other food products at Lexington, in the State of Nebraska; that the same were sold and shipped to the said B. O. Terry, of Castle, Sullivan County, Missouri, by the said Lexington Mill and Elevator Company, a corporation as aforesaid, of Lexington, Nebraska, on or about the 1st day of April, A. D. 1910, and were sent by common carriers engaged in interstate commerce, to wit, from Lexington, in the State of Nebraska, to Council Bluffs, in the State of Iowa, over the Union Pacific Railway Company, and by it delivered to the Chicago, Burlington and Quincy Railroad Company at Council Bluffs, Iowa, and by it carried to Osborn, in the State of Missouri, and there delivered to the Quincy, Omaha and Kansas City Railroad Company, from which point said Quincy, Omaha and Kansas City Railroad Company transported said shipment to Castle, Sullivan County, Missouri, and there delivered the same to the said B. O. Terry; that all of said railroads are common carrier corporations engaged in interstate commerce between the States of Nebraska, Iowa, and Missouri, and among the other States and Territories of the United States.

The United States attorney aforesaid further gives the court to understand and be informed that the flour so contained in said packages and sacks as aforesaid was treated by a process for the bleaching of flour known as the Alsop process, which said process consists of the generation by some means of electricity of nitrogen peroxide gas, which is mixed with atmospheric air, and the mixture brought into contact with the flour; and your libelant charges that by this treatment the flour contained in said six hundred and twenty-five (625) sacks, and each and every part thereof, has been caused to be adulterated within the meaning of the act of Congress, in the following manner and particulars, to wit:

(a) In that a substance known as nitrites or nitrite reacting material has been mixed and packed with the said flour so as to reduce and lower and injuriously affect its quality and strength, in these respects, among others, namely: that the capacity of the said flour to change and improve, as it would have changed and improved if aged and conditioned by natural processes, has been destroyed; that by direct action the elasticity of the gluten has been lessened and impaired, so as to injuriously affect the bread-making qualities of the flour; that by direct action other ingredients of the said flour have been injuriously affected, so as to reduce, lower, and impair its bread-making qualities.

(b) In that by the treatment as aforesaid the said flour has been mixed, colored, and stained in a manner whereby damage and inferiority is concealed in these respects, among others, namely: that the inferiority of freshness or newness, an inferiority which is present in flour made from new wheat or in flour freshly milled from wheat that is either old or new, and an inferiority which

manifests itself, among other things, in inferiorities of color, of elasticity of gluten, and of the quality of other ingredients which affect its value for bread-making purposes, is thereby concealed; and that said flour has been caused to simulate the appearance of flour made from wheat which has been properly aged and conditioned by natural processes and of flour which has been properly aged and conditioned by natural processes, after being milled from wheat that is either old or new; and this treatment by the Alsop process, as aforesaid, has concealed the inferiority of said flour, and has given it the appearance of a better grade of flour than it really is.

And further, that the flour contained in said six hundred and twenty-five (625) sacks, and treated by the Alsop process as aforesaid, was when milled, and now is, of a grade of flour inferior to a patent flour, and was when milled, and now is, of a grade of flour inferior to the grade known as finest quality of hard wheat flour; and that the said flour, inferior in these respects, has been caused to have the appearance of a patent flour and of flour made from the finest quality of hard wheat, and thereby the inferiority contained in said flour was and is concealed, and in other respects also the inferiority of said flour was and is concealed.

(c) In that by the treatment as aforesaid the said flour has been caused to contain added poisonous or other added deleterious ingredients, to wit, nitrites or nitrite reacting material, nitrogen peroxide gas and other poisonous and deleterious ingredients and substances, which may render said flour injurious to the health.

The United States attorney aforesaid further gives the court to understand and be informed that the flour contained in the aforesaid packages and sacks was and is misbranded within the meaning and intent of the act of Congress of June 30, 1906, in the following manner and particulars, to wit:

(a) First, in this, that the packages and sacks containing such flour were labeled as aforesaid, "L. 48 Pounds Lexington Cream XXXXX Fancy Patent. This flour is made of first quality hard wheat. Lexington Cream. Lexington, Nebraska, Lexington Mill and Elevator Company;" that in truth and in fact a patent flour is and is known and recognized to be the best grade of flour, and consists only of that portion of the flour content of the wheat known as the middlings; and your libelant charges that the flour contained in said sacks is not a patent flour, but is a grade and quality of flour inferior to a patent flour, being a mixture of the middlings, together with a commercially inferior grade of flour, and a flour which before bleaching was darker in color than a patent flour, and inferior in grade, quality, and strength to a patent flour, and that this mixture shipped into Missouri and labeled as aforesaid was sold under the distinctive name of another article than itself, and was labeled as aforesaid so as to deceive and mislead the purchaser, in the respect that it purported to be a patent flour, whereas in truth and in fact it was not a patent flour.

(b) Second, in this, that the sacks containing said flour were labeled as aforesaid, "L. 48 pounds. Lexington Cream XXXXX Fancy Patent. This Flour is made of finest quality hard wheat. Lexington Cream. Lexington, Nebraska, Lexington Mill and Elevator Company," whereas in truth and in fact the said flour was not made of first quality of hard wheat, but was milled, in whole or in part, from a grade or grades of wheat inferior to first quality hard wheat, namely, "yellow berry" and other inferior wheats and that the flour thus labeled as aforesaid, "This flour is made of first quality hard wheat" was sold under the distinctive name of another article than itself; that it purported to be made from the finest quality of hard wheat, whereas in truth and in fact it was made in whole or in part of wheat inferior to first quality hard wheat, namely, "yellow berry" and other inferior wheats; and, therefore, was sold

under the distinctive name of another article than itself, and misbranded within the meaning and intent of the act of Congress.

WHEREFORE, it is prayed that process issue and that the United States marshal of this district be commanded by order of this court to seize the packages and sacks of flour aforesaid for confiscation, destruction, or sale, and the same held to be dealt with as this honorable court may order and determine.

ARBA S. VAN VALKENBURGH,
United States Attorney.

Whereupon the claimant answered said amended libel as follows:

IN THE DISTRICT COURT OF THE UNITED STATES FOR THE WESTERN DIVISION OF THE WESTERN DISTRICT OF MISSOURI.

UNITED STATES OF AMERICA, *Libellant*, *vs.* 625 SACKS OF FLOUR.	Answer of the Lexington Mill and Elevator Company to the Amended Libel.

To the Honorable, the Judge of the District Court of the United States for the Western Division of the Western District of Missouri:

Comes now the Lexington Mill and Elevator Company, a corporation organized under the laws of the State of Nebraska, and a citizen and resident of the State of Nebraska, and shows to the court:

1. That it is interested in the property seized under the writ issued in this cause, to wit, six hundred and twenty-five sacks of flour, more or less, which interest is more fully set forth hereafter, and it prays that it may be made a defendant in this cause and permitted to defend against the seizure, forfeiture, and condemnation of said merchandise.

2. This claimant shows to the court that it manufactured said flour at its mill in the city of Lexington, State of Nebraska, and sold the same to B. O. Terry of Castle, in the State of Missouri, and caused said flour to be shipped from the city of Lexington, in the State of Nebraska, to the said B. O. Terry at Castle, in the State of Missouri; that said flour was sold by said Lexington Mill and Elevator Company under a guarantee that the same was not adulterated within the meaning of the act of Congress known as the Food and Drug Act of June 30, 1906; that this defendant did not receive pay for said flour, and after the seizure of said flour by the process issued in this cause this defendant was required to and did furnish to the said B. O. Terry other flour in lieu of that seized in this cause, by reason whereof the flour seized in this cause has become and is the flour of this answering defendant; and if said flour is by the order and judgment of this court seized, forfeited, and condemned this answering defendant will suffer loss to the extent of the price and value of said flour, to wit, the sum of seven hundred and fifty dollars.

3. This answering defendant admits that said flour was manufactured and shipped from the State of Nebraska into the State of Missouri by the lines of railroad set forth and described in the amended libel herein.

4. This answering defendant admits that said sacks and each of them were branded and labeled as described in the amended libel, except that instead of being branded "This flour is made of finest quality hard wheat," the said sacks were branded, "This flour is made from first quality hard wheat."

5. This answering defendant admits that the flour so contained in said packages and sacks was treated by a process known as the Alsop process, but this defendant denies that said sacks or the contents thereof, or any portion thereof, has been caused to be adulterated within the meaning of the act of Congress as alleged in said amended libel. This defendant denies that a substance known as nitrites or nitrite reacting material has been mixed or packed with said flour,

or any part thereof, so as to reduce or lower or injuriously affect its quality or strength in any respect whatsoever. This defendant denies that by said treatment said flour has been mixed, colored, or stained in any manner whereby damage or inferiority is concealed in any respect whatsoever. It denies that said flour, or any part thereof, has been so treated, or has been treated in any manner whereby the grade or quality of said flour, or any part thereof, has been concealed, and denies that by such treatment the said flour, or any part thereof, has been given an appearance of a better grade of flour than it really is.

6. This defendant denies that the said flour, or any part thereof, is inferior to a patent flour, and denies that the same, or any part thereof, was when milled, or now is, of a grade of flour inferior to a grade of flour known as the finest quality of hard wheat, and denies that the quality of said flour, or of the wheat from which it was made, has been in any manner concealed. This defendant denies that by the treatment of said flour, the same, or any portion thereof, has been caused to contain any added poisonous or other deleterious ingredients which may render said flour injurious to health.

7. This defendant admits that said sacks containing said flour were labeled as alleged in said libel, except that the same was labeled as being made from first quality hard wheat instead of being labeled made of the finest quality of hard wheat. This defendant denies that the so-called patent flour is known or recognized to be a grade of flour consisting only of that portion of the content of the wheat known as middlings, and says it is not true that the flour contained in said sacks is not a patent flour, or that it is of a grade or quality inferior to a patent flour, or that it is a mixture of middlings together with a commercially inferior grade of flour, or of a flour which was at any time of a color darker than a patent flour or inferior in grade or quality or strength to a patent flour, and this defendant denies that the same has been mixed and shipped into the State of Missouri and sold under a distinctive name of another article than it is, or that the same was labeled in any manner so as to deceive or mislead the purchaser, or that it did deceive or mislead the purchaser in any respect whatsoever.

8. This defendant admits that said sacks were labeled showing that the said flour was made of the first quality of hard wheat, and this defendant alleges that the same was made from the first quality of hard wheat, and denies that the same was made in whole or in part from a grade or grades of soft wheat, and that it was sold under a name of any article different from what it really was, or that the same was in any respect misbranded.

10. Further answering said amended libel, this defendant admits that said flour has been treated by the Alsop process, and in this connection alleges that the process by which it has thus been treated consists of generating in rapid succession a flaming electric discharge in a current of air in proximity to such electric discharge, and in conducting the air as modified by such discharge into the presence of the flour as it is being continuously passed through a revolving reel or agitator, but this defendant denies that the flour thus treated is in any way adulterated or that by said process any poisonous or other deleterious ingredient is in any manner added thereto or imparted thereto, or that the flour thus treated is in any way injurious to health or contains any added deleterious ingredient or that the same is in any manner adulterated or that by such process any damage or inferiority in said flour is in any manner concealed, or that the quality or strength of said flour is in any manner affected, reduced or lowered.

11. Further answering said complaint and libel, this defendant and claimant states that it is informed and believes, and therefore avers, that this court is without right or authority of law and the officers of this court are without right or authority of law to seize the flour so manufactured and shipped into inter-

state commerce by this claimant, for the reason that the Food and Drug Act of June 30th, 1906, under which pretended authority is exercised and under which the seizure of the flour in controversy herein was made, is wholly invalid, unconstitutional and void, in that it deprives this answering claimant of its property without due process of law, and is in violation of article 1, section 8, paragraph 3 of the Constitution of the United States, giving to Congress the right to regulate commerce among the several States, and is in violation of article 10 of the amendments to the Constitution of the United States which provides that—

"The powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people."

And this answering claimant further shows to the court that it is informed and believes, and therefore so avers, that the said act known as the Food and Drug Act of June 30th, 1906, is wholly illegal and void, for the reason that said act is uncertain and indefinite, particularly in this, that said law does not define any standard of grade, quality or purity, and in this regard delegates legislative functions to the courts clothed with jurisdiction of cases of a civil or criminal nature brought under said law in violation of article 1 of the Constitution of the United States providing that—

"All legislative powers herein granted shall be vested in a Congress of the United States, which shall consist of a Senate and House of Representatives."

WHEREFORE, having fully answered, this claimant asks that said complaint and libel be dismissed, that said flour seized under the writ issued by this court be released and restored, and for such further and different relief as may be just in the premises, and that this defendent and claimant may recover its costs herein expended.

The issues raised by the above amended libel and the answer thereto were submitted by the court to a jury, which, after hearing the testimony of witnesses and arguments of counsel, was instructed by the court as follows:

IN THE DISTRICT COURT OF THE UNITED STATES, WESTERN DISTRICT OF MISSOURI, WESTERN DIVISION.

UNITED STATES OF AMERICA *vs.* SIX HUNDRED AND TWENTY-FIVE (625) Sacks of Flour. Lexington Mill and Elevator Company, Claimant.	No. 285.

THE CHARGE TO THE JURY BY THE COURT.

SMITH MCPHERSON, *Judge.*

April 9th, 1910, Arba S. Van Valkenburgh, the then United States Attorney for this Judicial District, in his official capacity as such officer filed with the clerk of this court a pleading designated by law as a libel. Later on, to wit, May 19th, 1910, Mr. Van Valkenburgh as such officer as aforesaid filed an amended libel in the name of the United States of America, which in effect charged that the said claimant, the Lexington Mill and Elevator Company, April 1st, 1910, sold and shipped from Lexington, in the State of Nebraska, to a grocer by the name of B. O. Terry at and of Castle, in Sullivan County, Missouri, a shipment of flour containing six hundred and twenty-five (625)

sacks of flour of forty-eight pounds of flour to the sack. The said libel charges the route of shipment, namely, over two or more connecting railroads between the two said points. The said Terry buying said flour and receiving said shipment for the purpose of retailing said flour to consumers at the said town of Castle and to his customers in the vicinity thereof, and for said purposes the said Lexington Mill and Elevator Company made said shipment.

It is further charged in the said libel, that is to say, that the flour in question was treated by a process for bleaching flour known as the Alsop process, which process consists of the generation by means of electricity of nitrogen peroxide gas which is mixed with atmospheric air, and the mixture brought into contact with the flour in a state of agitation, and that the flour was thereby caused to be adulterated in certain particulars, namely:

(a) In that substances known as nitrites or nitrite-reacting material has been mixed and packed with the flour so as to reduce and lower and injuriously affect its quality and strength in these respects among others, to wit, that the capacity of the said flour to change and improve as it would have changed and improved if aged by natural processes has been destroyed. That by direct action the elasticity of the gluten has been lessened and impaired so as to injuriously affect the bread-making qualities of the flour; that other constituents of the flour have been injuriously affected so as to reduce, lower, and impair its bread-making qualities.

(b) In that by the treatment of the flour by the Alsop process it has been mixed, colored, and stained in a manner whereby damage and inferiority is concealed in these respects among others, to wit: That the inferiority of freshness or newness, an inferiority which is present in flour freshly milled and which manifests itself, among other things, in inferiorities of color, of elasticity, of gluten, and of the quality of other ingredients which affect its value for bread-making purposes, is thereby concealed; that said flour has been caused to simulate the appearance of flour which has been properly aged and conditioned by natural processes after being milled; that this treatment by the Alsop process has concealed the inferiority of said flour and has given it the appearance of a better grade of flour than it really is, and further that the flour was when milled, when bleached, and now is, of a grade of flour inferior to the flour made from the first quality of hard wheat, and that by the Alsop bleaching process it has been caused to have the appearance of a patent flour and of a flour made from the first quality of hard wheat, and that thereby the inferiority of said flour was and is concealed and that in other respects also the inferiority of said flour was and is concealed.

(c) In that by the treatment as aforesaid the said flour has been caused to contain added poisonous or other added deleterious ingredients, to wit, nitrites or nitrite-reacting material, which may render said flour injurious to health.

The amended libel further charges that said flour is misbranded in substance as follows:

(a) That the bags and sacks containing such flour were labeled as follows: "L. 48, Lexington Cream XXXXX Fancy Patent. This flour is made from the first quality hard wheat."

That in truth and in fact a patent flour is, and is known and recognized to be, the best grade of flour, and which consists only of that portion of the flour content of the wheat known as the "middlings." But that the flour contained in said sacks is not patent flour, but is a grade and quality of flour inferior to patent flour, being a mixture of middlings together with a commercially inferior grade of flour, and a flour which before bleaching was darker in color than a patent flour and inferior in grade, quality, and strength to patent flour,

and that this mixture was shipped into Missouri labeled under the distinctive name of another article, and was labeled so as to deceive and mislead the purchaser, in the respect that it purported to be a patent flour whereas in truth and in fact it is not a patent flour.

(b) That the label on each sack contained a statement, "This flour is made of first quality hard wheat," whereas in truth and in fact the flour was not made of first quality hard wheat, but was milled in the whole or in part from a grade or grades of wheat inferior to first quality hard wheat, namely, "yellow berry," and other inferior wheat, and was sold under the distinctive name of another article than itself, and that the flour seized purported to be made from the first quality of hard wheat, whereas in truth and in fact it was made in whole or in part of wheat inferior to the first quality hard wheat, namely, "yellow berry" and other inferior wheat and therefore was sold under the distinctive name of another article than itself and was misbranded within the meaning of the act of Congress.

To this amended libel which contains the Government's charge and a statement of the alleged cause of action, the Lexington Mill and Elevator Company, claimant, herein, has filed its answer which in substance and meaning states:

That the Lexington Mill and Elevator Company is interested in the flour seized; that the same was manufactured at its mill in Lexington, Nebraska, and sold to B. O. Terry of Castle, Missouri, and was shipped from Lexington, Nebraska, to Terry at Castle, Missouri, under a guaranty that the same was not adulterated; that the claimant has not been paid for the flour, but that after the seizure was required to and did furnish Terry other flour in lieu of the flour seized; that if the flour seized be condemned, claimant will suffer loss to the extent of its value, namely, seven hundred and fifty ($750) dollars; it admits the shipment of the flour by the route alleged in the libel, and that the flour was branded as indicated by an amendment to the amended libel.

It admits that the flour was treated by a process known as the Alsop process, but denies that the same was adulterated within the meaning of the act of Congress, and denies that any substance known as nitrites or nitrite-reacting material has been mixed or packed with the flour or any part thereof so as to injuriously reduce or lower its quality or strength in any respect whatever, and denies that the flour has been mixed, colored, or stained in a manner whereby damage or inferiority is concealed in any respect whatsoever, and denies that the same has been treated in any manner whereby the grade or the quality of the flour has been concealed, and denies that the treatment of the flour has given it the appearance of a better grade of flour than it really is, and denies that any of the flour is inferior to a patent flour, and denies that any of the same was when milled or now is of a grade of flour inferior to a grade of flour made from the first quality of hard wheat, and denies that the quality of said flour or wheat from which it was made was in any manner concealed, and denies that the same or any portion thereof has been caused to contain any added poison or other added deleterious ingredient which may render said article injurious to health.

It admits and alleges that the flour was labeled as the evidence shows it to have been labeled, but denies that so-called patent flour is known or recognized to be a grade of flour consisting only of that portion of the content of the wheat known as "middlings," and says that it is not true that the flour contained in said sacks is not a patent flour, or that it is of a grade or quality inferior to patent flour, or that it is a mixture of middling together with a commercially inferior grade of flour, or of a flour which was of a darker color than a patent flour, or inferior in grade, quality, or strength to a patent flour, and denies that the flour was mixed and shipped into Missouri and sold under the distinctive

name of another article than itself, or that the same was labeled in any manner so as to deceive or mislead the purchaser, or that it did deceive or mislead the purchaser in any respect whatever.

It admits that the sacks were labeled as the evidence shows them to have been labeled, but denies that the flour was made in whole or in part from grade of soft wheat, or that it was sold under the name of an article different from what it really was, or that it was in any respect misbranded.

It admits that the flour was treated by the Alsop process and in that connection alleges that the process consists of generating, in rapid succession, a flaming electric discharge in a current of air in proximity to such electric discharge, and in conducting the air, as modified by such discharge, into the presence of the flour as it is being continuously passed through a revolving reel or agitator, but denies that the flour was in any way adulterated, or that by the process any poisonous or other deleterious ingredient has in any manner been added thereto or imparted thereto, or that the flour is in any way injurious to health or contains any added deleterious ingredient, or that the same is adulterated in any manner, or that by such process any damage or inferiority is in any manner concealed, or that the quality or strength of the flour is in any manner reduced or lowered.

To this answer the Government by its counsel has filed a reply.

On the issues thus outlined as contained in the amended libel, and the answer and reply, this case is to be determined.

By reason of the libel heretofore referred to a writ of seizure was issued by the order of this court commanding the United States marshal for this district to seize the said shipment of flour and the marshal still holds the same subject to the further orders of the court herein.

The statute under which this proceeding was brought and the case now being tried is an enactment of the Congress of the United States approved by the then President June 30th, 1906 (four years ago). This statute as to its validity is challenged by the claimant herein. But with that question you have no concern other than to observe it, because the court holds that the Congress of the United States with the approval of the President had the power under the Constitution of the United States to enact the statute that was enacted and under which we are proceeding, and the court holds and so directs you that the statute is a valid enactment, and to be enforced in any and all cases where the evidence and the facts come within the wording of the statute.

The statute is named "The Food and Drugs Act," and is an act for preventing the manufacture, sale, or transportation of adulterated or misbranded or poisonous or deleterious foods, drugs, medicines, and liquors, and for regulating traffic therein, and for other purposes. It will be observed that the statute deals with drugs, medicines, liquors, and foods. A part of the statute is with reference to drugs, medicines, and liquors, and likewise confectionery, but with which in this case we are not concerned except as the same has a bearing with reference to foods. That part of the statute with reference to foods reads as follows: "That for the purposes of this act an article shall be deemed to be adulterated in the case of food:

"First: If any substance has been mixed and packed with it so as to reduce or lower or injuriously affect its quality or strength.

* * * * * * *

"Fourth: If it be mixed, colored, powdered, coated, or stained in a manner whereby damage or inferiority is concealed.

"Fifth: If it contain any added poisonous or other added deleterious ingredient which may render such article injurious to health * * *."

The statute further prohibits the misbranding of articles of food and provides in substance as follows:

"That the term 'misbranded,' as used herein, shall apply to all drugs, or articles of food, or articles which enter into the composition of food, the package or label of which shall bear any statement, design, or device regarding such article, or the ingredients or substances contained therein which shall be false or misleading in any particular * * *."

Any statement or expression of opinion by the court during the trial of this case with reference to any fact or alleged fact or any criticism by the court of any witness or party or counsel on either side, are each and all withdrawn, and you will treat and consider the case as if such statements or criticisms by the court were not made. And I charge you to give no consideration to the same or any part thereof.

You are the sole judges of the facts in this case. Much testimony in this case was given by scientists and experts who testified before you. The testimony of the experts as to their opinion is not binding upon the jury and is merely advisory and may be given such weight by the jury as the jury may deem proper in view of all the facts and circumstances in evidence, or such expert testimony may be wholly disregarded by the jury in arriving at their verdict.

While you are the judges of the facts and of the testimony, and what weight shall be given thereto regardless of expressions of opinion by me, it is my belief that I can be of substantial aid to you in stating some facts which in my opinion are so well established by the evidence as that you ought to have but little or no argument with reference thereto, and take the same as established facts.

However, notwithstanding my statements or expressions of opinion with reference to any fact in the case, you are to remember that you are the sole judges of the facts in the case, and of all deductions to be made therefrom.

It is an established fact and concerning which there is no conflict in the testimony that the flour in question in this case was transported from Lexington, Nebraska, to Castle, Missouri, in interstate commerce and was subject to seizure for confiscation, if it is adulterated or misbranded in any respect or particular alleged in the amended libel.

It is also an established fact in the opinion of the court that the flour seized and in question was made from wheat of a 1909 crop grown in the State of Nebraska and known by the name of No. 2 Turkey wheat, and that the wheat was ground at the claimant's mill at Lexington, Nebraska, on the night of March 31st, 1910, and shipped the next day to the said Terry at Castle, Missouri, by whom it was received in about seven days.

It is also an established fact in the opinion of the court that the wheat from which the flour was made contained a percentage of what is called yellow berry wheat. The witness, Mr. Tucker, the head miller of claimant, testified that the yellow berry was about or approximately ten to twenty-five per cent of the entire amount of the entire wheat used to make the flour in question that has been seized in this case, and the testimony of other millers in Nebraska and Kansas shows that the wheat called "yellow berry" is frequently indeed commonly found mixed with Turkey wheat as it is grown in those States, and that the percentage of such yellow berry varies, frequently running higher than fifty or seventy-five per cent of the Turkey wheat produced in various places and communities in said States. And there is evidence to the effect that but a small part, probably about one per cent of the Turkey wheat produced, in the various places in these States which are referred to in the testimony, that is wholly free from the yellow berry wheat. And it appears that it is the common practice of millers in Kansas and Nebraska to mill Turkey wheat mixed with this yellow berry.

It is admitted that the flour seized in this case was treated by the Alsop process for the purpose of bleaching and whitening the same; that that process employs a gaseous substance referred to in the testimony as nitrogen-peroxide gas—NO_2 or N_2O_4.

It appears that nitrogen-peroxide gas is—in concentration—a brownish or yellowish gas heavier than atmospheric air, of offensive odor, corrosive in character, and a poison and deleterious substance, and if taken by a human being in sufficient quantities will produce poisonous action and death.

It appears that when nitrogen-peroxide gas is brought into contact with water or moisture, there is by chemical change produced nitrous acid and nitric acid in equal quantities, and it also appears that each of these acids so produced is a poisonous and deleterious substance which if taken by a human being in sufficient quantities will produce poisonous action and death.

It appears that the water or moisture content of flour is equal to about ten or twelve per cent of the total weight of the flour, amounting to about five pounds of each of the sacks seized or about twenty pounds in a barrel of flour.

It appears that nitrous acid readily combines chemically with other substances such as are contained in wheat flour and thereby forms nitrites of various kinds, depending upon the character of the substances with which the acid chemically combines.

It appears that such nitrites as may be formed by the introduction of nitrous acid into flour are poisonous and deleterious substances, and that if taken by a human being in sufficient quantities will produce poisonous action and death.

It appears that nitric acid readily combines chemically with other substances such as are contained in wheat flour, and thereby forms nitrates of various kinds depending upon the character of the substances with which the acid combines.

To enable the Government to obtain a verdict at your hands in its favor, it is required to furnish such a measure of evidence as to sustain the allegations of the amended libel by a fair preponderance of the evidence. By a fair preponderance of the evidence is meant a greater weight of evidence and it is sufficient if it satisfies your mind that the allegations which it supports are true without regard to which side produces the evidence or the witnesses giving the same. It is not incumbent on the Government to show that the allegations of the amended libel in a case like this are true beyond a reasonable doubt. Proofs beyond a reasonable doubt are only exacted in a criminal case, and this is not a criminal case within the meaning of that rule, but it is an action in the nature of a civil action. You are the judges of the weight of the evidence, and of the credibility of the witnesses, and it is for you to say what the truth is.

It is incumbent on the Government to prove that the flour seized was adulterated and misbranded in *some* respect or particular alleged in the libel. But it need not prove that the floor was adulterated or misbranded in *all* of the respects and particulars alleged. If it appears from the evidence in this case that the flour was adulterated in *any* respect or particular alleged, then you must find for the Government that the same was adulterated, and if it appears in the evidence that the same was misbranded in *any* respect or particular alleged, then you must find for the Government that the same was misbranded. On the other hand, if you find that it was not adulterated in any respect or particular alleged, then you must find against the Government on that issue. And if you find that it was not misbranded in any respect or particular alleged, then you must find against the Government on that issue.

One of the issues submitted to you is the alleged violation of the first subdivision relating to food in section 7 of the act, which in substance declares

an article of food to be adulterated if any substance has been mixed and packed with it so as to reduce or lower or injuriously affect its quality or strength.

Upon this point the substance of the charges made by the Government is, (a) that the capacity of the flour to change and improve as it would have changed and improved if aged by natural processes, has been destroyed by the treatment of the flour by the Alsop process, whereby substances known as nitrites or nitrite-reacting material have been mixed and packed with the flour; and (b) that by direct action of such process the elasticity of the gluten has been lessened and impaired so as to injuriously affect the bread-making qualities of the flour; and, (c) that other constituents of the flour have been by such process injuriously affected so as to reduce, lower, and impair its bread-making quality.

On the first branch of this particular issue it appears that wheat flour improves by lapse of time and processes of natural aging. I charge you that if the treatment of this flour by the Alsop process for the purpose of bleaching and whitening resulted in any injury to the capacity of the flour to change and improve as it would have changed and improved if aged by natural processes, that your finding must be for the Government that the flour is adulterated.

On the second branch of this particular issue, I charge you that if you find from the evidence that by the direct action and as a result of the treatment of this flour by the Alsop process the elasticity of the gluten has been lessened or impaired so as to injuriously affect the bread-making qualities of the flour, that your finding must be for the Government that this flour is adulterated.

On the third point of this particular issue, the Government claims that the treatment of this flour by the Alsop process caused substances known as nitrites or nitrite-reacting material to be mixed and packed with the flour so as to reduce, lower, and impair its bread-making qualities, and so as to render the same injurious to health. If you shall find from the evidence that the flour seized was by such treatment so injured, your finding must be for the Government that this flour was adulterated.

The substance of the charges of the Government that this flour is adulterated in violation of the fourth subdivision relating to food of section 7 of the law in question, is that by the treatment of the same by the Alsop process the flour has been mixed, colored, and stained in a manner whereby damage or inferiority is concealed in these respects, namely, (a) that the said flour has been caused to simulate the appearance of flour that has been naturally aged and conditioned by natural processes after milling; (b) that the treatment by the Alsop process has concealed inferiority in said flour, and has given it the appearance of a better grade of flour than it really is; (c) that the flour is of a grade inferior to patent flour and inferior to flour made from the first quality of hard wheat, and that treatment of the same by the Alsop process has caused it to have the appearance of a patent flour and of a flour made from the first quality of hard wheat.

It appears from the evidence in this case that wheat flour when freshly made is inferior to what that same flour will become by the lapse of time and the processes of natural aging and conditioning; that the inferiorities of freshness or newness manifest themselves in inferiority of color, of elasticity of the gluten, and of the quality of other ingredients which affect its value for bread-making purposes; and it further appears that by the lapse of time and aging and conditioning by natural processes wheat flour will improve for a period of time, stated to be from two to four months, or thereabouts; and that such improvement increases the value of the flour and makes it lighter in color; and it

further appears that this bleaching process makes the freshly milled wheat flour appear to be like and to simulate the appearance which that same flour will assume after natural aging and conditioning. And it further appears that this flour when seized was not naturally aged or conditioned, but was newly milled flour.

On this branch of this particular issue it is for you to say in the light of all these facts and all the evidence whether or not the inferiority of freshness or newness was concealed by the bleaching process.

On the second branch of this particular issue, I charge you that if treatment by the Alsop process has given to this flour the appearance of a better grade or quality of flour than it really is, you should find for the Government that it is so adulterated.

And upon the third branch of this particular issue, I charge you that if you should find from the evidence that this flour is of a grade of flour inferior to patent flour or is a flour inferior to flour made from the first quality hard wheat, and that bleaching by the Alsop process has caused it to have the appearance either of a patent flour—as that term will be explained to you in this charge—or the appearance of a flour made from the first quality of hard wheat, then you must find for the Government that this flour is adulterated.

The Government charges adulteration of this flour in violation of the fifth subdivision relating to food of the section of the statute under which we are proceeding. The words of that provision are as follows: "If it (in this case meaning flour) contain any added poisonous or other added deleterious ingredient which may render such article (in this case meaning flour) injurious to health."

The substance of the charge found in the amended libel is that by the treatment of the flour by the Alsop process it has been caused to contain added poisonous and other added deleterious ingredients which may render the same injurious to health, to wit: Nitrites, nitrite-reacting material, nitrogen peroxide gas, nitrous acid, nitric acid, and other poisonous and deleterious ingredients and substances.

It is the claim of the Government that if the flour contain any added poisonous or other added deleterious ingredient of a kind or *character* which may render (that is, which is capable of rendering) such article injurious to health, it is adulterated, and should be condemned for confiscation.

On the other hand, it is the claim of the claimant that even though the flour contain added poisonous or other added deleterious ingredients, it may not be condemned unless it shall further appear that such added substances are in such quantity that the flour shall be thereby rendered injurious to health.

This statute was enacted for the purpose of benefiting and protecting the consumer, which in this case means those who eat bread and cake and pastry and gravy and other products made from wheat flour. This was the purpose that Congress had in mind when it enacted this statute. And in enforcing this statute in proper cases the fact that it will subject the millers to some expense or the fact, if it be a fact, that it will enable the millers to market their flour more readily or at a better price, is entitled to no consideration and will receive no weight at your hands.

It will be noted that the act does not say, "any added poison," but does say, "any added poisonous ingredient." The word "poisonous" as an adjective conveys a descriptive meaning and is used in a qualitative sense, and not in a quantitative sense. That is, it refers to the kind of substance, and not to the quantity of the substance. This idea or meaning is further emphasized and rendered more certain by the qualifying clause "which *may* render such article injurious to health." It does not say, "which *does* render such article

injurious to health," but manifestly it was the purpose of Congress to include in this distinction all ingredients of a *poisonous character* to which, in their essential nature, might be ascribed the tendency to affect health injuriously.

This statute is essentially a remedial one, for the correction of known or supposed abuses with respect to the adulteration of food and other articles of human consumption. It is primarily a statute of prevention. Its meaning is made clear when its purpose is known and borne in mind.

It is not conceivable that the Congress of the United States, when it passed this act, intended that producers and vendors might continue to add poisonous and other injurious substances to food so long as the quantity added was not sufficient to produce observable poisonous or injurious effects upon the health of consumers, nor is it conceivable that Congress intended to require that the Government before proceeding to condemnation of an article of food as adulterated must prove that it contains added poisonous or other added deleterious ingredient in such a quantity as *would* render such article injurious to health. It is known to everyone that there is no method of ascertaining or measuring the effect of the consumption of such substances in food upon the public health or upon the health of any particular individual.

It is clear that it was intended by Congress to prohibit the adding to food of any quantity of the prohibited substances.

The fact that poisonous substances are to be found in the bodies of human beings, in the air, in potable water, and in articles of food, such as ham, bacon, fruits, certain vegetables, and other articles, does not justify the adding of the same or other poisonous substances to articles of food, such as flour, because the statute condemns the adding of poisonous substances. Therefore the court charges you that the Government need not prove that this flour or foodstuffs made by the use of it would injure the health of any consumer. It is the *character*—not the *quantity*—of the added substance, if any, which is to determine this case.

The flour seized in this case is an article of food within the meaning of the act of Congress. And if the treatment of the same by the Alsop process caused it to contain any added poisonous or other added deleterious ingredient of a kind or character which may render the same injurious to health, then it is adulterated and must be condemned.

It is admitted that this flour was treated by the Alsop process for the purpose of bleaching or whitening, and the evidence establishes that nitrogen-peroxide gas was employed for that purpose and further establishes that that gas, nitrous acid, nitric acid, and nitrites of the kind which may be produced by such treatment are poisonous and deleterious substances, and that these substances when taken in sufficient quantities will produce poisonous action or death.

It appears from the evidence in this case that the bleaching process imparts and adds to flour substances referred to in the testimony as nitrites or nitrite-reacting material, and such substances were imparted to the flour seized in this case by the bleaching process. It further appears from the evidence that such substances so imparted or added to this flour are qualitatively both poisonous and deleterious, that is to say, that these substances are of a poisonous and deleterious character.

It is well known that wheat flour is not eaten raw. There is evidence in this case that tends to show that during the process of making bread nitrites or nitrite-reacting material contained in the flour is lessened and may be eliminated under some cricumstances, but it is also well known that wheat flour is used for the making of other articles of food—biscuits, dumplings, pastry, cake, crackers, gravy, and perhaps other articles of food—which may be consumed by all classes of persons—the young, the old, the sick, the well, the weak, the

strong; and I charge you that it is right for you in reaching your verdict to take these facts into consideration together with all the other proven facts and circumstances in the case.

With reference to the issue as to misbranding, the same divides itself under two heads, one with reference to quality of the flour, and the other with reference to kind of wheat from which it was made. The flour is branded as a fancy patent flour and it is also represented by label on each sack that the flour is made of first quality hard wheat.

There is much dispute in the evidence as to the meaning of the phrase "patent flour." Some of the witnesses for the Government testified in substance that the phrase had a well-defined meaning among millers, bakers, and in the flour market generally, and that it means that the flour so called patent flour, is less than the total flour content of the wheat, and includes what is known in the milling process as the purified middlings, but it is not claimed by the Government nor any of the witnesses that patent flour is or contains any definite or specific percentage of the total flour content of the wheat. On the other hand, some of the witnesses for the claimant testified that the phrase "patent flour" has no definite or recognized meaning among millers, bakers, flour dealers, or elsewhere, and that flours containing the total flour content of the wheat excepting low grade, sometimes called "red dog," are labeled and sold in the market as "patent flour."

It is the law that if the phrase "patent flour" has a well known and well understood meaning generally among millers, flour purchasers, bakers, and in the flour markets of the country, then such meaning as so understood is to be attributed to that phrase. In other words, patent flour is the kind of flour that it is generally understood to be by millers, bakers, flour purchasers, and in the markets generally. You are therefore to determine, first, Has the phrase "patent flour" any well defined and well known meaning? And, second, Is the flour seized that kind of flour, namely, "patent flour?" If it is, your finding must be against the Government on this branch of the case. But if it is not a patent flour, as that phrase is understood as heretofore explained, your finding must be for the Government upon this branch of the case.

On the second branch of the charge of misbranding contained in the amended libel, the facts appear to be that the flour seized was manufactured by the claimant at its mill from wheat which was raised in the year 1909 in the general vicinity of Lexington, in the State of Nebraska; that the wheat weighed about fifty-nine pounds to the bushel, and was of a variety known at No. 2 Turkey wheat, in which there was a quantity of wheat known as yellow berry or as sometimes called by millers, "yellow belly," amounting to from ten to twenty-five per cent of the total wheat used to make this flour. The wheat known as yellow berry is commonly found in Nebraska and Kansas growing with Turkey wheat. It differs in color and quality from pure Turkey wheat, and is considered by the millers less desirable and is of less value commercially.

The words upon each sack, "This flour is made of first quality hard wheat," is in effect a representation that the flour seized was made from the best hard wheat.

You are to determine whether or not that representation is true. And in so doing you will not be controlled by the fact, if it be a fact, that the wheat used was the best grown in the district where claimant procured his supply for milling, but you have a right to consider the same in comparison with other wheats grown in different places and parts of the country as disclosed by the evidence in the case, and in the light of all of the evidence on this question say whether or not the wheat used was in truth and in fact first quality hard wheat.

I am now about committing this case to you gentlement for decision. We have been engaged in this trial continuously for five weeks of time, during

most of which time the weather has been oppressively and well-nigh unbearably hot. Your work, as well as that of all of counsel in the case and my own work, has been exceedingly laborious and fatiguing. I commend you for the patience you have given to the testimony and to the argument of counsel. I have the right to insist and do insist that you now take this case to your room and give both the facts in the case and the law as I have given you in charge your best and most deliberate judgment. In view of statements that have been made by counsel during the progress of this case, you will not consider and you must put to one side all questions of who the counsel are, or where they are from. This is not a contest between States or sections of the country. Ours is but one country, and this enactment by Congress is for the entire country. The fact that the Patent Office at Washington issued a patent for the Alsop process has nothing to do with the question of branding correctly, or misbranding of flour. The fact that the Patent Office issued a patent for the Alsop process does not warrant nor authorize the adulteration of flour as made by the Alsop process if it is adulterated. All these things must be put to one side, and your verdict must be determined in accordance with the law and facts in the case. It is of no importance to you, nor is it of importance to me, who will be pleased or displeased in this case, whether of counsel or of the parties, or of any other person. The only question is, What is the right, and what the wrong of this case?

Your verdict must recite whether this flour was misbranded or not, and your verdict must further recite whether this flour was adulterated or not, within the meaning of what I have heretofore said to you. And that there may be no uncertainty as to your verdicts, I hand you two pairs of verdicts. Your foreman will sign the one of each pair and bring the same into court for record, the other of each pair having been destroyed by you. And you will make no other findings than these two. All matters bearing on these two forms you will give due weight thereto, and all matters not having a bearing thereon, you will utterly disregard.

You will observe that one of these pairs of verdicts I now hand you is with reference to misbranding. If the flour seized was misbranded in any particular as alleged in the amended libel, your foreman will sign the one thus reciting, but if not misbranded in any particular as alleged in the amended libel, your foreman will sign the other. You will also observe that I hand you a pair of verdicts with reference to adulteration. If the flour seized was adulterated in any one of the ways or methods as alleged in the amended libel, your foreman will sign the one reciting the adulteration; if you do not so find, your foreman will sign the other. You will now take the case.

Thereafter the jury, after consideration of said evidence and instructions, returned its verdict in due form of law, finding for the libellant and sustaining the allegations of adulteration and misbranding charged in the amended libel herein.

On July 6, 1910, the court rendered the following decree of condemnation and forfeiture of said flour:

UNITED STATES OF AMERICA
v.
SIX HUNDRED AND TWENTY-FIVE (625) Sacks of Flour. } No. 285.

On this day again comes the parties to this cause, Leslie J. Lyons, United States Attorney, and Pierce Butler, Esq., Special Assistant Attorney General, on

behalf of the United States, also comes the Lexington Mill and Elevator Company, claimant, herein by its counsel, Bruce S. Elliott, Judge A. E. Helm, and Judge E. L. Scarritt, and the jury sworn to try this case as on yesterday, and thereupon the jury came into court under the charge of the sworn bailiff and returned two verdicts signed by their foreman, which said verdicts are in words and figures following, to wit:

"IN THE DISTRICT COURT OF THE UNITED STATES, WESTERN DISTRICT OF MISSOURI, WESTERN DIVISION.

UNITED STATES OF AMERICA
vs.
SIX HUNDRED TWENTY-FIVE (625) Sacks of Flour. Lexington Mill and Elevator Company, Claimant. } No. 285.

VERDICT.

We, the jury, find that the flour seized in this case is adulterated.
July 6, 1910.

JOHN W. THOMASON,
Foreman."

"IN THE DISTRICT COURT OF THE UNITED STATES, WESTERN DISTRICT OF MISSOURI, WESTERN DIVISION.

UNITED STATES OF AMERICA
vs.
SIX HUNDRED TWENTY-FIVE (625) SACKS OF FLOUR. Lexington Mill and Elevator Company, Claimant. } No. 285.

VERDICT.

We, the jury, find that the flour seized in this case is misbranded.
July 6, 1910.

JOHN W. THOMASON, *Foreman.*"

and announced that the same are the verdicts of the jury.

Thereupon, the court orders said two verdicts and each of them filed and recorded on the records of this court, which is accordingly done, to which the said claimant, the Lexington Mill and Elevator Company, at the time in open court objects and excepts.

Thereupon, on motion of the United States attorney, it is ordered, considered, and adjudged that the Lexington Mill and Elevator Company pay the taxable costs herein made to be taxed by the clerk, for which a writ of execution will issue, to which ruling, order, and judgment the said claimant at the time in open court excepts.

It is further considered, ordered, and adjudged that the flour seized herein and now in the possession of the United States marshal for this district be, and the same is hereby, condemned and confiscated to the United States of America, as being food adulterated and misbranded within the meaning of the act of Congress approved June 30, 1906, and that all of the same be destroyed by the United States marshal.

From the foregoing as to the confiscation and destruction is excepted the flour heretofore released by order of the court. To each, all, and every of the foregoing orders, directions, judgment, and findings, the claimant, the Lexington Mill and Elevator Company, in open court excepts.

And said claimant, the Lexington Mill and Elevator Company, is given twenty (20) days from this date to file a motion for a new trial, or a motion

to modify any or all of the foregoing, and a motion to vacate or set aside any or all of the foregoing, and by the word motion is meant to include any exceptions or objections to any of the foregoing, or all of the same; and also the right and privileges is hereby given to said claimant to serve and file bill of exceptions or notice of appeal from any or all of said orders within the time allowed by statute and the rules of court. No process or writ shall issue until the motion for new trial is ruled on, if filed within said 20 days.

SMITH MCPHERSON, *Judge.*

After the rendition of said decree, the above-named claimant filed a petition and motion for a new trial, and a notice of an appeal from said decree by writ of error and appeal, or both, to the United States Circuit Court of Appeals for the Eighth Circuit, and further a motion in arrest of judgment.

By order of court, the hearing on the motions for a new trial and in arrest of judgment was set for November 1, 1910.

At the trial the libellant and claimant, respectively, introduced the following witnesses who testified in substance as follows:

JOHN E. MITCHEL, called by libellant, testified:

My business is the manufacture of electrical and milling machinery. In it I am associated with two companies, the Mitchell-Parks Manufacturing Company and the Alsop Process Company. I am general manager of the latter company. Mr. Bruce S. Elliott, one of the attorneys of record, is employed by the Alsop Company in the defense of this suit. The Lexington Mill and Elevator Company, of Lexington, Nebr., uses a bleaching apparatus which was installed by my company, the price paid for the same being based upon the daily capacity of the mill.

(Recalled:) The New Prague Mill, referred to by the witness Wolf, employs the Williams bleaching process. The milling company gave us its note for $12,000 for the privilege of being allowed to continue to use the Williams process, and having since refused to pay the note, we are now bringing suit against it. We have contended that the Alsop process employs nitrogen peroxide as the bleaching medium and that the Williams process also employs nitrogen peroxide. I have never denied that the Alsop process uses NO_2 mixed with air.

(Recalled:) The American bleaching process is practically the same as the Alsop process, the only difference being in the mechanism for generating the electricity. I am perfectly satisfied, from what chemists tell me, that the Alsop process, the Williams process, the American process, and the Naylor & Gerard process all manufacture nitrogen peroxide gas.

B. O. TERRY, called by the libellant, testified:

I own a general store at Greencastle, Mo., dealing, among other things, in flour at retail. I use about three carloads of it a year. The flour seized in this case I ordered from the Lexington Mill and Elevator Company, of Lexington, Nebr., through a salesman. I received 625 48-pound sacks on the 7th day of April, 1910. Of these 625 sacks, the marshal seized 597. The price of patent flour from other mills that I was figuring with at the time was from $5.25 up to $5.35. The price of the flour seized was $5.

JAMES H. SHEPARD, a witness for the libellant, testified:

My residence is at Brookings, S. Dak. I am 50 years of age, and a graduate of the University of Michigan. For the last twenty-two years I have held the position of professor of chemistry at the South Dakota State College, and have

served as chemist of the agricultural experimental station at Brookings, S. Dak. For nine years I have been chemist to the South Dakota Pure Food Commission. Have written several text-books on the subject of chemistry. Have been engaged for the last twenty-two years in original investigation and study of water and of all kinds of foods, plants, and grains. For the last five years I have been engaged in determining the digestive coefficient of our grains and grasses. Along the line of pure food work, I have made many researches. I have issued a great many bulletins on many different pure food subjects. As to the bleaching of flour, I have made a special study. I am acquainted with the so-called Alsop, Andrews, and Frichot methods of bleaching, and have taken part in many public hearings and trials in this country and in England, where the question of bleaching flour by the use of nitrogen peroxide gas was involved.

The essential apparatus in the Alsop process is a small chamber with two electrodes. One of these electrodes is stationary; the other is raised up and down by suitable crank motion, so as to approach the first. These electrodes are charged with a heavy current of electricity. When the points of the electrodes touch, the current flows just for a second, and when they are pulled apart a flaming discharge takes place between the two. This discharge is of a high temperature—so much higher than the ordinary temperature of combustion that it causes the nitrogen and oxygen in the air to combine—actually to burn, one might say—and the result is a compound called nitrogen peroxide. While the electrodes are in operation, a current of air sweeps out the nitrogen peroxide, and a further supply of air is drawn in. After being swept along, the nitrogen peroxide is carried by a tube to a box, which is provided with a rotating apparatus. To this box, called an agitator, comes the finished flour from the mill, and is made to fall down through the nitrogen peroxide and air. During this passage, the bleaching is effected.

The nitrogen peroxide, such as is formed in the Alsop process, when pure and concentrated is a dark brownish red gas, which is heavier than air, powerful, corrosive, and extremely poisonous. When inhaled in small quantities, it produces an irritation of the lining membrane of the nose and the throat, and if it were inhaled in sufficient quantities, would result in death. If this gas is diluted with air, it becomes lighter colored, and the color may be reduced to a point where it is not recognizable; but the odor remains, and on account of its great pungency, can be detected in the atmosphere in very minute quantities. The odor around an agitator is quite marked. I have observed pipes used to carry this gas in an Alsop machine, and have found that they had become corroded, the length of time of such destruction depending on the metal used and the thickness of the pipe.

When peroxide of nitrogen comes in contact with water, it immediately splits up and forms two acids, one of them nitrous acid, and the other nitric acid. Nitric acid is one of the most powerful acids known to chemistry, one of the most corrosive, and one of the greatest solvent reagents. Nitrogen peroxide may be produced in almost innumerable other ways than by the electric arc. Nitrogen peroxide is always nitrogen peroxide, wherever found, or under whatever circumstances made or produced, just as water is always water. It is a definite chemical compound.

I am familiar with the process of milling. The first step in the process of manufacturing flour is to clean the wheat, scrubbing it, if necessary, to get it clean. Next in the modern roller mill, the wheat is tempered. It goes through a suitable box and a certain quantity of steam is blown in. This is a very important part of the milling process, as it toughens the outside of the wheat berry. After being tempered, the wheat is run into a set of rolls,

which may be divided roughly into two classes, the rolls of one class having little corrugations on them; those of the other being perfectly smooth. The wheat is first run through the corrugated rolls. Here the bran or a large part of it is loosened, and the grain itself is cracked into coarse kernels like sand. The coarse grits made in the first roll are called "middlings." It is from the grinding of these middlings that the best and highest priced flour is made. After the middlings have been all cleaned up and made as pure as possible, they are carried on over to the smooth rolls, which begin to crush them, and make them fine. From there the stream is put through a bolting cloth, and some of the branny portions are removed, and the result is a stream of patent flour.

New wheat taken right from the harvest field and threshed out from the shock is not as well adapted for milling as the same wheat would become if stacked before threshing, and if stored for a time after threshing. While in the stack the wheat undergoes a change called "the sweat." This sweating causes the wheat to come out plumper, with a better color, better taste and flavor, and better adapted for milling purposes. After being threshed and put in bins, the wheat undergoes a second sweat, and is then in prime condition for milling. It is then what is called a properly aged and conditioned flour. These changes are now known to be due to very minute bodies called enzymes. If wheat has not been allowed properly to age and condition, it will not, when made into flour, make bread having a good loaf volume. The flour will not raise right, and may be altogether unsatisfactory. If, however, the flour is allowed to stand for a while, it will improve wonderfully. That is, the flour will age and condition as well as the wheat. Properly aged flour is always better than the freshly milled flour.

As the flour grows older, its color changes from a yellowish tint to a beautiful creamy white. The gluten is improved in its toughness, its elasticity, and makes a better volume of bread. The enzymotic changes due to aging produce agreeable flavors and odors. It is also a fact that wheat which has been allowed to age and condition makes flour of a lighter color. Now the application of the Alsop process bleaches out the color of the flour, sometimes making it approach chalky whiteness. The bleaching tends to reduce all flours to a standard, irrespective of the age of the wheat or the age of the flour or the kind of wheat. Of the three grades of flour, patent, clear, and straight, the patent is the lightest in color, the straight comes next, and then comes the clear. The bleaching process tends to make them all look alike.

By Alsop bleaching nitrogen peroxide is added to the flour. Certain chemical changes take place when the nitrogen peroxide unites with the moisture in the flour. Nitrous and nitric acids are formed, and from the nitric acid are produced nitrates, and from the nitrous acid, nitrites. In flour the moisture content runs by weight from 10 to 12 per cent. This moisture is capable of being extracted directly from the flour.

Nitrous acid has never been prepared pure. It exists only in water solution. It is a poisonous substance. The nitrites which are formed by a combination of nitrous acid with bases are poisonous also. The term nitrite reacting material comprises both the terms nitrous acid and nitrites.

Nitric acid, sometimes called aqua fortis, is one of the three most important acids known to chemistry. It is very corrosive, and a great solvent. It unites with metals to form salts, called nitrates. All the common metals are dissolved by it. The changes wrought by the Alsop process and the changes which take place in natural aging are not at all comparable. In so far as they cause the color to become lighter, they are comparable to some extent. The enzymic action of natural aging produces agreeable flavors and odors, whereas the Alsop process introduces disagreeable flavors and odors. Flour, while naturally

aging, continues to improve for some months. Flour bleached by the Alsop process, is as good the moment after bleaching as it ever will be. No enzymotic changes will take place in it.

In my own experiments I have used all the way from 2½ parts per million of nitrogen peroxide up to 180 parts per million. At various places between these two limits, I observed changes in the color of the flour. The coloring matter of flour is not a simple color, but a mixture of two colors, yellow and orange. The darker colored flours have more of the orange, and the lighter, more of the yellow. The yellow and orange do not reduce equally on bleaching, the orange fading away faster than the yellow. The point is finally reached where the orange disappears entirely, and the addition of more nitrogen peroxide will not bring it back. When you get down near the zero point on the yellow, the flour is almost chalky white. When more nitrogen peroxide is added, an increase of the yellow is noted. I have prepared tables showing the changes in the colors. For example, a patent flour made from Dakota No. 1 winter wheat showed, when unbleached, 12 points of orange and 13 of yellow. I added 4.5 parts per million of peroxide. My orange sank to 2 points; my yellow, which was 13, sank to 11 points—a great difference. At 18 parts per million of nitrogen, my orange showed 2, and my yellow had fallen to 6. When 72 parts per million were used, my orange fell to zero, and my yellow rose to 11. At 180 parts, the orange still remained zero, and the yellow had risen to 13—the point started from on the yellow.

Under no circumstances can all the nitrogen peroxide used in bleaching be recovered. I have been able to recover only from 10 to 14 per cent. If in freshly bleached flour, two parts of nitrite reacting material were recovered, we should be safe in saying that at least twenty parts of nitrogen peroxide had been used in bleaching the flour. The effect of lapse of time is constantly to reduce the amount of nitrites recoverable. The explanation is that the nitrous acid and the nitrite reacting material is constantly being changed to nitric acid. Some of it also will be lost by evaporation.

(The witness demonstrated that nitrogen peroxide gas, in a bottle marked Exhibit 6, the gas being in the ratio of one part to four of air, could be poured into another bottle.)

The amount of nitrite reacting material recoverable in bread made from bleached flour depends on several factors. Bread can be so made by using large quantities of yeast, that very little be recovered. The way the ordinary housewife makes bread, a good percentage of it is recovered. An increase in the amount of nitrogen peroxide used to bleach will not show a proportional increase in the amount recoverable. The explanation is that after a time the absorptive capacity of the flour is reached.

The average amount of gluten in flour is 11 or 12 per cent. The gluten is the most valuable constituent of the flour. I have made experiments to determine the amount of injury which bleaching causes to the gluten. Protein is distinguished from all other food stuffs because it has nitrogen in it. The total nitrogen consists of albuminoid nitrogen and of amido nitrogen. The former is the useful and valuable constituent for nutritive purposes. A long line of experiments which I made show that on bleaching, the albuminoid nitrogen is reduced, and that the amido nitrogen increases as the bleaching is intensified.

I have made numerous experiments for the purpose of determining the comparative digestibility of the same flours, bleached and unbleached. In most cases, the unbleached flour digested more rapidly than the bleached.

The amount of nitrite reacting material recoverable is no index to the amount of damage done to the flour, nor is the amount recoverable any index to the amount of nitrogen peroxide used.

Forty parts per million of the gas are found to increase the time of digestibility 121 per cent. Eighty parts per million inhibited digestion.

Patent flour costs sometimes as much as 75 cents a barrel more than the clear, and from 20 to 30 cents more a barrel than straight. Bleaching causes the clear to look to ordinary observation like the patent. In the absence of bleaching, color is an index to the quality and kind of flour. Bleaching, by making all grades similar in color, destroys this index.

I have not gone to a mill employing the Alsop process and taken samples of the same flour, bleached and unbleached. I never found any nitric acid in flour. Not all of the purified middlings go to make patent flour. Sixty-five per cent is about the average contained in the patent, although the amount varies from 55 to 75 per cent of all the flour that the wheat can produce. Each miller grinds according to his own ideas. The kinds of wheat make a great difference.

It inevitably occurs in the ordinary business of milling that new wheat is ground, and new flour is sold. Natural aging improves the flour in color, flavor and odor; also in the elasticity of the gluten. Those who are accustomed to handle raw flours become able to determine these things.

The color of the flour made from the wheats of Kansas, Nebraska, Iowa, and Missouri is darker than that of the flour made from South Dakota wheat. People want a white flour. Bleaching, if pushed far enough, will emphasize the presence of the branny particles. By bleaching carefully, their presence would not be emphasized.

I have never isolated nitrites as such. I have made no digestive experiments with flour bleached in an Alsop machine. In my laboratory bleaching, I use a large vessel of a capacity of eight or ten times the amount of flour put in. I keep the flour there for three or four minutes, at the end of which time all the gas has disappeared. In my digestion experiments I used a solution of pepsin, an active principle of gastric juice, with 0.2 per cent of hydrochloric acid solution, which is a very close proximation to the digestive juice of the stomach. A variation of from one to two hundredths of 1 per cent I would set as the limit of experimental error in determining the nitrogen content of flour.

When flour has been freshly bleached, I am able to determine that fact by the sense of smell.

A complete demonstration of the existence of nitrous acid or nitrite reacting material can be made by washing the flour in water, then turning off the water, and then to the solution applying a reagent known as the Griess reagent. If nitrous acid is there, a pinkish color immediately begins to develop. This method is well known to all chemists. Chemists know that nitric acid is present in bleached flour, because nitrogen peroxide coming in contact with water always forms nitric acid.

The yeast plant does not consume nitrites directly, but reduces them to nitrates.

OVERTON W. TUCKER, called by the libellant, testified:

I am a miller by trade, and employed as head miller by the Lexington Mill and Elevator Company at Lexington, Nebr. I set the mill for the flour that was seized in this case. Ninety per cent of the total flour content of the wheat was included in the flour seized in this case. Like all the wheat in Nebraska, some yellow berry or yellow belly was included in the wheat that made this flour. I can not say positively that there was not as much as 35 per cent yellow berry or 40 per cent or 50 per cent. Our mill had two Alsop bleaching machines in it, two electrifiers for making the flaming arc and one dynamo. Both electrifiers were in operation. An amperage of from 3 to 3½ was divided about equally between them. The voltage was possibly 450 volts on both

of them. Both machines pumped the gas into the same tank, which was connected directly with the agitator. The grade of wheat used in milling this flour was what we call a No. 2 hard wheat. There is no wheat on the market that grades No. 1 hard wheat. Yellow berry is a hard wheat. The rest of the wheat used is known as Turkey Red. The farmers do not intentionally sow the yellow berry. Since I have been in the mill, the galvanized pipe between the storage tank and the agitator has not been removed. I have not noticed any corrosion to speak of. I have, however, taken it out once or twice to clean it.

The stuff I took out of the pipe was a dark brownish substance. It had a slight odor like Exhibit 6. The cleanings from the storage tank had somewhat the same smell. The flour accumulates a little in the angles and corners of the spout and remains there sometimes a good while. The average daily output of our mill is 330 barrels. Its capacity is about 350. We only bleach patent flour. There are two agitators in the mill, one of them being used for bleaching patent. The other agitator, which was not in use at the time the flour seized was milled, was put in for the purpose of bleaching cut-straights. A cut-straight is the clear and a per cent of patent turned in with the clear. To make the flour seized about 42 pounds out of wheat running 59 pounds to the bushel were used. At the time the flour seized was milled, both agitators were running. The clear flour, which was not bleached, went through the second one.

DANIEL M. WALSH, a witness for libellant, testified:

I am a food and drug inspector in the Bureau of Chemistry, United States Department of Agriculture. On April 11, 1910, I took from the 597 sacks of flour which had been seized by the marshal and were at the warehouse of B. O. Terry, at Castle (Greencastle) Mo., three sample sacks. These three sacks I marked, for the purpose of identification. Two of them I forwarded to the chief of laboratory, Bureau of Chemistry, U. S. Department of Agriculture, Chicago, Ill., and the third sack I shipped to the chief of laboratory, Bureau of Chemistry, U. S. Department of Agriculture, St. Paul, Minn. I am able to identify the sample sacks of flour in court as being those taken by me April 11, 1910.

ANDREW L. WINTON, a witness for libellant, testified:

I am chief of the Chicago Laboratory, U. S. Department of Agriculture. From Yale University I received the degrees of Ph. B. and Ph. D. For twenty-three years I was a chemist at the Connecticut Agricultural Experiment Station, and during eighteen years of that time I was in charge of the analytical laboratory there. I am the author of numerous scientific articles on the analysis of agricultural products and foods; also the author of a book on the microscopy of foods. Recently I assisted in the revision of Leach's "Food Inspection and Analysis," a comprehensive work on the composition and analysis of food products.

On April 12, 1910, I received the two sacks of flour shipped to me by Walsh. One of these sacks I forwarded to the Bureau of Chemistry at Washington. On the day of receipt, I made an analysis of the flour contained in the other one, for the purpose of learning whether the flour had been bleached, and also of determining its grade. My analysis showed that it contained nitrous acid, free or combined, so as to form nitrites, 1.80 milligrammes calculated as nitrogen per kilogram of flour, or in other words, 1.8 parts per million. My analysis further showed that the flour contained 0.57 per cent of ash; acid calculated as lactic acid 0.113 per cent, and a gasoline number, so called, of 0.66. Determinations of the gluten and baking tests were also made.

I am familiar with the Alsop bleaching process, having visited some twenty mills where it was at work, and having also examined in the laboratory flour bleached by it. In the mills I was able to detect the nauseating odor of the gas.

At ordinary temperatures this gas is brownish in color, heavier than air, and can therefore be poured like a liquid. It has a strong suffocating odor. If inhaled in its pure condition, it causes coughing and serious disturbance. At high temperature its formula is NO_2; at lower temperature N_2O_4.

In my opinion, nitrous and nitric acids are added to flour by Alsop bleaching. NO_2 coming in contact with moisture, forms these two acids on absorption. Flour contains from 10 to 15 per cent of moisture. The acids thus formed possibly combine with bases to form respectively nitrites and nitrates. It is my opinion, however, that the acids remain largely in the form of free acids. My ash determination, which was 0.57 per cent, means that this amount of mineral substance, consisting largely of phosphates of lime and potash, also smaller amounts of magnesia, and a little sulphur, as well as a small amount of iron, remains after burning the flour. Ash is significant as to the grade of the flour. A patent flour contains a relatively low percentage of ash, a straight flour a somewhat larger percentage, and a clear flour a still larger percentage. The red dog contains more than the clear, and the bran more than the red dog. In my experience, patent flours never contain over forty-two or forty-three hundredths of 1 per cent of ash.

The Alsop process makes lighter the coloring matter that is associated with the oil. The coloring matter and the oil are not the same thing. Strictly speaking, the oil is colorless. By putting a measured amount of flour in a bottle, then introducing a measured quantity of gasoline, shaking the bottle and allowing it to stand over night, the gasoline takes up the coloring matter. Then by comparison with standard colors of known flour, the color of the particular flour can be expressed in definite figures by its gasoline number. Unbleached Nebraska flours show a considerably higher gasoline number than does the seized flour.

Bleaching increases the acidity of the flour, but does not increase it in the form of lactic acid or as organic acid. The inorganic acid—mineral acid—is increased.

In my laboratory I have examined a great number of samples of flour, perhaps 300 or so, ground in the laboratory, and representing wheat from all over the country. These were protected from any possible contamination from laboratory fumes. In no case have I ever found such flour to contain nitrites or nitrous acid. Therefore, I believe that these substances are not normal constituents of flour.

The amount of nitrous acid steadily increases with the amount of bleaching gas used. Lapse of time gradually reduces the amount of nitrous acid recoverable. It goes into some other form.

So that by bleaching, the mineral acidity of the flour is increased, the constitution of the fat is altered and its flavor deteriorated. The gluten is altered in its physical character and diminished in quantity, all of which injures the flour in its bread-making qualities as compared with unbleached flour. Comparing bleaching with natural aging, the former improves the color only. Natural aging on the other hand, improves the color, flavor, and gluten. Besides this, bleaching introduces nitrous acid, which injures by deterioration the physical character of the flour.

In a series of tasting and smelling tests of the same flour, bleached and unbleached, baked into bread, I was able in every instance to distinguish the unbleached by its better aroma and flavor. In a 50-pound sack of flour there would be, on the assumption that that flour contained 1.8 parts per million,

nine hundred-thousandths of a pound of nitrous acid calculated as nitrogen. On the same assumption, there would be in a 50-pound sack of flour 3 grains of nitrous acid calculated as nitrite of sodium.

From extensive experiments, it is my opinion that only about one-fifth of the NO_2 used goes into the form of recoverable nitrites. On that basis, there was employed to bleach the sack of seized flour examined by me, 350 cubic centimeters, or about one-third of a quart of pure nitrogen peroxide. Nitrogen peroxide is the same, however produced.

A great number of experiments lead me to the conclusion that when bread is baked, the amount of nitrous nitrogen found therein is generally decreased from two-thirds to one-half; in other words, the amount of nitrous nitrogen found in the baked product is from a third to a half of the amount found in the flour itself. When the flour contained nitrites, I invariably found nitrites in the bread. The presence of nitrites is disclosed by testing with the Griess solution. This is a well-known method for determining quantitatively the amount of nitrous nitrogen in flour or other substances.

(Recalled:) In one of the sacks of the seized flour brought from Castle, Mo., there is nitrite reacting material calculated as nitrogen in the proportion of 1.6 parts per million. Miss Wessling made bread from that flour, which I have tested for nitrite reacting material, finding in a loaf baked by the domestic method 0.82 of a milligramme calculated as sodium nitrite, and in another loaf 0.92. In one of the two loaves baked by the Koellner method, I found 1.16 milligrammes, and in the other 1.43 milligrammes. In biscuits made by Miss Wessling from the same flour, I found 2.57 milligrammes calculated as sodium nitrite.

ANDREW S. MITCHELL, a witness for libellant, testified:

I am a chemist and pharmacist by training, and a chemist by profession; I am now chief of the St. Paul Laboratory of the Bureau of Chemistry in the U. S. Department of Agriculture. This position I have held for about two years. Before that, for nearly eight years, I was State chemist of the Dairy and Food Commission of Wisconsin, and chemist of the State Board of Health. Previous to that I taught in the Milwaukee High School, and for about five years was professor of chemistry and toxicology in the Milwaukee Medical College and School of Dentistry.

On April 13, 1910, I received the sack of the seized flour sent by Walsh. An analysis by a method different from that employed by Doctor Winton made on the day of receipt showed 2.3 parts of nitrogen as nitrites per million, or, computed as NO_2, 7.5 parts per million. By Doctor Winton's method I got 1.6. My analysis showed an ash content of 0.53 per cent.

I have made many examinations and tests of bleached flour. Treatment by the Alsop process adds to and mixes with the flour nitrogen peroxide gas in various forms, and it also injures the flour in its quality and strength by altering the physical and chemical properties of the flour in various way—introducing mineral acidity, injuriously affecting the gluten in strength, toughness, and elasticity, and changing its normal color, destroying the golden yellow color of the fat, rendering it more solid in consistency, and entirely changing its taste and smell.

The aging and conditioning of flour under proper conditions improves it, developing that quality in the gluten known as strength, developing its flavor, and improving the whole flour, and incidentally lightening its color. Bleaching does not produce these results, but causes only an instantaneous lightening of color, due to the immediate action of the gas.

The amount of nitrite reacting material recoverable from the flour is very much less than the amount of NO_2 employed in treating it. Inside the first two

weeks, under usual conditions, I can recover approximately 20 per cent. This, expressed as nitrogen, would be less than one-third of the amount expressed as NO_2. The amount of NO_2 added to the sack of flour I received, taking into consideration the time of my analysis after bleaching, and the amount recovered, I should compute as 30 c. c. per kilo of flour. In other words, a pint and a third of undiluted NO_2 was applied to the flour. In the terms of Exhibit 6, where the gas is in the proportion of 1 to 4, this would amount to nearly a gallon. Computed in terms of sodium nitrite, assuming that the NO_2 all combined with bases, 4 grains roughly had been added to this sack.

It is true that with lapse of time the amount of recoverable nitrites diminishes. Depending considerably on conditions, the amount recoverable will be about a third less after the flour has stood for a month. There is no difference in the effect on flour of NO_2 mixed with air, whether the NO_2 is produced by the flaming arc or by chemicals in the laboratory.

Baking by the Koellner method reduces the nitrites in the bread to from 35 to 40 per cent of those present in the flour. By what is known as the domestic method about 20 per cent remains. A large amount of yeast and a long period of fermentation further reduce the amount of recoverable nitrites.

Not having examined smoked ham, bacon, vegetables, nor corn starch, I am not prepared to say how their nitrite content, if any, compares with that of bleached flour. Bread baked from unbleached flour in an oven where the products of combustion may reach it, coal or gas being used as fuel, may acquire a trace of nitrites. The burning of gas in a kitchen may impart some nitrites to the air, and a trace may go into the flour. The quantity of nitrites in the air is very infinitesimal. Bleached flour will impart nitrites to the air, not absorb them from it. The Griess test is so delicate that it will disclose nitrites in the proportion of one to a billion—one in a thousand million.

DR. WALTER KEMPSTER, a witness for libellant, testified:

I am 69 years of age, a practicing physician of Milwaukee, Wis., a graduate of Long Island College, Brooklyn, N. Y. I first did professional work in the army during the civil war. Afterwards I became interested in the subject of nervous disorders, and have since made that a specialty. I served as an assistant physician in a New York hospital for the insane for eight years; afterwards, as superintendent of the Northern Hospital in Wisconsin for thirteen years. I have investigated for the United States Government economic conditions concerning the immigrants coming from foreign countries into the United States. I have investigated the subject of transmission of cholera and other dangerous infectious diseases from the several countries of the Old World into the United States. In my work I have given attention to the matter of foods and diet, and their effect upon the health and well being of the people.

I am familiar with the substance known as nitrogen peroxide, and with the effects of its ingestion with food or otherwise into the human system. It impairs digestion, not only in the stomach, but throughout the entire intestinal tract. It induces constipation and obstipation, and interferes with the process of absorption of foods. Finding its way into the blood, it attacks the corpuscles, so that they become rusty and can no longer carry oxygen from the lungs to the tissues of the body, and perform the natural functions upon which life depends. The destruction of these blood corpuscles produces anemia, or if intensified chlorosis, and, if the obstruction be complete, death must result. Nitrogen peroxide also weakens the action of the heart, and the tissues do not receive the quantity of oxygen necessary to maintain them in normal condition.

A person in normal condition would resist the action of nitrogen peroxide much longer than one who is delicate or suffering from some form of disease;

but, in the end, a normal person must also succumb. I consider the continuous eating of small quantities of this substance more harmful to the human system than to take a large dose at one time or to continue large doses for a short time, because the condition produced by the ingestion of the material acting continuously on the blood, or on the cells in the blood, reduces them in number and in their capacity for doing work. The effect of small doses long continued is illustrated among those people who eat for a considerable length of time rye bread in which the rye has been "smutted," as it has been called. After a time, they have a form of disease known as chronic ergotism, which almost always results in death. This disease is quite common in certain parts of Russia. In certain parts of Italy a very fatal form of disease known as pellagra results from the continuous eating of meal made from a low grade of corn.

A medicine containing a form of nitrites, referred to as nitrite of amyl, was formerly administered by inhaling in doses of about five drops, but, since the discovery of its deleterious effects, has been largely discontinued. It was administered to check or interrupt spasmodic forms of disease, such as epilepsy. But when it was noted that the general health of patients became impaired, an investigation disclosed that the nitrite of amyl was responsible, and thereafter only in rare instances was this treatment used.

The nitrites which are found in the air exist in very minute quantities—too minute to exert an influence. Nitrites sometimes exist in well water, but when such is the case it is not fit to drink. They are also found in vegetables when decomposition commences, and as decomposition increases a greater quantity of nitrites are evolved. They are sometimes present also in smoked meats, ham, bacon, etc. My investigation of bleached flour has led me to conclude very decidedly that it is improper for use. I consider nitrites injurious to the human system, whether they be introduced into it from the human saliva, air, water, bacon, ham, bleached flour, or other foods, and believe the effect just as bad in one form as another, depending on the quantity taken.

HAMILTON POPE JONES, a witness for libellant, testified:

I am a graduate of the medical department of Tulane University, New Orleans, La., and a physician with a general practice. In 1897 I had charge of the Yellow Fever Hospital in New Orleans. In 1898 I took part in the active campaign in Cuba, and after the necessity for surgical work stopped I had charge of a yellow fever hospital there. In 1905 again I had charge of the Yellow Fever Hospital in New Orleans. I was for a number of years assistant to the professor of chemistry, medical jurisprudence, and toxicology at Tulane University, and from 1904 to 1907 I was administrator of chemistry in the Medical Department of Tulane University. Since that time I have changed my branch of teaching to that of clinical medicine and diagnosis in the wards of the Charity Hospital at New Orleans. For about a year and a half I was chemist in the State Hospital, and for the past eight or nine months I have been food commissioner of the State of Louisiana. As state analyst I had to examine a great variety of foods, and inasmuch as the water supply of the State of Louisiana had never been studied thoroughly, I undertook to make a comprehensive examination of the water supplies of the various cities and towns throughout the State. My attention was particularly drawn to contamination of waters coming about as the result of the death and decomposition of low forms of vegetable life.

I am familiar with the substance known as nitrogen peroxide and with the nitrites resulting from combination of that gas—nitrous acid—with organic and inorganic matter. I have made particular study and investigation to ascertain whether or not nitrites are to be found in vegetable and animal bodies

as a normal constituent. In making these examinations I procured from the city market some thirty varieties of staple vegetables, including roots, turnips, potatoes, sweet potatoes, lettuce, celery, cabbage, beets, radishes, pumpkins, etc., and bananas and apples. I examined the exteriors and interiors of these vegetables for nitrites, and the results of my investigations show that frequently when vegetables are grown in soil that contains decomposing organic matter, like fertilizers together with nitrifying bacteria, the surface of the root or plant may have nitrites on it. But I found that no vegetable in its interior structure contains nitrites unless it be in a state of decomposition. The coloring matter of certain vegetables, such as the pink portion of spinach, the root of the radish and of the beet, is dissolved by acetic acid of the same strength as that which is used in the ordinary Griess-Ilosvay test for nitrites. Consequently, in these cases, the test is of no value, and some other test has to be used.

I have examined many fresh meats, such as beef and mutton, and also fish, but have never found nitrites in them in any quantity. I do find nitrites in smoked ham.

I have examined the saliva of some eighty individuals, healthy and diseased, males and females, old and young, children at the breast, and at various degrees of age, strength, and decrepitude, and in every instance I have found nitrites present in the saliva. In one exceptional case I found the saliva as much as 11 parts of nitrites to the million. The highest average in other cases was about one-fourth of a part per million. Many examinations showed not as much as this, but the merest trace. In order to determine whether they were a secretion of the salivary gland, the parotid gland, the sublingual gland, or whether they were formed of decomposing food in the mouth, I took a fine catheter and withdrew the pure saliva from the parotid of seven individuals, and in no case did I find nitrites present in the pure salivary juice. In the second series of experiments I secured sublingual secretions from the sublingual glands of three individuals, and in none of these instances did I find nitrite reacting material present. Fearing that the question might be raised as to whether a mixture of parotid gland secretion and the sublingual gland secretion might not produce nitrite reaction, I secured a parotid gland secretion from three separate individuals and mixed it with the pure sublingual secretion from the same individuals, and in no instance from the mixed parotid and sublingual secretions did I get a nitrite reaction, which I believe proves conclusively that nitrites do not come from the glands which secrete what is ordinarily known as saliva. I attribute the presence of nitrites or nitrite reacting material in the mouths of all individuals, whether they be infants without teeth or older persons, to the decomposition of foods left in the mouth, and the extent of nitrite action in any individual will depend upon the degree of care with which the mouth is looked after.

As a rule, nitrites which are found in drinking water or surface well waters, and all waters, except rain water, are the result of decomposition of organic material, and indicate that the water is being actively polluted. In deep well waters, nitrites may come from several sources. Certain substances, iron salts for instance, will reduce nitrates to nitrites. Then again, organic matter may have filtered through the earth, and later, coming in contact with the air, caused the nitrite reaction. If the source of waters is not known, they are condemned, because the presence of nitrites is an indication of decomposition, and this is true if they are present only to the extent of one one-thousandth of a part in a million.

Nitrogen peroxide gas is poisonous, as are nitrites such as are found in waters and other sources of supply. Nitrites may be produced by the electric

spark or flaming arc, by the decomposition of organic matter, and by certain bacteria that reduce nitrates to nitrites.

Nitrites are sometimes given for medicine—the usual form administered being sodium nitrite—the effect of which, taken into the stomach, is to reduce blood pressure, and if the doses are kept up for any length of time, the stomach becomes irritated, and the patient's digestion is disturbed. They are usually given to break a very serious condition of disease, in which we feel that the harm possible to be done by the nitrites is less than that of not controlling the particular condition of disease that demands their use. The disturbance to digestion takes the form of loss of appetite, nausea, and vomiting. I have never used more than a dose of a grain at a time, and it is usual not to continue the use of nitrite of sodium for more than eight days or two weeks.

Nitrites unite with the coloring matter in the red blood cells, forming with it a definite compound which prohibits the cell from doing its duty in carrying oxygen from one part of the body to the other, the cell lacking the necessary hemoglobin. This action is in obedience to chemical laws, and is as certain to follow when nitrogen peroxide is introduced into the blood as is the law of gravity. The effect is proportionate to the amount ingested.

I have examined bleached flour containing nitrite reacting material, and believe that bread made therefrom will contain nitrites in smaller quantities, but in proportion to the amount in the flour. Nitrites or nitrogen peroxide is a definite substance with definite power of combining with certain elements of the blood. The effect upon the health will be proportionate to the amount taken, no matter what the source of the nitrites may be.

I have made experiments upon rabbits and dogs by the direct injection of varying amounts of nitrites into the circulation, and the smallest amount that I used which gave me a positive lowering of the blood pressure was in the proportion of about one part to two million eight hundred thousand (1 to 2,800,000) parts of the body weight of the dog experimented upon. I also experimented with a man 28 years of age and weighing 128 pounds, and found that a half grain of sodium nitrite caused a fall in his blood pressure of 12 millimeters, the relation of weight of medicine and weight of man being as one is to one million six hundred eighty thousand (1 to 1,680,000)—the fall in blood pressure being equivalent to about 10 per cent of his total heart power.

GUSTAV MANN, a witness for libellant, testified:

I reside at New Orleans, La., am 46 years of age, and at present professor of physiology in the Medical Department, and head of the Biological Department of the Academic Section of Tulane University. I received the degrees of doctor of medicine and master of surgery from Edinburgh University, Scotland, and bachelor of science from Oxford University, England. I have published two books, the first dealing with physiological histology, published in 1902, the second dealing with the chemistry of the body, published in 1906. In addition, I have written and published about thirty papers, among which was one dealing with plant physiology, for which I was awarded the Dobie Smith gold medal. I have written another paper dealing with the chemical change which the nervous system undergoes during the time we are awake and working. I was awarded the gold medal of Edinburgh University for my M. D. thesis. I am at present working on processes of digestion, paying particular attention to those products which are absolutely necessary for the maintenance of life. I have made a study of the composition of bread from wheat flour and the nutritive value of its principal constituents.

Leaving out of consideration the amount of water in flour, its remaining constituents may be very roughly divided into 1 per cent of fat, 90 per cent

of starch, and 10 per cent of gluten. Of these, the life-giving substance is the gluten—the protein substance. Starches and fat simply produce heat in the body, and would not keep one alive. The protein is essential to life. The crude gluten of the flour may be divided into two portions, one of which is soluble in alcohol, and the other not. The alcohol soluble part contains a constituent called lysin; the nonalcohol soluble, a constituent called tryptophane. The lysin and tryptophane are absolutely essential to life.

I am familiar with the action of NO_2 on flour. It seems to have greater affinity for the fat than it has for the other substances. Although I have not studied this action in detail, I am of the opinion that the chemical nature of the fat is altered. When the 1 per cent is satisfied, the nitrous acid acts on the starch and the gluten. The effect on the starch is very slight only a little being changed to sugar. As to the protein, the change in it can be divided into several stages. The initial change is that of rendering the gluten short, so that it will not pull out into as long strings as normal gluten does. Secondly, there is a difference in its smell. In addition to these physical changes, there is a distinct chemical change. If the starch is washed out, it may be shown that there is an increase in the organic acidity of the gluten in addition to the increase in the mineral acidity of the flour. The demonstration that this is true is difficult, but I have made it. A further point, and perhaps the most interesting, is the difference in digestibility of bleached and unbleached flour.

My experiments show that the 90 parts of the flour composing the starch are practically not acted upon at all. If, therefore, with 100 parts in all, 90 are not acted upon, the quantity of gas, whatever it is, will have its action intensified ten times on the 10 parts which are acted on. The gluten is so affected.

As soon as the gas introduced into the flour meets the moisture or water contained in it, nitrous and nitric acids are formed in equal amounts. Nitric acid is a very strong corrosive, and in fact one of the strongest that can be dealt with. If ordinary nitric acid be poured upon bread, you will get what is called the xantho proteic reaction—simply a yellow protein reaction. What are formed in this instance are diazo compounds. These are exceedingly poisonous. The chemical action under treatment by the Alsop process is the same, differing only in degree. Once the xantho proteic reaction is obtained, digestion is impossible.

A number of gastric digestion tests made on the gluten of bleached and unbleached flours, both flours being treated in exactly the same way in the course of the experiments, have led me to the conclusion that the amount of digestion is much greater in the unbleached than in the bleached. In some experiments, where one part per million of NO_2 was used in bleaching, the bleached digested to the unbleached in the ration of 100 to 87. Where 2.5 parts were used, the ratio was 76 to 53. At five parts per million, the ratio was as 75 to 40. The preceding experiments were made immediately after bleaching. After these same flours had stood for some weeks, I made some further tests. After four weeks, I found that the bleached flour, which in the first instance had taken a certain length of time to digest, then required more time. After seven weeks, it took still longer. This shows that as time went on, it became more indigestible. In pancreatic digestion also bleached flour takes longer. In some experiments, the difference in the rate between bleached and unbleached was in the ratio of 6 to 4.

I have experimented on the plant drosera with bleached and unbleached flours. This plant catches insects and digests them by means of juices comparable to those of the stomach. In considering the question of digestion, there is no difference between plant and animal cells. The miscroscopic

changes in the cells of this plant, indicative of digestion, which will be produced by unbleached flour in twenty hours, take on the average in the case of bleached flour treated to the extent of 2.5 parts per million, thirty hours. With the application of more NO_2 the time increases.

In my opinion, as the result of Alsop treatment, the flour or any article made from it is distinctly diminished in nutritive value and in digestibility. An extra amount of work put upon the body in digestion is, of course, an injury to the food. The extent of the injury to the flour cannot be determined by the amount of nitrite reacting material recoverable after bleaching, because the length of time that the NO_2 has been in contact with the gluten determines the amount of injury. Inasmuch as the NO_2 remains in contact after bleaching, the injury to-day is not so great as it will be to-morrow.

NO_2 is NO_2 the world over. Assuming that treatment by the Alsop process and by nitrogen peroxide in a bottle in the laboratory add like amounts of nitrite reacting material, there is no difference between them. NO_2 is a definite chemical substance. So also is a nitrite a definite chemical substance, and its effect on the system is the same however introduced, whether from the saliva, ham, decaying vegetables, etc.

The effect of nitrite reacting material formed in bleached flour upon people of different ages, capacity, and strength is a difficult question to answer. Take two persons, one in good health, the other in poor health. It is quite possible that the person not in good health will have a gastric secretion lessened in amount and the pepsin not being as vigorous as in a healthy individual. Now, inasmuch as there is a deleterious action of the nitrous acid on the enzymes, I should expect that a person who is not in good health would suffer more than a person in good health. If a child could eat the same amount of bread as an adult, nitrites being present, such a child would suffer more than an adult. Now everyone has some nitrites in his mouth—a certain amount is swallowed every day—and gradually the body becomes accustomed to deal with the amount normally present; that is to say, the body becomes compensated for that amount. This means that we are spending energy to undo the effect of the nitrites present. Inasmuch, therefore, as we have to compensate already, I say let us not add more to any food whatsoever, because of their distinct injury to health.

Since court adjourned last night, I have compared the peptic digestibility of the seized flour with unbleached flour of the same kind and quality sent to replace it. There is a difference between them of 50 per cent in favor of the unbleached.

SAMUEL T. BALLARD, a witness for libellant, testified:

I am of the firm of Ballard & Ballard, doing a milling business at Louisville, Ky. I have been in this business since 1880. Our daily output is 2,500 barrels, but we sometimes run as high as 3,500 or 3,600. I have visited a great many mills throughout the country, and am familiar with the principles of milling flour and with bleaching after the milling process has been completed. Our firm was one of the first to install the Alsop process, and is a stockholder in the Alsop Company. Besides the Alsop process, I have seen the Williams process, and Doctor Wesener's nitrosyl chloride process in operation, and also a process that Nordyke & Marmon were experimenting with at a mill in Nashville.

We used Alsop bleachers in our mills for four years previous to about March 1, 1909. The machines were the old style as made by the Alsop Company. They consisted primarily of a cylinder about 2 feet long and about 4 inches in diameter, two cylinders in a machine. In the cylinder was a moving rod through which electricity passed. Air was pumped through these cylinders, and

as the rods were pulled apart by mechanism, the electricity was turned on. As they separated, a powerful electric flame was generated, and in some way changed the quality of the air—making it whatever it is—we always speak of it as "gas." We had four machines, so adjusted as to run one or all as required. Our practice was to run three machines, having the fourth on hand in case of emergency. In this way, we were able to maintain a uniform quality of gas. As high as ten Alsop agitators were in our mill at one time. Near the agitators along the line of the conveyer and in the packing room, you could always smell the pungent odor of the gas.

We made frequent experiments in order to find out how much bleaching the flour would stand, and what effect more would have. I noticed that in the agitators, spouts, and conveyers, or wherever the flour would lie for some time, it would become yellow, and more and more yellow until it assumed the color of a dark red orange. This took two or three months. Every other week in our mill any flour which had collected in the spouts, etc., was cleaned out. After about two years' use, I noticed that the galvanized iron pipes, some 2 and some 4 inches in diameter, for conducting the gas, were eaten up and rotted out. In the joints and elbows of these pipes was much sediment of a reddish brown color which looked like iron filings.

When we stopped bleaching we were making an 85 per cent high grade flour, and a 15 per cent low grade. We are now making 55 per cent patent. The balance is 35 per cent clear and 10 per cent low grade. The patent is whiter and clearer than the clear, and the clear whiter than the low grade. We can bleach our clear in the ordinary commercial way, and it will be whiter than our patent. I don't think our low grade can be bleached as white as the other grades. Patent bleached lightly and clear heavily can be made practically the same in color. We can bleach our clear in the ordinary commercial way, and it will be whiter than our patent. The bleaching seems to continue after the color is first taken out, and after awhile the flour becomes a lavender or purplish hue—a sickly hue. Bleached flour does not become musty as unbleached does if stored in a place which is not very dry. Mold comes on bread from unbleached flour sooner than on that from bleached flour. So far as I can see, bleaching in the laboratory and by the Alsop process has the same effect. As between unbleached flour which is aged and freshly bleached flour, the former has a lighter, creamier, yellower color than the latter. Natural aging also improves the quality of the flour. Bleached flour deteriorates from the day it is made and bleached.

Wheat from the vicinity of Kentucky is lighter in color than that grown in Kansas, Nebraska, Missouri, and Iowa.

I consider that bleaching is no part of the milling process. The milling process consists in making pure flour and separating all impurities from it; that is what I consider the art of milling; and after the flour is made I do not consider that then treating it with chemicals is part of the milling art.

WILLIAM WOLF, a witness for libellant, testified:

I am one of the owners of a bakery at Baton Rouge, La., turning out about 3,500 loaves a day. Our business is confined almost exclusively to making bread. I have used bleached and unbleached flours—having purchased both kinds from the New Prague mill, New Prague, Minn. While the sponge of the bleached flour worked fair, after doughing everything seemed apparently dead—it appeared lifeless—came very slow—we gave it more time. The unbleached held up better and there was more elasticity to the dough. I do not know whether or not these flours were freshly milled, nor as to their grades. Different flours have different gluten strengths, and flours may vary from year to

year. The difference I found in the flours I used was, however, greater than I usually found.

ARCHIE C. COMSTOCK, a witness for libellant, testified:

I am head miller and mill manager of the Ellsworth Mill, Ellsworth, Kans. The capacity of this mill is about 400 barrels per day. The wheat used is raised in the vicinity of Ellsworth, and I am acquainted with the wheats of that section of Kansas, including those known as Turkey red and yellow berry, although little of the latter is grown there. Where the yellow berry grows, it comes from the same seed as the Turkey red.

We commenced bleaching about two years ago, using the Williams process, but have recently stopped. This process consists of the use of nitric acid in a cell with two electrodes projecting through, and the acid fumes created are blown into agitators or conveyers and there mixed with the flour. The effect of this treatment was to whiten the flour, although the color procured was a dead flat white without the bloom which unbleached flours show. The amount of whitening was regulated by the amount of gas employed, either by concentration of the mixture or by lengthening the time of exposure in the agitator. There is a limit, however, and if permitted to remain beyond that limit the flour turns yellow again. Extremely hard bleaching or exposure for several days turns it sulphur color. Three-ply rubber hose used in conducting gas from the cell to the conveyers was found, after five months' use, to have rotted, so that it could be broken with the hands. Flour collecting in angles and corners and remaining exposed for a long time turned this sulphur color. The odor of the gas could be detected in the packing room.

We made patent, straight, clear, and low-grade flour. All grades, except the low grade, were bleached, which would make the bleaching cover from 95 per cent to 97 per cent of the flour yield. Before bleaching, the grades and order of whiteness were patent, straight, and clear. Straight bleached could be made as white as the patent unbleached; the clear could not, but bleaching could make the clear similar in color to the straight. Before bleaching, we made a patent running from 75 per cent to 80 per cent. After bleaching, it ran about 85 per cent.

Flour made from wheat which has not gone through the sweat is decidedly darker in color than that which has. Bleaching the former renders it very similar in color to the latter. Fresh flour is darker than aged. Bleaching renders it very similar to the aged.

Bread made from unbleached flour has a rich nutty flavor, which is destroyed by the bleaching. The dough from the bleached is weaker than that from the unbleached.

Assuming that the wheat used to make the flour which was seized was No. 2 Turkey red wheat, which had mixed with it from 10 per cent to 30 per cent of yellow berry, in my opinion, such flour would not be considered the product of first quality hard wheat. Assuming further that a barrel of flour is yielded out of every 4 bushels and 30 pounds of wheat, and that 90 per cent of such flour was put in these sacks, I am of opinion that such is not a fancy patent flour. I consider patent flour that which is made from purified middlings, and I have never seen any wheat equipment that would produce middlings enough to make a 90 per cent patent flour.

HARRY GIFFORD, a witness for libellant, testified:

I am head miller of the Aberdeen Mill Company of Aberdeen, S. Dak. The mill bleached flour for about five years previous to January, 1909, but stopped bleaching at that time. The Williams process was the one in use. Previous to installing the Williams bleacher, I visited a number of mills for the purpose of examining the Alsop process, and in this way studied its work. In our bleach-

ing apparatus the strength of gas was regulated by a rheostat. If we wanted a stronger gas, we turned on more electricity. The flow of air into the gas was controlled by a fan and valve. The more air permitted to mix with the fumes, the weaker became the solution, and in consequence the bleaching would not be so strong. We made patent, clear, second clear, and red dog, and sold all four for human consumption. The relative whiteness is in the order named, except for red dog, which can not be called white. We maintained the same percentage for patent as formerly, but after starting to bleach the percentage formerly used in first clear was extended to take in parts of the wheat which had before gone into the second clear. The clear bleached looked better than the patent unbleached. It took about the same amount of bleaching reagent to bleach a clear as it did a patent. The color of flour made from wheat that has not been sweated or conditioned is not so good as that of flour made from the same wheat that has been through the sweat and conditioned, nor is its quality so good. Aged and conditioned flour is superior in color and bread-making qualities to that made from wheat not conditioned and aged. But after bleaching, the difference between a conditioned and an unconditioned flour is not apparent to the eye. I know Mr. Tucker and heard his testimony, and, assuming that he testified correctly as to the manufacture of the flour seized, I should not consider it a fancy patent flour.

I have a baking plant and laboratory at the mill and have made baking tests of the same flour, bleached and unbleached. I have found that the unbleached flour maintains its creamy white color from the dust to the bread, but that the bleached flour loses a per cent of its creamy color and makes whiter bread than the unbleached. Before going into bread, the dough of an unbleached flour is very elastic, what we call when we dough, "it comes back good and strong." In the bleached there seems to be a lack of taste. I never was able to see any particular difference in the texture of the bread. Bleaching makes the flour look better, but does not improve it in any other manner.

The odor around my mill was just like that in the Alsop mills. Flour exposed for considerable time in angles and corners turned an orange color—a real yellow. A loaf of bread on my table once had a yellow streak in it about the size of a lead pencil. I then experimented by putting some of this overbleached flour in the dough, and baking it. It came out in a streak as the first had done.

The wheat we use comes from North and South Dakota—it is a hard spring wheat, and makes a white creamy flour.

MERTON F. DENNISON, a witness for libellant, testified:

I reside at Red Wing, Minn. I have been a practical miller for thirty years and superintendent of the La Grange Mill, Red Wing, for nine years. The capacity of this mill is 1,200 barrels daily. We bleached by the Alsop process for one year. The machine was controlled in two ways, by regulating the volume of air, and the amount of electricity. Increasing the volume of air decreases the amount of bleaching. Increasing the amount of electricity increases it.

The odor of the gas was perceptible in almost any part of the mill. The gas attacks metal; it rusted very badly the iron flights of the Mitchell agitator and the pipes conducting the gas from the tank to the agitator.

Patent flour, properly speaking, should be middlings flour. Of course, we gained a little on it by improving the milling, and ran into the patent some second break flour. Besides first patent, we make a straight, a standard clear, and second clear, as well as red dog. The patent is 80 per cent, the straight, consisting of the patent and first clear together, about 94 per cent. The other 6 per cent, after the straight is taken out, would be second clear. We bleached the patent and started to bleach the clear, but found it did not pay.

Flour improves with aging and conditioning after milling—gets whiter and works better. When fresh it is darker in color and works sticky when made into dough. I don't think aging will give the whiteness you can obtain with bleaching. The bleached doughed up very much whiter—the gluten was a gray white, whereas in the unbleached it was a creamy yellow. I sometimes thought the bleached did not dough up quite so dry nor work so strong as the unbleached, but, of course, that is pretty hard to tell. The gluten of the unbleached certainly is a little stronger—stretches out a little thinner. I did not have a scientific method of making the comparisons.

The Alsop machinery in my mill is now used to drive out the Mediterranean moth—a great pest. Modified air in the same strength as used in bleaching accomplishes this.

In my opinion, there are no milling methods known that will take 90 per cent out of the flour, as described by Tucker, to the extent of what may properly be called purified middlings. The flour he described is not first-class patent—I should call it an ordinary straight.

We mill hard spring wheat. Different wheats vary in strength, but in making my comparisons of gluten, etc., I used the same kind of wheat. A housewife in judging color of flour will not make a side by side comparison.

(Recalled:) In the agitators between the beaters and the outside jacket is a space of about 18 inches, and the flour would accumulate on the sides, stick there and in time turn sulphur colored. The same sort of accumulations gathered near the spout from which the flour ran out of the agitator. Twice we cleaned out perhaps half a bushel of the stuff, and then adopted the scheme of putting brushes inside the agitator to sweep it clean. The smell of this sulphur flour was peculiar—much like that of soldering in a tinsmith's shop.

WILLIAM GRAHAM, a witness for libellant, testified:

I have been a miller for thirty years, and am one of the proprietors and in charge of the operation of the Groton Milling Company at Groton, S. Dak. We bleached for a couple of years and stopped recently. Our apparatus was the Naylor & Girard, consisting of an agitator, with a fan at one end, and a jug on top containing acid. A galvanized No. 4 wire was fed into the acid in the jug, and yellow fumes arose, which were blown into the flour. In twenty-four hours about 12 feet of wire was consumed. The degree of bleaching can be controlled by the amount of wire fed into the acid. On the pipe that carries the fumes little dark yellow scales of iron gathered.

The unbleached flour has a yellow tint, the bleached a dull or ashy white. I get a little better volume of loaf from unbleached flour, it contains a little more water, in taste it is more palatable, and its flavor is like that of nice, clean, sound wheat, the gluten is more elastic and will stretch out better over the end of your finger.

I made some experiments, storing away four sacks of the same flour, two of them bleached and two unbleached, for the space of five months and eighteen days. A sack of bleached and a sack of unbleached were kept in a light, airy place. Baking tests by the Koellner method on these two sacks, using the same amounts of flour, water, etc., gave the following results. Bleached: 515 grams bread; time to raise, 55 minutes; temperature of oven, 360°; cubic inches of bread, 88; number of inches of seed, 9⅝ (flax seed is used by the millers in their baking tests to determine the volume of the loaf, loaf and seed being put into the same box); color, a dull white; flavor, not so palatable; texture, good. Unbleached: 522 grams bread; time to raise, ditto; temperature of oven, ditto; cubic inches of bread, 93; number of inches of seed, 9; coloring, creamy white; flavor, good; texture, good. Now, the other two sacks, one bleached, the other

unbleached, were kept in an air-tight box, and then baking tests made. The results for the bleached were: Grams of bread, 519; time to raise, 50 minutes; temperature of oven, 360°; cubic inches of bread, 88; number inches of seed, 9§; color of bread, dull white; flavor, not so palatable. Unbleached: 522 grams bread; time to raise, ditto; temperature of oven, ditto; cubic inches bread, 88; number inches of seed, 9§; flavor, good; texture, good.

Flour from new wheat is darker in color than flour from old wheat. The former bleached is lighter than the latter. Aging improves fresh flour also in color, dough, gluten, and capacity to hold water. The extent of bleaching determines the amount of whitening.

I consider a first patent flour made from good, clear, sharp, purified middlings. A 90 per cent patent can not be made from our spring wheat. I do not know anything about Nebraska wheat.

DELBERT R. ATHEY, a witness for libellant, testified:

I reside at Des Moines, Iowa. I have been a millwright and miller since 1889. I have installed six new plants for treating flour by the Alsop process and have reset two old ones. I have seen thirteen or fourteen different ones in operation. Odors of the fumes are always observable around mills where the process is used, and these odors are just like the NO_2 in the bottle (Exhibit 6). The gas corrodes the tanks and pipes. I have noticed that in two different mills. A tank at Loomis, Nebr., was very badly corroded along the seams up and down its sides, and the seams on the top and bottom were eaten through in places. A quart or so of rust scales of a yellowish color and powdered substances that resembled wood ashes came out of one 2-inch galvanized iron pipe 10 feet in length in that same mill. Saffron-colored flour, which smelled like the gas, I have seen collected in the angles and corners of the apparatus. These accumulations were particularly marked in the spout.

CHARES J. WOLAVER, a witness for libellant, testified:

I am a flour broker residing at Muskogee, Okla., with experience as manager of a mill and a machinist by trade. For three years I was manager of the Purcell Mill and Elevator Company in Purcell, Okla., capacity about 600 barrels, which used the Williams process. Assuming that Turkey hard wheat is mixed with from 10 per cent to 30 per cent of yellow berry, in my opinion it is not first quality hard wheat, and is not so considered in the trade. Patent flour is made from purified middlings. I do not think a 90 per cent patent can be made from wheat consisting of Turkey hard, in which there is from 10 per cent to 30 per cent of yellow berry.

Before bleaching, the Purcell Mill and Elevator Company made out of Oklahoma soft wheat a 60 per cent to 65 per cent patent. When we started bleaching, the patent was increased up to 85 per cent or 90 per cent, although exactly the same kind of wheat was used and the same milling method employed. This percentage was continued during the whole time we bleached. This long patent was made as white by bleaching as the short patent had previously been. Bleaching, in my opinion, did not improve the quality of the flour, but, on the contrary, injured it to some extent. After bleaching, flour no longer improves, in my opinion. Color was the index by which we sold our flour before bleaching, and after lengthening the patent we were able to sell to the same trade. Bleaching made the second flour look like that formerly sold. Also the clear or bakers' grade, naturally darker than the patents, could be bleached as white as they were. In bleaching our flours we had a standard and bleached to that standard. Before bleaching, when we were making 65 per cent, we were able to hold our trade, but we could not then have made a higher percentage and held our trade. I know of no government or state tests for patent flour. At one time an associa-

tion of Kansas millers in the Turkey hard wheat territory established a grade of 65 per cent patent.

On one occasion, after we had been using the bleacher for about two months, we had some flour returned to us because it contained some very yellow flour and also some green specks. I went out and investigated. On taking the top off the conveyer, we found that the flour had deposited in parts of it and turned yellow. Also a brass coupling used to connect the rubber hose with the conveyer had on it a sort of green substance that lodged in the conveyer and would break off in chunks and go into the flour. After that we had to clean out the conveyer about once a week.

FRED H. KRITE, a witness for libellant, testified:

I am 72 years of age, and have been in the milling business for the last forty years. I am secretary of the Hezel Milling Company, East St. Louis, Ill., and in charge of its mill, which has a daily capacity of 500 barrels. We started bleaching in 1904 and continued until February 15, 1909.

An ordinary iron steam pipe about 8 feet long, used for about one year to carry the gas into the agitator, is here in court, and shows the effects of corrosion. Pipes in place for a year previous to the installation of this pipe had corroded so badly that they had to be thrown into the scrap heap. A cast-iron valve between the tank and the agitator in use for four and one-half years has screwed into one end a piece of wrought-iron pipe about 2 inches long. This piece had to be renewed regularly in from four to six months. Only two or three of the threads which formerly extended half an inch into the valve are left. There is a hole in the cast-iron part of the valve, and only one of the threads is left. Mr. Wharton, a government inspector, took some of the rust which had accumulated in these pipes.

Some one told me it was healthy to inhale the gas, so for nearly three weeks I inhaled one swallow every morning. Then my stomach got out of condition, and I stopped it, for fear of having to quit eating.

Before bleaching, our best patent was known as "U. S. Patent"—a 55 per cent patent. Sold under the same brand after bleaching, it was 75 per cent to 85 per cent. The remainder of the flour, 25 per cent or so, we called extra fancy. This extra fancy bleached would very nearly approach the color of the patent unbleached.

Aging flour drys it, and brightens its color. It is possible to regulate the color by the amount of bleaching.

I have frequently noticed that if you bake bread out of flour even moderately bleached, and break the bread while still hot, you can smell the gas. It has also a different taste—strongly bleached flour does not seem to have any taste. The unbleached is much sweeter. Frequently and regularly as part of the milling process, I doughed up our regular best patent unbleached, and found it as tough as a piece of tissue paper, and could stretch it out or widen it. That could not be done on the same flour bleached, because it would break off.

When mills started bleaching, they were very careful not to tell their neighbors a word about it. When bleaching became general, I found that I had to put 80 per cent in in order to stay in competition with other mills. After we had had the bleacher for a while, we did not bleach the patent much, but bleached the other grades and added them to the patent.

F. WESTERMAN, a witness for libellant, testified:

I reside at Chicago, Ill. For thirteen years I have been associated with F. Westerman & Co., or the Quaker Biscuit Works, a concern engaged in the manufacture of crackers and cakes. I am a practical man in this line, and understand mixing of doughs and baking. I use from 12,000 to 15,000 barrels

of flour a year. I once tested at the same time 1,200 pounds of bleached and 1,200 pounds of unbleached flour. After fermentation, I noticed that the bleached flour had a dark gray color, and a flavor inferior to that of unbleached flour, which was far superior in color, and possessed the natural flavor of the wheat. In baking bleached flour, the smell from the oven was like that from a galvanizing works. Bleached flour made into dough goes in dark and bleaches out white when baking. Unbleached goes in with a yellow cast, and bakes out white, with a yellowish cast on the cheek or top of the cracker. I am unable to tell by inspection alone bleached flour from unbleached. Nor am I able to tell by inspection alone the grades of flour. In unbleached flour the color and shade are a guide in determining whether it is a patent or clear, a long patent or a short patent. Lower grades of flour bleached look whiter than patent unbleached. For example, a straight bleached would be whiter than a patent unbleached. When I discovered that I was using bleached flour, I made that fact known to the broker and complained to the Secretary of Agriculture.

ALEXANDER TAGGART, a witness for libellant, testified:

I have been a baker for over fifty years. I reside at Indianapolis, Ind., and am treasurer of the Taggart Baking Company of that city, which uses about 150 barrels of flour daily, and produces daily a little over 35,000 loaves of bread. I have general supervision of everything we manufacture, especially of the bread and crackers.

I had experience with bleached flour about four years ago, and will not now purchase it knowingly. This happened when I examined a quantity of bread baked the previous night, and found that it was not of the usual quality; cutting it open I smelled it, and noticed that the color was nasty and slaty and that there was an absence of the flavor which should have been there. On investigation I found that the flour was purchased of Jennison & Co. of Appleton, Minn., and was bleached. On another occasion, I observed that crackers, instead of having a brittle nice rich appearance, were slaty and hard and did not dissolve easily in water. These flours were supposed to be high grade. About eighteen months ago I had another experience with bleached flour, finding the crackers flinty instead of brittle and crisp. Bread from bleached flour will have a hardly discernible odor, but good taste or flavor is lacking.

Color is the guide to quality of flour; high grades must be white. I have used soft wheat flour from Michigan, and southern and central Indiana; hard winter wheat flour from Kansas; and hard spring wheat flour from Dakota and Minnesota. Of these grades, the soft winter wheat flour is the whitest. Next comes the Kansas, and next in order the Minnesota spring. In strength Dakota and Minnesota flours rank first, Kansas next, and then the soft winters from Indiana and Michigan. Strength keeps pace with color, the whitest flours just mentioned being weakest. Bread made from bleached flour is different in color from that made from unbleached, but the difference is not so great that an ordinary purchaser would notice it. The difference in flavor was such that it could be easily detected by a baker, but it is doubtful whether an ordinary family could detect it.

VICTOR ALBRECHT, a witness for libellant, testified:

I reside at St. Louis, Mo., and have been a flour merchant for forty-three years. I am familiar with the flours on the market at St. Louis. We get them from Missouri, Illinois, Kansas, Nebraska, and some years from Oklahoma, Idaho, Washington, and Colorado. Patent flour in the commerce of this part of the country is recognized as from 65 per cent to 75 per cent of the wheat middlings; the balance of the flour content is extra fancy or low grade, the lowest of which is called red dog. Patent percentages vary with the kind of

wheat. Soft wheat from Missouri, Illinois, Tennessee, or Indiana makes a 65 per cent to 75 per cent patent; the hard wheat of Minnesota and Kansas runs from 70 per cent to 80 per cent in its patents; Nebraska wheat does not go so far as Kansas. Assuming that the flour seized in this case is 90 per cent of the flour content of Nebraska Turkey hard wheat, and that it contains from 10 per cent to 30 per cent of yellow berry, such is not a fancy patent flour.

In 1907 I bought the stock of the Eggers Milling Company's "Good Luck Patent," took some of it home, and watched my wife bake with it. The bread she made was a dead gray color, and had not a good taste.

If flours are not bleached, one does not have to be an expert to distinguish their grades by color. The grades of bleached flours can not be told by color. Unbleached fresh flour kept in a warehouse gets whiter for about four months, at which time the maximum whiteness is reached. The color of unbleached aged flour is creamy white. The color of bleached flour is dead white. Bleached flour does not improve with age as unbleached does. I have doughed up many specimens of bleached flour, and my experience is that they dough up short, and have not the strength of unbleached. When purchasing flour, I look at it and compare it with another flour. You can tell by looking and feeling and doughing up whether it is a patent and what per cent; whether it is bleached or unbleached I can tell by comparison with other flour.

Soft winter wheats are the whitest of the light grades; next comes the Kansas dark hard wheat flour; next the Minnesotas and Dakotas. The Minnesotas and Dakotas are strongest in strength of dough; next Kansas Turkey hard; and after this, Nebraska and the soft wheats. The flours lightest in color are the weakest in strength.

Different mills have different patents made from the same wheat. I do not know of any two mills that make exactly the same percentage, as so much depends on the miller and on his equipment, and on the kind of wheat he is grinding. In Kansas, Nebraska, and Minnesota, some millers call their 90 per cent flour a patent, and these flours I have bought and sold on the market only, however, as and for 90 per cent patent. I know of no standard fixed by the Government or by the State of Missouri for patent flour.

I test for bleached flour by means of the Griess-Ilosvay reagent—take the flours, smooth them down, and drop clean clear drops on them. Bleached flour turns pink; unbleached gives no reaction.

Dr. JOHN MARSHALL, a witness for libellant, testified:

I reside at Philadelphia, and am professor of chemistry in the University of Pennsylvania, teaching general chemistry and physiological chemistry there. I received my academic and scientific education at Pennsylvania College at Gettysburg, Pa., and was graduated as doctor of medicine in the University of Pennsylvania. Subsequently I studied physiological chemistry at the University of Tuebingen, Germany, and graduated with the degree of doctor of natural science. For the past thirty years I have been teaching chemistry in the Medical School of the University of Pennsylvania. I have made no special study of the subject of bleached flour, and only in a general way have become familiar with the Alsop process. My testimony is based on my general learning and knowledge of the substances referred to in the assumption of facts given me.

Assuming that the flour seized in this case was subjected to treatment by a process known as the Alsop process, which consists in the production of nitrogen peroxide gas, which, when mixed with atmospheric air was brought into contact with the flour while it was in a state of agitation, and the flour thereby became bleached or whitened to some extent, I am of opinion that such treatment added to or imparted to the flour nitric acid and nitrogen peroxide.

Nitrogen peroxide is a gaseous substance, brownish red, very irritative to the mucous membrane, and a poisonous substance. Nitric acid is a liquid capable of being volatilized, and exceedingly irritative, corrosive, and poisonous. Assuming that bread made from bleached flour contains such substances, and also nitrite reacting material, it would have added to it substances poisonous in character. The physical and chemical effect on a person taking such substances with his bread would be as follows: The nitrite contained in the bread would act upon the red coloring matter of the red corpuscles of the blood so as to change or convert the hemoglobin of the blood into a substance known as methemoglobin—a foreign body in the blood circulation. When this happens, the oxygen is so firmly fixed in combination with the hemoglobin molecule that the vital processes of the animal body are not sufficiently strong to separate the oxygen from the hemoglobin, and consequently the substance methemoglobin circulates in the blood stream as a foreign body, not as a carrier of oxygen, until finally it is destroyed by the liver. Or if the quantity produced be beyond that which the liver is able to destroy, that excess quantity may appear in the urine of the individual. The effect is to remove from the blood circulation a certain varying quantity of hemoglobin which no longer may functionate as a carrier of oxygen to the tissues for the purpose of oxidizing various substances necessary to sustain life. Therefore, an extra strain is placed upon the liver to remove this methemoglobin; and, in the case of adults, an extra strain is placed upon the red bone marrow in its production of corpuscles and hemoglobin, the oxygen carrying material, in order to replace that which has been rendered inert by the action of nitrite by having been converted into methemoglobin. The effect would be injurious to health.

More fully as to the immediate direct effect of changing the hemoglobin to methemoglobin:

In the blood stream there are red corpuscles, invisible to the naked eye, which contain a red coloring substance known as hemoglobin, when not combined with oxygen, and when combined with oxygen forming a dissociable compound, oxyhemoglobin. In respiration, the hemoglobin contained in the red corpuscles of the venous blood is brought into the lungs, where it having an affinity for the oxygen, which is one of the gaseous constituents of the air, combines with the oxygen to form oxyhemoglobin. This oxyhemoglobin contained in the red blood corpuscles is then conveyed, through the arterial system, to the various parts of the body, and, at the terminals of the arterial system, passing through a mass of tissue, it gives up its oxygen, to oxidize the tissues, or materials that may be in solution there, to form carbon dioxide, and to form water, and this oxyhemoglobin is thereby reduced to the condition of hemoglobin, which is returned by the venous system to the lungs, to be again oxygenated. That is where the hemoglobin will again combine with oxygen to form oxyhemoglobin, and a given quantity of hemoglobin may serve to carry a given quantity of oxygen to the system. Now, however, if any of this hemoglobin is converted into methemoglobin, which is a compound of oxygen with hemoglobin, in which the oxygen is more firmly combined than in the case of oxyhemoglobin, although the quantity of oxygen is the same, the oxygen is so firmly attached—combined with the hemoglobin—that the vital processes are not sufficiently strong to separate the oxygen from the hemoglobin, nor to use the oxygen to oxidize the tissue and tissue material, to sustain life, and, consequently, it passes through the circulation to the arterial system and the venous system, and continues this cycle until, finally, it is destroyed by the liver. Therefore, a certain quantity of the hemoglobin is rendered inefficient. It no longer functionates as a carrier of oxygen to the system, serves, or acts as a foreign body in the blood circulation, and, therefore, must be removed. As

I have said before, an extra strain is placed upon the liver, in order to remove it, and an extra strain is placed upon the red blood marrow, in adults, to regenerate the corpuscles, and to replace the corpuscles of the hemoglobin that have been rendered inactive by the action of nitrite, and the formation of methemoglobin.

In my opinion, the nitrite in the flour seized and the bread made from it will work this change in the hemoglobin. The extent of such action undoubtedly varies with the amount taken into the system—the difference between a deadly dose and a minute one is only one of degree. In other words, the degree of injury depends on the amount present. Health may be impaired by the taking of such nitrite in bread without the appearance of any observable symptom of impairment of well-being; the injury may not be observable by the instruments which are employed for making such diagnoses, and assuming that bread containing nitrites in minute amounts be regularly eaten, substantial injury to health may result, without the presence of any particular symptom. So far as the blood is concerned, the chemical action would occur without the acquisition of any tolerance on the part of the body, whether the quantity were large or small.

Assuming it to be the fact that nitrites are found in saliva, my opinion as to injuriousness is not changed. Nitrites, from different sources, have the same action. Although present in saliva, they are not normal to it, and are found there because of bacterial action, by means of which nitrates are reduced to nitrites. In my opinion, nitrates or nitro compounds are formed in flour by bleaching. It is also true that in the intestines the action of bacteria may reduce nitrates to nitrites. Nitrites, in my opinion, are not normal constituents of sound vegetables, nor are they of meats free from any stage of decomposition. When present in such articles, nitrates have been reduced to nitrites by putrefactive processes. Nitrites may be produced in ham by the process of curing.

When the bleaching medium has been applied to the flour for a relatively long time, and has turned it yellow, the action of nitric acid upon the gluten has produced a nitro compound called xantho-protein. This substance is poisonous, its effect being the same that one would observe from the action of nitrites. It contains NO_2 groups and forms in digestion nitro-albumose and nitro-peptone, which are reduced to nitrites, and thereupon form methemoglobin. Flour bleached merely enough to whiten it would contain a less quantity of nitrite material than flour bleached until it had become yellow, and, therefore, in the case of flour bleached only to whiteness, the action of the nitrites would be less because of the lesser quantity of nitrite material in it, whereas in the case of flour bleached to yellowness, the quantity of nitrite or nitro material would be larger, and consequently the action greater. It would be the same poison, differing only in amount.

Ten or 12 grains of sodium nitrite might be a fatal dose. Much would depend on the individual, however. A medicinal dose is from 1 to 3 grains. The action of 3 or 4 grains taken in the course of ten hours could be determined in the blood by means of the spectroscope. I have never seen a person suffering from poisoning from nitrites taken either in food or drink.

Corn starch which is alkaline in character takes up nitrites from the air. If, however, it is not alkaline, but acid in character, it will not take up nitrites from the air. Flour is acid. Nitrites, whether present in the saliva, in cured meats, or in water, are all the same, and their chemical action is as certain as the law of gravity. As of many other substances, it may be said of nitrites, that their effects are injurious, although no symptoms may be observable.

W. R. M. WHARTON, a witness for libellant, testified:

I am an inspector in the Bureau of Chemistry, United States Department of Agriculture. I took a substance from one of the pipes in Mr. Krite's mill. The pipe, although not in use at the time, was in its usual position between the generator and the agitator. This substance I turned over to Mr. A. V. H. Mory, of the United States Food and Drug Inspection Laboratory at Kansas City, for analysis and examination.

A. V. H. MORY, a witness for libellant, testified:

I am a chemist of the Bureau of Chemistry, United States Department of Agriculture, in charge of the Kansas City, Mo., laboratory. I received from Inspector Wharton the substance in Exhibit 18 (from the pipe in Krite's mill). An examination and analysis of it shows that it can best be described as a corrosion of iron, differing from ordinary red iron rust in that it contains a quantity of nitric acid in combination—nitrates. In addition to these nitrates, there are present also oxides or hydrated oxides of iron, which are formed by electrolytic action resulting from the presence of NO_2. The quantity of nitric acid in combination was about 13.5 per cent by weight.

(Recalled:) Analysis of the flour sent to Terry to replace the seized flour gave as its ash content in one case 0.481 and in another 0.482 per cent.

To bleach a kilogram of the flour seized there would be required 125 c. c. of NO_2 diluted in the proportion of one part of NO_2 to four parts of air. Assuming that the flour seized contains 1.8 of nitrite reacting material calculated as nitrogen, there would be in 1 kilogram of this flour 9 milligrams of nitrite of sodium and 10.8 milligrams of nitrate of sodium. In 1 pound of the flour there would be 4 milligrams of nitrite of sodium. Sixty-five milligrams is 1 grain. The average medicinal dose of sodium nitrite is given in the United States Pharmacopœia as 1 grain.

Now, 1.8 parts per million of nitrous nitrogen, being the equivalent of 1.8 milligrams per kilogram, and the ordinary analytical balance taking account of one-fortieth of that amount, or one-tenth of a milligram, the amount of nitrite reacting material present in the flour seized may certainly be deemed a weighable amount in chemistry.

I did not, of course, extract any sodium nitrite from the flour seized.

E. H. GRANDBERRY, a witness for libellant, testified:

I reside at Junction City, Kans., and have been a miller for thirty-five years. For about a year and a half when I was with the Kramer Milling Company at Anthony, Kans., I used an Alsop bleacher. The bleaching of a straight or a long patent gives them the same color as the short patent unbleached. Patent flour is made from middlings. In my opinion a fancy patent flour of a percentage of 90 could not be made from the wheat Tucker used to make the flour seized. Without other flours for comparison, bleaching makes a flour appear of higher grade than it is in fact.

Bleaching weakens the dough. From my observation bleached flour deteriorates instead of improving with age.

The soft winter wheats make a whiter flour than the hard wheats. The hard Turkey wheat of Kansas makes a whiter flour than the hard spring wheats of the North and Northwest.

Flour exposed for a long time turns yellow. When our bleacher was first installed and before we learned how to run it, we had a complaint because of brownish colored "dough balls" due, I suppose, to moisture in the flour, which broken by a purchaser in sieving, gave an odor like that of the gas. Thereafter I was compelled to bolt or sift out those formations before the flour was sacked.

C. H. BARNARD, a witness for libellant, testified:

I reside at Wellington, Kans., and have been a miller for thirty-three years. I am now with the Hunter Milling Company, which has a capacity of 1,500 barrels daily.

About four years ago I made investigations to determine whether or not to install an Alsop machine. I had one of two sacks of the same flour bleached by the Alsop machine in the Aetna Mill and Elevator Company at Wellington, took both sacks home, and made bread from them. The odor of the flour was disagreeable. Also, from a mill in Wichita, Kans., I got a sack of bleached and a sack of unbleached of the same grade, and after baking noted the same results. Later I took two more sacks to the Aetna mill, had one bleached there, and then baked both, with the same results. The dough of the bleached was short and not so elastic.

Patent is purified middlings. Eighty per cent is the maximum obtainable from hard wheat.

In the wheat we mill the high grades of flour are darker than the lower, except the low grade. Aging makes flour whiter, enlarges its moisture and absorbing capacity, makes it work more easily and improves the elasticity of the dough.

When the Aetna Mill and Elevator Company was using the Alsop process, I was familiar with their flour, both bleached and unbleached, and with the effect of bleaching. Our mills sold them a great deal of flour. At that time they were branding their flour, "Aetna Silk High Patent." Now a straight contains from 95 per cent to 97 per cent of the flour content. If a man can add any clear or other flour, and run the percentage up to 110 per cent or 120 per cent, he has got that straight "stuffed" with something else. Stuffed straight bleached could be made to resemble patent flour. The clear flour which the Wellington people bought from us they mixed with their 95 per cent patent, and branded the same "Aetna Silk High Patent."

Yellow berry is deteriorated Turkey wheat, and is considered objectionable, as the flour is softer and the color not so white. Yellow berry is very common in Kansas, ranging in the wheats ordinarily obtained from nothing to 100 per cent. In fact, I have never milled a carload of straight Turkey red. I do not know what the situation is in Nebraska. We have no wheat grading No. 1 hard.

GEORGE FREEMAN, a witness for libellant, testified:

I reside at Kalamazoo, Mich. I am a baker of twenty years' experience, having served an apprenticeship of three years in England, and then an improvership, as it is called, of one year at Birmingham, and after that I worked as foreman of a shop. I came to America in 1896, worked in a bakeshop for four years, then went to the Chidlow Institute in Chicago. Thereafter had experience in other bakeries, and for the three years last past have been an active partner in the Witwer Baking Company, Kalamazoo. Our output is from 10,000 to 15,000 loaves daily.

I have made a study of the essentials of flour for good bread making. A good flour should contain as a foremost consideration a good amount of high-quality gluten, which will give strength, capacity for water absorption, and for expansion of loaf, as well as a good grain and even texture. There must also be good flavor and color.

The gluten is the protein of the wheat. Gluten is made up of gliadin and glutenin in about equal quantities. The former is the soft, springy, elastic part, soluble in diluted alcohol. The glutenin is regarded as inferior. The nearer you go to the middle of the wheat kernel—the germ—the more gliadin is found. The quality of the gluten depends on the relation between these two constituents.

Flour with the best baking qualities contains two parts of gliadin to one of glutenin. Since the patent flours contain more gliadin, we demand that the percentage shall be low—65 per cent. If the proportion of glutenin is raised, you get a less elastic dough, and bread which won't retain moisture, and the crust will be hard and tough.

Patent flour, as recognized in the trade and in flour markets, is flour which should be made from purified middlings—the central portion of the wheat berry to the extent of about 65 per cent of the total flour content of the wheat. This kind of flour makes the ideal loaf. Straight flour is harder to ferment, takes longer, and makes a coarse, undeveloped loaf, with a coarse, dry, hard, tough crust, and the dough "runs."

For between three and four years I worked an average of a carload and a half of bleached flour a week. My first experience was with a sack of bleached branded "Sleepy Eye," in which I noticed a very bad odor when mixed into dough. Afterwards I noticed the same smell in different samples of flour. From the time we got to know that we were buying bleached flour regularly, our flours showed an analysis different from what they had before—the patent was longer, the ratio of gliadin to glutenin was not the same, and the ash was higher. Color came to be of no value to me in looking at a flour.

Unbleached flour improves greatly for from sixty to ninety days. Our experience was that the sooner bleached flour was used, the better. After being stored for a month, it would make better bread than it would in two or three months. The gluten from the unbleached is elastic. Push it down, and it will spring back. The gluten from the bleached is practically dead inert matter. Press it down, and the impress of your finger remains. The bread from bleached flour is noticeable for its lack of flavor.

GEORGE A. HULETT, a witness for libellant, testified:

I am at present professor of physical and electrochemistry at Princeton University. I was graduated at Princeton University in 1892; was assistant in chemistry there for four years after being graduated; then I studied in Germany for three years in Oswald's Laboratory in Leipsic, where I took a doctor's degree. On returning to this country, I took a position as instructor in physical and electrochemistry at the University of Michigan, where I remained for five years as instructor and assistant professor. In 1905 I was called to Princeton University as professor of physical chemistry, and I have been there ever since.

I have examined the flour seized in this case, to determine whether it contained nitrogen peroxide and nitrous acid. By previous experience I have learned that I could find NO_2 and nitrous acid in bleached flour, and that they could be pumped out of it. The experiment on the flour seized was as follows: Five hundred grams of the flour were put in a glass flask, the flask sealed up, and then by means of a mercury pump, all the air extracted. A tube led off from the flask, and to that was applied a cooling mixture, which would condense the moisture coming from the flour, including the oxide of nitrogen, and also the products of nitrous acid. This is simply a method of distillation. Part of the liquid was condensed, which was perfectly clear. I put it in a flask, and to it applied the Griess reagent. The pink color resulting showed that the liquid contained nitrous acid. A quantitative determination of the amount present in the flour showed 2.5 parts of NO_2 as nitrous acid per million of liquid, by the usual Griess method. By this method the amount of acid present is shown by the resulting color. The greater the amount of acid, the more intense the color.

Using the same method as above, I extracted the moisture from bread made from the seized flour by Miss Wessling. This liquid also turned pink on an

application of the Griess solution, and a quantitative determination of the amount of nitrous acid in it showed 1.2 parts of NO_2 as nitrous acid per million parts of liquid. The amount in the liquid extracted from the flour, as already stated, was 2.5 parts per million.

The fine particles of the flour are not closely packed, and in between them there is air. This is shown by the fact that the specific gravity of flour is about 0.65 or 0.64, which means that a given volume of flour is about one-third air. Now, another line of experiments showed that there is an equilibrium between the flour and the air that is in intimate contact with it. I put flour in a flask, completely exhausted the air, both in that part of the flask not occupied by flour and in the flour itself, and then let in some pure fresh air. With temperature constant, the flask was then allowed to stand, with occasional shaking, for twelve hours, the object being to allow the pure air to take up whatever NO_2 it would from the flour. Then the air in this flask was withdrawn into the vacuum of another flask. Caustic potash was put in the second flask to absorb the gas, and the amount of nitrites resulting was then determined. The first flask was pumped out again, more fresh air let in, and the experiment repeated. The amounts recovered in each case were in fairly good agreement, which would indicate that the flour gives up NO_2 to the air surrounding it.

Now, if flour is bleached with 18.6 parts of NO_2 per million, assuming that the NO_2 all goes to nitric and nitrous acids, 9.3 parts per million remain in the flour as nitrous acid. To compute roughly in terms of nitrogen, divide by 3.3, which would give the amount of nitrous acid as a little less than 3 parts per million. I bleached three samples of flour, one with 18.6 parts of NO_2 in a million, another with 28.4 parts, and a third with 74 parts. The flour bleached with 74 parts was found to have in the air in contact with it 5 parts of NO_2 in the million parts of air; the flour bleached with 28.4 parts had in the air in contact with it 1.4 parts of NO_2 per million; the flour bleached with 18.6 parts had in the air in equilibrium with it 0.6 part of NO_2 per million. So that the NO_2 in the air increases with the amount of NO_2 used in bleaching. The fact that there is a changing concentration of NO_2 in the air in contact with the flour forces the conclusion that we are dealing with a solution, and not with a chemical combination. The NO_2 in contact may be there entirely as a solution in water, or in all events, if NO_2 is recovered, it must be there in part as a solution. For if all of the NO_2 combined with bases to form nitrites and nitrates, no NO_2 would be in contact with the air of the flour, and, of course, none could be recovered by the methods detailed.

I have examined bread from bleached flour, and am able to recover in the bread about one-third of the nitrites present in the flour.

By putting caustic potash above bleached flour in a desiccator, exhausting the air, and allowing the apparatus to stand, then removing the caustic potash, putting in some more to replace it, and repeating the experiment several times, and then by determining the nitrites present in the various specimens of caustic potash, it is possible to get an idea of the amount of NO_2 recoverable from the flour. For example, taking 10 grams of the flour bleached with 18.6 parts of NO_2, I recovered in three successive trials, first 0.0000291, second 0.0000061, third 0.0000046, making a total of 0.0000398 gram of NO_2 recovered from that flour. Now if 18.6 grams of NO_2 is used to bleach a million of flour, it will take to bleach 10 grams 0.000186 gram of NO_2. Inasmuch as the amount recovered in the above experiment was 0.0000398, there was recovered 20.9 per cent, or one-fifth of the amount of NO_2 used. The full theoretical amount recoverable is one-fourth.

I have seen the Alsop bleacher at work in the Southwestern Milling Company's mill at Kansas City, Kans. The generator was a 500-volt direct-current

machine of 7½ kilowatts. As the gas was passing into one of the agitators at a time when the machine was showing about 4 amperes, and bleaching flour, I took a sample of it in a flask in which a vacuum had been created. Immediately after taking the gas, I took a sample of the flour just before it entered the agitator—unbleached—and also a sample at the exit of the agitator—bleached. This flour, when analyzed, showed 0.55 part of nitrogen as nitrites, or 1.8 parts of NO_2. By using caustic potash and the Griess test, I calculated the amount of NO_2 in my flask of gas, and found 300 parts of NO_2 in a million parts of air. Normal air contains less than one part to the hundred million, so that this gas in the bottle was thirty thousand times as strong in NO_2. If 300 parts of NO_2 were used to bleach to the extent of 0.55 part of nitrogen, the bleaching of the flour seized to the extent of 1.8 parts as nitrogen would take over three times the concentration of gas, or something like one thousand parts per million.

By determinations we made, it took the flour about twenty seconds to pass through the agitator, in which it was exposed to the gas in the strength just noted. Against a white background, I could see the color of the gas in the flask. The effect of the gas upon the flour is the same, however produced.

Inasmuch as the removal of the nitrous acid in my experiments did not affect the color of the flour, I should be inclined to say that the nitric acid, and not the nitrous, did the bleaching.

When the NO_2 comes in contact with water, H_2O, there is formed H_2NO_3, which breaks to form HNO_2 nitrous acid, and HNO_3, nitric acid. If, now, sodium is present, sodium nitrite, $NaNO_2$, will result. If there were enough of this base, no HNO_2 would be recovered by the pumping method, and the failure to recover any NO_2 from soda biscuits proves that there has been this chemical combination. I tried to pump NO_2 out of soda biscuits, but was unable to get any. On the other hand, if NO_2 or HNO_2 is recovered from flour, that is proof positive that there has not been complete combination. So the purpose of my pumping experiments on the flour was to find out whether all was chemically combined, or whether it existed in solution.

Dropping a few drops of the Griess test on some of the seized flour, the reaction for nitrites is shown by the pink color. Dropping some of it on unbleached flour of the same kind, only the faintest reaction takes place. The pink color is due to the formation of a definite compound called azo dye, which results, when the Griess solution is brought into contact with a substance containing nitrous acid.

HANNAH L. WESSLING, a witness for libellant, testified:

I reside at Chicago, Ill., and am employed in the Food Inspection Laboratory, United States Department of Agriculture, at Chicago. I studied chemistry at the University of Cincinnati, taking the degree of bachelor of science, and a year later the degree of bachelor of science in chemistry. Following my graduation, I taught chemistry in the Woman's Medical College at Cincinnati. After that I taught chemistry in the high school at Newport, Ky., and from there went to Chicago to accept my present position. The greater part of my time in Chicago has been spent on work of various kinds with flour, including the baking of unbleached flours and of flours bleached in the laboratory and in mills.

I baked the bread from the seized flour used by Doctor Hulett in his experiments.

I have baked bread from the flour seized in this case, from unbleached flour of the same kind sent to Terry by the Lexington Mill and Elevator Company to replace the flour seized, and also from another unbleached flour purchased in Kansas City. Two samples of each kind were baked, one sample by the

Koellner method; the other by the domestic. Application of the Griess test to the bread baked by both methods from the seized flour turned it pink. Application to the bread from the other flours showed no reaction. For purposes of illustration, I did some baking as follows: I mixed into the dough of the seized flour, and into the dough of some unbleached flour called "Aristos", before baking, some of the Griess solution, using the solution undiluted in one case, and in another using it diluted one in four. The pink color of the dough in the case of the bleached was, if anything, intensified in the set of biscuits made with the undiluted solution. Those made with the dilute solution also showed a decided pink. A third set of biscuits made from the same dough, mixed only with water, showed no pink color. When the Griess test is applied to the half of one of this last set of biscuits, it turns pink; the other half, not treated, is white.

I found the amount of ash in the flour seized 0.57. I have examined the ash in very many patent flours, and consider that in the seized flour considerably above that in the patent. Also the gluten of the seized flour was tough and less elastic than the gluten from the patent flours, besides which it had the grayish color of a bleached flour. Compared with "Aristos", its loaf volume was in every case smaller. The color of the bread was different, being of a dull grayish color, and dead or lifeless, and not having the brightness or silkiness that the unbleached always shows. Its flavor I might designate as being flat in comparison with an unbleached patent we were using at the time, which was sweet and palatable—nutty, you might say.

My observation has been that when flour is bleached, the quality of the gluten is always affected, being less strong and less elastic than the gluten from the corresponding unbleached flour. The quantity recoverable also is less. The flavor is always injured, there being either simply a flat flavor, or, if not that, a strong flavor leaving an unpleasant aftertaste.

I have never known any case where there was sufficient nitrite reacting material in the flour to give a decided reaction, where you did not find some in the bread. As to the effect of yeast, my experience has been that the longer it acts on the flour, the less is the amount of nitrite reacting material left in it. By using excessive amounts and giving a long time to rise, you might possibly get rid of all. Such a method, however, could not be considered one of general use. Our method of baking, which we have called the domestic, is based as nearly as possible on methods used in the household. Even the method known as the Koellner method, however, gives a bread that is very comparable with ordinary home-made bread in texture, flavor, etc. Because by the Koellner method the bread is given a shorter time to raise, the amount of nitrite reacting material left in it is somewhat larger than that left when the domestic method is used.

I have examined flours bleached by electricity, and also by the use of nitric acid and other chemicals, but I have perceived no difference in the effects on the flour. Nor was any difference observable in flour bleached in the laboratory and in that bleached commercially.

(Recalled:) Analyses of the flour sent to Terry to replace the flour seized (said by Leflang to be the same kind of flour) showed in one case 0.486, and in another 0.487 per cent of ash.

S. F. Acree, a witness for libellant, testified:

I am associate professor of organic chemistry in Johns Hopkins University. I graduated with the degree of bachelor of science from the University of Texas in 1896. In 1897 I was assistant in the University of Texas, and received the degree of master of science. From 1898 to 1901 I was in the University of

Chicago doing graduate work. I was also assistant and fellow there during that time. In 1902 I received the degree of doctor of philosophy. From 1901 to 1904 I was associate professor of chemistry in the University of Utah. In 1903 and 1904 also, on leave of absence, I was at the University of Berlin. From 1904 to the present time I have been connected with Johns Hopkins University. I have also done work in the lines of physical chemistry, and I have done some work with enzymes.

Nitrogen peroxide is a gas containing, as its chemical constituents, nitrogen and oxygen. It is heavier than air, very irritating when inhaled, and makes one sick if he has to work much with it.

I saw flour bleached by the Alsop process at the mill of the Southwestern Milling Company, Kansas City. A quantitative analysis of the flour bleached, while the apparatus was running in the same way as when Professor Hulett took his gas, gave me 0.6 of a milligram of nitrite reacting material expressed as nitrogen in each kilogram of flour. That would be 0.6 part per million. When Doctor Hulett took his sample of the gas, the generator was connected with four agitators. Three of these were then shut off, and I took a sample, which, when analyzed, showed in every litre 1.1 c. c. of NO_2, or, expressed in another way, 1,100 volumes of NO_2 to the million volumes of air

When NO_2 is applied to the flour by the Alsop process, the first chemical change is that it combines to a large extent to form nitrous and nitric acids. Nitric acid is a very powerful chemical reagent—one of our strongest oxidizing agents. When brought into contact with organic substances, such as flour or starch, sugar, wood, or any number of other organic things, it decomposes them very badly. Nitrous acid is also to a certain extent an oxidizing agent. It has the acid properties of most acids, and will hydrolize or decompose by contact with substances like sugar.

When the nitric acid decomposes, it generates NO_2, and acts upon certain constituents of the flour—the gluten, starch and fat, for instance—so as to form other acids. The coloring matter of flour is chiefly in the fat. I extracted in gasoline the fat from the bleached flour seized, and from the unbleached substituted for it; that from the latter has a yellow color; that from the former less color. A further effect is that the nitric acid, in the process of decomposing fats, produces NO_2, nitrous acid, and also palmitic, stearic, and oleic acids. Inasmuch as the fat in its natural condition is far more nutritive than the palmitic, oleic, and stearic acids, any amount of decomposition would be deleterious.

As to the gluten, the nitric and nitrous acids and the NO_2 decompose it into simpler constituents known as amino compounds. I sprayed dry flour with an amount of nitric acid corresponding to 100 c. c. of NO_2 per kilogram of flour, and also with an amount corresponding to 33 c. c. of NO_2 per kilogram, and in both instances the flour was bleached. Where 100 c. c. was used, the temperature rose $4\frac{1}{2}^\circ$ F. This is proof of chemical reaction, for in general chemical reactions are associated with the formation of heat. That the nitric acid partly combined with the flour, and partly acted upon it, is shown by the fact that by treating the sample with water, which would dissolve any free nitric acid, I was able to recover only 40 per cent of the amount used.

The nitric acid in combination with the nitrous acid brings about some further decomposition of the proteid constituents. The amino acids, which I have shown to be formed by the nitric acid in the decomposition process, are further acted upon by the nitrous acid, as experiments show. By adding 0.0085 milligram of N_2O_3 (that is nitrous acid expressed as N_2O_3) and in a few minutes analyzing the solution, I found that only 0.0011 milligram of N_2O_3 was left. That means that seven-eighths, or roughly 85 per cent, of that nitrous

acid, present there in very small quantity, had been decomposed, and, of course, had decomposed the corresponding amount of these other products. The products so produced were, first, nitroso compounds, next, diazo compounds, and, finally, hydroxy acids. The nitroso compounds of the derivatives I am speaking of are in general very unstable substances—they decompose of themselves, they would in some cases yield oxides of nitrogen, in other cases nitrogen, and they would act so as to decompose other substances around them. They are poisonous, raise blisters on the skin, and have various ill effects. It is my opinion that they are most certainly produced by the Alsop process of bleaching, as are also diazo compounds and hydroxy acids. Chemists who have worked with nitroso and diazo compounds in the laboratory have warned fellow-chemists about their bad effects on health. So long as there is any NO_2 or nitric or nitrous acids in the flour these chemical actions I have described continue.

The flour seized is still undergoing these changes. There is a well-known method of determining whether there is gas in a liquid or solid; namely, by putting a substance like sodium hydroxid into the same vessel with the substance to be tested. This alkaline substance takes up the gases, if any, which diffuse and can afterwards be examined to determine their presence. I have myself tested bleached flour by this method, and have always found NO_2 in it.

Now, in baking, water is added to the flour. The NO_2 not already combined unites with this water to form nitrous and nitric acids. The nitric acid begins at once to decompose the constituents of the flour. It is one of the fundamental laws of chemistry that in general the higher the temperature, the faster reactions take place, and, roughly, they proceed twice as fast for each rise of 10 degrees in temperature. If, then, you bake at 200° C., the nitric acid will react roughly 250,000 times as rapidly as at the ordinary temperature.

The action of the NO_2 goes on continually after it is once added to the flour. In addition to the already described action of the nitric acid in forming NO_2, uniting in turn with the flour to form more nitric acid, and so on, there are other similar reactions. For example, the nitric acid formed may act first on the gluten, forming more NO_2; this reacts with the water, forming more nitric acid, which acts on other constituents, forming more NO_2, and so on. So that the amount of NO_2 formed may be much more than that present originally, and a relatively small amount may work almost unlimited change in the substance of the flour. There is another phase about that. Nitro starch, for example, acts upon flour, and may form many times as much NO_2 as could come from the nitro starch itself. But so far as the action on the proteins is concerned, they contain nitrogen, which, with the air is involved in these reactions, and the air itself is really made to oxidize the nitrogen of the proteid. The result is that more and more NO_2 is formed. These reactions, are, of course, also complicated with others, and it should be said that the nitrous acid itself removes certain of the things formed, for otherwise the reactions would go on for an indefinite number of times. The principle applying to these reactions is that of catalysis. An apt illustration of catalysis is seen in the commercial manufacture of sulphuric acid.

On mixing nitric acid with wet flour, experiments show that it begins at once to act and continues its action for several days. That this reaction is not peculiar to nitric acid is shown by the fact that hydrochloric, sulphuric, and sulphurous acids begin at once to decompose wet flour just like the nitric. A number of things will take the color out of flour, and bleach it just like NO_2; for example hydrochloric acid gas, sulphur dioxide gas, and on wet flour sulphuric acid and hydrochloric acid. So that it seems that these are very general reactions.

In flour there are two different kinds of enzymes, amylolytic and proteolytic. These are common to most plants and are needed by them for food. The former acts on the starch, the latter on the proteins. They are very sensitive to the action of acids, and in their work of bringing about the natural aging of flour would be deleteriously influenced.

It is chemically impossible by treating flour by the Alsop process to increase its proteid content either by changing the starch into proteid or in any other way. The amount of moisture that the treatment could add or subtract would be very very little. The amount of ash could not possibly be decreased.

Nitrogen peroxide does not mean "nitrogen through oxygen," but means that there is more oxygen in this nitrogen peroxide than there is in nitric oxide.

ALFRED STENGEL, a witness for libellant, testified:

I reside at Philadelphia, Pa. I graduated from the Medical School of the University of Pennsylvania in 1889. Since that time I have been connected with various hospitals of Philadelphia as pathologist and physician. For several years I was pathologist to the German Hospital and the Philadelphia Hospital, and for the last fifteen years I have been physician to several of the hospitals in Philadelphia, including the Howard Hospital, the Philadelphia Hospital, the Pennsylvania Hospital, the Children's Hospital, and the University Hospital. In my earlier years I made special studies in pathology and published a text-book on that subject. I have been since 1898 professor of clinical medicine in the University of Pennsylvania, and was for a time connected with the Woman's Medical College in a similar capacity. I have been a contributor of articles on pathological subjects and on medical subjects; I was general editor of Millenockle's Encyclopedia of Medicine, translated from the German and published in English. For a time I was editor of the American Journal of Medicial Science, and I have been connected with various associations, including the Association of American Physicians, the American Medical Association, the Society of Pathologists and Bacteriologists, and a number of other local medical organizations. I am engaged in the practice and teaching of my profession in Philadelphia.

The flour treated by the Alsop process, assuming that it gives the reaction for nitrite reacting material on being treated by the Griess test, has had added to it nitrous and nitric acids, both of which are poisonous and deleterious substances. Assuming that bread made from such flour contains nitrite reacting material, as shown by the Griess test, I think the consumption of such bread would be injurious to health. Its injurious effect would depend on the quantity of nitrite reacting substances present in the flour or in the bread. If present in very large quantity, the flour or bread would be decidedly injurious; if present in very small quantity, a longer time might be required for the manifestation of any injurious effects, and they might not be obvious immediately after, or even some time after, consuming the material. Nitrites have a decidedly injurious effect on the blood, so altering it that it becomes incapable to the extent to which it is altered of carrying on its proper functions. If an overwhelming dose of nitrites were taken, the change in the blood, together with other changes, might be rapidly destructive of life. In very small quantity, the effect would, of course, be proportionally less.

Nitrites change hemoglobin, as it is called, so that it is no longer capable of carrying oxygen; that is, render it incapable of carrying on the important function of the blood which enables us to breathe in air, exhale carbonic acid gas, and go on living. Second, nitrites are also powerful depressants of the circulation, lower the blood pressure, and injure the health by interfering with proper circulation. Third, nitrites destructively affect the walls of the blood

vessels, the walls of the heart, and the muscular tissue generally. Fourth, their effect upon digestion is injurious in the possibility of irritating the stomach and intestinal tract and interfering with digestive processes. These are the four ways in which nitrites, in quantities sufficient to make their effects manifest, influence the body to the disadvantage of health. In minimum quantities beyond the reach of chemical detection, the effects would be correspondingly diminished, but I believe that nitrites in any quantity act in the same ways and are deleterious. The necessary or inevitable tendency of eating bread containing nitrite reacting material made from the flour seized would be to the detriment of health.

The human system develops no tolerance and has no defense against this particular kind of poison. There are certain substances against which the human body has some means of defense—well known detoxicating mechanisms. But in the case of nitrites, there is no mechanism of that kind.

Nitrites found in the air, in vegetables, and in smoked meats, if they are so found, and in saliva, are poisonous, and if ingested into the stomach would have the same effect as nitrites from any other source. The assumption that the effects of eating this bleached flour bread may not be observable by the most skillful diagnostician, not manifesting themselves by symptoms or illness or anything of that kind, would not alter my view that the nitrite reacting material in this bread is injurious to health, for the reason that if quantities of nitrites infinitesimally small are taken into the body, it is not to be expected that effects are going to be manifest like the effects of large quantities. Take, for example, a person who lives in a room which is covered with green wall paper, containing arsenic. He might not show any immediate effect of the arsenical poison, but, after a long period of time, might grow unaccountably ill, and the effects be produced by the daily inhalation of a little arsenic. Just so, in the case of nitrites, it is known with certainty that injurious effects follow the eating of bread containing nitrites, because the nitrite bodies are poisonous and have a certain definite chemical effect upon the system. There is no mechanism by which that effect can be avoided. If they are there in such small quantities that after each ingestion no effect can be seen, the addition of one dose after another will bring about deleterious effects. So that, although the effects of minute quantities may not be demonstrable by experiments, I am still of the opinion that the nitrites are injurious. It might take years to bring about the ill effects. It would be impossible to conduct an experiment and keep a human being or an animal under certain conditions for that length of time, in order to prove that these ill effects occur. In the absence of experimental proof that very poisonous substances are injurious to health, and produce poisonous results in the specific instance, it is well recognized in medicine, that the fact that a substance is a poison and has certain definitely known poisonous injurious effects, is in itself sufficient to bar that substance from the daily use as a food, or the frequent use in any way, even in small quantities, unless it be known that there are defensive mechanisms or ways that the body has of protecting itself against small quantities.

A deleterious food product would be one capable of damaging the health of an individual. A poison is a substance which, when taken into the system, causes damage to the individual. There are some substances, such as benzoic acid, which if taken in sufficient concentration, would produce injury, but which in small amounts may not be injurious. So of acetic acid. Nature has a way of defending itself against a certain amount of hydrochloric acid. Benzoic acid is found in cranberries; acetic acid in apple cider. Nicotine, however, is not like these, but is always harmful, irrespective of the amount. So far as the nitrites in the air are concerned, they are not absorbed when taken into

the lungs in anything like the quantity taken into the stomach would be absorbed.

In my practice, I have never seen anyone in whom I could recognize symptoms that I could attribute to nitrite poisoning from food. I don't think it is known just how much nitrites would have to be taken into the system in order that their presence might be noticed in the color of the blood. The use of the spectroscope is a matter requiring considerable expert ability. If in ten hours an average individual, from 30 to 40 years of age, weighing 140 pounds, and in good health, should take into his system 8 or 9 grains of sodium nitrite, I should expect to find methemoglobin in his blood spectrum, but not certainly, because some persons can stand an enormous dose of poison.

My conclusion that a person eating that bread might have the hemoglobin of his blood converted into methemoglobin is not based upon any actual observation or actual knowledge, but on the reasoning that effect must follow cause.

OTTO FOLIN, a witness for libellant, testified:

I am professor of biological chemistry in the Harvard Medical School, Boston. I was graduated from college in 1892, and then studied chemistry, chiefly organic chemistry, for four years at the University of Chicago. For two years after that I studied physiological chemistry in Europe. Later I was made assistant professor of analytical and physiological chemistry at the University of West Virginia. At the end of the year I was called to the McLean Hospital of Massachusetts as research chemist, a position which I held until I took my present position at Harvard University. I have published numerous papers in this country and Europe on my researches in the field of physiological and organic chemistry. I am a member of the American Medical Society, of the German Chemical Society, of the American Physiological Society, of the Society of Experimental Biology and Medicine, and of the American Society of Biological Chemists. My specialty is the chemistry of the animal body and the chemical processes which substances undergo in the animal body, and more particularly in the human body. I have not made any particular study or research in respect to flour bleached by nitrogen peroxide gas mixed with air.

Nitrogen peroxide under ordinary conditions is a gas of varying color, but usually dark red to the tint of brown. There is no difference in the substance or chemical properties of the gas, however made. Although it may be produced in various ways, the principle of most of the ways is the same; namely, the use of nitric acid. It is, of course, also produced by the electric spark.

The bleaching power of NO_2 depends upon a mixture of nitric and nitrous acids, but whether nitric acid is the only cause of bleaching, or whether the nitrous acid also takes part, I am not prepared to say. The NO_2 alone will not bleach—a certain amount of moisture is necessary to convert it into nitrous and nitric acids. In the production of these acids, it makes no difference how the gas is produced.

In the so-called overbleaching of flour, which causes it to turn yellow, there has been produced by the action of the nitric acid on the gluten a class of bodies known as nitro bodies, usually yellow, though sometimes colorless. Such action may be illustrated by mixing the flour with dilute nitric acid. The characteristic yellow color resulting is due to the firm fastening of the nitro group to the gluten molecule. This yellow reaction is the same that has been spoken of as the xantho-proteic.

In my judgment, in the bleaching of flour with nitrogen peroxide, it is inevitable that nitro bodies such as are present when flour is mixed with dilute nitric acid must be formed, and the difference between the overbleached flour

and ordinarily bleached flour in this respect is in the nature of the case, in my judgment, only one of degree. There are more of these bodies in one case than in the other, but they are there in all cases when flour has been bleached with nitrogen peroxide gas. That conclusion rests in the first place on the inevitableness of the action of nitric acid on the gluten of the flour. There must of necessity be several thousand times as much gluten in flour as there is coloring matter in it; consequently it follows, as a matter of necessity, that several thousand times as much of the bleaching agent will strike the gluten as will strike the coloring matter in the flour; the small proportion of the nitrogen peroxide which strikes the coloring matter, will bleach that coloring matter, will destroy it, and render it colorless; but in the meantime other parts of nitrogen peroxide will strike the gluten several thousand times, and produce a yellow color. So that in this bleaching process, in my judgment, and I have made no bleaching experiments with flour, while you bleach the coloring matter that is there, you, at the same time, introduce another yellow coloring matter.

Assuming that although the natural color of flour, generally speaking, has the appearance of whiteness, it is in fact yellowish, and that the yellowish white is made up of two primary colors, yellow and orange, in varying degrees, and assuming further that the appearance of flour bleached by the Alsop process is made whiter, the laws of chemistry show that what takes place is as follows: The same amount of NO_2 acting, on the one hand, on the orange color, and, on the other hand, on the yellow color, will produce more visible change on the orange than on the yellow. A deep color is destroyed as easily as a light color. Bleaching a mixture of these two colors would result in a very great lightening of the orange color, but would have a less apparent effect on the yellow, the consequence being that the whole color of the flour is made lighter. Now, as to the yellow xantho protein. In my judgment, the production of nitro bodies begins from the very instant of the application of the gas, although not then visible, for the reason that there is orange and yellow coloring matter in the flour to begin with. As those organic natural colors are destroyed, their place is taken to a greater or smaller extent by these yellow nitro bodies. In my opinion, no such nitro bodies are produced during the natural aging of flour, no matter what length of time such aging continues.

Any such nitro bodies are injurious to health for the simple reason that they contain the NO_2 groups permanently fixed in the gluten molecules of the flour. These are staple compounds, they are not easily destroyed, they are not affected by such procedures as subjecting the flour to the action of yeast, or to the action of baking, or the action of digestion, but they stay in those protein molecules until those molecules get into the system, where they are as a whole broken up and destroyed and oxidized. In such case those NO_2 groups are again set free in different parts of the body—in what parts I do not know—but they will there unquestionably develop the toxic property of NO_2. The effect will correspond to the amount present in the food. Nor would it change my opinion in that respect in the slightest degree if it appeared that no change of well-being were observable in an individual who had eaten bleached flour, for the reason that, since the effect is in proportion to the amount present, if such amount is sufficiently small, it follows as a matter of course that the nitro bodies escape detection. Merely because they escape detection, however, is not the slightest reason for assuming that they are not there.

The law of mass action is that the speed of a reaction—the extent to which a chemical change takes place—depends upon the quantity of reacting substances present. In most cases, a change in the quantity means simply that you get a smaller amount of reacting substances—only a difference of degree. There are numerous exceptions—the quantity, the temperature, pressure, pres-

ence of other substances, all may contribute to produce a variation in the result. Each case has to be decided according to the nature of the reaction involved. I have not experimented with bleached flour, nor dealt with the particular gaseous medium produced by the Alsop process; but I am able to say that although the Alsop gas is diluted with air, its reaction will be the same in quality, although differing in quantity from that of concentrated NO_2. One of the reasons leading to this conclusion is that the flour turns yellow after long exposure, and there is no reason to suppose that in a shorter time the same reaction, differing only in degree, will not take place, especially as there is no reason to suppose that the gas is any stronger because there longer.

The formation of yellow color is accepted as proof of the formation of nitro bodies. There is no chemical reagent for them corresponding to the Griess test. The amount of nitrite reacting material present has not, in my opinion, the slightest bearing on the preceding production of nitro bodies during bleaching. The color of the flour after bleaching is not the criterion of the amount of nitro bodies that it contains, because you may underbleach flour, or, in other words, you may bleach it so as not to destroy the natural color which is there, in which case you may have a yellow flour containing a very minute quantity of NO_2; on the other hand, you may produce a flour which has essentially the same color, but which is overbleached, and which would contain very much larger quantities of NO_2.

WILLIAM F. BOOS, a witness for libellant, testified:

I reside at Boston, Mass. I am pharmacologist and chemist of the Massachusetts General Hospital and a physician with a consulting practice in the city of Boston. After receiving my bachelor's degree at Harvard College in 1894, I went to Heidelberg, where, after two years' study, I received the degree of doctor of philosophy in chemistry. After that I taught chemistry for one year in the Academic Department of Harvard. Then I studied medicine for four years at the Harvard Medical School, after which I served as house physician at the Massachusetts General Hospital for eighteen months. For two years after that I studied at Strassburg University, doing research work in pharmacology. For two years more I was assistant to the head of the Pharmacological Department in the University of Strassburg. Then I returned to America to the position which I now hold at the Massachusetts General Hospital.

I have seen an Alsop bleacher at work in the mill of the Southwestern Milling Company, Kansas City, Kans. I saw the gas as it was generated by the flaming arc. I also saw it as it was collected in the flasks from the bleaching apparatus. In some specimens it was distinctly visible.

This nitrogen peroxide gas is a compound of nitrogen and oxygen with a formula of NO_2 and N_2O_4, as the case may be, depending upon temperature and pressure. It is a brownish red gas, which, upon being inhaled, acts as a powerful irritant to the mucous membrane of the respiratory tract. It has a very characteristic odor, which I recognized in the mill where they were bleaching.

A poison is a substance which by virtue of its chemical constitution produces chemical, morphological, molecular changes in certain organs, these changes then leading to the impairment of function in the organ or organs affected.

NO_2, when introduced into the flour, produces nitrous and nitric acids in equivalent amounts, one part of each, on account of the moisture which the flour contains. The nitrous and nitric acids which were added to the flour seized may be present as such, and there may be present, or there may result from their presence, organic compounds derived from them. Assuming that bread or other foods made in whole or in part from this flour are eaten with

such customary regularity, as such food products are usually eaten by the people, and that such products contain these substances, the food so eaten would tend to be injurious to health, because the nitrous acid or nitrites would be absorbed into the system, where they would exhibit the characteristic action of nitrites or nitrous acid. Nitric acid, present either as such or in form of nitrates, would exhibit the characteristic action of nitrates or nitric acid. And so would the organic compounds which are formed in this flour from the action of the nitric acid also cause injurious results after their absorption into the system.

The characteristic effects of the action of nitrites are: First of all, there is a flushing of the face and neck, which may extend down as far as the upper part of the breast. It is due to a dilatation, or stretching of the blood vessels of the face and neck. There is also, at the same time, a dilatation of the vessels in the meninges or lining membranes of the brain, and also of the vessels in the brain itself. Very soon after this first flushing, there is felt an accelerated pulse in the temporal arteries, which causes a sort of hammer-like effect in this artery. This is due to the action of the nitrites on a certain nerve, which, normally, keeps the heart from going too fast. This nerve is depressed, or paralyzed by their action, so that it no longer controls the heart, and the heart begins to beat more rapidly. This beating of the heart more rapidly, with the limited dilatation of blood vessels in the head, neck, and chest, causes, at first, a rise in blood pressure. Very soon, however, the blood pressure falls considerably, due to a paralysis of the vaso-motor center, which controls the dilatation and contraction of the blood vessels in the body. In consequence of the paralysis, there is a general dilatation of blood vessels. This, of course, accounts for the great fall in blood pressure. There may be, at the same time, a certain degree of dizziness, and there may be a mild narcosis. Patients affected by these substances may sway, or even fall. In all cases there is a tendency to the formation of methemoglobin in the blood. If a sufficient amount of these substances is introduced into the system, the entire blood of the person turns a very much darker color than it normally has. Normally, the blood is bright red, the color that you know as crimson. After these substances have been introduced into the blood, outside the body, or inside the body, the blood turns to a chocolate color. Of course, the degree of this chocolate color is dependent upon the amount of these substances taken into the system. But, there will be a formation of met-hemoglobin, probably with the smallest amount taken into the body, only it would be so slight that we would not be able to detect that formation. This formation of methemoglobin is a very serious matter for us, because the red coloring matter of the red blood corpuscles, the function of which is to take up oxygen in the lungs, and to carry that oxygen throughout the body, and to give it up to the cells of the body, and the structures of the body that require it, loses its function. The red coloring matter can no longer either absorb or give up oxygen. Therefore, we have a lack of oxygen, a suffocation of the entire system, and death, in cases of nitrite poisoning, is caused by this suffocation of the blood through the formation of methemoglobin.

There are some substances, like vinegar or acetic acid, salt, baking powder, benzoic acid, or benzoate of soda, alcohol, and the like, which are common articles of human consumption, which may become poisonous upon the ingestion of appropriate quantities. There are other substances, not of this character, falling within the definition of poison, from which there results poisonous action when any quantity, however minute, is taken, this action being the same in kind, and differing only in degree. Strychnine, atropine, heavy metals, such as lead, copper, and mercury; physostigmine, chloride of lime, chlorine gas,

cyanide of potassium, corrosive sublimate, and aconitin may be mentioned as examples. Nitrites belong to the latter class.

The nitrates formed from the action of nitric acid may become an injurious factor in food made from flour, because they will be converted into nitric acid in the stomach. Also, the nitro compounds mentioned by Doctor Folin are among the most notorious poisons of organic chemistry. Assuming that the yellow color in flour is increased by bleaching, that indicates the formation of xantho protein—a nitro compound of gluten.

I have seen one case of nitrite poisoning, and twelve or more have been described in the literature, some of them of fatal issue. There is a great difference in the powers of resistance of different people to the action of poisons, and the power to endure constant eating of nitrites in bread would be variable. The spectroscope is not delicate enough to detect very small quantities of methemoglobin. It is true that nitrates occur very generally in plants and vegetables that we eat. Nitrates given to children show a much greater tendency to produce nitrites, and consequent absorption, with poisoning, than in grown persons. There seems to be present in the child's intestines a peculiar form of bacillus coli communi, which is very much more active in producing nitrites than the bacillus which lives in the intestines of grown persons. There is no way to my knowledge by which nitrites become harmless by reason of immunity or tolerance or anything of that kind.

It is not necessary that the addition of poisonous or deleterious substances to food be such that the consumption of the food will show itself by symptoms, in order to justify a conclusion that the same may be injurious to health.

Because a certain substance is stated in the United States Dispensatory as being used or having been used, is no reason why it should be rational to use it. The use of nitric acid to-day by any intelligent physician as a medicine would, to my mind, be almost criminal.

A nitro compound is an organic compound formed by the action of nitric acid upon the protein molecule. This compound differs entirely from the nitrite. By the action of nitrous acid upon the protein there probably results a nitroso compound. Assuming that there is sodium or potassium or magnesium or other bases in the flour, the nitric and nitrous acids, combining with them, would form nitrates and nitrites respectively. The nitric acid and the nitro-compounds do not respond to the Griess test. The nitrite reacting material, either the gas itself, the nitrous acid, or the nitrites, do respond.

SCOTT P. CHILD, a witness for libellant, testified:

I am a physician engaged in the general practice of medicine at Kansas City, where I have been for eleven years. I graduated from the Medical School of the University of Pennsylvania in 1896.

I have myself administered nitrites and noticed their effects. They are given as a rule in connection with heart and circulatory disease, for the purpose of lowering an existing condition of elevated blood pressure, and are administered as drugs in known doses. We find that there are certain characteristic symptoms and signs following their administration. Those apparent to the eye are the flushing of certain blood vessels, especially of the face and the upper parts of the body and extremities, an alteration in the rate of the pulse, and in the heart rate, and an influence upon respiration, and also certain changes in color, which color we refer to the condition of the blood peripheral circulatory vessels.

Assuming that the flour seized was bleached by nitrogen peroxide gas, and that bread made from this flour will contain nitrite reacting material in measurable quantities, the continued persistent use of bread stuffs made, in whole or in part, from this flour, would lessen the digestibility of such food,

and necessarily limit the amount of certain products digested and absorbed, and thereby would necessarily limit normal nutrition and the maintenance of what is termed the metabolic equilibrium of the human individual. I must assume that the digestive power of the ferments which act under certain known normal conditions must be limited by the presence of these deleterious poisonous products in any quantity. The substances stated to have been found in the bread are not normally present in the digestive juices, nor in food products. The digestive juices, from long periods and centuries of addiction, have accustomed themselves to digesting the starches and proteids such as are found in the cereals, without the introduction or presence of the elements which are introduced into this particular flour. Therefore, in my opinion, the introduction of such poisonous substances, to the impairment of digestibility, would render food made from the flour seized injurious to health, or tend to render it so. The tendency in digestion would be that, delayed over the normal periods of digestion a portion of this food would be carried through the gastro-intestinal tract, and could not be absorbed, and so keep up the normal state of health of the individual.

I have given amyl nitrite and nitroglycerine as medicines, but not sodium nitrite. I have not personal observation of the effects of the latter, nor have I positive observation of the effects of eating bread containing nitrites.

ROBERT T. SLOAN, a witness for libellant, testified:

I reside at Kansas City. I was educated in the Kansas City Medical College and in the Medical Department of the University of New York. I have been practicing for twenty-five years. I taught for a while at the Kansas Medical College, and then in the Medical Department of the Kansas State University, my first subject being physiology, and now, for the last eight or ten years, internal medicine.

Assuming that the flour seized was bleached by a process known as the Alsop process, the bleaching being effected by treating the flour with nitrogen peroxide gas mixed with atmospheric air, to such an extent that the flour was substantially whitened, that upon such treatment the gas coming into contact with the flour, and the moisture contained therein, there were formed in that flour two acids, nitric acid and nitrous acid, and there were added thereto poisonous substances, among them nitrites, organic and inorganic; and assuming further that by this treatment the flour and its products were rendered less digestible; and assuming further that the consumption of bread containing nitrites so added would have an effect upon the blood of the consumer, depending upon the quantity of nitrites consumed, and that the effect is a chemical one, changing the hemoglobin to methemoglobin, I am of opinion that the continued and customary use of bread made from such flour would be injurious to health, or would tend to be injurious. That opinion is based upon my knowledge of the effect of nitrites as used in medicine on the economy of the body. The continued use of small doses of nitrites, day after day, month after month, would have a tendency to depress the blood pressure, to lower it, and often to cause a lowering of the body temperature to a slight extent. These effects diminish the natural nutritional acids of the body, make the individual less resistant certainly to fatigue and conditions of that sort, and possibly less resistant to the ravages of infectious and degenerative diseases. In the case of persons suffering from neurasthenia, the tendency would be toward greater suffering, because the circulation, blood pressure, temperature, etc., are more depressed in such cases to start with.

Nobody knows what the symptoms of chronic nitrite poisoning are. I believe, though, that I have seen many cases, although I could not trace them.

C. E. BREWSTER, a witness for libellant, testified:

I reside at Rosedale, Kans. I am second miller at the Southwestern Milling Company's mill there, where "Aristos" flour is made. I was present when Professor Hulett, Doctor Boos, and Professor Acree examined the place, bleached some "Aristos," and took some gas. We are not now bleaching flour commercially, but I have been familiar with the Alsop bleacher, and set it running as near normal as I could. We have two electrifiers in boxes by themselves, and one dynamo. The rating of the machine is 500 volts, 15 amperes and 7½ kilowatts; 4½ amperes were on at the time of the bleaching. One specimen of the gas was taken when all four agitators were running, another with only one, and a third sample with none in operation. When we were bleaching, the odor of the gas was always apparent about the agitators and pipes.

A. C. LEFLANG, a witness for claimant, testified:

I am manager of the Lexington Mill and Elevator Company which milled the flour seized in this case. The flour was made from Nebraska No. 2 hard winter wheat of a minimum weight of 59 pounds to the bushel. After being cleaned and scoured and the screenings cleaned out, it will weigh 61 or 62 pounds. We make a first grade or patent and clears; the low grade we have never counted as flour. We do not bleach the clear.

In the Alsop process, by which the flour seized was bleached, the current is led to the electrifier where the making and breaking of the arc changes the air in some way, and that air is then conducted to the storage or receiving tank by pipes, and from there piped to the agitator, where the flour and air are mingled by the rotation of wings—arms that are rotated inside of the drum. The pipe from the electrifier to the agitator is about 30 feet long. The agitator itself is about 6 or 7 feet long and 24 or 30 inches in diameter, and lies horizontally. The electrodes touch and then come apart not more than an inch. This makes a little thread of electricity in the center of an arc of bluish light about an inch in diameter—the "flaming arc."

I have become familiar with the strength and quality of flour, and can state that flour bleached as described has not been injured in any way in its quality and strength. If there is inferiority due to branny specks, bleaching discloses them more readily.

The only place I have ever noticed any odor is in the flour bin itself never on the packing floor nor in the room where the electrifier is. I could not see the gas by letting it blow out of the electrifier. Pipes between the electrifier and the agitator have been in use for five and one-half years, and show only a slight natural rustiness. A rubber-lined cotton hose has been in use for one and one-half years between the electrifier and the pipe that runs to the agitator.

I have never heard of a standard for patent flour. Every mill establishes its own first grade, and terms it patent. We have used the same brand as on the flour seized for about twelve years. For the last ten years we have milled Nebraska winter wheat.

There is no difference between flour bleached by the Alsop process and the same flour bleached to the same extent by nature. Bleaching, from my experience and knowledge, has the same effect of aging flour as nature. They have the same effect on quality, improve the color, and make the same size loaves. The reason we bleach is to age the flour and to improve the color. People want a white flour and white bread, and bleaching enables us to sell the flour quickly, place it upon the market without storage, and sell it at a lower price by not having to hold it for from thirty to sixty days in the ware-

house. I do not think that bleaching increases the nutritive value of the flour. It does not make it dead white.

Our motor is equipped for 7½ horsepower. The gas generated smells like the NO_2 that has been exposed in the courtroom. To age our patent flour by bleaching to the extent of three months' natural aging takes about three-fourths of a horsepower an hour. A little bleaching is equivalent to a little aging, and much bleaching to much aging.

Natural aging improves color and quality. Fresh flour, then, is inferior to the naturally aged in these respects. Bleaching of fresh flour makes it look like the naturally aged. If, then, bleaching does not work precisely the same changes that natural aging does, it is a deception and conceals the true quality of the flour. So that to establish my former conclusion that the flour seized was naturally aged, it must be established that this NO_2 is the equivalent of time in the changes that it works.

The natural color of Nebraska wheat is a defect. The color of a 50 per cent flour is very close to that of a 100 per cent. If, then, a long patent is bleached, it can be made whiter than an unbleached short patent. If patents, clears, and straights were all bleached, there would be the same relative difference then that there was before bleaching, except that the patent and clear would differ more widely, because the little brown specks in the clear would show up more plainly. As milling methods have improved, it has become possible to get more flour out of the wheat. We made about the same percentage before we put in the bleacher as we have since. Real Turkey wheat is only raised in one small district in Kansas. In Nebraska we have a wheat that has a dark red color, and makes a very good flour, and that is what the millers in speaking with each other call their Turkey wheat. It is probably a wheat that would hardly grade Turkey, however, in a market like Kansas City. Then we have our other kernel, the yellow berry or the yellow belly, kernels that are mixed with the Turkey. They grow from the same seed, and they change back and forth without any apparent reason.

The Purity flour sent to Terry was just like that seized, except that one was bleached and the other was not.

DR. JOHN A. WESENER, a witness for claimant, testified:

I reside at Chicago, Ill.; am 45 years of age, a consulting, analytical, and research chemist; I took part of my course in chemistry at the Michigan Agricultural College and finished at the University of Michigan in 1888; I took a course in medicine at the College of Physicians and Surgeons at Chicago, graduating in 1894; I held the chair of chemistry for twelve years in the medical college of the University of Illinois, formerly the College of Physicians and Surgeons of Chicago; I also was professor of chemistry in the Pharmacy School of Illinois for one year, and professor of chemistry in the American Dental School, which is now the Dental Department of Northwestern University; I am president of the Columbus Laboratory, located in the city of Chicago and in existence since 1893; I have associated with me in this laboratory Dr. Adolph Gehring, for eight years director of the municipal laboratories of the city of Chicago, and Dr. W. A. Evans, the present health commissioner for that city. The Columbus Laboratory was originally devoted to strictly medical work and received specimens from all over the United States from doctors for analysis and diagnosis; I think I have examined something like 30,000 urines, pumped out 3,000 human stomachs and examined their contents, made examinations of all excretas and a great many of the secretions of the human body. For the last ten years we have gradually branched out in the Columbus Laboratory and are now doing a great deal of food work and

have been doing special work on flour analysis. I have made a special study of the examination of the gastric juice of the human stomach, and of its hydrochloric acid, and have written many articles on digestion. I have made quite a study of flour; our laboratory has a flour department, devoted to determining the commercial value of flour, its baking quality, soundness, everything about it. I am a member of several chemical societies, the American Medical Association, am a fellow of the Academy of Medicine, belong to the Society of Chemical Industry. I have for the past ten or twelve years been constantly examining flour, wheats and grains; have made analyses for a great many of the experiment stations here in the United States, like those of Iowa, Tennessee, Virginia, Michigan; for that of Canada, and have also written a manuscript for the Secretary of Agriculture on the subject of durum wheat.

I have made a thorough study of bleached flour, beginning sometime in 1903; have, with my associate, Professor Teller, examined some 15,000 specimens; in such examinations, we search carefully for the quality of the gluten, the color of the flour, its absorption, the size loaf it will make, the amount of ash for each particular grade; we go into the quality of the bread made from such flour, the fermentation period and the quality and condition of the gluten therein. As a result of my examinations, I have found no constituent of the flour either injured or improved by bleaching—the only change I have noted is that the coloring matter is gone; I have found no odor or flavor in the bleached flour which is not present in the unbleached, and no difference in the gluten, starch, fat, or in baking qualities; I have found nitrite reacting material, the substance that gives a red color with the Griess reagent, present in the bleached flours submitted to me for examination, in the proportion of about one part per million as nitrogen; I have also examined flours that have been naturally aged and bleached to see if they contained any of this nitrite reacting material, and have found it present to the same extent as in those which had been rapidly bleached by the Alsop process, or through the oxide of nitrogen process; I have found in a great many instances much less and in some instances more. It is not possible, by any chemical means, to determine whether flour has been naturally bleached, as by the air, or by the use of the Alsop process. I have never been able to detect any chemical difference between naturally bleached flour and that bleached by the Alsop process. The coloring matter in flour is a distinct chemical body, and it reacts toward oxide of nitrogen in a certain way; when it combines with these oxides of nitrogen, it loses its yellow color, and it does not make any difference whether the oxide of nitrogen is introduced by the flaming arc discharge or whether it is taken up by this coloring matter from the air. I have never examined a flour that had lost its color but what I have found nitrites, whether it was naturally or artificially bleached.

This coloring matter in flour is a base just the same as sodium is in starch, and it will combine with oxides of nitrogen, and when it combines with oxides of nitrogen, it loses its yellow color, but it would not make any difference whether it comes from the air or whether it comes from an electric machine or from any other source. That is the natural chemistry. I have taken unbleached flour, containing this yellow coloring matter, which showed no reaction for nitrite reacting material, exposed it to the air and noted that the color disappeared, and then I found the nitrite reacting material, and sometimes, after an exposure of a week or two, I found as high as four parts of nitrite reacting material per million; that was naturally aged, or oxidized, and the nitrites were introduced in that way. The only change I noted in naturally bleached flour was loss of color and a certain amount of moisture. This loss of moisture will toughen and strengthen the gluten, but that is not a chemical

change in the gluten; these same two changes take place when the Alsop process is used, only more rapidly. Nitrites and oxides of nitrogen are constantly present in the air and predominate on a bright sunny day more than on a humid or rainy day. In view of the wide distribution of these nitrites throughout nature, I am of the opinion that they are absolutely necessary to life; that is, this change that brings about the formation of nitrites, is absolutely necessary to life. Without it, life would become extinct, both animal and vegetable life.

I have found in the laboratory, in bread made from bleached flour, that there are in most instances no nitrites left in the bread, but that there is always a reduction of from 80 to 97 per cent of the nitrite material. It remains in bread made from unbleached flour the same as in that made from bleached. In the process of bread manufacture, before the dough is ready for the oven, if the fermentation has been for a long period, or if a certain kind of yeast has been used, which feeds on nitrites, there might be no nitrites in it when ready for the oven, but if a yeast had been used which does not feed quite so readily on the nitrites, or if the fermentation had been for a shorter period, there might be some trace of nitrites left, but there is always a reduction, even in these cases, of from 80 to 97 per cent of that found in the flour. I have made very careful and exhaustive tests to find whether bleaching affects flour in its digestive value, and have never found an instance where the digestive value of bread made from bleached flour has in any way been changed, injured, or differs from bread made from unbleached flour; I have made these tests of the flour as a whole, and of its separate constituents. I understand a patent flour to be one which represents the top grades, taken out of a certain wheat; it may represent 100 per cent of the middlings; flours which have been examined and passed as patent flour vary in percentage of the total flour from 50 to 100 per cent. Spring wheat is hard wheat and usually contains more gluten and a higher percentage of ash than that obtained from the hard winter wheat; the softer winter wheat contains less gluten, is much lighter in color, and contains less ash.

It is absolutely impossible to practice deception by bleaching flour. Take a yellow flour containing a certain percentage of impurities, as bran or fiber, compare it with the same flour bleached, and the yellow flour will conceal these impurities more than the bleached, as the moment you take out that yellow color, you have a white background and all of these impurities are exposed. So that deception is practiced more easily when flour is not bleached.

In my opinion, neither nitrous or nitric acid is added to flour by the Alsop process; I have not been able to find nitrates as such or nitrites as such in either bleached or unbleached flour, only nitrite reacting material. I am the inventor of a patented process for whitening flour.

By the action of the yeast all nitrates are always changed to nitrites. All deep-well waters and spring waters and drift wells are rich in nitrate salts. I made a loaf of bread using water which contained some nitrates—not nitrites, but nitrates—fermenting it in the usual bread process, and baking it, and after baking I cut off a slice and then applied the Griess reagent to it to show the nitrites in the loaf of bread. This shows the action of the yeast cell on the nitrates changing them to nitrites.

I took some of Pillsbury's Best flour, unbleached, and exposed it to the air of my kitchen from January 24 to February 24, 1910, to show how rapidly the oxides of nitrogen in the air will take out the yellow color, and found that after this exposure it contained 2½ parts per million of nitrite reacting material. Some of the same flour, hermetically sealed on January 24, 1910, still retains its yellow color because the air could not get at it. Nitrites are always present in the body; they are found in the saliva, for the reason that we take in ni-

trates with the vegetables we eat, and those nitrates are eliminated to some extent by the kidneys, also by the salivary glands, and when the nitrates eliminated by the saliva come in contact with the bacteria that always exist in our mouths, they are immediately reduced to nitrites; we swallow these and the bacteria in the stomach immediately begin to feed on them. I have found in artificial digestion that the nitrites disappeared and I have also given some of my assistants test meals of bread containing nitrites and pumped them out after half an hour, or an hour, and examined the stomach contents, and found no nitrites present. The presence in food of nitrogen, as nitrites, in the proportion of one part per million would not have any effect whatever upon the health of persons consuming such foods.

The bleaching reagent produced by the Alsop process is N_2O_3, nitrogen trioxide, and not NO_2. The flaming arc itself produces NO, not NO_2. When NO unites with air there results some NO_2 and some N_2O_3, one-quarter NO_2, and the balance N_2O_3. When that nitrogen peroxide gas comes into contact with water, nitrous and nitric acids are formed after a time. Nitric acid, nitrous acid, and nitrogen peroxide gas are all poisonous in sufficient doses. So of N_2O_3. Whether nitric acid is a good condiment to season the flour with depends entirely on how much you put in.

Unbleached flours that contain their natural color do not contain nitrites, or possibly the very minutest trace. Nitrites are very rarely normal constituents of wheat—it is known that it sometimes contains them. I said before that bleached flour does not contain nitrous acid or nitrites. It does contain nitrite reacting material. This nitrite reacting material it contains which is not a nitrite is as follows: There are a lot of compounds that contain certain groups that react with the Griess reagent to produce the pink color. One such nitrite reacting material responding to the Griess test is terpene nitrosite, and another such is the nitroso phenol compound. So far as I know, there is no way of disclosing whether flour has been naturally or artificially bleached.

But one-tenth per cent of the 1 per cent of the oil in flour is coloring matter—10 parts in a million. This 10 parts of coloring matter will combine with about 5.7 parts per million of nitrogen. The formula by which I determine how much gas the coloring matter of the flour will combine with is as follows: From the coloring matter, which was crystallized, which I then treated with other chemicals, it is $C_{10}H_{16}$, known as the terpene group, and these terpenes some of them have color. The moment they become saturated either with chlorine, bromine, N_2O_3, or nitrosyl chloride, the coloring matter becomes bleached or decolorizes because the coloring matter and these agents come in chemical union. I have not as yet made the combustion analysis on this coloring matter, but I have gotten an iodine number on it, which would correspond to $C_{10}H_{16}$, and I have got an increased weight on these pure crystals when I treated them with N_2O_3 or nitrosyl chloride, which increase in weight would correspond to what this formula $C_{10}H_{16}$ would take up.

Assuming that there were a grain of sodium nitrite in bread, and that that amount were eaten daily by the sick and the well, the old and the young, babies and grown persons, I doubt whether such bread would be rendered in any degree, however slight, injurious to health. Of course, I would want to experiment on that. I hold that the public may rely on the sound business sense of the commercial people of this country and the scientists they employ to protect them along that line, not to add poisons to food. The only object in bleaching flour is to remove this yellow color the same as nature does. Now, if any miller is foolish enough to put nitric acid in enough to burn up his flour, he would lose everything. If nitric acid exists in bleached flour, it would only be a poison if in sufficient concentration. The same is true of NO_2, strychnine, and prussic

acid. Poison is really a relative term. What may be a poison to one individual in the food may be meat and bread and butter to another. As Shakespeare says, "What is one man's meat is another man's poison." I know people that can not eat strawberries. Some people like meat; others get poisoned from eating meat. There is no substance which by itself inherent is a poison. If one sixty-thousandth part of a grain of strychnine was handed to a child in a biscuit, I should say that there was no poison there, unless some minor physiological effect were obtained.

In flour the coloring matter is the base which takes up nitrites, as does the alkali in corn starch. The distinction between nitrites and nitrite reacting material is that the latter is a material which is not a nitrite; but when the Griess reagent acts upon this compound, it makes a nitrite out of it.

I found that where flour was really overbleached, it digested quicker than where it was commercially or normally bleached. That is a good thing for flour, because it is recognized that mineral acids are always added to food in the first process of digestion. Nitric acid is very extensively used by physicians to promote digestion, and also hydrochloric acid.

The human body's natural defenses against nitrites, named in detail, are as follows:

Nitrites when they enter into the stomach, that is the inorganic nitrites, when they enter into the stomach are rapidly consumed by the bacteria that are in the stomach and also in the intestines. If organic nitrites are given, such as ethyl nitrite, or I should say amyl nitrite, the gastric juice decomposes the amyl nitrite into nitrous acid. This nitrous acid immediately decomposes because it can not exist as nitrous acid, and any NO_2 which is formed will combine with the mucus which is secreted by the stomach, and then it will make fine food for the bacteria and be rapidly consumed. Any nitrite that goes through the body, that is, through the intestinal track and is absorbed into the body will be oxidized to nitrate and some of it will be broken down into other forms, but nitrites, nitrite medication, increases the nitrates in the urine, the nitrate medication on the other hand will also probably produce nitrites in the gastrointestinal canal. The pancreatic ferment, the ferment which is always secreted by the sweetbread gland, will reduce nitrates to nitrites, and from the fact that this ferment can do that; that we are taking in nitrites with our vegetables daily, and other foodstuffs, why, there must be some defense for the nitrites generated by this pancreatic ferment from the nitrates, and this defense that I have mentioned, namely, bacteria; second, oxidation; third, different compounds producing decomposition compounds; and fourth, entire consumption of the nitrite as such.

The oxides of nitrogen are poisonous in sufficient concentration. Chlorine gas in sufficient concentration is a deadly poison. Flour is a poison when eaten raw. As to putting table salt and flour in the same category as chlorine gas, cyanide, prussic acid, and strychnine, there is a difference of degree. Bread is food and salt is food up to a certain quantity. Food is poison—if you take too much of it. You can get a poisonous reaction from overeating with bread. In a mechanical way, sand and glass would be poison. I don't know of any one substance inherently of itself in a certain dose which is a poison; it is always a question of the test, the amount, the concentration and other conditions that have got to be taken into consideration before you can call it a poison; all toxicologists are agreed on that; you will find it in every text-book on toxicology. There is no substance which of itself can be recognized as a poison in small doses. No substance can be said to be poisonous until there is enough of it to show symptoms either by a single dose or taken over a long

period. If there were some nitrites in ham, but not enough to be a poison, some in turnips, but not enough to be a poison, some in the New England dinner, but not enough to be a poison, some in bacon, but not enough to be a poison, some in water, but not enough to be a poison, some in flour, but not enough to be a poison, I can conscientiously swear that each one would be free from poisonous substances unless the taking of one would show symptoms of injury either at the time or by constant use of that substance. So, if there were half enough in ham to be poison, half enough in bacon, half enough in carrots, and none in the bleached flour to start with, but when bleached by the Alsop process, half enough to be poisonous is put in, then I would say that no poison was added to any of these things in that sense any more than nature adds a poison to that same flour when you age it—nature does the same thing.

N_2O_3 is a compound, but does not exist as a gas. It is understood by chemists generally that the mixture of NO with air goes completely into NO_2, and makes no NO. But I know that NO and NO_2 often go as N_2O_3 in making chemical reaction. I say that N_2O_3 is the gas which bleaches, but that it does not exist as N_2O_3 gas, but as NO_2 plus NO. That is the only way I can explain it. I have liberated this N_2O_3 directly underneath this coloring matter, so that no air would come in contact with it, and as soon as that N_2O_3 was liberated the color went back quick, and I found that, and got this N_2O_3 out of that coloring matter. My analysis of the Alsop gas figures 75 per cent N_2O_3 and 25 per cent NO as a mixture. My analysis, in the most scientific way I could do it, was made by drawing the gas which came through the flaming arc into a solution of normal alkali—normal caustic soda solution—NaOH—for a given volume. I forget the volume. Then I titrated the amount of alkali that was used up by these gases, and I got a certain acidity. I do not remember what acidity. Then I titrated with deci-normal potassium permanganate, the formula for which is $KMnO_4$, and I found that I used a certain amount of this permanganate. Hence it acts upon the N_2O_3 or potassium nitrite, as I had it in this alkali, to form the nitrate—the nitrate of sodium in that case—of course I used caustic soda, and from the total acidity, and from the amount of permanganate necessary to raise nitrous acid to nitric acid I figured out the amount of N_2O_3 that would be in that Alsop gas, and it was in the amount of 75 per cent to 25 per cent of NO_2, and I know NO_2 as such does not act upon the coloring matter at all. So it must be the N_2O_3. I do not remember the concentration of the gas. If you want to use enough pure air, and in sufficient quantity, you would produce exactly the same result in regard to bleaching.

The formula for the terpene in flour is $C_{10}H_{16}$. The common terpene of nature is not yellow as this is—this is a new terpene. So far as all the chemical works in the English and German language have gone, they say that terpenes are naturally colorless, and after long keeping turn yellowish. We have discovered a new kind of terpene. I first made this discovery public yesterday. I think I could find my notes of my experiments at home.

Medicinal doses of nitrites have no relation to any substance in the flour in suit. I have never seen any flour turn yellow by the Alsop process.

In chemistry two substances may be together in a state of disassociation. Theoretically it would be possible to take a poisonous gas and form from it harmless compounds. N_2O_3, poisonous in sufficient concentration, would produce a harmless compound. So chlorine gas in a diluted condition will not poison flour. I can not name a poisonous gas that will. I do not know the name of the enzyme in the yeast that reduces nitrates to nitrites. I am the authority for the statement that yeast consumes nitrites as such. I do not recall any other authority, but believe I could find one.

JOHN E. BURGNER, a witness for claimant, testified:

I reside at North Platte, Nebr. I am a practical miller of thirty-five years' experience. Our mill has a daily capacity of 150 barrels, and has used an Alsop bleacher for almost six years. There is practically no pressure in the pipes. I have never been able to detect any odor in the flour. From generator to agitator is about 80 feet. Since the bleacher was installed, the iron and rubber pipes and the valve have not been changed. We bleach our flour to make it whiter, and because it gives better satisfaction to the trade. Flour is improved by bleaching to the extent that it puts it in the same condition that about ninety days natural aging does. I never detected any difference in odor, flavor, or loaf volume of bleached and unbleached.

We bleach our patent, but not the clear. We could stop bleaching without dismantling the mill—simply take the belt off the machine. New flour is inferior in bread-making qualities. Aging makes such flour whiter. When we bleach fresh flour we make it look like the aged. A long patent is usually darker than a short. Bleaching the latter reduces its color—that is what we bleach it for. Yellow berry makes the flour a little darker than that free from yellow berry. I think I can bleach the yellow berry so that it looks like flour free from yellow berry. So that bleaching standardizes the color of all flours made from varying kinds and conditions of wheat. I can smell the odor of the gas at the agitator and in the bin. Bleached flour continues to improve. We put three months' improvement on in twenty seconds. So that if it also ages naturally, it gets double improvement. The bleaching process not only makes the fresh flour look like the aged, but, in my opinion, it is like it.

W. D. VODRIE, a witness for claimant, testified:

I am a baker at Omaha, Nebr.; have been in that business forty-two years. My bakery has a daily capacity of 2,000 loaves. My experience with bleached and unbleached flours has been that they work about the same, except that when the flour is new the bleached flour works much better. Comparing bleached flour and that naturally aged, they are about the same, except that the bleached flour is whiter. I have used bleached flour continuously for nearly three years. I have only used unbleached once or twice. The bread I made from it was very dark and I lost a good deal of trade by it. I never had that sort of trouble from bleached flour. I never observed any difference in odor or taste between bread made from unbleached flour and that made from bleached. I consider a patent a better flour than a straight; a short patent is better than a long patent; that is, it makes better bread. Before bleaching came in, a short patent would be whiter than a straight, and a naturally aged flour would be whiter than fresh flour, made from new wheat, and the straight whiter than the clear; when a flour is bleached, the color does not indicate anything as to whether it is a patent.

FRANK EARL ROTH, a witness for claimant, testified:

I reside at Lincoln, Nebr.; am secretary and manager of the Gootch Milling and Elevator Company, located at Lincoln, Nebr., with a daily capacity of 300 barrels. We have been using an Alsop bleacher for nineteen months, ever since the mill was started. Since installing the bleacher we have not made any change in the piping. We bleach because the trade demands flour that will make white bread, and because it enables us to put our flour on the market, aged, rather than to leave it in the mill, unbleached, until it ages properly to make white bread. We have two agitators connected with our bleachers, one for patent and one for clear. I have smelled the gas in the bleaching arc and in the flour bin, where the flour is run in. We do not advertise our bleached

flour as bleached. Bleaching makes the flour lighter in color. If both are unbleached, a new flour is yellower than one naturally aged.

ALVAH EDGECOMB, a witness for claimant, testified:

I am manager and secretary of the Updike Milling Company of Omaha, Nebr., a mill with a capacity of 500 barrels daily. I have had thirty years' experience. In my mill I have used an Alsop bleacher for the last three years and have had experience with one at two other mills. The effect of the bleaching process is to whiten in color and age the flour. New wheat flour by bleaching acquires all the qualities of flour aged for sixty days. I have sold bleached and unbleached flour to bakers. They want the bleached. The benefits which the miller derives from bleaching are a great deal better color and the aging. The process does not conceal impurities in the flour, nor is there any difference in the odor and the taste between bread made from bleached flour and that made from unbleached. I have used bleached flour in my own family for about six years. No sickness has been caused by their eating it, nor has there been other sickness. The gas used in the bleaching gives off an odor noticeable in the agitator and flour bin. If 25 per cent of the patent is taken from a straight, it will be lighter in color than what is left. The straight so "cut" will be darker than if it had not been "cut." A short patent is lighter than a long patent; yellow berry darker than Turkey free from yellow berry; fresh flour darker than aged. Bleaching brings the colors of all kinds of wheat closer together, and makes them look more alike—the good flours and the bad flours, the short patent and the long patent, the flours from the new wheat and from the old wheat, from the yellow berry and from every other kind of wheat.

I have seen sulphur colored, yellow flour on the walls of the flour bin. The odor of the gas in the bin is apparent. About once a month we clean it out with a broom—possibly 10 pounds of this sulphur flour comes out of each bin. Brown powdered dust comes out of the galvanized iron pipes when they are cleaned once a year. This dust is coarser and more granular near the generator than it is farther away. I have not detected the odor of gas in the storage room, although I have smelled it in the bin.

Bleaching flour made from an unsound wheat gives it the same color as flour made from sound wheat. There is not the same relative difference between the different grades of flour after bleaching as there is before bleaching if all are bleached. My company, the Updike Milling Company, had a carload of flour seized by the Government in Iowa, and the Government later dismissed the case. We also had some more flour seized which had been sold on sample to the United States Government as a straight flour. It is possible to take a part of the patent, like 15 per cent, out of a straight, bleach it and make a very beautiful white flour that will sell for the top notch. The 80 per cent or 85 per cent left, which is called the "cut straight," could also be made white by bleaching, so that by cutting the straight, the miller would profit to the extent of the price of the patent removed. I do not know that the flour sold to the Government was a cut straight. I do not bleach my clears, only my straights and percentages. The process will not age clears, nor improve their selling qualities. Since we were threatened with misbranding, I do not label my bleached flour "patent." I have never had any bleached flour returned, except from an industrial school, an Iowa state institution, which returned it because it was bleached. I sent unbleached to replace it.

ADOLPH BOETTLER, a witness for claimant, testified:

I reside at St. Louis, Mo.; have been thirty-six years a baker; am president of American Bakery Company, St. Louis, consisting of 7 bakeries; I buy the flour for the concern, some 150,000 barrels annually; I buy both bleached and

unbleached; in my opinion, at the early crop, artificial bleaching ages flour the same, in baking quality, as the natural bleaching, and thereby prevents what is known as "sweating." Bread made from bleached flour has a whiter color than that made from new unbleached. I have examined loaves made from bleached and unbleached flours, and have never noticed any difference in odor or taste, nor have I known the baking qualities of flour that has been bleached to be impaired by such bleaching.

In purchasing flour I inquire whether it is bleached or not and test it; I think bleached flour should be so branded; I never heard of any flour being advertised as "bleached;" it is very difficult to distinguish in appearance between bleached and unbleached flour; bleaching makes the flour whiter, but does not improve its quality a bit; I consider light, cream-colored flour the best, but bleaching such flour does not deteriorate it; I should prefer bleached flour to unbleached made from new wheat. In my opinion as a baker, aging only improves flour as to color and dryness, and, therefore, gives it greater absorption. I have used thousands of barrels of bleached flour and have never heard of its making anyone sick. Bleached flour does not improve or retrograde with age, but remains practically stationary in condition. The only claim I make in behalf of bleaching is that it eliminates the danger of sweaty flour which is unfit to use. Bleaching does exactly what nature eventually does. I have never detected any odor of gas in bleached flour. My bakeries produce about 50,000,000 loaves a year. For some time we used eggs preserved in cans with borates for making cake—"liquid" eggs.

F. S. HOHENGARTEN, a witness for claimant, testified:

I am manager of a branch bakery of St. Louis, Mo., with a capacity for using from 40 to 50 barrels of flour daily. I have been a baker for twenty-two years. I use bleached and unbleached flour and have never noticed any difference in odor or taste between loaves made from bleached and those made from unbleached flour. In baking quality, loaf volume, and strength, bleached flour is not inferior to unbleached; at early stages of the new crop, bakers prefer the flour bleached, making it the same as aged flour; formerly we had to wait a certain period before we could get to the new flour and use it, until it was through a period of sweat. Bleached flour is at times whiter than the unbleached, but there is not much difference in color between bread made from bleached and that made from unbleached flour; yellow flour bakes out nearly as white as white flour, enough like it to be marketable; the only advantage to the baker of bleaching is to be able to use the new crop at once; I buy mostly bleached flour, but use both kinds in the same manner; I am unable to distinguish bleached from unbleached flour by its appearance, odor, or taste.

C. H. COLLADAY, a witness for claimant, testified:

I reside at Abilene, Kans., and am manager of the Security Flour Mills Company of that city. An Alsop bleacher has been used ever since the construction of the mill two years ago. In that time no changes or alterations have been made in the piping. We make a 65 per cent patent, a 95 per cent patent, and a clear, none of which are branded "patent." We bleach the first two, and if the customer wants it, the clear; otherwise the clear is not bleached.

There is no foreign odor to a sack of bleached flour, taken right off the packer. Bleaching ages flour and does not affect its quality or strength. I consider yellow color a defect in flour, but not an impurity. I can smell the bleaching gas at the flour bins when the bleacher is working, but nowhere else in the mill, the rest of the system being air-tight. Natural aging is simply the time which elapses between the grinding of the flour and the use of it. Bleaching is aging. Therefore, bleaching is three months' time, and has the

same effect. In 1909 my mill branded a 95 per cent to 98 per cent flour "Silver Leaf Patent," but subsequently took that name off; our bleached flour was not labeled "bleached," except in Kansas, where the State laws require such label; bleaching a 98 per cent patent makes it whiter than a 65 per cent unbleached, while by bleaching both flours, the 65 per cent would be whiter than the other; bleaching does not make flour look exactly as natural aging does, though it has the same general effect; for baking purposes bleached is as good as unbleached; the smell in the flour bins comes from the gas which comes down out of the agitator with the flour; flour is not delayed more than five minutes in going through the bin, which is never entirely full; I do not know where the gas goes after it gets in the agitator.

L. N. SHOECRAFT, a witness for claimant, testified:

I am a wholesale flour dealer at Clinton, Iowa. I remember buying 615 sacks of bleached flour from the Wells-Abbott-Nieman Company fifteen months ago, of which I sold all but 12 sacks, which I have kept and am still using in my family. I liked the flour and didn't want to take any chances of not getting any more, as the manufacturer told me he was going to discontinue bleaching. I do not advertise "bleached" flour as such, and do not know anything about bleached flour.

T. J. HOLDERIDGE, a witness for claimant, testified:

I am a mill manager at Kingman, Kans.; I have been in the milling business eighteen or twenty years. The mill managed by me has been in operation five years, and we have used an Alsop bleacher ever since the mill started; we make an 80 per cent patent, and what we call a "straight" grade, and a baker's 17 per cent or 18 per cent, which last is what is known as a "clear"; I bleached the patent and the straight, but seldom the clear; one cannot change the grade of a flour by bleaching it. I use bleached flour in my own family. I have replaced no pipes, valves, or rubber hose, connected with the bleacher, since it was installed. I consider flour bleached by the Alsop process to be about the same in quality and strength as flour naturally bleached; an 80 per cent patent is a higher grade than a straight and naturally lighter in color; the color was an important consideration in flour before artificial bleaching commenced; different kinds of wheat have different colors, and the whitest flour gets the best prices; the natural color would indicate the length of the patent or whether it was a straight or clear, to a certain extent. So that before bleaching, color was an index of the quality of the flour and of the kind of wheat from which it was made. The Alsop bleacher can be controlled so as to bleach light or heavier, and so we use it to control the color of the flour; yellow berry makes a yellower flour than Turkey wheat; a straight flour could be bleached so as to be even lighter in color than a 70 per cent patent; bleaching will take the flour, which before bleaching was less desirable in appearance, and less salable in the market, and bring it near to the appearance of the more desirable and more valuable flour; the purpose of the bleaching is to whiten and age the flour; the expert can distinguish bleached from unbleached flour by the difference in color.

Wheat which has been through the sweat in the stack and again in the bin, and given some time to condition, is in the best condition for milling; flour that is allowed to age two or more months is better and becomes whiter than if not so aged. As a rule it will spoil in a year. Bread made from unbleached flour, naturally aged, is better than that made from fresh flour, even if that flour was made from old wheat, and such is the general understanding of housewives, millers, and bakers; bleaching fresh flour makes it look very nearly like naturally aged flour. With the bleaching process, flour from new wheat, fresh from the harvest, can be made to look practically as good as flour made from

old wheat, aged three or four months. I can smell the bleaching gas if I go up to the bin, where it empties from the agitator. Flour usually stays in the bin only a few minutes, but sometimes four or five barrels may remain over night. I brand my 80 per cent flour "patent"; the clear I put in jutes and brand it "S", as a designation. Inferiority in wheat from the presence of yellow berry would be practically concealed by bleaching. Getting rid of the yellow berry is considered a problem. The yellow berry is a softer wheat than Turkey wheat, and will never make so strong or so good a flour as Turkey wheat, bleaching or no bleaching. The yellow berry or the yellow color is a defect in flour, and bleaching it would make it so near in color to wheat that did not have the yellow berry in it that it would take a genius of an expert to tell the difference. By bleaching it can be made to look as good. Flour made from yellow berry, if it is sold as such, and known to be such, will not bring as much as flour made from Turkey.

I seldom bleach my clears, unless specifically ordered; I put "electrically bleached" on each sack of flour sold by me in Kansas, but not on that sent out of that State.

LUCIUS E. SAYRE, a witness for claimant, testified:

I reside at Lawrence, Kans.; in 1866 I graduated at the Philadelphia College of Pharmacy; after graduation I had charge of the laboratory of Frederick Brown, Philadelphia; then for ten years had charge, as chief clerk and manager, of the business of Henry C. Blair & Sons, Philadelphia, dispensing pharmacists, then went into business at Philadelphia in partnership with Joseph P. Remington, as manufacturing pharmaceutical chemists and dispensers; at that time I was elected an instructor in Philadelphia College of Pharmacy, and professor of pharmaceutical chemistry at the Women's Medical College of Philadelphia; subsequently to that I was called to the deanship of the School of Pharmacy of the University of Kansas, which position I have held since 1885; after my studies at the Philadelphia College of Pharmacy, I obtained the degree of B. S. at the University of Michigan, and the degree of A. M. at the Philadelphia College of Pharmacy. I am a member of the American Chemical Society and of a number of similar bodies in which I have held important offices, at one time being chairman of the American Pharmaceutical Association. For a good many years I have been engaged in research work on various subjects, such as "loco weed", botanically known as *Astragalus mollissimus*, which infected the fields of western Kansas; later I investigated the "cactus grandiflorus," discovered a new principle, gelsiminin in the plant commonly known as yellow jasmine, and discovered a new form of pepsin known as "scale pepsin," with which I supplied the Philadelphia hospitals; I am by appointment of the Kansas legislature, director of drug assaying and drug analysis. In addition to being dean of the School of Pharmacy of the University of Kansas, I am also professor of materia medica at that institution; I have been connected for thirty years on the revision committee of the United States Pharmacopoeia.

I first became interested in bleached flour in October, 1908, when two samples of flour were sent to my laboratory, the question being whether these two flours differed materially so far as their wholesomeness was concerned. One of these flours was labeled "bleached" and the other "unbleached." I made a determination to see if one of them was actually unbleached and one of them was bleached, and found this to be true. For the purpose of the investigation I had bread made from each of these two samples. I partook of this bread myself for some time, and had it served at my own table. I could not distinguish between the two breads made from the bleached and the unbleached flour except in the matter of color. I also submitted the flour to the process of digestion and I found that the action of the ferments was the same so that I could not dis-

tinguish between the flours. In this experiment the digestive agency was pancreatic which in the human system corresponds to the digestion which takes place in the alimentary tract. In the body there are two kinds of digestion, the gastric digestion, that is, the digestion of meats and albumen and substances of that sort, and the pancreatic digestion or the digestion of the starch. The main portion of flour consists of starchy substances. After obtaining results with the pancreatic digestion, I made similar experiments with saliva and again found no difference in the digestibility of the two flours.

My next experiment was an attempt to account for this similarity of action of the two flours, admitting that there was nitrite reacting material in the bleached flour; in other words to account for this lack of retardation which one would expect from the presence of nitrite reacting material. I suspected the possibility that nitrite reacting material was not in any way inhibiting the action of the ferments, and as an experiment started pancreatic and peptic digestions from which I took a portion every few minutes and tested for nitrite reacting material. These experiments were controlled by an Oswold thermostat, and the water bath was arranged so that a circulation was constantly kept up. All conditions were uniform as far as they could possibly be made. In all cases with both kinds of digestion the nitrite reacting material disappeared completely in from fifteen minutes to one hour and a half. From these experiments I conclude that in digestion the nitrites or nitrite reacting material is disintegrated or broken down so as to make the nitrite reacting material disappear, so far as chemical tests and observations are concerned. Carrying these conclusions to flour bleached by the Alsop process, my observations convince me that nitrites, even in the quantity of 1.8 parts per million, are broken down and become inert, so to speak, and absolutely inactive. I am not prepared to say that really digestive substances may be formed, but from my observations or from my reading I think it is possible for certain compounds to be changed by the breaking down of nitrites into new substances which are not foreign to the digestive process. Further than this, I do not think there is any possibility of nitrite reacting material or nitrites in the quantities found in flour or bread ever getting into the blood circulation.

I have made experiments to ascertain the effect of nitrites on the blood when taken internally. On two successive days I took three grains in one dose in the morning about 9.30, and the second dose of three grains about two hours later. I allowed that time to incubate, so to speak, or to pass into circulation with the heat of the body, and then with a spectroscope in the laboratory I tested for met-hemoglobin. At no time during either day was I able to get any met-hemoglobin. I then administered nitrite to two of my helpers. On the first day they took three grains every hour until nine grains had been taken. After a sufficient time had elapsed their blood was tested for met-hemoglobin with negative results. The administration was repeated on the second day with the same result.

I never practiced medicine, but I read medicine with Dr. Oak Wright. I am a medical doctor, but was never licensed or qualified to practice medicine under the laws of any State. I am not a physician. I am not a surgeon, or a physiological chemist in the sense that term is now used. I am not a toxicologist. I am a general analyst. The foundation for this work was in the Philadelphia College of Pharmacy, and in connection with my work with the revision committee of the United States Pharmacopœia, and I suppose the point might be made that my experience of forty years is the best school that I have attended. The committee for the revision of the Pharmacopœia consisted of twenty-five members up to 1910, when this number was raised to fifty members.

I do not consider unbleached flour of good quality, nor flour bleached by the

Alsop process if of good quality, to be poison. Whether table salt is poison or not depends upon the quantity taken. Strychnine would be poisonous in certain doses. Everything depends on quantity, or rather those articles which are poisons are dependent upon the quantity. Flour is not to be regarded as a poison. It is food. I am not a pure food officer, but am connected with the Kansas Board of Health in connection with the operation of the pure food and drugs law, and have charge of the drug laboratory as director. I believe that there are certain substances, such as wholesome foods, which may accurately be said to be not poisonous, and further I believe it to be true that there are substances which by their nature are poisonous substances in certain quantities. The rule of my department is that no poison shall be added to food, and if, for example, we have a breakfast, to the cantaloupe of which some prussic acid has been added, but not enough to produce a result or show a symptom, and if we have some coffee to which some prussic acid has been added, but not enough to produce a symptom, some shredded wheat biscuit with some prussic acid in it, but not enough to show a symptom, some eggs with prussic acid in them, but not enough to show a symptom, I would say that to each of these portions of the breakfast there had been added poison, no matter how minute the quantity, and even though this quantity be so minute that no physiological effect can be observed, traced, or in any manner discovered. I would believe the same regarding the addition of strychnine or corrosive sublimate. I would not say this with respect to any poison. I say a question of poison is a question of quantity, and in quantity I have reference to the nature of the poison. For example, I may say that many of the innocent substances, as for instance vinegar, could not be taken in the form of acetic acid, yet it could be added in a quantity that would be entirely innocent. The same is true with citric acid and with many of those substances which would be, in concentrated form, poison, but in minute quantities would not be.

If it be true that natural aging improves the digestibility of flour and that bleaching is the same as natural aging, it would appear that the bleached flour should digest better, but I can not say what ought to be or what ought not to be.

I do not know that nitrites produce methemoglobin in the blood, having no experience from personal observation in the experiments I have made. I have seen methemoglobin through the spectroscope, taken from the blood of a human being. This was in the case of a child who died at London, Ohio. This death was caused by acetanilid. I have also seen methemoglobin produced in a test tube by the addition of nitrite reacting material to blood.

Nitric acid, nitrous acid, N_2O, N_2O_3, N_2O_4, NO_2, are poisons in concentrated form; that is, all of these substances if taken in certain quantities will have a poisonous effect. Nothing is poison except in quantity. They all fall in the poison group in concentrated form. One can tell how much poison of a given character it will take to kill another human being, within certain limits, but you can not tell exactly, as this depends upon the body weight, the condition of the individual, and many other circumstances, all of which are usually summed up under the term "resistance." A very small amount of such substances as strychnine or hydrocyanic acid would be fatal to the ordinary person. In the treatment of flour by NO_2, HNO_2, HNO_3, or N_2O_3 there would be formed in the flour such substances as nitro and nitroso bodies and also amino and diazo compounds, and xantho-proteic compounds, which would not respond to the Griess test. I would not like to testify as to the poisonous properties of flour in which such reactions have taken place, as I have not performed any experiments. Its action would depend altogether on concentration. I do not believe that it is generally understood to be injurious to the flour if we have

formed nitroso amines produced by nitric acid and the nitro amines and the diazo compounds. I will not, however, express any exact opinion.

I do not consider nitrite of sodium as a food. It is a drug. If nitrite of sodium is added to the flour a drug is added to the flour. I also consider nitrite of potassium, nitrite of magnesium, and nitrite of calcium to be drugs. If we assume that in the bleaching of flour there is added to the flour nitrite of magnesium, potassium, sodium, and calcium as a permanent combination, there would be, of course, drugs added to the flour. Assuming that in all flour there were some of each of these bases, potassium, sodium, calcium, and magnesium, since each of these bases shows great avidity for the radical of nitrous acid and nitric acid, we would have in the flour KNO_3, $NaNO_3$, $Ca(NO_3)_2$, and $Mg(NO_3)_2$ from the nitric acid, and from the radical of the nitrous acid we would have the nitrites of sodium, potassium, calcium, and magnesium. This follows as a result of chemical laws, which are certain and fixed. Now, carrying this over to flour where we have a complex mixture of organic and inorganic material in which we have some potassium, some sodium, some starch, some proteid, and some coloring matter, which coloring matter is, according to Doctor Wesener, a terpene and which terpene is naturally yellow but turns colorless on aging, but of which I never heard before, and if to this mass is added a radical nitrous acid, that is, NO_3, and if there is not enough of that radical to satisfy each of the bases, the nitric acid radical will not distribute itself throughout the mass in a manner depending upon the mass of the individual constituents and upon the affinity of the radical for these constituents, but will combine with the element for which it has the greatest affinity, whatever that may be. If it has the greatest affinity with this assumed terpene, of course it would combine with that. If the terpene is sufficient to satisfy it, then that satisfies it. There is in chemistry an elementary law known as the law of mass action, which states, applying it to nitric acid or the radical from nitric acid, that given a complex mixture with various bases and moisture it will combine not with one but will distribute itself to each and to all of the bases for which it has any affinity and that the amount of chemical action with each depends upon the mass of it and upon its affinity. If, then, we leave out of the flour the terpene but if we have present the sodium, potassium, starch, protein, and oil and if the law of the mass action as it is defined in the textbooks of chemistry applies, the combination will be a nitrite of each one of them, depending upon the mass of each and the strength of the affinity of nitrous acid for each base.

In my digestive experiments I tested the digestibility of the starch. I did not test the digestibility of the oil nor the proteins. Raw starch is not digestible in pancreatic digestive fluid to an appreciable extent. It has to be prepared. Neither is raw starch digestible with saliva. My experiments proved solely that the digestibility of the starch was not impaired and the fact that one element of the food, in this case starch, is not rendered less digestible does not prove that the food is not injured or made deleterious. It would not be necessary, however, to have similar proof as to each of the elements entering into the flour, as in my opinion if anything deleterious had been added to the flour it would show itself upon starch digestion because this starch digestion is a very delicate reaction and with my knowledge of ferments it would show.

I have not made any experiments as to the effect of NO_2 upon the flour and I could not say whether or not it would increase the water content of the flour, and could not say whether such treatment would double the gluten or proteids of the flour In my work with flour I did not notice any increase in the proteids. I could not say whether or not it would be chemically possible to double the proteids of the flour by treatment with NO_2. When they say

that they can build up albumen from carbon alone, I am not prepared to state whether this is possible or not. I have never done this, but I believe it has been reported to be a fact. When or where or by whom I do not know. On good authority I would have to accept the statements made in the Alsop patent that before treatment the flour had the following compositions: water 9.84 per cent, starch 74.11 per cent, proteids 14.99 per cent, ash 0.44 per cent, fat 0.62 per cent, and that after treatment by the Alsop process the flour had the following composition: water 10.13 per cent, starch 62.24 per cent (which is a decrease of 12 per cent), proteids 26.71 per cent (an increase of proteids of about 12 per cent), ash 0.30 per cent (a decrease of ash), and fat 0.62 per cent (which is unchanged). I never performed such analyses, and these statements and all such statements depend on the authority, and I would have to go over his ground myself in order to testify under oath as to what my opinions are. If the best chemical authority in the world told me that the Alsop bleacher nearly doubled the proteids, as a chemist I would go over the ground as I have said before to ascertain the truth of that statement.

In my digestion experiments, I did not make any determinations as to the amount of starch, proteids, fat, or moisture in each of the flours used. After digestion I did not determine the amount of starch left or sugar produced or the amount of proteids, fat, or moisture remaining. I did not in my work determine the proteid digestion. During the course of my digestion experiments the digestive fluid was exposed to air. These experiments therefore took place in the presence of oxygen, and nitrites oxidized become nitrates. I am not physiologist enough to know that in the body digestion takes place in the absence of oxygen. I admit, however, that in the course of the digestion nitrates may reduce to nitrites. And if oxidation of nitrite to nitrate takes place, the nitrite becomes relatively harmless.

Nitric and nitrous acids are administered as medicines. Nitrous acid was, when I dispensed, administered very commonly in the form of what was known as "Chapmann's Diarrhoea Mixture." The formula of it is published in Griffith's Formulary, and the amount of nitrous acid is 1 fluid dram of the nitrous acid to 8 fluid ounces of camphor water and 40 minims of tincture of opium, given in cases of diarrhoea and dysentery.

Regarding diazo compounds, I may say I made tests for such compounds in the flour with which I worked, with negative results. In order to form a diazo compound of the aromatic series it is necessary to keep the temperature down, as it is generally admitted they are unstable at the ordinary temperatures. In my opinion, no sodium nitrite or any of those inorganic nitrites are added to the flour as we understand addition.

Acetanilid is a medicine used to reduce fever and is used as a headache cure. I know it has been used as an adulterant for some substances. It would be a bad thing to add to flour. Nitrite of sodium would not be a good thing to add to flour, and I presume it would be a bad thing. When I stated that the bleaching system added nothing to the flour as we understood the word addition, I meant that in one case if we would take a grain of sodium nitrite, for instance, and add it to several pounds of flour, that would be an addition. But if we took the gas and introduced the gas I would not have the right to say that I had added nitrite of potassium or sodium to that. It would, however, be the same substance whether produced in the flour or added to it if the substance is there. And if as a matter of fact the Alsop process makes nitrite of potassium, sodium, calcium, and magnesium in the flour, they are the same kind of substances as if bought in a drug store, but I do not think it is correct for me to say that sodium nitrite was added to the flour. Nitrous acid is the same whether made by the Alsop process or made in a drug store by a chemist.

The same is true of nitric acid and NO_2 gas. So that if it is proved that nitrous acid is poison in one case, nitrous acid is poison in all cases when it is in concentrated form. We have a rule in chemistry that one positive result is worth many negative results. For example, if in an analysis one man finds a certain substance, his testimony is worth the negative testimony of a great many men who did not find this substance in the course of the same analysis.

CHAUNCEY ABBOTT, a witness for claimant, testified:

I reside at Schuyler, Nebr.; am president and manager of the Wells-Abbott-Nieman Co., which has a capacity of 1,800 barrels a day. We have used an Alsop bleacher in our mill for the past five and a half years. We make four grades of flour, a best patent running from 82 to 85 per cent, and a second patent 95 per cent, a first clear and a second clear, sometimes called low grade. We bleach the two patents, and, when requested, we bleach the first clear, but never the second clear. I understand that a patent flour is anything better than a straight grade ranging from our 55 per cent to 95 per cent, or might be even more than 95 per cent. Anything under a straight grade. I have made investigations as to the effect of bleaching on flour consisting of baking tests made under my direction in a laboratory and kitchin, at the mill, and the results have shown that bleaching improves the quality of the flour, the same as age does; if you take two flours that are alike in all respects except that one is bleached and the other is not, the loaf from the bleached flour shows a greater volume, more loaves to the barrel, and finer texture, as well as lighter color. I have never noticed any foreign odor in bleached flour or any difference in taste or of smell between bread made from bleached flour and that made from unbleached, excepting that I think that when the bread is made from flour made from new wheat, which has not gone through the sweat, the flavor is slightly improved by the bleaching.

I can not bleach my long patent so as to give it quite the same color as the short patent, because these two flours have different color characteristics; it is not that they just differ in degree of color, but possess slightly different characteristics; the shorter patent has more of a creamy tint, while the longer patent has a sort of grayish white, because of foreign substances that we are unable to take out of the long patent with our present system of milling. If a flour contains inferiorities, such as bran, specks, etc., it is impossible to conceal them by bleaching; they would show out more, in contrast with the flour, if the flour were whitened, and for that reason, I prefer not to bleach our first clear. Before we installed the bleacher in our mill, flour used to collect on the inside of the roll frames, where the grinding is done, and stick there and take on a yellowish color. I am unable to procure pure Turkey wheat, unmixed with other wheats, to exceed 1 per cent of the total wheat ground at our mill in the course of a year; as to the remainder of the wheat we buy for grinding, some of it is tolerably dark in color, some has a portion of the berry dark and a portion yellow, some where the berry is almost, if not quite, yellow, and it comes to us more or less mixed in cars and wagons; if the "yellow" could be separated from the "dark," I think the yellow would be 35 per cent, the balance darker; in my opinion there is no material difference between flour made from yellow berry and that made from Turkey wheat. I can not swear, however, that Mr. Holderidge was wrong when he testified that Turkey wheat makes a stronger flour than yellow berry. I am contributing to the defense of this suit and am very anxious it should be won by our side. In my opinion, with about fifteen seconds' exposure, I can bleach flour made from yellow berry so it will be as good as flour made from other wheat. We use about three horsepower to 1,700 barrels, and bleach very lightly. I do not think bleaching could be

used to deceive, as my understanding is that, if it is used excessively, it will injure the appearance of the flour and give it a chalky, disagreeable appearance. Assuming that the Aetna mill made a straight grade of flour in August from mixed wheat, new and old, and added to it a 20 per cent clear, bleached the whole hard and heavily, so it looked white, and labeled it "high grade patent," I think that would be cheating and defrauding and concealing inferiority by the Alsop process.

In my opinion, bleaching does not improve the quality of my first clear, and as it is largely sold for export, the foreigner gets the benefit of natural aging by the time the flour reaches him. If one should take 15 per cent patent out of a straight and bleach what is left, the "cut straight," it could be made to look so like the straight by bleaching that it would be very doubtful whether a person could detect the difference. The bleaching makes the cut straight whiter and nearer the color of a straight which had not been cut. Hard Turkey without yellow berry makes a lighter colored flour than the same wheat containing 35 per cent yellow berry. Bleaching would bring them nearer together in appearance, and if the miller were disposed to be fraudulent, would be one means of enabling him to sell the flour from wheat mixed with yellow berry as and for a first quality pure hard Turkey wheat flour. Similarly short patent is considered better flour and sells for more than long patent, and bleaching can make the long patent whiter. Before bleaching commenced, color was not the one thing considered by practical men as indicating the quality of the flour, but rather the texture of the flour and the strength of the dough. The consumers do not inquire about the color at all and never did; all they are after is the bread it makes. Bleaching improves the gluten and the dough from patents; I never experimented with other grades; it ought to help a 30 per cent clear. I never have smelt any odor of gas about the mill, except when I open a valve on a pipe, where the gas is. I never noticed any yellow flour adhering to the walls of the bins, as testified to by Mr. Edgecomb regarding his mill. I get the same price for my unbleached clear as for my bleached clear. I should think an ordinary consumer could distinguish between a first patent and a clear, by the impurities and specks in the latter; I do not think a consumer could distinguish between a straight and a cut straight, nor between a long patent and a short patent. In my opinion wheat containing 35 per cent yellow berry is in fact first quality hard wheat, and is so rated in the market. There is the same relative difference between the grades which we bleach before and after bleaching.

F. D. LARABEE, a witness for claimant, testified:

I reside at Hutchinson, Kans. I am president of the Larabee Flour Mills Company and manage the business; we have two mills, one at Hutchinson of 1,100 barrels daily capacity, and one at Stafford, of 500 barrels daily capacity; we use an Alsop bleacher. We make three grades of flour, one of which would approximate 92 per cent, another 100 per cent, and a third the 8 per cent which is left when we are making the 92 per cent. This percentage is based on the flour content of the wheat after approximately 3 per cent of low grade is removed. We bleach the 92 per cent and the 100 per cent. The word "patent" is not used on our sacks. We sell our flour from coast to coast, but the greater part in the Southwest, the Southeast, and the Pacific coast, approximately 15 per cent of our output being sold in Missouri. The 92 per cent is a little whiter than the 100 per cent. We grind principally No. 2 hard Kansas winter wheat, averaging 59 pounds or better to the bushel. We get no No. 1 for grinding. I have never detected any foreign odor in flour that has been bleached by the Alsop process nor have I noticed any

color in the gas coming from the Alsop machine. The only pressure I have noticed in the pipes connected with the Alsop machine is that which would come from a slight draft, if you would call that pressure. We have made no difference in the percentages of our flour since using the bleacher. We can make 100 per cent flour because we have a perfectly equipped mill, using the long system of milling; in this system we have eight breaks for the wheat, double the number in the ordinary mill. After the breaks we grade all of our stocks carefully before coming to the next reductions, and we separate every reduction into a fine and a coarse separation, and grind and purify the fine and coarse stock separately. We feel by doing this that we get an accurate grind to each kind of stock, and it enables us to adjust the rolls to the particular stock. This handling allows us to keep the impurities out throughout the whole process of milling. We guarantee our 100 per cent to be just as good as other mills' 75 per cent patent, as far as giving satisfaction to the trade is concerned. I think each mill in our section has a standard of its own for patent. I doubt if we get 1 per cent of Red Turkey wheat a year for grinding. We have been using the pipes and hose now in our mills for about two years. I use bleached flour in my own family. I regard yellow color in flour as a defect and consider it an advantage to remove it.

I am one of the parties in charge of the defense of this suit and certainly want to win it. I have no interest in the mill that made the flour that was seized. I am not interested in the Alsop Process Company. My company experimented with an electric arc bleaching process and the Alsop people sued us for an infringement, and we sold out to them. We use three amperes at 500 volts in bleaching 1,100 barrels, regularly year in and year out. I do not consider color an impurity; we get a very clear, well dressed flour, which is yellow in color. Generally, as the patent gets longer, the flour is a little darker; our short patent, 80 per cent, is a little lighter than our long patent, but not enough so I could tell them separately, although I could if they were brought together. By bleaching the long patent, but not the short, I think it could be made alike in color, although there would still be a little difference, the long patent having a creamier shade. I think that flour naturally aged would work better in the dough than that freshly milled, and we always thought that if we could age flour before putting it on the market, it would be more sure to give satisfaction. After bleaching, my opinion would be that there might be some improvement, but not as marked as in the unbleached. I think our observation has been that to bleach our flour will insure its giving practically the same satisfaction as flour from thirty to sixty days old. Before bleaching commenced at all, it was our custom, like that of other mills, to load the flour right into the car from the factory. A man who would sell a cut straight as and for a straight is misrepresenting, certainly. It is not a reputable thing to take a straight grade of flour made from old wheat and new wheat mixed and add to that a clear made from some other flour of 15 per cent, and bleach it to make it look white and sell it as and for a high patent. I would not do it. On an assumption that the bleaching and whitening of flour by the Alsop process make the darker colored flour from inferior wheats simulate the appearance of the lighter colored flours from better wheats, and that the degree of simulation is such that the ordinary nonexpert flour purchaser can not detect the difference between them, I do not know whether the Alsop process has as a practical matter concealed inferiority and misled the purchaser. I think a flour ground from new wheat is improved by bleaching. I doubt very much if a dark flour, from inferior wheat, can be bleached and made to simulate the appearance of a lighter flour, from a superior wheat. Bleaching flour made from new wheat makes it appear a good deal the same as wheat conditioned, and work a good deal the same.

MRS. ADDIE BUCK, a witness for the claimant, testified:

I reside, with my husband and two children, one mile from Green Castle, Mo. About April 7, 8, or 9, 1910, my husband bought from Mr. Terry, the grocer at Green Castle, Mo., three sacks cream 5-X flour, made by the Lexington Mills, Lexington, Nebr.; one of these sacks was for my family, and the other two for my father's family living near me. I baked bread from this flour, and it baked as nicely as any flour I ever used. I do all my own cooking. The bread had a better taste to it than from any flour we had used for a long time. I never had any bleached flour before that I know of; this flour had a better taste to it, considerably, than any other flour I have had.

MRS. CHARLES KIDWELL, a witness for claimant, testified:

I reside at Castle, Mo., with my husband and one child; I bought one sack of Lexington Cream 5-X flour from Mr. Terry, the grocer at Castle, and made bread of it. I do my own cooking. I used the whole sack and it made good bread, whiter than other flours; it had a good taste and gave perfect satisfaction; we used it every day in our family.

MRS. L. P. HOUSTON, a witness for claimant, testified:

I reside near Castle, Mo., with my husband and four children. I used one sack of that Lexington 5-X Cream flour from Mr. Terry's store, and it made good bread, whiter than what we had been using, tasted all right, and gave entire satisfaction. I got some "Purity" flour from Mr. Terry after the other was seized, but it was not so good as the bleached flour.

ORLANDO M. FRIEND, a witness for claimant, testified:

I reside at Hannibal, Mo., and am with the Hannibal Milling Company, which has a capacity of between 700 and 800 barrels a day. I have been in the milling business about thirty-five years, and have used an Alsop bleacher in my mill for five or six years. The bleaching process ages the flour, aerates it, makes it whiter, dries it out some, and increases its absorption qualities, I should say. Dough made from bleached flour is more elastic and tougher than that made from unbleached. The bleaching process improves high-grade flours, but not those made from unsound or diseased wheats, as they have a soft blue undesirable color and the bleaching would make that color more apparent, just as natural aging would. There are other advantages to the Alsop process, aside from aging the flour and improving it in color—without it you would have to grind the flour very fine, and it would be of a soft, soapy nature, and would be impaired in quality somewhat, while by the use of the process, you can grind more granular and make a livelier, freer, and more acceptable flour. Granular flour is, I think, preferred by the miller to a finely ground flour. We don't advertise bleached flour, but we notify every one of our bleaching. I have never noticed any foreign odor in flour that has been bleached, or in bread made from it, nor any difference in taste. I use bleached flour in my family. Bleaching several grades of flour would leave them with relatively the same differences in color; the purer the flour, the more susceptible to the bleach; the process makes flour lighter in color, but if you would compare it with something white, yellow flour would still have the golden color to it. I visited the Rex mills recently; the gas was transparent; when we first opened the pipe and took the plug out, some dust fell out, but after the flour dust blew away, the gas was transparent. We grind soft winter wheat, which makes flour as white as any; the aim of the millers has been, as long as I recollect, to make a white product. Years ago, I have understood, that some millers put corn products into their flour—plugged it up so badly that it would scarcely make a dough. I would say it was better to make flour white by nitric acid than by corn.

JUSTIN R. SODEN, a witness for claimant, testified:

I am a merchant miller at Emporia, Kans., and have been in the business for twenty-four years. We grind from 155 to 225 barrels every twenty-four hours. Since 1905 we have been using an Alsop bleacher. I never detected any change caused by the Alsop process, other than in the color. With that process you can bleach your flour so as to have almost any age; there should be no difference, in baking qualities, between bleached flour and that naturally aged. I have never noticed any foreign odor to flour bleached by the Alsop process, nor any difference in taste or smell between bread made from bleached flour and that made from unbleached.

GERALD BILLINGS, a witness for claimant, testified:

I am in the baking business at Chesterton, Ind. I attended the Chidlow Institute at Chicago about nine months in 1902. I made a loaf of bread from the Wells-Abbott-Nieman flour that Mr. Shoecraft brought from Clinton, Iowa, using the short-dough process, which does not give so light a bread as the long-dough process.

FRANK S. LARABEE, a witness for claimant, testified:

I am associated with my brother, Fred Larabee, in the milling business at Hutchinson, Kans. The best wheat we can obtain for milling is No. 2 hard Kansas wheat weighing 59 pounds per bushel. In buying and selling flour, color is not regarded by the buyer as a test of quality. Assuming the color to be satisfactory, the skilled buyer will put the flour to other tests; he will test for the strength of the gluten, moisture absorption, and loaf volume. If a certain flour was presented to me, and I had no other flour to compare it with, I could not tell whether it was a straight or a patent. If lower grades are bleached the same amount as higher grades, they are not brought to the same appearance as the higher grades, and they have the same relative difference after, as before. In my judgment it is impossible, with Kansas wheat, to bleach a straight grade of flour, or a clear, so as to make it resemble, or give it the color of unbleached patent. I have never noticed any foreign or unpleasant odor in flour that had been bleached by the Alsop process; I have examined breads made from the same flour, bleached and unbleached, and have never noticed any difference in the taste or smell of such loaves of bread. In my judgment, bleaching by the Alsop process improves flour, gives it a whiter color, removes the yellow stain which is naturally in our flour, and ages it, after the manner of the actual aging. I use bleached flour in my own family. Flour made from bleached new wheat does not make a better loaf of bread than the same flour unbleached, except in color. I regard a yellow, or dark yellow color, a defect in flour, and that bleaching in removing it, removes a defect. Not exceeding 1 per cent of Turkey Red wheat is obtainable in the markets of Kansas. I know that corn has been put in flour to whiten it. I do not know what a patent flour is.

ALVAH W. ESTERBROOK, a witness for claimant, testified:

I reside at Kansas City, Mo., and am a chemist engaged in the testing of flours. Have an apparatus for preparing dough in my laboratory, of the modified Koellner system, and an electric oven for baking bread. I received two samples of flour from Mr. Friend, who testified here, from which I baked loaves in evidence under exactly the same conditions. A baker can make about the kind of bread he is after if he knows how. In all these flour cases I stopped the fermentation before it reached the maximum; the method I used was best adapted to testing the baking qualities of flours, and is that used by millers in their tests. I never worked in a mill.

HENRY STARK, a witness for claimant, testified:

I reside at Clinton, Mo., and am now and have been for thirty-five years engaged in the milling business. The capacity of my mill, the White Swans mill, of the Butte Milling Company, with offices in Kansas City, is about 1,200 barrels a day. We have had an Alsop machine in our mill for the last five years. I have never observed any foreign or unnatural odor to flour bleached by the Alsop process nor any difference in taste or smell between bread made from bleached flour and that made from unbleached. Flour stored in a warehouse where it can get plenty of air will get whiter from the air, and lose some weight in drying out. Bleaching produces the same color as natural aging. We bleach the patents and second grade, and we find that bleaching dries the flour and stops this runny substance present in new flour; it produces the same effect as aging.

Not all flours improve by aging, only flour made from sound wheat; that made from bad wheat, the longer it lies, the worse it gets. When I did not use the bleacher, I found I had to use considerably finer cloth, which of course means more power. By grinding very hard and making the flour finer, we can grind color into it; it is not so salable when ground so fine, and in order to get it so fine, you've got to fine up on your cloth and jam up on your rolls, which means more power and more oil, and not only that, but when I use the bleacher, I can make 100 barrels more in twenty-four hours than I ever could formerly. I have a valve on the intake pipe to my bleacher; the less air you let in, the stronger it bleaches; if you shut off all the air the gas won't go up; by turning this valve and by changing the voltage, you can control the color. We grind soft wheat altogether. I consider it preferable to control the color of my flour by nitric acid treatment, in a liquid or gaseous form, than by milling methods. The fumes of the gas from the Alsop bleacher do not give a very unpleasant smell. I have not been able to smell them in the flour, but you can smell it when it goes into the tanks, if you open the door, and when it comes out of the agitator, if you open the hole. I never knew bleaching to make the flour yellow. We use about six horsepower in bleaching 1,100 barrels, using two bleachers; you can bleach a straight to make it lighter than a patent, a sort of a chalky white, but it is not a desirable color. You can adjust your bleacher so as to bleach equivalent to a week's aging, or a month's or two months' or three months'. So you can make the soft fresh flour match up with flour of a given age, and look alike in color. That is what we habitually do—make our fresh flour look as near as we can like the naturally aged. I have never applied the Griess test or seen it done. I never put anything into my flour except the air as it went through the bleacher. I never used the Williams process, because it uses nitric acid, which I understand to be poisonous. I understand the Alsop process uses pure air, with the electric flame going through. If it were proven to me that the Alsop process uses exactly the same gas as the Williams process, I would throw it out.

JOHN T. SCHRAMM, a witness for claimant, testified:

I reside at Kansas City, Mo., and am head miller for the Southwestern Milling Company. Our best brand is known as "Aristos." We have been using an Alsop bleacher for the last four years, bleaching all our flour during that time, except from March, 1909, to January, 1910, and except from March, 1910, to date. The "Aristos" patent found in the markets of Kansas City at present is an unbleached flour.

B. HOWARD SMITH, a witness for claimant, testified:

I reside at Kansas City, Mo. I have lived there twenty-five years and have been in the bread-baking business for the past thirty years. I have [illegible]

under my control, five in Kansas City, Mo., and one in Kansas City, Kans., my output being about 1,700,000 loaves a month from all six plants. We use about 50 per cent bleached and 50 per cent unbleached flour mixed, as we get better results that way than from either used separately. I have never been able to see any difference between bread made from bleached flour and that made from unbleached. Unbleached flour, made from new wheat, when delivered to the bakery soon after grinding, shows a youngish appearance and does not have the volume; it is hard to make a decent loaf out of it; it slacks in the dough, softens up some; such flour does not make as good bread as after being bleached, either artificially or naturally.

G. A. GILLIS, a witness for claimant, testified:

I reside at Kansas City, Mo., and am manager of the Mid-Day Club there. My occupation is manager of hotels, clubs, and restaurants. I was formerly manager of the Harvey eating houses, on the Santa Fe System. We use bread from the Smith bakery entirely at the Mid-Day Club. I used bleached flour on the Harvey system; we thought it was a better flour than the other, made nicer bread, sweeter, firmer, and lighter in color.

W. C. DUNN, a witness for claimant, testified:

I reside at Independence, Mo., and have been head miller at the Wagoner-Gates Milling Company for twenty-three years. We have used an Alsop bleacher for the past four years, and have bleached all grades of our flour. We sell principally to the family trade. Most of our wheat comes from Kansas and around here. Bleaching dries the flour, makes the lower grades darker, and the higher grades whiter. It is not possible, in my judgment, to make a low grade of flour, by bleaching it, look like a higher grade that is unbleached. Bleaching is practically the same as aging, has the same effect. Yellow color in flour is a detriment and bleaching removes it. Color can be controlled to a certain extent by milling methods, but if I had to mill flour up to what the Alsop bleacher put it, I should say I would use 30 per cent more power.

E. D. LYLE, a witness for claimant, testified:

I reside at Leavenworth, Kans., and am in the flour-milling business. We have a capacity of 1,500 barrels a day; our annual output runs from 300,000 to 400,000 barrels a year. We have used an Alsop bleacher the last four years, bleaching four grades, everything but the low grades. Bleaching has the effect of three or four months' aging by natural processes, and I have never observed any detriment to the flour caused by it. Old wheat will make whiter flour than new wheat. Applying the Alsop bleacher to new wheat, you bleach it up to that standard, which is simply a matter of the gas you use. I have been eating bread made from this flour, at my own table, ever since I have been bleaching it, and it is not rancid or sour, does not have yellow balls in it nor "the yellow accumulation of dirty, nasty stuff that has been secreted in the corners" of my pipes or agitator or other places. We remodeled last year and took the bleachers out, but put the same pipes back and kept on using them, just the same. They had been in three years before that time and were not eaten by the gas or bursted by the pressure. I have never detected any difference in odor, taste, or loaf volume between bread made from bleached flour and that made from unbleached. You can't bleach unsound flour to make it look like sound flour, nor can you alter the character, quality, strength, or defectiveness in a flour by bleaching it. I am not a miller by trade; I am an operator. Three of our four grades are "Gilt Edge," 60 per cent; "Sunflower," 95 per cent; "Golden Age," a 35 per cent clear; by clear I mean a flour that is specky, that hasn't all the impurities removed. I know that the word "patent"

has been used by millers to imply the highest grade flour made; we used to brand a flour "patent" up to a year ago. We quit labeling it "patent" after the order of the Secretary of Agriculture regarding nitrogen peroxide gas. We have a different standard of color for each of the four grades we make; a type sample of each grade is maintained as a color standard. When we commenced to bleach, we changed the standard of color, and have maintained it since as near as possible at all seasons of the year and one year after another, whether the wheat is new or old or whether the kind of wheat varies. Natural aging had nothing to do with the standard adopted. We adopted a standard which we thought would make an attractive color for each particular grade—an arbitrary color. Our bleaching in each case is the equivalent of about three months' natural aging.

I never looked in the pipes for the action of the acids in them, nor have I heard of the pipes or agitator being cleaned out. I have smelled the bleaching gas at both our machines, but it doesn't smell throughout the mill. I never detected the smell of the gas around the packer nor the car, where the sacks are. I do not think the bleaching works any chemical change in the flour, because it doesn't show up in baking tests.

GEORGE L. TELLER, a witness for claimant, testified:

I reside at Riverside, Ill.; have been a chemist for the past twenty-two years. For two years I was assistant to Doctor Kedzie, at the Michigan Agricultural College, who made a special study of wheat. I was chemist to the Arkansas Agricultural Experiment Station for over nine years, where I made a special study of wheats and flours and all matters pertaining to them. I was two or three years chemist at the Chidlow Institute in Chicago, where my work was entirely with flours, and the remainder of the time I have been connected with the Columbus Laboratory. Previous to this time I graduated from the Michigan Agricultural College with the degree of B. S., and later received the title of M. S. from the same institution. I have analyzed a great many samples of flours, from all parts of the United States of America, China, Europe, and other places, including all classes of wheats grown in these different countries, and have done a great deal of work with bleached flour, from the receipt of the first sample in this country, from Ireland, up to the present time, examining several thousand samples. I do not know of a single sample of commercially bleached flour which I have examined which has been in any way injured or contained anything injurious to the flour, which could be attributed to the bleaching process. I never found that the bleaching injured the gluten, either by changing its amount or injuring it in any way that could be detected in bread making or along other lines. I have never noticed any odor that was retained by the flour after it left the mill; there is always a peculiar odor accompanying the bleaching of flour, which is characteristic of the reaction, apparently, that takes place in the bleaching process, but it is very fleeting.

Bleaching does not alter the starch content of the flour, nor any other constituent of the flour, excepting the coloring matter. I have examined a great number of samples of bread made from bleached and unbleached flours and have never been able to detect any difference in odor or taste between them; the color is always lighter in the bread made from bleached flour. When there is any difference as to loaf volume, it has been in favor of the bleached flour, but the differences in this respect are so slight, as to loaf volume, that they can, in nearly all instances, be attributed to accidental variations in the making of breads. As to the nitrite reacting nitrogen in bleached flour, I have found an average of about one part per million of color corresponding to the color which is obtained when the Griess reagent is applied to a nitrite. I

have found such nitrite reacting nitrogen in flour that is naturally aged as high as four times the amount that is present in commercially bleached flour. I have investigated this matter carefully, and I believe there is no means of determining whether flour is bleached by the Alsop process or whether it is bleached by the natural aging in the air, without knowing the history of the sample. I have never been able to detect any difference in the chemical reaction between flour changed by natural aging and that changed by artificial bleaching. I have taken unbleached flour and exposed it to the air of my kitchen and found that it lost color, and then applied the Griess test to the extract from the flour, and found that the color was apparent in this extract the same as it was in the flour bleached by the Alsop process. The chief change that takes place in flour by natural aging, aside from losing its color, is to be attributed to the drying out of the flour. The nitrite reacting substance in bread bleached by the Alsop process remains to but a very slight extent, generally; in bread the largest amount I have found in a sample of flour bleached by artificial means was three-tenths to four-tenths of one part per million, and in bread baked from the same flour at other times and by a little different process, the amount was reduced to nothing. I have often observed a trace of pink produced by applying the Griess test to bread made from unbleached flour. I have examined dough before it went into the oven, and found that the nitrites were removed through the process of fermentation; bacteria of yeast feed on nitrite reacting material and remove it from flour when they are allowed to act upon it. I have made experiments in which I set yeast and bleached flour in a soft dough and allowed them to stand together for a time and the nitrite coloring material was removed, and when the same flour and the same yeast were put together in the presence of chloroform, which would stop the action and growth of the bacteria in the yeast, the color was turned in the same amount that it was on the bleached flour, and the same amount that was on the untreated flour dough, that is, flour dough that had no yeast in it.

I have made a considerable number of experiments to determine whether or not bleached flours were any less digestible than the same flour when unbleached, and in some cases I have found that the bleached flours were more readily digested, the protein of the bleached flour, both by pancreatin and pepsin. These experiments were made by making bread from flours which were bleached and unbleached, the same flour, and exposing them to the digestive juices at the same temperature and same amount of digestive juice, watching the process of digestion, making determinations of that digested proteid, after the process was completed, and determining the amount of digestion from the actual amount of proteid nitrogen recovered in the solution after digestion. My conclusion is that commercially bleached flour is not materially altered in digestibility by the process of bleaching. I have compared the starch content of the seized flour with that of standard soft winter wheat flour, and find that the seized flour contains considerably less starch; it contained practically the same amount of starch when reduced to the moisture point, as a sample of Minneapolis spring wheat flour, which is always recognized as a hard wheat flour. I am examining flours daily for color and have observed that it is easier to note the presence of the outer portion of the wheat berry in bleached flours than in unbleached, because the yellow coloring matter assists in covering up these impurities. I have examined a great many samples of bleached and unbleached flours for their relative acidity, and have never been able to detect any increase in acidity. In my judgment neither nitric or nitrous acids are added to flour by the Alsop process, nor are nitrites as such or nitrates as such present in it. I do not think there are nitrites as such in naturally aged flour, but there may be nitrates as such, which might come

from the air, or the nitrites in the air which might possibly come to the flour. I am associated with Dr. John A. Wesener, and have collaborated with him a great deal in experimentation, and in the preparation of papers published in trade journals, and speeches and discourses before bakers and bakers' associations. A great deal of the work done in our laboratory falls to me. I am not a pharmacologist, physiological chemist, or toxicologist. I have specialized in some branches of organic chemistry.

I am very doubtful about the statement in the patent that nitrogen peroxide gas is used by the Alsop process to bleach flour—I think there is a mistake there somewhere. I am pretty sure that NO_2 may be produced from the flaming arc. The flaming arc may be used to manufacture nitric acid and is so used, and is supposed to be a very good way to manufacture it. I have heard of John A. Wesener's NOCl patent.

Anything is a poison if you get enough of it. The question whether a carload of flour is a poisonous substance I can not answer without qualification. A quart of HNO_3 concentrated is a poisonous substance. A carload of corn taken in quantity would be poisonous. I believe nitrosyl chloride and nitric acid to be poisons.

The coloring matter in flour is possibly one-thousandth of 1 per cent, or one part of color to 100,000 parts of flour. NO_2 will combine very rapidly with water to form nitrous, HNO_2, and nitrite, HNO_3, acids. HNO_2 coming in contact with potassium will form nitrite of potassium; and in contact with sodium, nitrite of sodium; in contact with calcium, nitrite of calcium; in contact with magnesium, nitrite of magnesium. And if it comes in contact with organic bases, it will form organic nitrites. Nitric acid coming in contact with each of these substances will form a nitrate of each, and coming in contact with organic bases, will form organic nitrates. I do not believe I can mention any substance that would not be a poison on certain conditions. So, then, our life depends on poison—we eat it, we drink it, we breathe it, we live amidst poison. If you put enough strychnine or nitric acid or NO_2, or salt, or sugar, into flour, you are adding poisonous material.

I thought it was a remarkable discovery when I found that unbleached flour took up four times as much nitrites from the air as from the Alsop bleacher. When I swore that there were no nitrites in bleached flour, I meant to admit that there was material there giving that pink color, which has disturbed so many people. In my publications, that material has been referred to as nitrite reacting material, and this reaction to the Griess test has been spoken of by chemists the world over as establishing the existence of nitrites. The reason why, in view of this fact, I swore that there were no nitrites in bleached flour is as follows: I am aware that this test has been attributed to the presence of nitrites and nitrite material for a great many years; I have also made some experiments in my laboratory, which I have made very carefully and repeated time and again, that indicate to me that there are other substances than the nitrites which, when they are applied under this test in some way, will become—they are changed in such a manner that they will eventually yield the pink color which is given by the Griess reagent, that they are not originally nitrites and that they are, therefore, not in the flour as nitrites, but that they give the pink color with the Griess reagent. If a flour has been seriously injured by the bleaching process, I would not call it commercial bleached flour. If you found any strychnine in the stomach, I think you could say you found a poisonous substance. Finding nitrous acid, I could not say the same, because that is a normal constituent of food—not all nitrous acid, but the same material that gives the nitrites.

The terpenes are the essential oils of plants. The rule is that they turn yellow as time goes on. It is only a few years that chemists have understood terpenes at all. If flour freshly milled be treated before bleaching with the Griess test, it will in general give the nitrite reaction. After bleaching it always will, so far as I know. If you apply enough nitric acid, it will combine with the different constituents of the flour, the law being that if flour be treated with nitric acid, it will combine with the proteins, with the starch, and with the oil, and if there be not enough to satisfy each base chemically, it will distribute itself among the various bases, depending upon the volume or quantity of each base, and the strength of the chemical affinity between it and each base. It is pretty hard to say just what N_2O_3 is. Two gases combining form it. NO and NO_2 are gases, and when brought together in the right combination, the NO_2 will form with bases nitrites. The formula for the formation of nitrites from N_2O_3 is as follows: N_2O_3 plus H_2O equals $2HNO_2$. I will not say that it is the common understanding among chemists that N_2O_3 exists only as a liquid. As far as I can go is to say that NO and NO_2 may exist together and that they combine. N_2O_3 brought in contact with water will form nitrous acid. It does not follow that nitrites will be formed in the flour, because it makes a difference whether the substance is put there as nitrous acid or as N_2O_3. I am satisfied that nitrous and nitric acids as such do not bleach.

The substance in bleached flour that gives the Griess test is, to the best of my knowledge, a body that is produced by the action of oxides of nitrogen upon the coloring matter. The formula might be written $C_{10}H_{16}$. That is the general formula for terpene. All the essential terpene oils do not necessarily have the same formula. The amount of NO_2 that will satisfy the coloring matter in flour may be figured as follows: $C_{10}H_{16}$ is 120 for the carbon and 16 for the hydrogen—136; NO_2 is 32 plus 14, or 46; 46 divided by 136 would give the amount of NO_2—somewhere in the neighborhood of 33 or 34 per cent of the coloring matter. There are ten parts of terpene per million of flour. If we take one-third of that amount, that would be three parts per million of NO_2 that we should have combined with that terpene. Expressed as nitrogen, it would be about one-third of that, or about one part per million, which is about the average we find in bleached flour. That amount of NO_2 per million would satisfy the terpene if my calculation was right, and would impart one part per million of nitrite reacting material to the flour. I do not explain how, if the terpene is satisfied by one part per million, it may happen that I have found four parts per million of nitrate material. Some ammonium nitrites may have adhered to the flour. If more gas is used than enough to satisfy the terpene, the excess might go to the protein—a good thing if it did sometimes—and might form nitroso compounds and nitro compounds, and if strong enough, the xantho proteic reaction.

In many instances, it is absolutely essential, in order to get the best results, to increase mineral acidity. A little nitric acid would not hurt anything. It makes a larger volume of certain flours. The more you bleach flour the more digestible it is.

If NO and NO_2 together be led through NaOH, in some instances at least, the NO will not pass through as such. Probably the two will combine in the proportions to form nitrite of sodium. If there are any bare instances where the NO passes through as such, it might indicate that the NO and NO_2 were a mixture, and not a compound such as N_2O_3. Chemical laws are always constant—some interpret them, however, wrong. The substance besides nitrite that produces a pink color by the Griess test is a substance which may be called a nitrosite, which is formed by the direct action of N_2O_3 with a terpene.

MRS. P. L. WILLIAMS, a witness for claimant, testified:

I reside at Kansas City, Mo. I own and have been running a restaurant for over eight years; feed on the average of 1,100 people per day, consisting of men and women from all walks of life. I have been working in the restaurant business all of my life. I always made all my own bread until within the last year or two. I always have good bread. I have been using bleached flour, "Aristos flour," made by the Southwest Milling Company, for most three years. I also used Butte and Mosier flour. Bleached flour makes the best bread. If we get new flour and it is not bleached, it does not make as good bread as it does if it is bleached. Bleaching makes the bread lighter and whiter—doughs better and is better to handle.

HERBERT W. EMERSON, a witness for claimant, testified:

I reside at Lawrence, Kans.; am a teacher of physiological chemistry at the University of Kansas; graduated from the University of Michigan in 1901 and again in 1902. In 1903 I did post-graduate work there and held the Parke-Davis scholarship. In the fall of 1903 I came to the University of Kansas as instructor in physiological chemistry. In 1905 I was assistant professor of physiological chemistry, and since 1907 have had charge of the physiological chemistry at the University of Kansas. Member of the American Medical Association, American Pharmaceutical Association, Kansas Academy of Science, and American Association for the Advancement of Science.

I have carried out a number of experiments on the digestibility of bleached flour. Experimenting on unbleached flour containing no nitrite reacting material and on bleached flour containing one part per million, I could distinguish no difference in the rate of pancreatic digestion—no retardation. Quantitative determinations of hydrolyzation of starch and sugar showed no difference. As to the effect of digestion on the nitrite reacting material itself: First, in pepsin we found that it disappeared in from one-half hour to one hour; and, second, in pancreatin, we found that in the first experiment it disappeared very rapidly; in subsequent ones, it disappeared very slowly, if at all. My conclusion is that in some way in the processes of digestion, the nitrite reacting material disappears.

Experiments to determine the presence or absence of inorganic nitrites in bleached flour led me to the conclusion that there were none in it. There could be no free nitrous acid in the flour I so worked with. Experiments also led to the conclusion that there could be no free nitric acid in bleached flour.

Experiments with pancreatic and salivary digestion on bread from bleached and unbleached flour gave the same results as did the experiments on the flour. I can not distinguish any difference in the taste, odor, or appearance, except in the color, between breads made from the two flours.

As to the formation of met-hemoglobin, I have taken in 3-grain doses at intervals of one hour as much as 9 grains of sodium nitrite for two successive days, examined for met-hemoglobin by the spectroscope, and could find none. It is true that to the extent that met-hemoglobin is formed, injury is caused to the blood. If one molecule of the oxygen-carrying portion of the blood be destroyed, a person is pro tanto injured thereby.

I do not know whether or not in my digestion work I was comparing bleached flour with a freshly milled flour. It is my impression that aging improves the digestibility of flour. If that is true, the fact that I obtained the same results in my experiments, demonstrates that bleached flour does not improve in digestibility. There are bacteria which will reduce nitrites to nitrates. I did not, when noting the disappearance of nitrites, chloroform the bacteria.

Some substances are by nature popularly known to be poisons; others popularly known to be foods. N_2O_3, NO_2, HNO_2, and HNO_3 belong to the poisonous group. It is possible to spoil food with all of them. (I understand that N_2O_3 does not exist as a gas.) Adding 3½ tons of nitric acid and 3½ tons of nitrous acid a year to the output of a mill making flour at the rate of 200 barrels a day, or adding one-tenth of 1 pound of nitrous acid and one-tenth of 1 pound of nitric acid to each barrel, or adding 30 cubic centimeters of nitrous acid and the same amount of nitric acid, would, I think, if all were absorbed, be poisonous. I think it would be deleterious to health.

PENTON DALES, a witness for claimant, testified:

I reside at Lincoln, Nebr., and am a teacher of chemistry. I graduated with the degree of B. S. at the University of Nebraska in 1897. I had a scholarship there for two years; in 1899 obtained a master's degree; from 1899 to 1901 held scholarships at Cornell, and in 1901 got the degree of doctor of philosophy from Cornell. While there I was Professor Dennison's private assistant, my work for a year and a half being largely analytical chemistry. In February, 1903, I was given the research assistantship at Cornell, and in September, 1903, was called to the University of Nebraska as an assistant professor in analytical chemistry. I am at present professor of analytical chemistry and in charge of that department in the University of Nebraska.

I have made a few purely analytical tests upon flour. I tested one sample of the flour seized, and found no free nitric acid in it, nor did I find any in other samples of bleached flour. If unbleached flour were sprayed with nitric acid, a rise in temperature would be evidence, but not proof, of chemical action, because a great many salts will dissolve in water with a rise in temperature, and such is not a case of chemical action. I sprayed flour with water and found at least three cases where the resulting rise was certainly not because of the chemical action in the ordinary sense of the word. On spraying flour with dilute nitric acid, I was unable to observe any bleaching effect. The flours so sprayed showed no tests for free mineral acid, from which I conclude that the addition of nitric acid in the amount mentioned by Doctor Acree, and for that matter in larger amounts, will not show the presence of free mineral acids, for the reason that there is no response to the indicator—dimethyl-amido-azo-benzol.

Spraying flour with a small amount of nitric acid and allowing the mixture to stand does not increase acidity sufficiently to allow it to be measured within the limit of experimental error. The general truth in chemistry that if you bring together two substances, which react with each other, you will have a reaction, needs very important modification under the proper conditions. I can give a good many examples of substances which react under proper conditions, but which do not react at all under ordinary conditions. A mixture of marsh gas and air in mines is such a case—no reaction, unless some miner brings a fire along. Also hydrogen and oxygen can be allowed to stand around indefinitely and do not act unless a spark of fire or a catalytic agent comes in contact with them. There are other cases where reactions will take place one way under one condition, and another way under other conditions—such as the simple ones of mercury heated in oxygen at a moderate temperature, which gives mercuric oxide, and this mercuric oxide heated a little hotter goes back into mercury and oxygen again. Another case is barium oxide. Heated in oxygen at a moderate temperature, it takes up oxygen to form barium peroxide. At still increased temperature, it gives off the oxygen, forming barium oxide again.

A catalytic agent is a substance which increases or decreases the speed of a chemical reaction, without, as a rule, undergoing any apparent change. In some cases the catalytic agent is in part lost or destroyed. The case of oxides of nitrogen in the manufacture of sulphuric acid is a case in point. The catalytic agent there is invariably expressed in our texts as N_2O_3, which is in all probabiilty a mixture of the various oxides of nitrogen. Nobody has settled with absolute satisfaction how much is N_2O_3 and how much is broken up.

Substances do not necessarily act the same in concentrated and dilute solution. Take, for example, metallic tin, and treat it with nitric acid of moderate concentration, and you get the substance which we call metastannic acid and nitrogen peroxide. If you treat metallic tin with very dilute nitric acid, you get stannous nitrate and ammonium nitrate, two totally different substances from the first. If you treat metallic zinc with concentrated sulphuric acid, you get zinc sulphate and sulphur dioxide. If you treat zinc with dilute sulphuric acid, you get zinc sulphate and hydrogen. There are plenty of other examples.

NO_2 coming in contact with water will produce nitric and nitrous acids. I think nitric acid will combine with ingredients in the flour. I have proved that if added to flour, it does combine, and so combining has formed nitrates or other nitro compounds. Nitrous acid, as such, combining chemically with some of the ingredients which may be in flour will form nitrites.

WALTER M. CROSS, a witness for claimant, testified:

I reside at Kansas City, Mo., and am a chemist. I graduated from the University of Kansas and the University Medical College. During the last ten years I have conducted a commercial laboratory in Kansas City, and for five or six years have been chemist for the municipal corporation of Kansas City.

In analyzing drinking waters, I have found in numerous instances, nitrite reacting material, which I took to be nitrites—as much as four parts per million in one drinking water which I have in mind. Practically all of the surface underflow of Kansas City, Mo., contains nitrites. If I found five parts per million of nitrite, and ascertained that the water was free from bacteria, I would not condemn it, because I should not consider that it contained something which, taken into the system, would produce injurious results. I have found nitrites in foods bought on the market in Kansas City. Among them may be mentioned corn beef, pickled pigs' feet, pickled tongue, smoked whitefish, radishes, and ham.

When pancreatin was put into a flask containing an aqueous solution of sodium nitrite, after a short time, no nitrite reaction was obtainable. On exposing fresh flour to the air for three or four hours, it gave a pink color with the Griess reagent. Met-hemoglobin is not always produced when nitrites are taken into the stomach. This determination is based on an investigation I once made after taking 7 grains of sodium nitrite in one dose, and, after three or four hours testing for met-hemoglobin by the spectroscope. Assuming that the flour in this case, bleached by the Alsop process, contains 1.8 parts per million of nitrite reacting material, and assuming that bread made from it contains from one-fourth to one-fifth of that amount, the eating of such bread would not, in my opinion, produce any harmful effects, nor any effect at all.

Anything has a poisonous action on a human being which, if taken into the system, will have an injurious effect. Anything that changes your blood from hemoglobin to met-hemoglobin would be injurious. Unless the eating of some poison or injurious substance produced symptoms, it would not be injurious.

Chemists use nitrites in water as an indication of contamination by organic matter. In a book by Mason, "The Examination of Water," it is said: "Aver-

age in sundry surface waters, none; average in sundry surface waters known to be polluted, 0.006; average in sundry ground waters known to be pure, no nitrites; average in sundry ground waters known to be polluted, 0.003," or, three-thousandths of one part per million. My previous statement was that the nitrites of themselves were not regarded as the cause and the reason for condemning a water, but were merely a pointer indicating the activity of germs, these nitrites being the products of excretion of germs. The nitrites are a track showing that the germs are or have been present.

It would be possible to add sufficient nitrous acid, nitric acid, NOCl, NO_2, N_2O_3, to bread, so as to make it injurious; so of almost anything—salt, if you please. Strychnine and nitrous acid are much more poisonous than salt. Very few substances are not poisonous. One one-hundredth of a grain of strychnine would not be poison. If at post-morten I had examined a dead human being and had found one one-hundredth part of a grain of strychnine in his stomach, I cannot answer the question whether I found poison there. If on top of the strychnine I found another one one-hundredth part of hydrocyanic acid, the history of the case would guide me as to whether I found poison. I would say I found poison.

If I found water containing any determinable amount of nitrites, I should condemn the water for a city like Kansas City, unless, upon further examination, I found that there was nothing injurious in it outside of that. Care should be taken with respect to all organic foods, vegetables or meats, because nitrites in them may be associated with the most deadly disease germs. It is a humbug and fraud to say that nitrites are necessary to human life.

HENRY ALBERT, a witness for claimant, testified:

I reside at Iowa City, Iowa, and am a physician and teacher having charge of pathology and bacteriology at the University of Iowa.

I have investigated the production of met-hemoglobin by the administration of nitrites internally. To one of three white rats, I fed one one-hundred and fortieth of a grain of sodium nitrite, to the second one one-hundred and fortieth, and to the third one-fourteenth of a grain. One one-hundred and fortieth corresponds to three grains given to a normal man weighing 150 pounds. The first rat was killed at the end of one hour, and no met-hemoglobin found on examination of its blood; the blood of the second, killed at the end of two hours, showed no met-hemoglobin; the third, fed with one-fourteenth of a grain, killed at the end of one hour, showed no met-hemoglobin. I myself took 3 grains at 7 o'clock one evening, 3 at 10 o'clock the same evening, 3 at 9 o'clock the next morning, and found no met-hemoglobin in my blood.

In my experiments I used a pocket spectroscope. I do not know how delicate a test the spectroscope gives. I think it is recognized that usually nitrous acid will not change hemoglobin to met-hemoglobin. I do not know about the cases of nitrite poisoning reported by Emil G. Beck of Chicago, nor about the change of nitrates to nitrites in the intestinal tract, nor about the susceptibility of children to nitrate poisoning after the administration of bismuth subnitrate. I am not qualified to answer whether the action of nitrites on the blood is a chemical one, nor am I to answer what is the comparative resistance of a rat and of a baby to a poison. I have never seen any met-hemoglobin taken from the living blood stream.

Whether it would be a good thing to add to a baby's food nitrites, or hydrocyanic acid, or strychnine, or nicotine, or cigar ashes in the milk, or corrosive sublimate, would depend entirely upon what effect these substances would have on the baby. It is a fair statement of my position that I am unable to affirm that any substance in any particular quantity would be injurious until I had

observed symptomatic results of its administration. No amount of nitrites in water would lead me to condemn it, unless I found that people were made sick or killed or injured in health. In determining whether nitrites are injurious to food if added thereto, I class them with strychnine, corrosive sublimate, and prussic acid, and insist that I must know the quantity of each before I can form an opinion as to whether their addition to food eaten three times a day would be proper or not.

CHARLES A. REX, a witness for claimant, testified:

I reside at Lexington, Mo. For four or five years prior to May 1, 1907, I was manager of the Lexington flour mill. A piece of rubber tubing and a piece of pipe (now in court) were connected with the Alsop machine, when it was installed in this mill, and had been in place a little over two years when I left.

J. F. FORSTER, a witness for claimant, testified:

I reside at Lexington, Mo. I succeeded Mr. Rex at the Lexington mill. The piece of rubber tubing and the pipe were on the Alsop machine when I took charge of the mill, and have been there ever since. We have been bleaching flour every day that the mill has been running.

New wheat flour produces the same effect in baking as old wheat flour, and will make the same kind of biscuit. The gas of the Alsop machine has no color that I have ever seen, and I have never noticed any odor imparted to flour from bleaching. There is no difference in taste or smell that I could detect from bread from a bleached flour and bread from unbleached. My trade is among southern biscuit makers, who prefer the bleached flour, the kind I have been giving them. The color of flour is a secondary consideration as an indication of quality; baking quality is the first consideration. You can smell the gas in the bin before the flour goes into the sacks. Once every six months we used to clean out our pipes, getting a reddish brown dust out of them. By bleaching, you can produce in a few seconds the same change that nature produces in a long time—in months.

ALBERT W. ROCKWOOD, a witness for claimant, testified:

I reside at Iowa City, Iowa; am professor of chemistry and toxicology in the University of Iowa, head of the department of chemistry there; a graduate of Amherst College, and after that a student at Leipsic, Gottingen, and Strassburg; Ph. D. from Yale University for work in chemistry. For over twenty years I have been instructing in the University of Iowa.

I have made tests with bleached flour to ascertain whether, when a flour containing a certain amount of nitrite reacting material is baked into bread, with the use of yeast, there is or is not a disappearance of such nitrite reacting material, and I find that very commonly the nitrite reacting material has disappeared. It is always much reduced—sometimes after the usual time of bread raising a part remains, but on a few hours longer standing that also disappears. I have made a number of experiments to test the relative digestibility, by the salivary ferments and the pancreatic ferment, of flour bleached and unbleached. The rate of digestion of the starch was practically the same in all cases. In the case of moist gluten digested with pepsin hydrochloric acid, where the digestion is carried on for one hour and ten minutes at body temperature, the bleached digested 16.6 per cent, the unbleached 11.6 per cent; for two hours and thirty minutes, the bleached 19.2 per cent, the unbleached 14.7 per cent; for three hours and thirty-five minutes, the bleached 28 per cent, the unbleached 26.8 per cent. In the case of dry gluten and pepsin, the bleached in thirty minutes digested 67.3 per cent, the unbleached 62.4 per cent; in one hour, the bleached 74.6 per cent, the unbleached 72.1 per cent; in two hours, the bleached

91.7 per cent, the unbleached 89.1 per cent. So that in both instances I think my figures show that the bleached digested somewhat more completely than the unbleached. With pancreatic digestion, using moist gluten, my results were as follows: In one hour the bleached digested 1.7 per cent, the unbleached 2.8 per cent; in four hours, bleached 10.5 per cent, unbleached 8.5 per cent; in five hours, bleached 14.5 per cent, unbleached 11.6 per cent. As a result of my experiments I am of the opinion that bleached flour is not injured in digestibility, but is improved.

In smoked ham I have found nitrites in parts per million 3.2; in pork shoulder 0.66; in bacon 1.02.

I made a test on myself to determine the effect on blood of nitrites taken internally I took 8 grains of sodium nitrite in four 2-grain doses, one dose at 4 in the afternoon, another at 5 or 6, one the next morning on arising, and the last at 10 o'clock that morning. I noticed no ill effects. In the blood drawn at 11 o'clock I found no methemoglobin, nor did I find any three and a half hours later. I think there is a substance present in the body which might and would protect it against the action of a moderate amount of nitrites taken into the stomach—urea. My opinion is that eating bread containing one part per million of nitrite reacting material would not produce any appreciable effects of any kind upon the body.

I should be perfectly willing to add one part per million of nitrites to the food of the people of this nation—or two parts or three parts. I haven't any positive opinion as to its injuriousness when you get up into larger quantities. When associated with a considerable quantity, nitrites may be characterized as a poisonous substance. If we have any suspicion that substances would be poisonous, they ought to be excluded from foods Different individuals have different powers of resistance. While 40 drops of laudanum may be a maximum dose for adults, I know that several drops will be fatal in infants—I could not dispute that one drop has been fatal. Popularly, strychnine, etc., fall within the meaning of "poisonous substances," if you associate those terms with reasonable quantity. I suppose we have to determine by a considerable series of experiments how much of the nitrites added to flour by bleaching it will be dangerous to use.

Under some conditions, nitrites change hemoglobin to met-hemoglobin. This change destroys the function of the hemoglobin, and if carried far enough, death results. I have never seen methemoglobin in blood taken from the living stream. The test by the spectroscope is ordinarily a very delicate test, but I do not know how delicate. I am not able to say whether at least 20 per cent of the hemoglobin must be changed to methemoglobin before it is visible by the spectroscope. I am not able to say whether it is true that if from 50 per cent to 60 per cent of the hemoglobin is changed in adults, and a much less amount in infants, death will result. I should not want to have 1 per cent of my blood changed in that way every day.

The urea is present in the stomach because swallowed in the saliva. It will destroy nitrous acid. I do not know that it would destroy nitrites; it only destroys them after reduction to nitrous acid. It is my opinion that urea will not destroy nitrites in the saliva, probably not in the blood, and not anywhere except in the stomach—an acid solution. This substance is nature's only defense against them. I first knew a few days ago that urea is found in the saliva. I knew that it would destroy nitrous acids. Doctor Haines told me that urea in the stomach was a defense against nitrites. Smiederberg says: "Doses of 0.3 to 0.6 gram of sodium nitrite produced severe poisonous symptoms when administered to sick persons, which symptoms were referable in large part to the conversion of hemoglobin into methemoglobin." I have

tested a great many samples of saliva for nitrites, and think that the average amount present would be between one and two parts per million.

I could not tell why the bleached flour had improved in digestibility. I don't know that I have heard of NO_2, HNO_2 and HNO_3 being used to simulate enzymes. The flour I used in my experiments was not the flour seized, nor the "Purity."

JULIUS T. WILLARD, a witness for claimant, testified:

I reside at Manhattan, Kans., and have been professor of chemistry in the Kansas State Agricultural College for eight years. I graduated from the Agricultural College of Kansas at Manhattan, and studied at Johns Hopkins University. Under the food and drug law I have had charge of food analysis for the Board of Health for the State of Kansas.

About four years ago I began investigating bleached flour, and was the first one to use the Griess test in connection with the nitrites in it. Amino compounds occur in the normal body—urea is a prominent example. Urea and nitrous acid interact with the production of free nitrogen and carbon dioxide and water—a well known reaction. I have never noticed any unpleasant odor or unpleasant taste in bread made from bleached flour. I have made tests as to digestibility with pepsin, pancreatin, diastase, and saliva, on bleached and unbleached flours, and have also made baking tests. From the latter I concluded that there was no difference in the baking qualities of bleached and unbleached flour. As to digestion, I made ninety-four comparisons. In all cases there was practically no difference in the rate, the results being within the limit of experimental error. My conclusion is that the digestibility of bleached flour is injured neither as to its gluten nor as to its starch.

It has been my observation that if flour has been bleached, a reaction is obtained by the Griess test; if not bleached, it either shows no reaction or a very slight one. I never got the reaction on unbleached flour. Artificial bleaching can not be the equivalent chemically of natural aging. I so reported in 1906, and still think so. "Natural aging does not produce the oxides of nitrogen or the products of their action on the flour." I should expect bleaching, by all reasoning, to increase acidity, and I believe that it does. I also believe that bleaching at first certainly produces nitrous and nitric acids in the flour. These acids would probably further act chemically given in some form. Nitrous acid, if it acted on bases, would produce nitrites, and nitric acid, nitrates, the law of mass action applying. To the best of my knowledge, nitric acid would produce, besides nitrates, nitro compounds. Under proper conditions, also, it will form xantho protein, although concentration makes much difference. Taking all things relatively gross, reactions of the same character, but not of the same degree, might be expected with a less amount of the acid. In any concentrated form, nitric acid will certainly be a poison taken internally.

If it be the fact that color in flour be made up of two primary colors, yellow and orange, that the ratio is 13 in the yellow to 15 in the orange, the orange being the stronger, and if, further, on certain treatment the orange descends to zero, and by like treatment the yellow to 6, and if on still further treatment, the orange remains at zero, but the yellow ascends from 6 to 8 to 12 or 13, and so on, becoming stronger than the yellow started with—if such are the facts, they are perfectly consistent with the theory that all the innocent yellow has disappeared and been replaced by the wicked yellow, which is evidence of the action of the nitric acid upon the protein. Time and concentration would be a factor in producing this yellow matter.

C. A. A. UTT, a witness for claimant, testified:

I reside at Manhattan, Kans. In October, 1908, I secured for Professor Willard a sample of flour from the Manhattan Milling Company, and in March of this year I arranged to have another sample sent up from the Manhattan mill.

ROBERT C. CLARK, a witness for claimant, testified:

I reside at St. Joseph, Mo. For six years I have been manager of the Davis Milling Company of St. Joseph, a mill with a capacity of 700 barrels in twenty-four hours. The Alsop bleacher, which I have used for four years, I tested, before putting in the mill, for shrinkage in weight of the flour from its use. We took twenty-five 140-pound jute sacks of unbleached flour, and passed it up an elevator leg through the agitator. It was then passed down through another leg of the elevator and weighed off. Making allowance for the weight of the sacks, the shrinkage was 37 pounds—a loss of 1 per cent. We made another test by weighing unbleached flour made at the same time, passing it up through the agitator in the same manner, without bleaching it, and we found a loss of 11 pounds—a loss of less than half of 1 per cent. We made one further test by taking the first 25 sacks of flour bleached and passing it up through the agitator, without rebleaching, and found a loss of 7 pounds. Bread made from bleached flour is better in quality, strength, and volume as compared with bread made from unbleached of the same kind. Pipes in use for four years between agitator and electrifier have not had to be replaced by reason of having been rusted or worn out. I consider the bleached flour the best for food value; it is greater in strength. Bread made from it is not rancid, sour, yellow, nor bad, but sweet.

A bleached 17 per cent clear is better as to color than an unbleached 17 per cent clear. The Government seized some of our flour at Nashville. The Kansas Milling and Export Company had shipped a car of flour unbleached to a purchaser in Georgia, who had refused it on account of color. The manager of the Kansas Milling and Export Company sent to us for a sample of bleached flour; they took it and sent it down, the flour being sold on sample. Bleaching improved the color of this flour.

J. C. DOLAN, a witness for claimant, testified:

I reside at St. Joseph, Mo., and am connected with the Davis Milling Company of that city. I assisted Mr. Clark in making certain tests. We weighed up 25 sacks of fresh unbleached flour right off the mill, ran it through the agitator, bleached it, bucked it off, and found a loss of 37 pounds; we ran up the same amount of flour without bleaching, and found 11 pounds loss. Running 25 sacks of bleached flour to determine the actual loss in handling, we found a loss of 7 pounds. Two or three other experiments, before and after these, showed practically the same results. Bleaching whitens the flour, draws off part of the moisture, and gives it a little more absorption. It makes the bread better, whiter, more wholesome, and better looking on the table. The pipes running from the electrifier to the agitator have not been renewed, and none of them have been eaten out by the gas.

ROBERT BULLOCK, a witness for claimant, testified:

I reside at Crete, Nebr., and am connected with the Crete mills, which have used the Alsop process since October 11, 1904. I am head miller and have had charge of the mill, which has bleached nearly all the time for six years. We have used the same pipes and have made no change by reason of rusting or anything of that kind.

STELLA AGNES HARTZELL, a witness for claimant, testified:

I reside at Ames, Iowa. I took a B. S. degree from the University of Nebraska in 1901; for two years taught in the high school, and then came back to the University of Nebraska as assistant in chemistry. Later, I was made instructor in chemistry, agricultural chemistry, and assistant chemist in the experiment station at the University of Nebraska. Since December, 1909, I have been acting head of the experiment station at Ames, and still hold that position. I have made investigations of flours, studying their composition with Doctor Avery, chancellor of the State University. Then I worked on the bleaching of flour and later on bread baking. The flour Doctor Avery and I used was bleached and unbleached, obtained from Manhattan, Kans., and also from the Silver Creek mills in Nebraska. I found from the results of analyses that a

patent grade of flour was not always, according to the names that were sent in by the millers, a higher grade of flour than a straight. The highest ash content in these patent flours was 0.49 per cent, and the lowest 0.36 per cent. After baking, bread from bleached was whiter than that from the unbleached, but in odor and size of loaves I could find no difference. Nitrites were not present in the way I usually baked. In a few of the loaves made in a different way, I found some nitrites.

FREDERICK JAMES ALWAY, a witness for claimant, testified:

I reside at Lincoln, Nebr. I am chemist of the Nebraska Experiment Station and professor of agricultural chemistry in the University of Nebraska, positions which I have held since 1906. I attended the University of Toronto in Canada, where I received the degree of A. B. in 1894. Then I went to Heidelberg University, Germany, where I obtained the degree of doctor of philosophy. From 1898 to 1906 I was professor of chemistry in Nebraska Wesleyan University. I am a member of the American Chemical Society and the German Chemical Society. For the last ten years I have been carrying on research investigations and have published a large number of articles in American and German medical magazines. These investigations have been confined chiefly to nitro, nitroso, diazo, and related compounds.

The point at which nitro compounds will not be formed by nitric acid will depend upon the compound that is being treated and upon the dilution of the nitric acid. Assuming that nitrogen peroxid acts upon the moisture in the flour to form nitric and nitrous acids, the concentration of the nitric acid that would be produced from the gas of the Alsop process, as indicated by the flour that was seized, would be, applying the investigation I have made, about one-eightieth of 1 per cent. I do not think that any nitro compounds would be formed by the action of nitric acid of this strength upon flour. In speaking of the preparation of nitro compounds, 15 per cent nitric acid would be considered very dilute. Nitro compounds in general are yellow. When the gaseous medium which does the bleaching comes in contact with flour, the coloring matter is changed in some manner, so that it disappears, and we find nitrite reacting material. I have always assumed that nitric acid is formed by the action of the gas of the Alsop machine on flour. After treatment, I have never succeeded in isolating nitrates or proving that they were there, but I have always assumed that they were. So far as my investigations have gone, free nitric acid is absent in the flour after bleaching. I have taken some of the flour that was seized, extracted it with water, and tested that watery extract with an indicator, which would reveal the presence of free mineral acid—strong, such as nitric acid, sulphuric acid, and hydrochloric acid—and the indicator showed the absence of any free strong acid; not only was no acid indicated, but it was necessary, in order to get any evidence of free mineral acid, to add still more acid.

On June 18 I carried out eight experiments with 500-grain portions of flour, the flour being placed in a large flask—3-liter flask—and while it was being vigorously shaken, nitric acid or water, or a mixture of the two, was slowly introduced from an atomizer. As soon as the shaking, which lasted about two minutes, was over, the flour was transferred to a large beaker, and a thermometer placed down to about the center of the flour. The temperature invariably rose. Then the flour was tested with the Griess solution for nitrites or nitrite reacting material, and the next day—after eighteen or thirty-six hours; thirty-six hours in one case—it was again tested with the Griess solution, and also on that action was compared for color with the original unbleached flour by the ordinary method of slicking, and in no case did I find any bleaching effect. In no case except one did I find any evidence of nitrite; in that one the evidence was far too small to measure, and I would not be positive of it. I could detect no fumes of nitrogen peroxide at the time of spraying. In four experiments, I sprayed with water alone, and got a rise in temperature. A rise in temperature is not a proof of chemical action. In a large number of commercially bleached flours I examined there was no increase in acidity. Fat extracted from bleached flour showed no increase in the rancidity of the odor. As a result of my experiments I came to the conclusion that there had been no hydrolysis, that is to say, no breaking up of the fats in the flour into glycerine, and forming oleic, palmitic, and stearic acids, and no oxidation of the oleic acids to the acids of similar form such as those that occur in the butter from cows' milk. The nitric acid in the form of salts, which is assumed to be pres-

ent in the bleached flour, and the nitric acid in the concentration in which we would have it would have no action on the starch, unless it were possible to break it up into sugar. There is no probability that nitric acid in the concentration I have indicated would act upon the flour to form nitro starch.

I made tests of bread baked from the flour seized and found no nitrites. Ash determinations out of this flour showed in one case 0.62 per cent, in another 0.45, in another 0.53, in each of two others, 0.59 per cent, and, in still another, 0.45 per cent.

At the hearing in Washington, I stated: "In nearly all cases I found there was no difference in acidity. In a few cases I found there was a great difference. Where I took a sample of unbleached flour and treated it with increased quantities of the bleaching agent, I found up to a certain point there was no increase in the acidity, but a certain point came where it did increase the acidity, and from that point on, increasing the amount, steadily increased the acidity with slight fluctuations." My table of acidity carries out the decimals to only two places—a negative result—no indication either way. I think it is nonsense to speak of this gas as "aerating" or "aging" or "purifying." I do not believe the Alsop process does any aging to flour, or any purifying. I have had some doubts about the aerating. On page 102 of my bulletin I stated that the maximum effect of bleaching is obtained with from 100 to 150 c. c. per kilo. of flour. "Excess of this amount gives the disagreeable odor and makes the flour more objectionable for bread, as the amount increases." It is my working hypothesis that nitrogen peroxide is the active agent in bleaching, this hypothesis being accepted from the results obtained by my predecessors. I think that NO_2 is made by the flaming arc, and that when it comes in contact with moisture, it forms nitrous and nitric acids.

As to the Alsop process, if nitric acid results from the action on the moisture, I believe it would combine with constituents in the flour, forming nitrates, and if sufficiently concentrated, will produce xantho-proteic reaction. I certainly think 10 per cent nitric acid will produce the xantho-proteic reaction. In my bulletin I reported that the maximum of nitrites found in commercially bleached flour was 27½ parts expressed as sodium nitrite. The miller wrote he had given this flour "good treatment." The average in bleached samples I found to be 6.3 parts of nitrogen reacting material expressed as sodium nitrite. I never thought bleaching made the bread any better, except in color—nor the gluten—nor the nutrition. The only thing that can be said in favor of it is that it made the flour whiter. I was never able to get any unbleached flour that gave the nitrite reaction. You can tell bleached flour by the Griess test. My sentiments are that "It seems necessary to entirely prohibit artificial bleaching of flour, or to permit only the use of nitrogen peroxide, or to keep a number of investigators following up each new bleaching agent." I have found nitrites in large quantities in unbleached flour kept in the laboratory, but none when kept in a well-ventilated storeroom outside the city. A rise in temperature may be considered as evidence, but not as proof, of chemical action. I have always worked on the assumption that a good way to experiment was to put flour and gas in a bottle, shake it, and then make determinations.

I do not know whether nitrous acid is free or combined in bleached flour. I am not settled on that point. I do not know what the coloring matter is in flour, nor anything further, except that it is very minute. There are organic substances in flour, but I do not know of my own knowledge that if treated with nitrous acid they are capable of forming nitroso compounds. I do not know any substance in flour with which nitrous acid could unite to form diazo compounds. Under certain conditions we can have nitroso compounds produced in wheat flour. I regard diazo compounds as extremely poisonous, explosive substances. The amides with nitrous acid would produce nitroso compounds if the amid was sufficiently basic. Under proper conditions, diazo compounds will be produced in flour. Under proper conditions, nitric acid and starch may produce nitro starch. Under proper conditions, nitrous acid will act upon phenol and produce a poisonous substance. With sufficient concentration, I would expect nitrous acid to act upon phenol derivatives with unusual readiness. In my judgment, there are no compounds in flour, which, by the addition of nitrous or nitric acids in the concentration that would be present when flour is bleached by the Alsop process, would produce nitroso or diazo compounds. In my opinion, in the flour in suit, there are no nitroso, nitro, diazo, or xantho-proteic compounds. I do not know of anything that will give the Griess test except nitrites of organic or inorganic form, or something that forms nitrous acid and nitrites. The nitroso phenols are not nitrites.

When you overtreat flour with NO_2, everything seems to go wrong. If KOH placed in a jar above bleached flour shows nitrites, that proves that the flour is exhaling bleaching gas. If unbleached flour, substituted for the KOH, shows nitrites, it follows that NO_2 has come from the flour below. I consider the statement in the patent that the proteins are practically doubled a ridiculous one, so also the statement that the nitrogen is increased 21 per cent, as chemically absurd. I would not expect that it increases the nutritive value of the flour at all. I do not know whether nitrogen trioxide exists as a gas. That is a much disputed point in the very latest literature. It is conceded by everybody that it does exist as a bluish liquid. Before publishing my bulletin it never occurred to me that N_2O_3 did the bleaching. More recently it seemed probable.

The nitric reaction in the distillate from bread does not necessitate the presence of free nitrous acid in the original bread, because there are always organic acids present in the bread, and the nitrite, in contact with the organic acid and moisture, under reduced pressure, liberates the oxids of nitrogen, which, passing into the water or with water, would give the nitrite reaction. When nitrous acid is heated near to the boiling point, it decomposes. In bread making, the temperature is a little below the boiling point.

At the time my bulletin was written I was not aware of the presence of nitrous acid or NO_2 in the air. When I first came down here I learned of its presence. I could conceive that the natural whitening was due to nitrogen peroxide. I knew that there was ammonium nitrite in the air. I should not expect ammonium nitrite to bleach flour.

RALPH W. WEBSTER, a witness for claimant, testified:

I reside at Chicago, Ill. I graduated from the University of Chicago in 1895, and from the Rush Medical College in 1898. I received the degree of doctor of philosophy from the University of Chicago in 1901. During these periods I was fellow in chemistry in the Rush Medical College, and fellow in physiology at the University of Chicago. Later I became assistant in physiological chemistry and pharmacology at the University of Chicago, and after that instructor in pharmacology. In 1903 and 1904 I was abroad in the laboratories in Vienna, Berlin, and Frankfort. I am now professor of pharmacological therapeutics in the Rush Medical College, devoting time to the practice of medicine, and specializing in physiological chemistry and toxicology.

From examinations I have made of bleached flour, my opinion is that there are absolutely no traces of free nitrous or nitric acids in it. The usual action of nitrous acid upon the protein material is the abolition of nitrogen, which has and can have only one meaning, namely, the action of nitrous acid upon the amino groups forming hydroxyl compounds. Hydrolysis, from a chemical standpoint, is the splitting up or the breaking down of a substance under the influence of acids, of alkalis, of ferments, of heat, and various other agents, resulting in the splitting up of complex molecules into simpler molecules by the addition of water. In my opinion, absolutely no hydrolysis would be produced in this bleached flour under the influence of nitrous or nitric acid in such quantities as have been assumed to be present in the flour. Assuming that hydrolysis would occur, however, the amino acids would not, in my opinion, be changed into diazo bodies or nitroso or nitro bodies by the action of nitrous acid in the concentration assumed to be present. Sodium nitrite is a combination of the metal sodium and the radical NO_2—it is a salt of nitrous acid. It is found in various organs, having been definitely shown to be present in the white matter of the brain, in the lungs, in the bronchial tubes, in the lymphatic glands, the cervical glands, the various maxillary glands, and other fluids of the body, especially the saliva.

I have myself taken two grains of sodium nitrite, and have given it to four other people, and have tested the blood for the presence of methemoglobin, and have been able to demonstrate that none is present. My method was the use of the micro-spectroscope, which will detect the presence of methemoglobin from one blood corpuscle. The system has several means of handling the nitrites which may be taken into it—one is by oxidation to nitrates; the second, by the action of denitrifying bacteria; the third, the action of urea upon nitrous acid. Urea is a compound consisting of two amino groups linked to CO. It is formed by the breaking down of protein—of the several products of protein; it is formed in many tissues of the body, and found in various organs, etc. The urea, in the presence of acid and nitrites, will decompose the nitrous acid. I took a dilute solution of sodium nitrite of definite strength, added dilute hydrochloric acid, and applying the Griess reagent, got the characteristic red color.

If to this solution urea be added, and the Griess reagent applied, we get absolutely no reaction.

In my opinion, nitrites or nitrite reacting material disappear through the process of digestion. I have taken the bleached flour in suit, have made suspensions in water, and have treated it with both the pepsin hydrochloric acid and the pancreatic digestive fluid, and have allowed the fluids to act in the incubator at different temperatures for varying periods of time. During the digestion, the nitrite reacting material absolutely disappeared in the course of half an hour, under the influence of the pepsin hydrochloric acid. Under the influence of the pancreatic fluid, action was somewhat slower, and it had not disappeared at the end of an hour and a quarter. Allowing it to stand over night, however, it did disappear.

A poison is an unorganized substance—it may be either organic or inorganic—which may be introduced into the body or may be formed within the body, and which, owing to its chemical properties, exerts either a harmful influence or exerts influence sufficient to cause death. I know of no substance that is inherently a poison in all dosages. Assuming that the flour in suit was bleached by the Alsop process, and, as a result of such bleaching, contains 1.8 parts per million of nitrite reacting material, and assuming that in the baking process none of that material disappears, in my opinion, the constant daily eating of bread made from such flour could not be harmful or deleterious to the health. The effect of any kind that it would have on the system would be comparable to the effect of unbleached flour. On the basis of the nitrite contents, there would be no effect of any kind that I could conceive of.

From my work on foods, I have concluded that poisonous substances in food are bad under certain conditions, and harmless under others. All depends on the amount present. Whether it is all right to leave to the baker, grocer, miller, and all the persons who prepare foods for human consumption, the adding of minute substances which, if added in larger quantity, would be harmful, depends entirely on whether the substances so added would have any effect in the amount present. If formaldehyde were added to milk for breakfast in such quantities that there were no observable or demonstrative effects, I should say it was not deleterious. If in wheat cakes there are nitrites and nitrates added by bleaching, sulphites in the sirup, borax and coal tar in the butter, these substances would be all right if the amounts were small enough. So of lead chromate in coffee—not enough to produce any deleterious effect observable by anybody. So of borax in buttermilk. So, if the breakfast had some sulphites in its apricot sauce, with sugar, I could not answer that these would not be all right, without some experimental evidence on which to base my opinion. The action of these substances, each harmless, may be increased by combination one with another. If you had four items for breakfast, each containing nitrites, each harmless by itself, but each just under the danger point, I should condemn the breakfast. With formaldehyde, nitrites, borax, lead chromate, sulphites, each just below a safe amount, I should have to know the reaction the substances gave before condemning them. I should wait and see what the results would be by experiment on animals.

Within certain limits, perhaps, every substance known to mankind is a poison within the terms of my definition. I don't know of any substance which, if added to food, would be a poison in and of itself, independent of the matter of quantity or concentration. There is a distinction between the common idea of poison and the scientific idea. My idea is not the one common among the laity. In the medical books and in the speech of the people certain substances are spoken of loosely as poisons—aconite, prussic acid, strychnine, corrosive sublimate.

The microspectroscope will detect the presence of methemoglobin in one corpuscle of the blood. I do not know whether nitrites producing methemoglobin strike down the corpuscles one at a time, or invade the blood, flowing through it, just as ink does when introduced into a transparent fluid. If there were many hundreds of millions of blood corpuscles, and only 100 were changed, a factor in discovering methemoglobin would be whether you secured any of that 100. If the nitrites do not act this way, but affect all by just touching along, diffusing rapidly, painting slightly at first, then more and a little more, until possibly death comes when 70 per cent of the function is destroyed—if this is the action, any methemoglobin at all should be disclosed by the spectroscope. I am not qualified to answer whether if 1 per cent were changed, methemoglobin would be found—or 3 per cent, or 10 per cent or 15 or 20. At 25 per cent, methemoglobin may possibly be disclosed; I don't know. I do not think

you can get any symptoms from the action of methemoglobin before 20 per cent is destroyed.

Urea is a normal constituent of the saliva of well human beings. In the saliva it would not destroy the nitrites. I do not know of any authority which states that in the saliva it is a defense against nitrites. Urea is in the stomach and other parts of the body. Here, where the nitrous acid is liberated from the nitrites, there would be a tendency toward destruction of the nitrites. Urea, besides coming into the stomach from the saliva, is excreted there.

Benzoate of soda in small quantities is absolutely harmless. The benzoate of soda would be comparable with the nitrites occurring normally in certain foods. I favor adding formaldehyde to milk as a preservative in hot weather. There would be no reason for adding it to perfectly pure milk.

WALTER S. HAINES, a witness for claimant, testified:

I reside at Chicago, Ill. I am professor of chemistry, materia medica, and toxicology in the Rush Medical College, and professional lecturer on toxicology in the University of Chicago. I have held my present position in the Rush Medical College for the past thirty-four years, and in the University of Chicago for the past nine years. I am a member of the Chicago Medical Society, Illinois State Medical Society, the American Medical Association, the American Chemical Society, and a fellow of the Chemical Society of London, a member of the Committee of Revision of the United States Pharmacopœia, chairman of the Committee on Pharmacology of the Chicago Medical Society, toxicologist to the Presbyterian Hospital in Chicago, and a member, appointed by the governor of Illinois, of the State Commission on Occupational Diseases.

In my own personal observation I have found nitrites to occur in human saliva within the range of about one-tenth part of nitrogen as nitrite reacting material to a million up to about 5 parts of nitrogen as nitrite reacting material to a million. From 1 to 2 quarts of saliva is swallowed daily by an average adult. From earliest infancy until death saliva is swallowed, and it always, or very nearly always, contains nitrites or nitrite reacting material. Without any question this has been going on for ages, and the system has become accustomed to such nitrites. It has become a part, or rather the nitrite reacting material has become a part, of the processes of life. Consequently, I can not conceive that a substance which is all the time entering the body, which has, as far as we know, always been entering the body, would possibly have any influence upon it in an unwholesome way. I believe when nitrites are taken into the body by the mouth, that as they pass into the stomach and the material becomes acid, there are certain substances present in the stomach which cause their decomposition; among others, urea, which is found in the saliva and swallowed and becomes a part of the stomach's contents, and through somewhat similar bodies that have been called amino compounds. Urea, it is well known, in the presence of an acid and a nitrite, decomposes the nitrous acid of the nitrite, liberating three substances—nitrogen, water, and carbonic acid gas. I believe that nitrites taken into the stomach with our food are very largely, if not completely, decomposed in the stomach in this way. There is another way in which they may be disposed of, namely, by oxidation. There is always air in the stomach, and during the process of digestion they may be converted by oxidation to nitrates. This is another method of decomposition. Finally, when nitrites pass into the intestines, if any escape these actions of the stomach, they meet with certain microbes, some of which have the power of destroying them—the so-called denitrifying bacteria, which break them up completely, and, therefore, they are further eliminated from the food if they have not already been destroyed. Assuming that the flour in this case was bleached by the Alsop process, and as a result of that bleaching, the flour contained 1.8 parts per million of nitrite reacting material, and that bread made from such flour contained all of the nitrite reacting material which was in the flour, I do not think that the constant daily eating of such bread could produce the slightest harm, and, on the above assumption, I do not think it would have the slightest effect of any kind on the system.

At body temperature, urea and nitrites react within half an hour. I have not personally looked for urea in the saliva. As applied to the adulteration of food, I should say strictly that "deleterious substance" was the same as "poison." Nitrites in appropriate quantities are poisonous substances. Assuming that the bleaching of the flour seized introduced into it nitrites, I should say that qualitatively—not quantitatively—they are deleterious and poisonous. Assuming that the law prohibits the adding of any substance of a character

which is qualitatively poisonous, and that nitrites have been added to the flour and the bread, then I must agree that the food substances are adulterated. It is recognized that nitrites, in the right amount and concentrated, will produce methemoglobin in the blood. To the extent that this change takes place, it is not normal or wholesome. In the language of scientists, a toxic alkaloid is the same as a poisonous alkaloid; in the common use of language by the people and by scientists certain substances are spoken of generally as injurious, without the idea of quantity. As language is ordinarily used, if strychnine were found in food, it would be correct to say you found poison in food, and untruthful to say you found none. I argue that because we have been eating some nitrites all the time, and our fathers and mothers before us, and it has been found present in our tissues, therefore, it is not injurious, and may be added to food with impunity. Pneumococci are usually found in the saliva; the tuberculosis germ may be found in the system, and it is sometimes in the air we breathe. We acquire a great degree of immunity as to these germs. There are other disease germs in the air which we take in. For them the human race has acquired a very considerable tolerance. I presume it would be a good thing to get rid of them finally and conclusively. It might be a good thing to get rid of half of them. The human system becomes accustomed to the pneumococci and acquires practical immunity for a time, this immunity being then lost, so that it is a part of wisdom to keep them out of the air and food. That is true relatively of all disease-bearing impurities in the air.

My answer as to the bread was based to a great extent upon the quantity of nitrites assumed to be in it. Whether a given amount of nitrite would be injurious depends to a certain extent upon the individual's power of resistance. Sensitiveness to poison varies in different individuals. The toxicity of certain substances is affected by surrounding circumstances and the presence of other substances. I have seen a statement to the effect that the action of apomorphine may be increased by nitrite, perhaps, three or four hundred per cent, but I am not sure about the figure. I do not think it would be a good thing to spray flour with urea, because we do not need any more urea in the system. We have acquired perfect tolerance for it.

I have testified twice on the side of the flour bleachers—in North Dakota and at the hearing at Washington. In neither place did I promote the idea that urea was a defense to nitrites. It is something which has come to me since this trial commenced. If, as a matter of fact, nitrites do not diminish in amount in the stomach digestion, then my theory would, of course, not be true. In some cases it is true that a large part of a poisonous substance is absorbed within half an hour. Prussic acid acts very rapidly. If it is true that common articles of diet may be adulterated by injurious substances, like formaldehyde, chromate of lead, copperas, and sulphite, a collective action might be produced. I do not believe in adding substances that are deleterious to food. Formaldehyde, nitrites, chromate of lead, borax, sulphites, sulphates of copper, ammonium fluoride, saccharine, in sufficient quantities, are all poisonous. If it should appear that by adulterating foods to make them look better, fifteen poisonous substances were added to our breakfast, seventeen to our dinner, and twenty-two to our supper, making fifty-five doses per day, each one of which in appropriate quantity will have no injurious effect, whether it is time to stop adding any more of these depends upon the amount of each that is present in the foods. These substances have been used. Assuming that of each of them there was just as much standing alone as was not injurious, I should say that the adulteration was an attack upon health. If the same poison were present in each, up to half the limit of safety, the addition would not be desirable. If one-tenth of the limit of safety were reached in each of the fifty-five doses, they would be injurious to health and poisonous. I do not agree that it follows, from the standpoint of public health, that the only safe course is to exclude the addition of poisons to food in every possible instance and every possible form and with respect to all the quantities. I think that the public requires that poisonous substances be added to our foods if they serve a useful purpose.

I make a distinction between substances like lead chromate and formaldehyde, which are not naturally found in the body, and substances like nitrites, which are naturally found in the body. Benzoate of soda, nitrites, and saltpeter, in small amounts, being substances which are naturally found in the body, and to which the body is accustomed, I should regard as not injurious additions. I do not think it is safe to leave it to any tradesman to say how much poisonous preservatives he will add to any particular food.

E. R. LECOUNT, a witness for claimant, testified:

I reside at Chicago, Ill. I am professor of pathology in the Rush Medical College, and am connected with the Cook County Hospital, the Presbyterian Hospital, and St. Lukes Hospital in Chicago as pathologist. I obtained my medical degree at the Rush Medical College, and pursued post-graduate studies in Johns Hopkins University, in the Pasteur Institute in France, and in the University of Berlin, Germany.

I examined the spleens of six guinea pigs and six white rats, turned over to me by Doctor Haines, for the presence of pigment which results from the destruction of blood when methemoglobin is present, and found no evidence of such destruction, nor evidence of chronic methemoglobin. I did this because in any long-standing destruction of the blood a pigment is deposited in the spleen in considerable amounts. These processes are the same in all warm-blooded animals. In all my experiments I have never observed or read of a case of a human being having chronic nitrite poisoning.

I have seen a case of methemoglobin in the blood of a human being who had chronic acetanilid poisoning. I have never seen in the spleen of animal or man the results of chronic methemoglobin. I never heard of chronic methemoglobin or evidence of its being found in the spleen. Having experimented on rats, I should be willing to put nitrites in babies' food if there was any necessity for doing it. The blood of a lower animal is somewhat different from that of a man—the latter has a tendency to dissolve the former. If there were no object to be accomplished either from the standpoint of health or the quality of the food, I would not add nitrites in any quantity. Before I would advise keeping poisoning out of food, I must be convinced that the food is very harmful. I am unable to answer whether adding nitrite poison to bread in any quantity helps health. I think one grain of sodium nitrite in a loaf of bread would be harmless. Two grains per loaf of bread might be perfectly safe for an adult. I would not recommend it without more experimentation.

PAUL SCHWEITZER, a witness for claimant, testified:

I reside at Columbia, Mo. I am emeritus professor of chemistry of the University of Missouri; member of the American Chemical Society; a fellow of the American Association for the Advancement of Science; a member of the St. Louis Academy of Science; a corresponding member of the New York Academy of Science, and an honorary member of the Missouri Pharmaceutical Association. I studied in Berlin largely under Henry Rose, Schneider, and Sonnenschein, and in Gottingen, where I took my degree. When called to Missouri in 1872 I was made professor of analytical and applied chemistry. In 1874 I was made head of the department, and, as such, professor of agricultural chemistry and professor of physiological chemistry and toxicology. My specialty for the last ten or fifteen years has been analytical chemistry in reference to toxicology and domestic or sanitary chemistry.

The average adult by breathing will take in from the air into his system in twenty-four hours one-tenth of a grain of nitrous acid. I have never looked upon such an amount as being poisonous. If the bleached flour contains 1.8 parts per million of nitrite reacting material, 1 pound of flour would contain just one-eightieth of a grain of nitrous acid. In 1 pound of bread made from such flour, if nothing was lost, there would be one one-hundred-and-twentieth of a grain. The amount of nitrous acid that we receive in twenty-four hours by inhaling the air would be twelve times as great as the amount received by eating a loaf of bread. Bread made from bleached flour, if otherwise well made, would be just as healthful as any other bread. I have tested various waters and found a combined amount of nitrous and nitric acids of from 40 to 60 parts per million. The presence of nitrites or nitrates in potable water, as such, is not looked upon by the analyst as dangerous.

I have opposed the use of formaldehyde in milk in any amount. I should not want the smallest part of lead chromate in coffee. I hold the position that until it has been shown beyond the slightest doubt that a foreign substance is not injurious when added to food, it should be prohibited, even when it is being proved not to be poisonous. I do not want any of these substances in the food. I am wholly opposed to the use of borax and coal-tar dye, because naturally no food contains them. I object to coloring in food in any way, whether by a coloring substance that is poisonous or not. To use saccharin in any amount and in any food, in order to make that food appear like being sweet, I look upon as a crime that ought to be punished. Notwithstanding that the system requires some fluorin, I still condemn the addition of fluoride to foods, unless

labeled so that people may know what is being put in. Peas treated with copper sulphate, I look upon, in the first instance, as fraud upon the people, and, in the second instance, if a sufficient quantity of copper has been added, as detrimental to health. As to borax and coal-tar dye used in cheese, if it is used in order to give that article of food an appearance better than it had, I would stamp as a fraud; whether in the amount used, it could be proven dangerous to health, would depend upon the individual case in which the amount had been ascertained.

Assuming that a flour mill making from 100 to 200 barrels of flour daily produces gas enough to make 7,000 pounds of nitric acid in the year's work, and that this bleaching process adds to the flour nitrous acid or nitric acid, or both, in any such quantities as that, or any quantities comparable to that, it would be a very bad thing. If appropriate quantities are used, I think nitrous acid will produce nitroso compounds in flour; nitric acid, nitro compounds. If enough nitric acid were present, nitro albumose and nitro peptones would be produced. Scientifically, a very exact definition of poison can not be given, because there is no unit of measurement. I think it is true that foods adulterated by adding substances, which may be poisonous in quantity, may be injurious to health, though you can not observe any symptom or effect upon the people when they use the foods, or shortly thereafter. If there is one single administration, there may be absolutely no possible effect, and yet it might prove deleterious to health.

FRANK W. LIEPSNER, a witness for libellant, testified:

I reside at Washington, D. C. I am a chemist in the Bureau of Chemistry, U. S. Department of Agriculture. Since this lawsuit commenced, I have examined the substance that looks brownish in color, and something like iron rust, for nitrates, in four of the pipes used to conduct the gas from the electrifier to the agitator, and also in the water pipe—exhibits introduced by claimant. In two of the gas pipes I obtained a very heavy test for nitrates. In the other two, a strong test, and in the water pipe, no test. Examining for nitrites, I obtained a heavy test in two of the gas pipes, in the two others a fair test, and in the water pipe no test. In two of the pipes I obtained heavy tests for nitrites on the water soluble material; the water pipes showed no test. By heating the scrapings from two of the pipes, I obtained heavy fumes of NO_2 gas. Heating the scrapings from the water pipe, I obtained no colored fumes and could get no odor of NO_2.

S. F. ACREE (recalled), a witness for libellant, testified:

Oil extracted from flour treated by nitrogen peroxide gas will not give the Griess test. Nitroso phenol, subjected to NO_2, gives no test. Turpentine or terpene, treated with NO_2, will give the Griess test only faintly. The nitroso amines in overbleached flour gives the Griess test only very faintly when it is applied directly. Nitroso amines, first treated with an alkali, will give the test. I have made tests to ascertain whether urea, at body heat, will decompose nitrous acid. In one experiment, in which one-tenth part per million of nitrous acid, expressed as nitrogen, and the equivalent quantity of urea, in the presence of 0.2 per cent hydrochloric acid, were allowed to react for two hours at body temperature, there was no change. A check test containing the same amount of nitrous acid as the preceding showed no change. In a similar experiment the same amount of nitrous acid was used, and fifty times as much urea, so that we might see all the more whether urea will react with the nitrous acid. The temperature was the same; time, two hours. There was no appreciable reaction. My experiments show that the rate of decomposition of the nitrous acid and urea is very slow.

This notice is given pursuant to section 4 of the Food and Drugs Act of June 30, 1906.

JAMES WILSON,
Secretary of Agriculture.

WASHINGTON, D. C., *December 18, 1910.*

722

○