

The following have been certified on subjects enumerated:

R. M. Chapman (Cottonseed Meal and Cake), Hammond, Ind.; Gascoyne and Co., Inc. (Cottonseed Meal), Baltimore, Md.; I. F. Laucks (Fish Oils and Oriental Oils), Seattle, Washington; McCandless Laboratory (Cottonseed Meal), Atlanta, Ga.; Stillwell Laboratories (Cottonseed Meal and Soap stock), New York, N. Y.; and Wiley and Company (Cottonseed Meal), Baltimore, Md.

Committee: DAVID WESSON (So. Cotton Oil Co., 120 Broadway, N. Y. City).

MOISTURE COMMITTEE REPORT

BY P. S. TILSON

Quoting our President, Dr. Battle, "The determination of moisture has generally proven a bug-bear to almost every one who has tackled it. Its very simplicity is no doubt the cause of so much variation in results, which we always see in comparing the work of different chemists. It is so easy to weigh out a portion of any material, put it in a bath, let it stay there any reasonable time, take it out, cool and weigh, that few people give it much further thought. It is so easy when we do all this, that we are positive our moisture figures must be right. Also everyone has a pet bath he uses which he knows is correct, and the various steps are so simple that there is no possibility of any confusion, and our figures are so certain that we are willing to swear as to their accuracy. Indeed a moisture determination after all is more of a complementary one, and we usually insert it more for the looks of the thing, than for any real service it may render."

I received my appointment as chairman of this committee last November; in fact this chairmanship or honor came to me at this late date by default. After accepting this chairmanship I advised our President that this committee would give its sole attention to procuring if possible an oven of uniform as well as constant temperature—for without this as a starter nothing of a worthwhile nature could be accomplished along the lines of cooperative moisture work. In line with this thought there was sent out a questionnaire in order to ascertain whether or not the members of our Society actually knew the nature of the moisture oven they were using and also to ascertain how many possessed a moisture oven of uniform as well as constant temperature. Out of 48 replies received, to this questionnaire besides Dr. Richardson's Labs. only four reported that they had a uniform and constant temperature oven that met the requirements of our official methods. Some of those who filled in the questionnaire reported that their moisture ovens varied from 83° to 131°. Can you wonder at the variations shown in moisture determinations as set forth in the Smalley Foundation, check meal work?

A letter was addressed to all manufacturers of electrical control ovens asking them if they would undertake to manufacture an oven of uniform and constant temperature at a moderate cost of \$75.00 to \$100.00 each, giving them the following specifications: "In general the requirements of this oven are as follows: one shelf about 16 inches square or its equivalent, space above this shelf not less than 6 inches, temperature on all parts of this shelf—corners, centers, etc.—shall be 102°C. plus or minus one degree and must remain so whether the oven is empty, full or partially full of moisture dishes, etc.; this oven must be well ventilated; the price must not exceed \$100.00 and the oven must be electrically heated and controlled; it must not require more than one hour in reaching the above temperature and remaining constant." Our object was to avoid a jacketed oven containing liquids. To these inquiries two companies agreed to undertake the above; they were The Thermo Electric Instrument Co., Newark, N. J., and The Chicago Surgical and Electrical Co., Chicago, Ill. Just what some of the other companies had to say in this matter and in reply to this letter we quote below.

E. H. Sargent, of Chicago, says: "We do not believe that you will be able to find and certainly we are not in a position to furnish you with an oven even nearly approaching to your specifications and certainly not for \$75.00." The Chicago Surgical & Electrical Company, of Chicago, says: "There is no oven in our regular line of apparatus, that could be used for your purpose."

Eimer and Amend, of New York, says: "We regret to report that we are not in a position to quote you an inexpensive oven to meet your specifications."

The Apparatus & Specialty Company, of Lansing, Michigan, says: "All of these ovens have the same disease of not being the same temperature at all points on one level."

Hear also what Dr. Baxter, of Harvard University, who has done research work along this line quite extensively says: "I appreciate the difficulties which you are having with electric ovens and wish very much that I could help you, but I am afraid that my experience has not allowed me to find a remedy for the difficulty which you are having."

Your attention is again called to Mr. L. M. Tolman's very able article on the "Determination of Moisture in Check Meals," printed in the March, 1923, number of the *Cotton Oil Press*. From his summary of information received you gather a very accurate idea of the wide variation of results reported by drying at different temperatures all of which more firmly impresses upon us the necessity of our Society adopting a uniform moisture box and not only a uniform box but one of uniform and constant temperature.

Perhaps no member of our Society has given more thought and study

to this perplexing problem than Dr. W. D. Richardson, Chief Chemist, Swift and Company, Chicago. What Dr. Richardson has to say at this time along this line we quote you below:

"Referring to your questionnaire in regard to moisture oven: we solved this problem, so far as our own laboratories are concerned, a number of years ago by the introduction of a standard jacketed oven which maintains a very constant temperature by means of a glycerine water solution in the jacket which is heated by electric coils. Any other source of heat might be used.

"When I was chairman of the Moisture Committee, an immense amount of work was done in this laboratory on moisture determination. All types of ovens and methods were used, desiccation *in vacuo* over sulphuric acid, ordinary air ovens heated in various ways and controlled in various ways, vacuum ovens, tube ovens, using hydrogen, CO₂, nitrogen, etc., and jacketed ovens. A report of this work was made during several successive years to the American Oil Chemists' Society, and finally a blueprint of the oven recommended was delivered to the Society. A number of copies of this blueprint were distributed to members. No action was taken by the Society.

"The problem is not to determine the moisture in cotton-seed meal, since by any method free moisture is not entirely driven off before moisture of combinations begins to be removed and the one determination runs into the other. At any rate, moisture in small amounts, say 0.1 to 0.2% between weighings, continues to come off for a very long period of time. The problem then is to arrive at a figure closely approximating the free moisture by a simple and direct method, which in the hands of different analysts gives concordant results.

"This can be accomplished by the oven referred to, blueprint of which is enclosed. We have installed this oven in our fifteen branch laboratories and the results on check samples which are sent out every month are very good indeed, considering the innate inaccuracy of any moisture determination on such organic materials as cotton-seed meal, fertilizers and stock feeds.

"I am taking the liberty of answering your questionnaire in this way since I can thus convey to you a better idea of work done in the past and the present situation so far as our own laboratories are concerned.

"We can furnish one of these ovens complete with electrical heating units for \$125.00, in dozen lots \$100.00 each."

Dr. Richardson also shows that with uniform ovens in the hands of sixteen different chemists in sixteen different laboratories on a sample of dried blood that the moisture content gave only a maximum variation of plus or minus 0.3% from the average.

Under date of April 18th, The Thermo Electric Instrument Company

advised that they had been successful in manufacturing an oven that would meet all of the above requirements. They further say, "that after testing this oven for a number of days, we found that the temperature as obtained at six different points widely distributed on the shelf level, with the shelf loaded with twelve regular aluminum moisture dishes, was within 101°C. and 103°C. at all times.

"The price of this oven will be \$80.00 f.o.b. Newark, N. J., if the members of your Society will buy this oven directly through our factory sales organization rather than through laboratory apparatus and other types of jobbing houses."

This oven was shipped to my laboratories and thoroughly tested out, both for uniform and constant temperature, and our daily records of the test are given in the table below.

The oven was operated in the Houston Laboratories from Thursday, April 24th to Thursday, May 1st, inclusive, except Sunday. Six thermometers were used, one in each of the four corners and one each in right and left center, resting in standard moisture dishes. The oven was loaded with from 6 to 36 standard moisture dishes on different days during the week.

	Temperatures					
	1 L-B	2 L-F	3 L-C	4 R-C	5 R-B	6 R-F
Maximum temperature	106°	103°	102°	101.5°	103°	102°
Minimum temperature	102.2	101	100	100	101	101
Average temperature	103.7	101.9	101.4	100.4	102.3	101.7

Moisture determinations on C. S. Meal

	Electric oven—3 hours			Water jacket drying oven—6 hours temperature 98°		
	Max. %	Min. %	Av. %	Max. %	Min. %	Av. %
Sample No. 1	9.53	9.40	9.48	9.28	9.28	9.28
Sample No. 2	6.73	6.37	6.55	6.40	6.33	6.37
Sample No. 3	9.33	9.27	9.30	9.38	9.20	9.29
Sample No. 4	10.90	10.44	10.69	10.80	10.55	10.67
Sample No. 5	9.49	9.15	9.30	9.23	9.20	9.22

The manufacturers have remedied the defect shown in the table (temperature 106 degrees) and Mr. Freas is here with one of the ovens for your inspection. I consider that this oven—so far as tested—comes as near meeting the specified conditions as is possible to construct a moderate price oven, and at \$80.00 each it is within reach of most laboratories. I believe the first step of our problem has been solved. The committee asks that our Society recommend to the Chemist Committee for adoption this oven, as well as all other ovens of uniform and constant temperature that meets the standard requirements of our official methods.

Committee: P. S. TILSON (Houston Laboratories, Houston, Texas), H. S. BATTLE, R. D. CALDWELL, GLENN NOGGLE, W. D. RICHARDSON, H. C. MOORE.