MOIRE METHOD FOR ESTIMATING INTERNAL VACUUM OF A CAN WITHOUT DESTROYING THE CAN

Iwao Shiga

(This article was previously published in Canner/Packer, Oct., 1959)

Internal vacuum of a can is generally measured by means of a puncture vacuum gauge tester, and flip vacuum testers are usually used for estimating the vacuum without puncturing the can.

Internal vacuum may also be estimated by means of the optical method such as appeared in the issue of Aug. 10, 1953 of the Canner.

A new method that I wish to describe herein is based upon "Moire" phenomenon appearing on the disc of glass plane grating which is placed on the flat cover of a can having no expansion ring like that of 6 fl. oz. fruit juice can. For convenience' sake the new method is designated as Moire Method.

Description of the method

A can to be examined is placed within a vacuum desiccator (Fig. 1) and subjected to a gradually increasing external vacuum (or inside vacuum of the desiccator) untill an equilibrium between the internal and external vacuums of the can is established, and then the vacuum gauge attached to the lid of the desiccator at this instant is read.

A tester may be able to catch an instant when the internal and external vacuums of can have just come to an equilibrium by observing the change of Moire pattern on the disc of plane grating placed on the can cover (see Figure 2 &3).

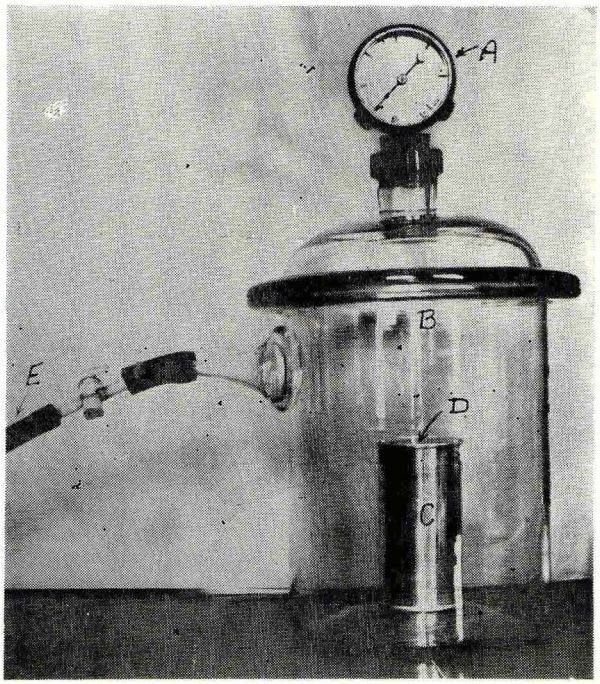


Fig. 1. Vacuum desiccator used in this method, and a can ready to be examined. A is a vacuum gauge, B the desiccator, C is a can to be tested, D a disc of a plane grating, and E a pressure rubber tube connected to an aspirator.

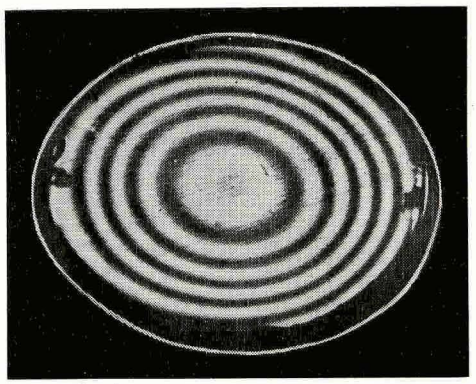
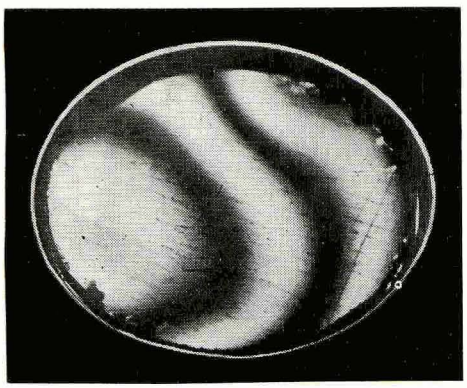


Fig. 2. Whén an eight lines/one mm plane grating is placed on the flat top of a can having a good internal vacuum, the moire appearance is as in this photograph.



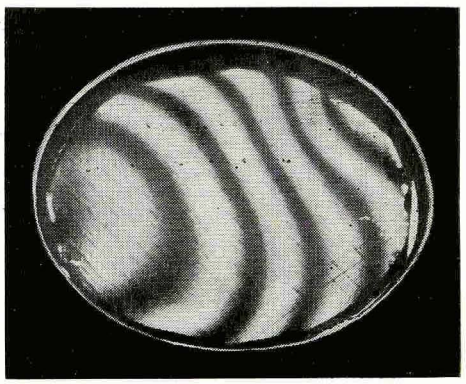


Fig. 3. When the plane grating is placed on a can with no vacuum, the moire appearance is like that on the two containers shown.

Experiments and results

To test the performance of the Moire method for the estimation of the internal vacuum, 23 cans of 202 x 402 size were seamed, especially without contents, under several different degrees of machine vacuum, by means of the semi-automatic vacuum seamer, and subjected to the tests. In the tests, internal vacuum was estimated by the Moire method at the beginning,and then determined again by means of FIRA Improved PunctureVacuum Gauge. Thus direct comparison of the two methods is obtained (Table 1).

TABLE 1. Comparison of the Moire method and puncture vacuum gauge method.

	Internal vacuum of cans in inches of Hg	
	Moire method	P. V. G. method
1	12.5	13.0
2	7.0	7.0
3	4.0	3.2
4	9.0	10.0
5	5.5	5.5
6	3.5	2.5
7	3.5	3.0
8	11.0	12.5
9	6.0	4.0
10	8.0	7.5
11	8.0	8.0
12	9.0	9.3
13	7.0	7.5
14	7.5	7.5
15	8.5	8.0
16	2.0	2.5
17	5.0	5.0
18	15.5	16.0
19	11.5	12.5
20	12.5	12.0
21	14.5	14.0
22	17.0	17.0
23	12.5	14.8

In order to further check the Moire method, commercial packs of orange juice, which had been stored for more than 27 months, were subjected to the tests mentioned previously. The data obtained in this case are shown in Table 2.

TABLE 2. Comparison of the Moire method and puncture vacuum gage method of determining the internal vacuum of cans.

	Internal vacuum of cans in inches of Hg	
	Moire method	P. V. G. method
1	13.5	14.0
2	14.0	13.7
3	13.0	13.5
4	23.5	21.0
5	21.5	21.9
6	12.5	10.8
7	13.5	11.8
8	7.5	6.1
9	13.0	13.6
10	12.5	11.3
11	14.5	14.0
12	14.0	13.0

The data presented in Table 1 and Table 2 show a reasonable agreement of the Moire method and the conventional puncture vacuum gauge method in estimating the internal vacuum of cans.

Summary

"Moire" appearance on the plane grating may be used as a useful method for estimating the internal vacuum of a flat top fruit juice can, without destoying the can and with reasonable accuracy.

Acknowledgement

The author wishes to thank Dr. M. Iwata of Osaka Ind. Tech. Exp. Sta. for his kindness in giving the author a piece of plane grating and valuable suggestion.