

AN ECONOMICAL SEMI-MECHANICAL STIRRER AND TAPPER FOR THE CRYOSCOPE

W. L. GREEN

*Bureau of Laboratories
Indiana State Board of Health
Indianapolis*

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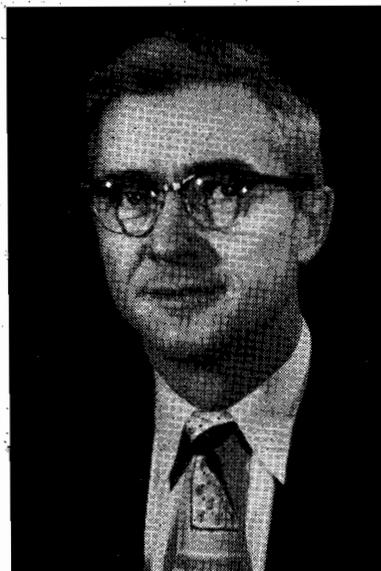
Construction of an economical semi-automatic sample stirrer and thermometer tapper for the cryoscope is described in detail. These accessories save time and permit closer duplication of results on freezing point of milk.

In 1953 Shipe (2) described equipment for automatically stirring the sample and tapping the thermometer in cryoscope determinations. He felt that mechanical methods would insure more uniformity and be more convenient than manual manipulations. Individual variations in interpretation of directions and in performance of determinations were minimized. More uniformity of temperature control and a time saving per determination were also accomplished.

Robertson (1) suggested two modifications of Shipe's mechanical stirrer and tapper. Previously recommended equipment involves considerable expense, therefore, an effort was made to simplify the device and reduce the cost without materially affecting accuracy.

Several years ago a mechanical stirring device was developed at the Indiana State Board of Health Dairy Products Section laboratory in Indianapolis, Indiana utilizing an automobile vacuum-type windshield wiper motor for power and stroke. The rotating wiper arm, considerably shortened, was connected with a piece of fish line through a single wheel pulley to the top of the stirrer. Recently this relatively simple device was modified to include an automatic thermometer tapper.

Figure 1 shows a front view of the apparatus. Figure 2 shows a side view. A vacuum-type windshield wiper motor was securely fastened to the center of the wooden back of an Eimer & Amend cryoscope with L-shaped pieces of metal. A 3/8 in. diameter hole was bored in the wooden back, for admitting the motor rocker arm shaft through to the front side. The center of this hole was located 12 3/8 in. above the top shelf holding the Dewar flask. A 3/32 in. diameter hole was bored near the end of the rocker arm at right angles to the shaft. In the end of the shaft, parallel to the axis, a hole was drilled and threaded to admit an Allen head screw 1/4 in. long and 3/32 in. in diameter. A



Mr. W. L. Green received the A.B. degree from the University of Kansas in 1936. He has served as medical technologist with the Detroit Department of Health; as chemist for the Detroit Water Board sewage treatment plant; and as milk sanitarian and milk laboratory supervisor for the Lawrence-Douglas County Health Department, Lawrence, Kansas. At present he is acting chief of the Dairy Products Section, Bureau of Laboratories, Indiana State Board of Health.

piece of welding rod 3/32 in. in diameter and approximately 5 1/2 in. long was inserted through the shaft and secured with the Allen head screw. The welding rod was bent at a 110° angle from the horizontal, 3 3/8 in. from one end. A loop (A) was made in the short end for attaching the nylon fish line. Two Marr electrical connectors were placed on the straight end of the welding rod to provide adjustment of the stroke.

A 3/16 in. diameter hole was bored in the wooden backboard for the support rod about 3/4 in. to the left and 2 1/4 in. above the rocker arm shaft. The pulley and arm extend forward 3 1/2 in. from the front of the wooden backboard and have a wheel 1/2 in. in diameter at the end. A piece of fish line is tied to the loop on the 3/32 in. welding rod arm, passes over the

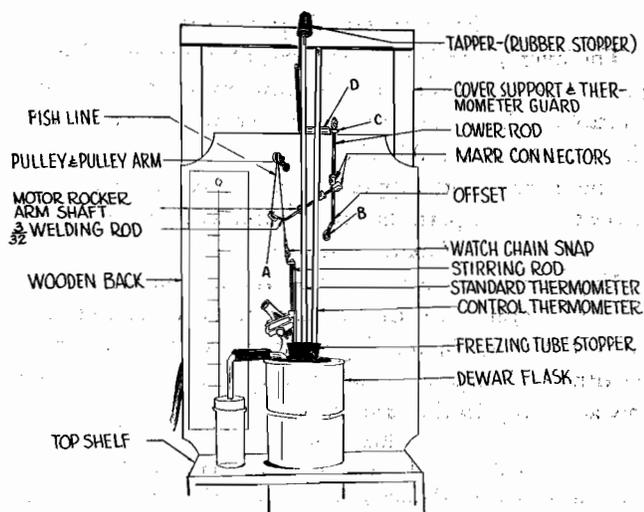


Figure 1. Front view, illustrating stirrer connected to cryoscope.

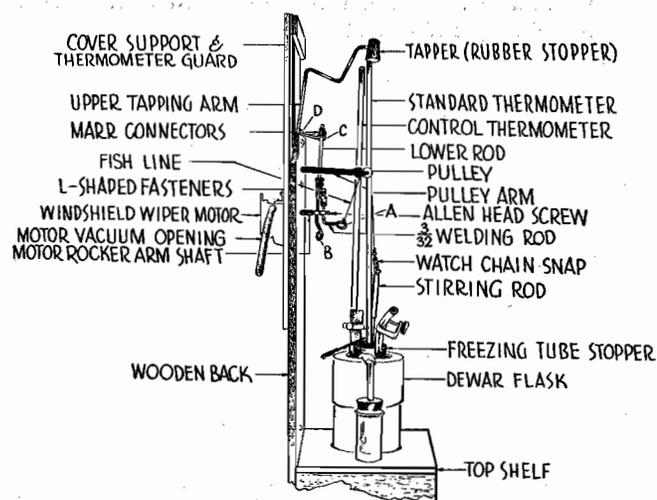


Figure 2. Side view, illustrating stirrer connected to cryoscope.

pully, and down to the top of the stirring rod. A snap from a watch chain is tied to the lower end of the fish line. An L-shaped metal piece, with a hole bored near each end, was secured on the top of the stirring rod with a small nut. The snap is fastened into the other hole. The fish line is adjusted to allow a 1 to 1 1/2 in. stroke.

The tapper consists of two lengths of 1/8 in. welding rod. The lower rod is approximately 6 1/2 in. long. The lower end of the rod has a loop (B) and an offset. Two more Marr electrical connectors are used on its upper end for adjusting the length of the tapping stroke. A piece of welding rod 1/8 in. in diameter and approximately 11 in. long was used for the tapping arm. A No. 0 rubber stopper was placed at one end and a loop (C) at the other end. The rod is held securely to the wooden back by a piece of metal fashioned in the shape of a hinge (D).

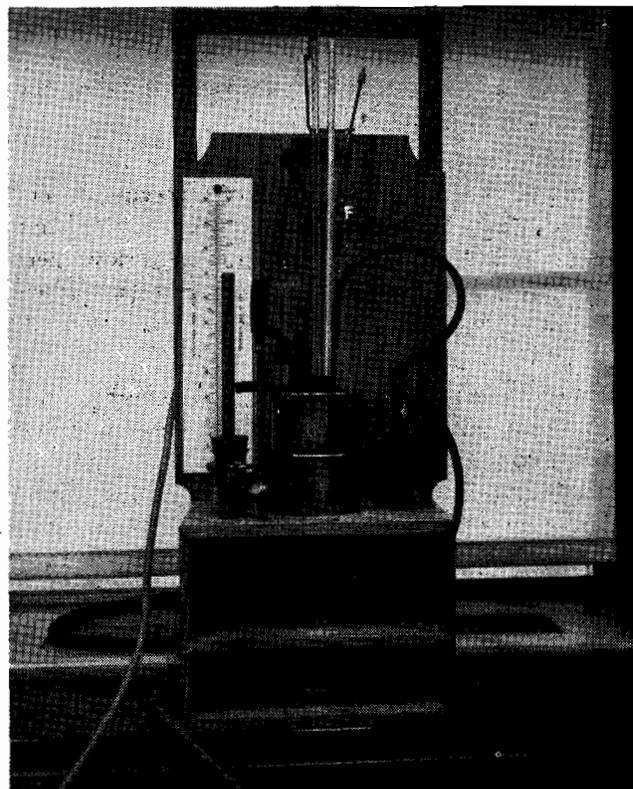


Figure 3. Front view, illustrating tapper connected to cryoscope. Shown by (F).

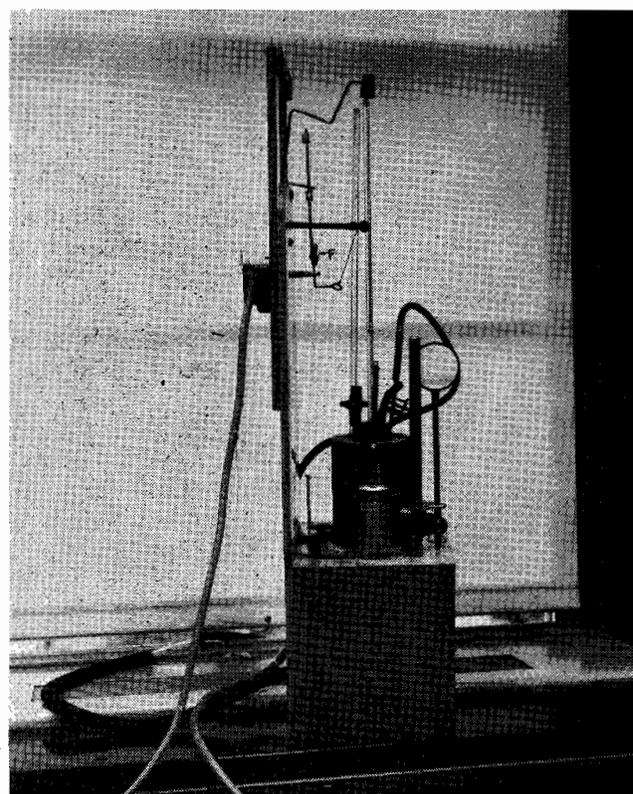


Figure 4. Side view, illustrating tapper connected to cryoscope. Shown by (F).

The stirrer is operated separately from the tapper. The stirrer is connected and vacuum turned on. Speed of stroke can be controlled at the vacuum valve, the wiper motor, or both.

Stirring proceeds until the sample is supercooled, at which point it is seeded to start the freezing action. The mercury immediately starts to rise rapidly and stirring is continued until the rising column slows perceptibly as it approaches its highest limit (i.e. when the thermometer reads about 0.07°C . below the expected freezing point).

The mechanical stirrer is then disconnected, the stirrer *slowly* and *carefully* manipulated two or three times by hand, after which the tapper is connected. Vacuum is again turned on. Tapping is continued until the mercury column remains stable (3) for at least one minute. A reading of the freezing point is then made, being careful to avoid parallax.

Maximum stroke of the tapper is one inch.

RESULTS AND CONCLUSION

The average of the differences observed in freezing point determinations on 18 raw milk samples was 0.0026°C . The minimum difference was 0.000°C . and the maximum was 0.007°C .

This stirrer and tapper is economical to construct, saves time, and permits closer duplication of results.

ACKNOWLEDGEMENTS

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3. Standard Methods for the Examination of Dairy Products. American Public Health Association, New York, N.Y. 10th Ed. pp. 272-4, 1953.