

CLAIMS

What is claimed is:

1. A bead beating instrument for preparing a sample lysate, comprising
an opening for receiving a flexible sample container containing a fluid sample between a first support member and a second support member,
a bead milling component associated with the first or second support member, the bead milling component comprising a reciprocating drive member operatively coupled to at least two alternating paddle elements that extend from the first or second support member to repeatedly and serially contact the flexible sample container to generate a lysate from the sample, wherein the at least two paddles are sized and positioned to contact substantially the entire flexible sample container.
2. The bead beating instrument of claim 1 wherein the reciprocating drive member comprises a motor driven cam shaft with at least two off-center drive lobes mechanically coupled to the at least two paddles.
3. The bead beating instrument claim 2 wherein the cam shaft comprises bearing members that contact the paddles.
4. The bead beating instrument claim 2 wherein the paddles each comprise a cam follower that contacts a corresponding off-center drive lobe of the cam shaft.
5. The bead beating instrument of claim 1 the reciprocating drive member comprising a mechanical actuator associated with each paddle, wherein the mechanical actuator extends to extend the associated paddle.
6. The bead beating instrument of claim 1 wherein each paddle includes a biasing member positioned and configured to bias each paddle toward or away from the lysis zone.
7. The bead beating instrument of claim 1 wherein the fluid sample comprises a quantity of zirconium lysis beads.
8. An instrument for amplifying nucleic acids in a sample, comprising
an opening for receiving a container, the container comprising a plurality of fluidly connected reaction zones including a lysis zone, an extraction zone, and an amplification zone, and one or more sealable ports fluidly connected to the reaction zones,

a bead milling component comprising a reciprocating drive member operatively coupled to at least two alternating paddle elements that repeatedly and serially contact the lysis zone to generate a lysate from the sample, wherein the at least two paddles are sized and positioned contact substantially the entire lysis zone,

an extraction zone for extracting the nucleic acids from the lysate in the extraction zone, and moving the extracted nucleic acids to the amplification blister, and

a heater positioned for controlling temperature of the nucleic acids in the amplification zone.

9. The instrument of claim 8 wherein the reciprocating drive member comprises a motor driven cam shaft with at least two off-center drive lobes mechanically coupled to the at least two paddles.

10. The instrument of claim 9 wherein the cam shaft comprises bearing members that contact the paddles.

11. The instrument of claim 9 wherein the paddles are each operably connected to a cam follower that contacts a corresponding off-center drive lobe of the cam shaft.

12. The instrument of claim 8 the reciprocating drive member comprising a mechanical actuator associated with each paddle, wherein the mechanical actuator extends to extend the associated paddle.

13. The instrument of claim 8 wherein each paddle includes a biasing member positioned and configured to bias each paddle toward or away from the lysis zone.

14. The instrument of claim 8 wherein one or more of the paddles comprise a temperature control element.

15. The instrument of claim 14 wherein the temperature control element is one or more of a heater, cooler, Peltier device, resistance heater, induction heater, electromagnetic heater, thin film heater, printed element heater, or positive temperature coefficient heater.

16. The instrument of claim 8 wherein the at least two paddles are configured to extend together to plunge fluid from the lysis zone.

17. The instrument of claim 8 wherein the bead milling component comprises a plurality of at least three beater arms arranged asymmetrically around a central axis and driven by a motor.