HIGH AND LOW VOLUME PRECISION PIPETTOR

CROSS-REFERENCES TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Appl. Ser. No. 62/726,063, filed August 31, 2018, which is incorporated by reference as if fully set forth herein.

BACKGROUND

[0002] The typical approach to having both high volume pipetting capability and low volume capability with precision and accuracy is to have two or more separate pipettor devices that are used interchangeably. This increases the cost and complexity of the pipetting system, and users have to choose between high volume and low volume pipetting. Users cannot pipette the other volume range without swapping out pipettor devices. Swapping out pipettor devices is more complex, requires more components, and is more time consuming.

[0003] Embodiments of the invention address these and other challenges, individually and collectively.

BRIEF SUMMARY

[0004] Embodiments of the invention are directed to devices and methods for pipetting liquids in high and low volume modes. In embodiments of the invention, a single pipettor device allows for high volumes of liquids to be transferred, yet provide for the ability to also transfer low volumes of liquids with high precision and accuracy without the need for two or more separate pipettor devices.

[0005] One embodiment of the invention is directed to a device for transferring liquid comprising: a piston (104); and a barrel (102) including a barrel body (102A), and a tip (122) formed in the barrel body (102A), wherein the barrel (102) comprises a larger diameter

WHAT IS CLAIMED IS:

1. A device for transferring liquid comprising:

a piston; and

a barrel including a barrel body, and a tip formed in the barrel body, the barrel including a larger diameter segment and a smaller diameter segment, wherein the barrel is configured to engage a first pipette tip sized to fit over the larger diameter segment, and wherein the barrel is further configured to engage a second pipette tip sized to fit over the smaller diameter segment of the barrel.

2. The device of claim 1:

wherein the piston includes a stepped profile, a drive rod portion and a free end portion extending from the drive rod portion, the free end portion having a different diameter than the drive rod portion,

wherein the barrel includes a stepped bore defined by the barrel body, the stepped bore having an axial hole and a coaxial counterbore, the axial hole passing through the tip, and wherein the device further comprises:

a first seal element between and engaging the barrel and the free end portion; and

a second seal element between and engaging the barrel and the drive rod portion.

3. The device of claim 2, wherein a length of the free end portion is greater than a length of the axial hole.

4. The device of any of claims 2 or 3, wherein the stepped bore further comprises a bore portion, wherein a diameter of the bore portion is smaller than a diameter of the counterbore and is larger than a diameter of the axial hole, and wherein the first seal element is fixed within the bore portion.

5. The device of any of claims 2-4, wherein, the smaller diameter segment coincides with the tip, and the larger diameter segment extends from the smaller diameter segment, and the counterbore disposed within the larger diameter segment.

6. The device of any of claims 2-5, further comprising:

a shuck plate disposed about the barrel and configured to move axially with respect to the barrel.

7. The device of any of claims 2-5, wherein the second pipette tip has a body forming a lumen, and a barrier spanning the lumen, the second pipette tip engaging the barrel, and wherein, when the second pipette tip is engaged to the barrel, an end of the free end portion can contact the barrier.

8. The device of claim 7, further comprising a shuck plate, wherein when the second pipette tip is engaged to the barrel, the shuck plate contacts the second pipette tip.

9. The device of any of claims 2-8, wherein the piston 104 further comprises an engagement portion extending from the drive rod portion.

10. The device of any of the preceding claims, further comprising:

an actuator coupled to the piston for moving the piston up and down.

11. The device of claim 10, further comprising a gripper having at least two gripper fingers, wherein the actuator is further coupled to the gripper for moving the at least two gripper fingers.

12. The device of any of claims 2-11, wherein the piston is disposed within the barrel such that at most one of the first seal element and the second seal element engages between the barrel and the piston.

13. The device of any of the preceding claims, wherein the second pipette tip includes a filter barrier that can be pushed by the piston to separate the second pipette tip from the barrel.

14. A method of using a device for transferring a liquid comprising (a) a piston, and (b) a barrel including a barrel body, and a tip formed in the barrel body, the barrel including a larger diameter segment and a smaller diameter

segment, wherein the barrel is configured to engage a first pipette tip sized to fit over the larger diameter segment, and wherein the barrel is further configured to engage a second pipette tip sized to fit over the smaller diameter segment of the barrel, the method comprising:

in a first high volume pipetting mode, aspirating a first liquid by withdrawing the piston from the barrel, and dispensing the first liquid using the first pipette tip; and

in a second low volume pipetting mode, aspirating, a second liquid by withdrawing the piston from the barrel, and dispensing the second liquid using the second pipette tip.

15. The method of claim 14, wherein the piston includes a stepped profile, a drive rod portion and a free end portion extending from the drive rod portion, the free end portion having a different diameter than the drive rod portion, the barrel including a stepped bore defined by the barrel body, the stepped bore having an axial hole and a coaxial counterbore, the axial hole passing through the tip, a first seal element between and engaging the barrel and the free end portion, and a second seal element between and engaging the barrel and the drive rod portion, and

wherein in the first high volume pipetting mode, the first liquid is aspirated by withdrawing the piston from the barrel such that the free end portion is above and moves away from the axial hole, and the first liquid is dispensed by dispensing the first liquid by inserting the piston nto the barrel such that the free end portion moves toward the axial hole; and

wherein in a second low volume pipetting mode, the second liquid aspirated by withdrawing the piston from the barrel such that the free end portion remains in the axial hole, and the second liquid is dispensed by inserting the piston into the barrel such that the free end portion remains in the axial hole.