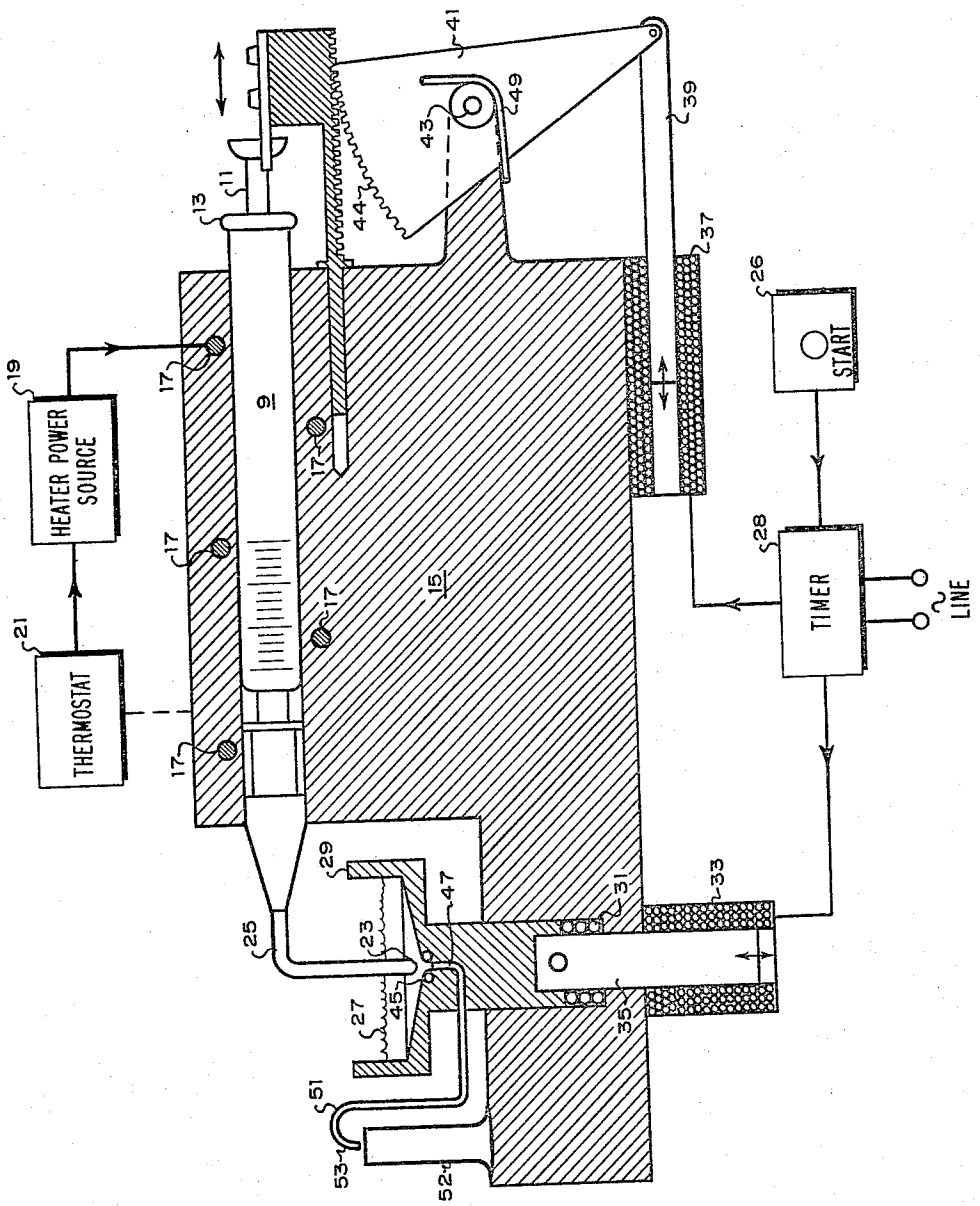
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DISPENSING APPARATUS

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# DISPENSING APPARATUS

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1 Claim. (Cl. 222—146)

This invention relates to apparatus for dispensing small amounts of fluid accurately and at a preselected temperature and more particularly to apparatus that is useful in blood coagulation testing which agitates particulate matter in the fluid to be dispensed.

It is an object of the present invention to provide dispensing apparatus which is easy to clean and which eliminates the need for check valves.

It is another object of the present invention to provide apparatus for automatically dispensing small volumes of liquid at a selected temperature.

In accordance with the illustrated embodiment of the present invention, a hypodermic-type syringe is actuated by electromechanical means to draw a quantity of liquid to be dispensed from a reservoir. The liquid is heated within the syringe to a selected temperature. The reservoir is then moved toward the inlet tube of the syringe to align the tube within an outlet in the lower wall of the reservoir. This forms a fluid-tight seal between the tube and the outlet, the upper end of which is above the liquid level in the reservoir to prevent liquid from escaping from the reservoir. With the tube and outlet sealed, the syringe is actuated to expel the quantity of heated liquid contained therein through the tube and outlet and into a suitable container.

Other and incidental objects of the present invention will be apparent from a reading of this specification and an inspection of the accompanying drawing which shows a cutaway view of the dispensing apparatus of the present invention.

Referring to the drawing there is shown a hypodermic-type syringe **9** including a plunger **11** and an outer barrel **13** which is held in position in frame **15**. The entire syringe **9** is readily removable to facilitate cleaning. A heating element **17** in frame **15** receives a sufficient amount of power from heater power source **19** controlled by thermostat **21** to maintain the syringe **9** and surroundings at a selected temperature. End **23** of the tube **25** connected to the syringe is disposed below the surface of the liquid **27** in the reservoir **29**.

In operation, actuation of button **26** starts the timer **28** which then actuates solenoid **33**. This moves the reservoir **29** downwardly against spring **31** so that the end **23** of tube **25** communicates with the liquid **27** in the reservoir **29**. The length of travel of the armature **35** is sufficiently restricted so that it does not complete the magnetic circuit in the solenoid **33**. This causes the armature to vibrate at the line frequency, which vibrations are transmited to the reservoir connected to the armature **35** for agitating pariculate matter in the liquid **27** within the reservoir **29**. A short time after the agitation of liquid **27** in reservoir **29** commences, the timer **28** actuates solenoid **37** which causes armature **39** to move longitudinally inwardly into the coil. This motion is transmitted by lever arm **41** on pivot **43** and the rack and pinion apparatus **44** to the plunger **11** of syringe **9** which is thereby moved longitudinally outwardly from the barrel **13**. Liquid **27** in reservoir **29** is thus drawn up through tube **25** into the syringe **9** where it is heated to a selected temperature.



Timer **28** then deenergizes solenoid **33**. Spring **31** urges the armature **35** and reservoir **29** upwardly to engage the ring gasket **45** at reservoir outlet **47** with the tapered end **23** of tube **25** to form a fluid-tight seal. Timer **28** then deenergizes solenoid **37** to complete the operating cycle. Spring **49** rotates lever arm **41** about pivot **43** which in turn moves the plunger **11** longitudinally inwardly to expel the heated liquid within the syringe **9**. The expelled liquid passes through tube **25**, the fluid-tight seal at end **23** and out through tube **51** connected to the outlet **47** in the lower wall of reservoir **29** into a suitable container **52**. The end **53** of tube **51** is elevated above the level of liquid **27** in reservoir **29** to prevent escape of the liquid **27** during the time solenoid **33** is energized. The accuracy with which a selected volume of liquid is dispensed is preserved by making the interior volume of the tube **51** over its entire length negligibly small compared with the volume of liquid dispensed in an operating cycle.

I claim:

Fluid dispensing apparatus comprising:

a reservoir for containing a fluid to be dispensed;

a fluid outlet in a lower region of said reservoir having a terminal end remote from the reservoir which is disposed above the level of a fluid to be dispensed contained within said reservoir;

a tube having an end disposed in line with said fluid outlet;

means coupled to at least one of said tube and reservoir for moving said one in a direction toward the other of said tube and reservoir between limits of travel to form a fluid-tight seal betwen the end of said tube and the outlet at one limit of travel and to position said end of the tube away from the outlet at another limit of travel for said end of the tube to communicate with a fluid to be dispensed contained in the reservoir, said means including an electro-mechanical solenoid coupled to said reservoir for moving the reservoir vertically along an axis passing through said end of the tube; and

additional means including a chamber with a plunger therein for altering the volume of said chamber and a heater disposed about said chamber for heating fluid present in said chamber connected to said tube for withdrawing fluid to be dispensed therethrough from said reservoir when the tube and reservoir are disposed near said other limit of travel and dispensing a portion of the withdrawn fluid through said tube and outlet when said tube and reservoir are disposed near said one limit of travel.

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