

[54] **PUMP FOR PARENTERAL INJECTIONS
AND THE LIKE**

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[51] Int. Cl. **F04b 43/08, F04b 45/06**

[58] Field of Search. **417/474, 475, 478,
417/479, 412**

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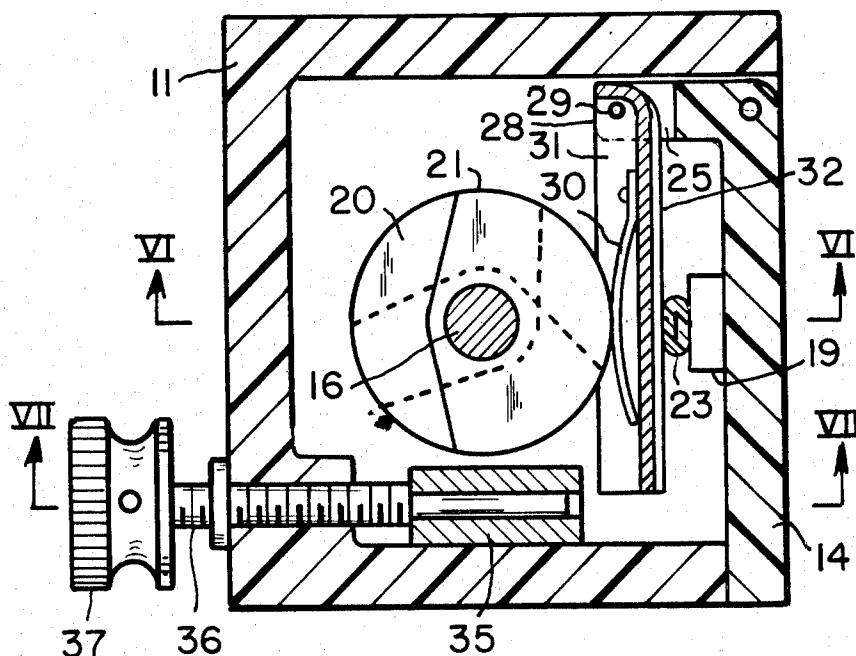
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[57] **ABSTRACT**

The pump for parenteral injections and the like operates by a peristaltic type action. the pump includes a shaft having a plurality of cams spaced therealong. The cams act on spring loaded members adjacent the cam which, in turn, sequentially squeeze a disposable, flexible tubing held by a support. An adjusting mechanism is also positioned adjacent the members so as to control the cross sectional area of the disposable, flexible tubing. The rate of flow is controlled by the adjusting mechanism.

4 Claims, 9 Drawing Figures



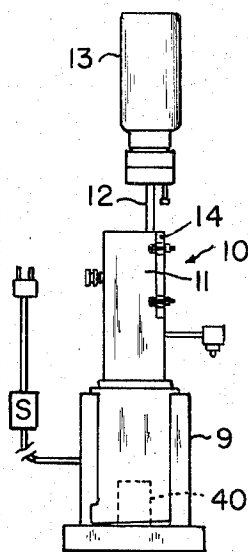


Fig. 1

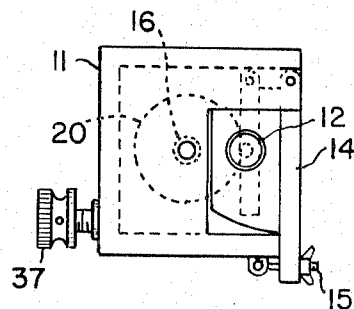


Fig. 4

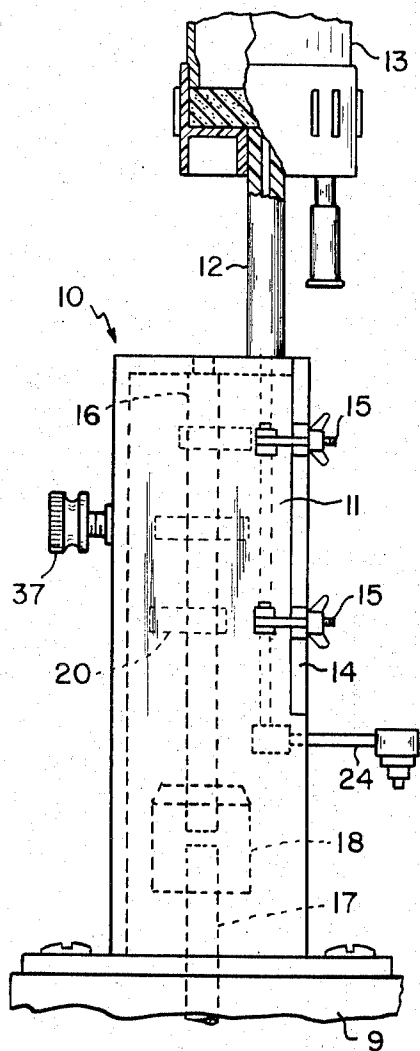


Fig. 2

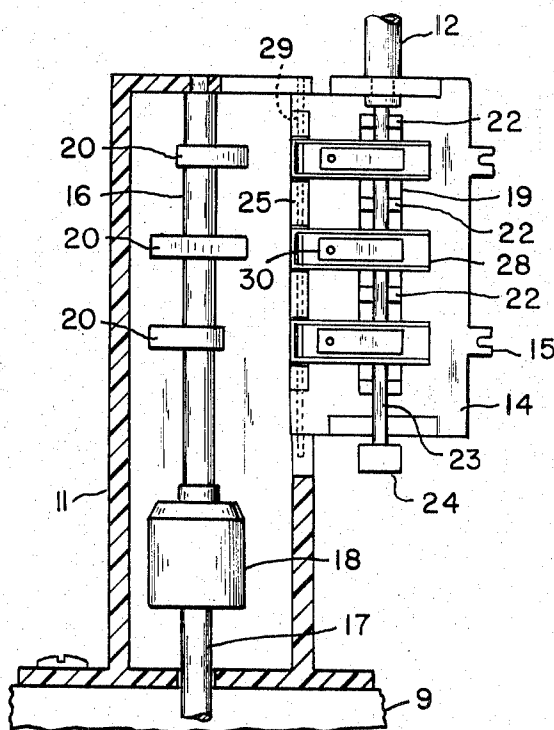


Fig. 3

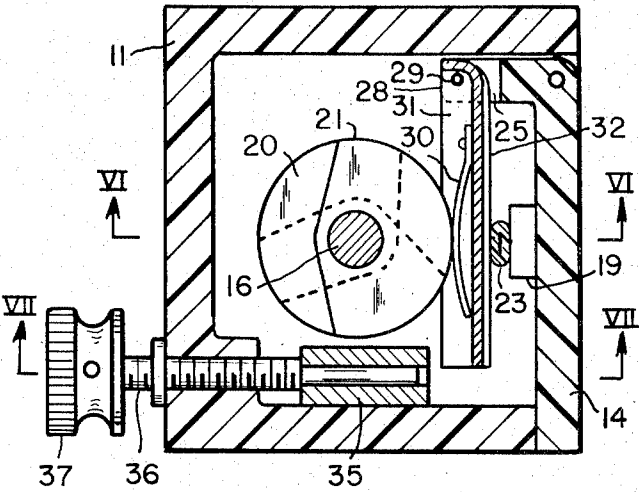


Fig. 5

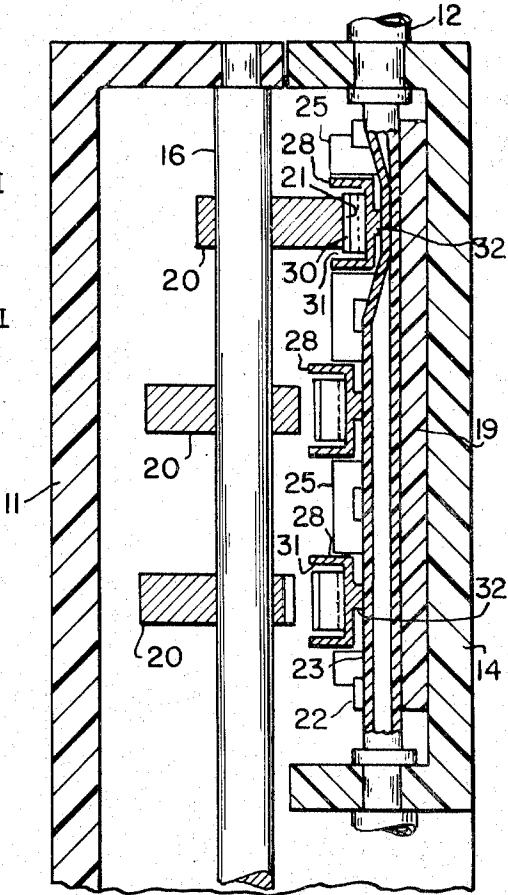


Fig. 6

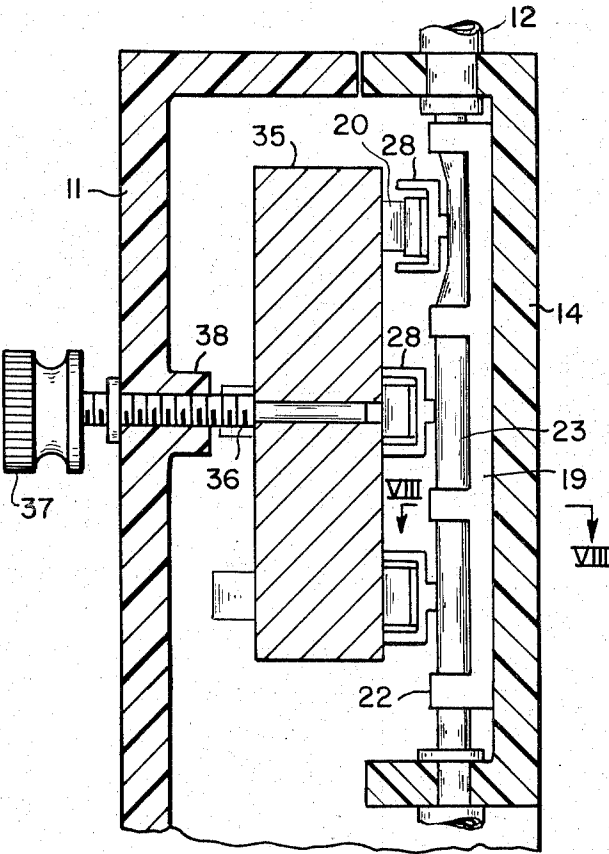


Fig. 7

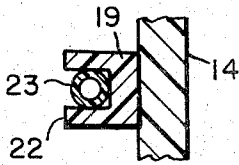


Fig. 8



Fig. 9

PUMP FOR PARENTERAL INJECTIONS AND THE LIKE

BACKGROUND OF THE INVENTION

My invention relates to pumps for parenteral injections and, more particularly, to pumps operating with a peristaltic type action.

Gravity operated apparatus are routinely employed for feeding fluids into the body. Gravity fed apparatus have the inherent drawbacks of not being able to provide fluid flow uphill and of depending upon the fluid head in the fluid dispenser for the flow rate. Gravity fed apparatus are thus unsatisfactory where precision of the flow rate of the fluid into the body is required. In addition, since there is no positive displacement, a gravity fed apparatus must work against and cannot compensate for back pressures created in the body or by a patient accidentally deforming the tubing employed.

A substantial number of intricate pump devices have been devised which operate independent of gravity. Among these are intricate devices employing peristaltic type action and variable speed motors to control the rate of flow. While such devices operate successfully, they are impractical from the standpoint of cost and maintenance, and generally are of a cumbersome size.

SUMMARY OF THE INVENTION

My pump overcomes the drawbacks of gravity fed devices by permitting a controlled, constant flow rate, unaffected by head pressure. However, this controlled flow rate is accomplished in a simplified manner which thereby eliminates the intricacies of the prior art pumps and provides a highly mobile apparatus. Because of the disposable nature of certain of the components which are utilized with my pump, sanitation is assured and the need for complex cleaning devices or procedures is eliminated.

My pump includes a shaft driven by a motor. The shaft has a plurality of spaced cams therealong which are sequentially offset from one another. The cams interact with spring loaded members which, in turn, sequentially squeeze shut a flexible, disposable tubing held in place by support means. An adjusting mechanism engages the members so as to maintain a desired deformation of the disposable, flexible tubing, thereby controlling the cross sectional area thereof which thusly controls the rate of flow.

BRIEF DESCRIPTION OF THE DRAWINGS

- FIG. 1 is an elevation of the overall pump;
- FIG. 2 is an elevation of the main housing;
- FIG. 3 is an elevation of the main housing with the housing door open;
- FIG. 4 is a plan view of the housing;
- FIG. 5 is a horizontal section through the housing;
- FIG. 6 is a section taken along section lines VI—VI of FIG. 5;
- FIG. 7 is a section taken along section lines VII—VII of FIG. 5;
- FIG. 8 is a section taken along section lines VIII—VIII of FIG. 7; and
- FIG. 9 is a plan view of a clam-shaped tubing.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The pump, generally designated 10, is used to inject

fluids into the body intravenously, subcutaneously or intramuscularly and is hereinafter referred to as a pump for injecting fluids parenterally into the body.

The pump 10 includes a main housing 11 mounted on top of a constant speed motor 9, FIGS. 1 and 2. A standard connection 12 extends from the housing 11 to a dispensing bottle 13. The housing 11 includes a door 14 which pivotably opens to permit access to the housing 11. Door 14 includes a positive locking device 15 which cooperates with the housing 11 to assure a rigid closure of the door 14, FIGS. 3 and 4. An adjustable weight sensitive switch 40, illustrated diagrammatically in FIG. 1, is operatively connected to the motor to shut it off when the weight of the fluid in the bottle 13 reaches a predetermined minimum level.

A cam shaft 16 couples to a drive shaft 17 of the motor through standard coupling 18 so as to be operable therewith. Shaft 16 terminates in a bearing connection with the upper surface of housing 11, FIG. 3. Three cams 20 are spaced along shaft 16 and the cam lobes 21 of each cam 20 are offset from one another so as to cause a sequential operation of the pump, which is described hereinafter; two of the offset cam lobes being illustrated by dotted lines in FIG. 5. Three cams represent the minimum number of cams practical and, therefore, three cams are shown for ease of presentation. It will be recognized that a greater number of cams can be employed.

The door 14 includes an elongated support 19 having a plurality of spaced pairs of fingers 22 which, when the door is closed, extend inwardly into the housing and which are aligned so as to form a channel for flexible tubing 23, FIGS. 7 and 8. The flexible tubing 23, which is disposable, is positioned within the channel formed by the fingers 22 and connects at one end to the dispensing bottle connection 12 and at the other end to a standard connection 24 which leads to a flow rate measuring device, such as a drip bottle, and an injection needle, not shown. All components which are in contact with the pumped fluid are disposable and, therefore, the standard connections 12 and 24 are disposable along with tubing 23, bottle 13 and the injection needle, not shown.

Also positioned along an edge of the door 14 are a series of shoulders 25 which are spaced from one another and which extend inwardly into the housing 11, FIG. 3. Three plate-like members 28, respectively, are pivotally mounted between the spaced shoulders 25 by means of a pin 29 which extend through an end of each member 28 and the shoulders 25. The plate-like members 28 are mounted adjacent the channel formed by the fingers 22 so that the members 28 are pivotable to extend across and to deform the flexible tubing 23. The members could also be mounted to the housing itself. Each member 28 includes a leaf spring 30 secured within a recess 31 on the rear surface of the members 28, FIGS. 5 and 6. The members 28 and the leaf springs 30 are so positioned that the leaf springs 30 engage the respective cam lobes 21 as the shaft 16 rotates to transmit force from cam lobes 21 to members 28 and thereby squeeze tubing 23. A spring is interposed between each cam lobe 21 and each corresponding member 28 to insure that tubing 23 will be completely collapsed upon rotation of cams 20. The springs 30 compensate for slight dimensional variations in the pump parts and in the wall thickness of the tubing. Additionally, springs 30 will have a slightly larger resiliency than

the tubing wall and, therefore, will insure complete collapse of the tubing while preventing the tubing from being cut. Each plate-like member 28 also includes a rib 32 which extends laterally and midway of the member 28 and which engages the flexible tubing 23 to squeeze it when forced thereagainst by movement of the cam 20. The ribs 32 minimize the surface area in contact with the flexible tubing 23 and increases the efficiency of the pump 10.

Referring to FIGS. 5 and 7, adjusting bar 35 is mounted within the housing 11 by means of a threaded shaft 36 which engages the threaded aperture in shoulder 38. Shoulder 38 extends inwardly from housing 11. The unthreaded end of shaft 36 cooperates with a blind aperture in the rear surface of the adjusting bar 35. Shaft 36 extends through the housing 11 and a knob 37 is rigidly secured to a portion of the shaft 36 external of the housing. The adjusting bar 35 extends parallel to the shaft 16 and is positioned adjacent the distal ends of the members 28.

My pump works as follows. The door 14 is opened; the flexible tubing 23 is inserted into the channel therefor; and the other disposable items referred to hereinabove are installed in place. The door is closed and the pump is then ready to operate. The motor is activated by conventional means and the shaft 16 rotates therewith. Since the cam lobes 21 are offset from one another, they sequentially engage the spring loaded wear plates 28 to squeeze, in turn, the flexible tubing to force the fluid out of the dispensing bottle by peristaltic type action, FIG. 6.

The cam lobes 21 are offset from one another so that, in operation, one cam is always in the closed position, i.e., against a wear plate which is engaged with the flexible tubing, to insure a continuous, unidirectional fluid flow. The adjusting bar is initially positioned so as to just engage the wear plates 28 without causing any deformation of the flexible tubing 23. The flow is measured in a standard manner as, for example, by a drip bottle, not shown. To reduce the flow, it is only necessary to tighten the adjusting bar against the wear plates to deform the flexible tubing and thereby reduce the cross sectional area thereof.

After a given period of time, as for example, when the fluid in the dispensing bottle has reached its predetermined minimum level, the pump automatically turns off, the door may be opened and the components which have been in direct contact with the fluid may be removed and thrown away.

A clam-shaped tubing 41 in which the portion at the ends of the major axis are further extended, FIG. 9, increases the performance of the pump by making the rate of change of the cross-sectional area of the tubing more constant at extreme adjustments. However, standard, flexible tubing of a circular cross section can also be employed.

My pump overcomes the drawbacks of a gravity feed

type device, yet is of relatively simple design and consequently, it is very mobile and practical.

I claim:

1. A pump for parenteral injections and the like comprising:

A. a shaft having a plurality of cams spaced therealong, each cam having a cam lobe, said cam lobes sequentially offset from one another;

B. a plurality of aligned, pivotally mounted plate-like members, each member positioned for engagement with a cam lobe of a corresponding cam and having a spring attached thereto and positioned between said member and the corresponding cam;

C. flexible tubing support means for supporting a flexible tubing in position adjacent the members for squeezing thereby;

D. an adjustable bar abutting the members and adjustable to alter the cross sectional areas of a flexible tubing;

E. a housing surrounding the shaft, cam and adjustable bar, said housing having a door which includes a flexible tubing support means; and

F. motor means positioned adjacent the housing and in operable engagement with the shaft.

2. The pump of claim 1 wherein the plate-like members are pivotally mounted to the door by means of a pin extending through a series of shoulders which are spaced so as to accommodate said member therebetween.

3. A pump for parenteral injections and the like comprising:

A. a housing having a door;

B. a rotatable shaft positioned within the housing having a plurality of cams spaced therealong, each cam having a cam lobe, said cam lobes sequentially offset from one another;

C. a plurality of spaced shoulders extending into the housing from the door;

D. a plurality of aligned, pivotally mounted spring loaded plate-like members, each member positioned for engagement with a cam lobe, said members pivotally mounted by a pin extending through the shoulders, adjacent shoulders accommodating a member therebetween;

E. a flexible tubing support formed of a channel secured to the door;

F. a flexible tubing positioned in the channel extending through the housing and adapted to be collapsed by contact with said plate-like members;

G. an adjusting bar abutting the plate-like members and adapted to alter the cross sectional area of the flexible tubing; and

H. a motor mounted adjacent the housing and in operable engagement with the shaft.

4. The flexible tubing of claim 3 being clam-shaped in cross section.

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