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Kamen

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[54] **MEDICATION INJECTION DEVICE**

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[52] **U.S. Cl.** ..... **128/218 A,** 128/DIG. 1

[51] **Int. Cl.** **A61m 5/20**

[58] **Field of Search** ..... 128/2 R, 2.05 R, 218 R, 128/218 A, 214 E, 214 F, DIG. 1, 234, 236

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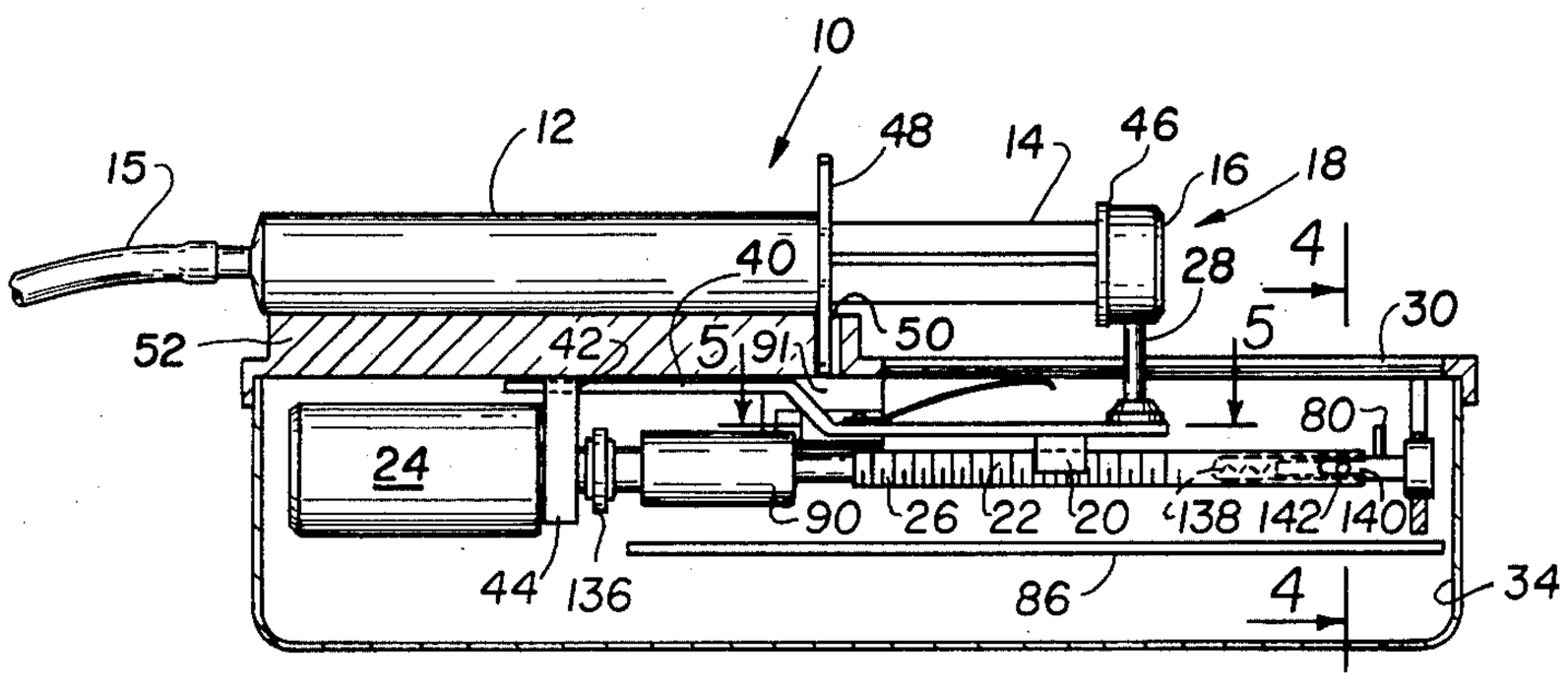
Primary Examiner—Dalton L. Truluck
Attorney, Agent, or Firm—Bauer & Amer

[57] **ABSTRACT**

A medication-administering device controlled for repetitive delivery, by intravenous injection or otherwise, of predetermined syringe volumes of said medication at present time intervals, wherein the syringe plunger medication injection stroke is achieved using a powering motor, and the control exercised over the mode of operation of the device is related to the rotational traverses of said motor. This minimizes non-uniform performance and other shortcomings which characterize prior art medication injection devices in which the performance of the powering motors are vulnerable to variances due to varying line voltage, changing work loads (i.e. medication with different viscosities) and the like.

5 Claims, 6 Drawing Figures



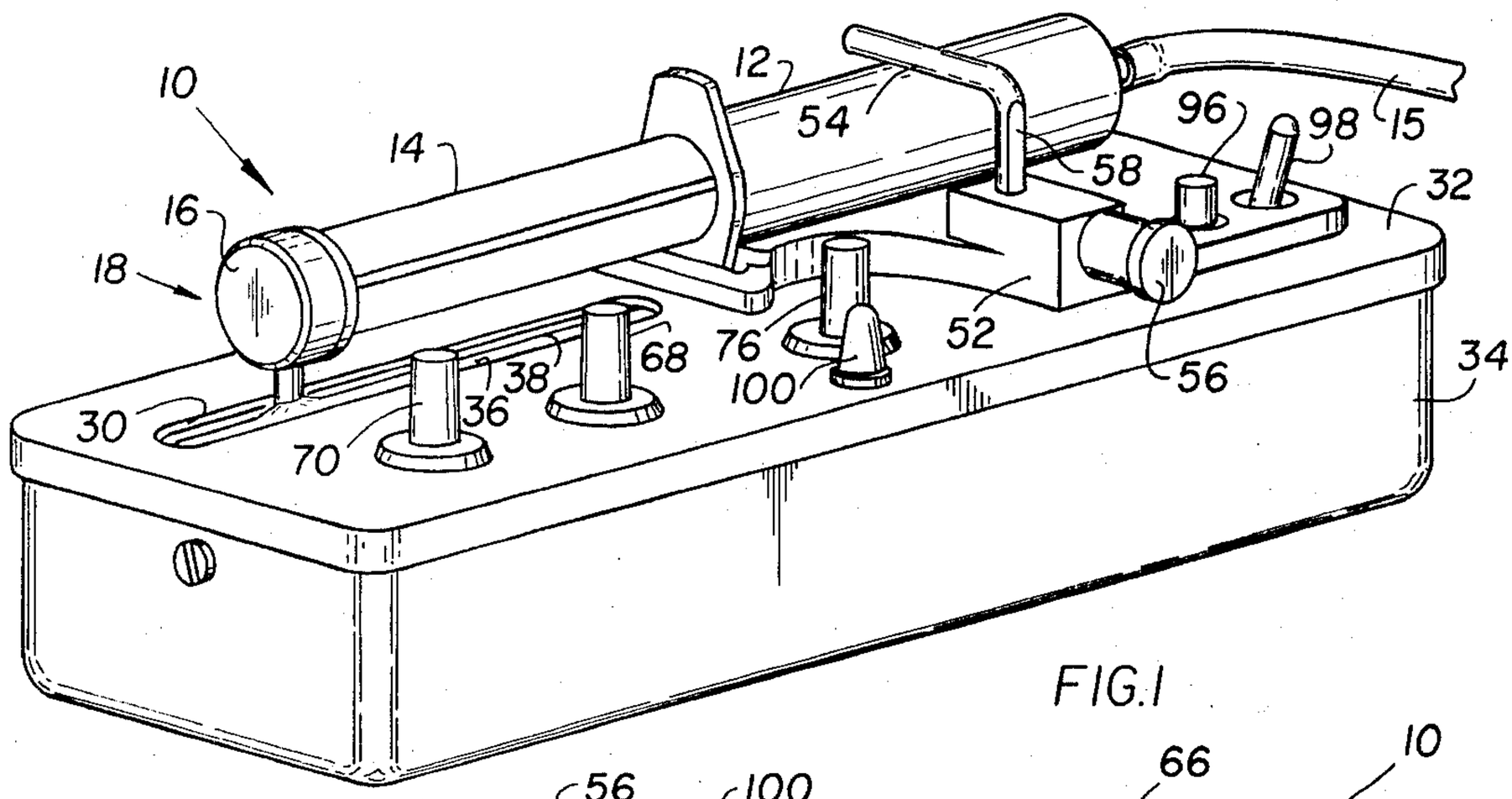


FIG.1

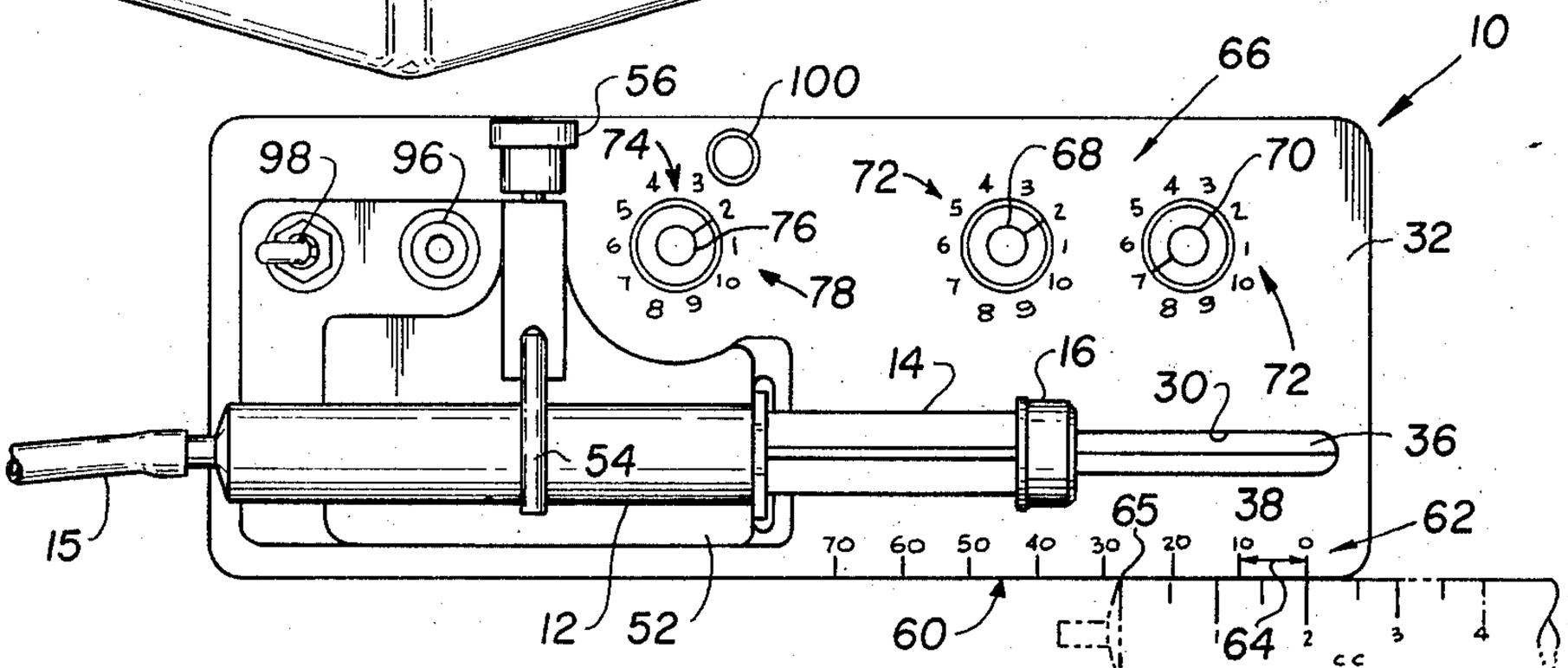


FIG.2

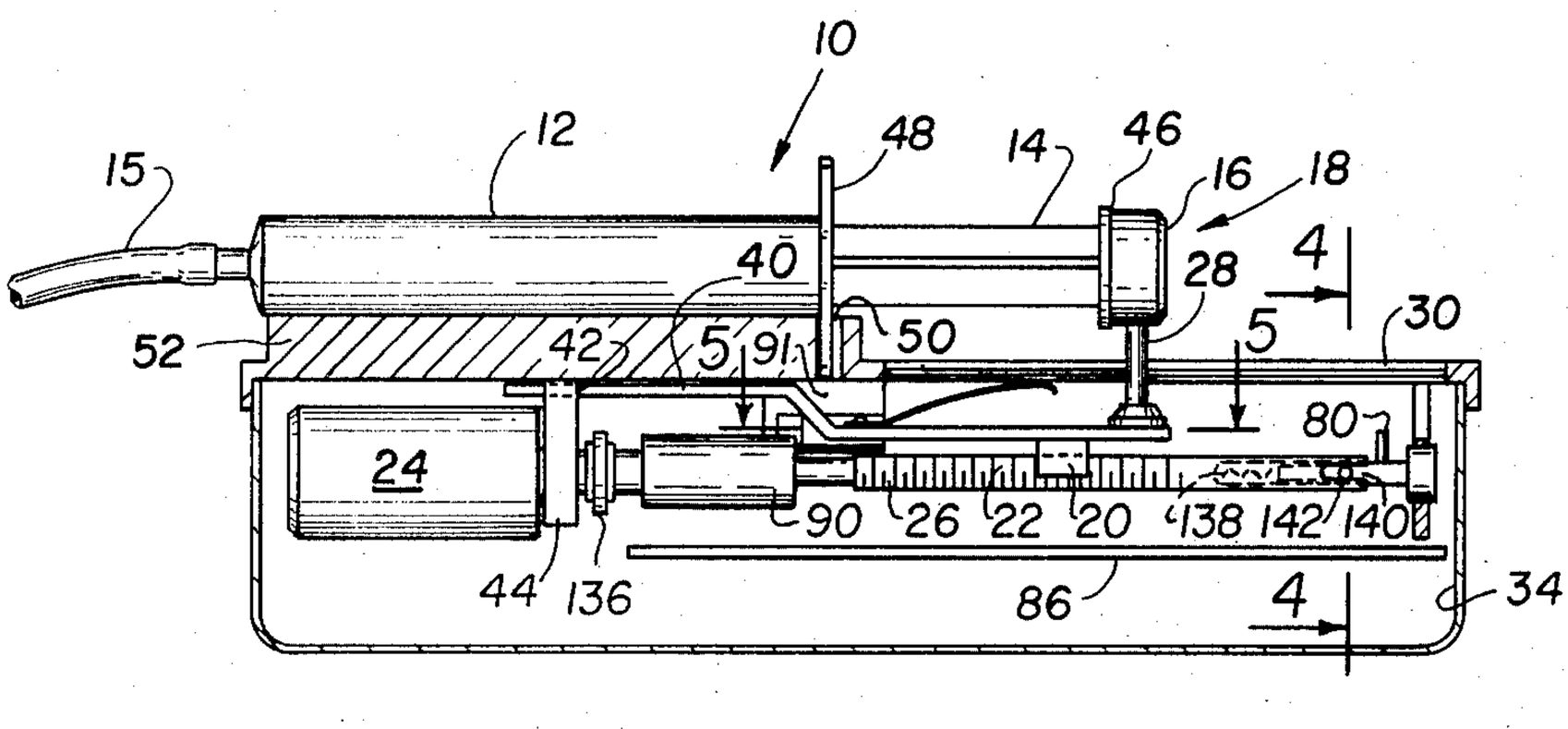


FIG.3

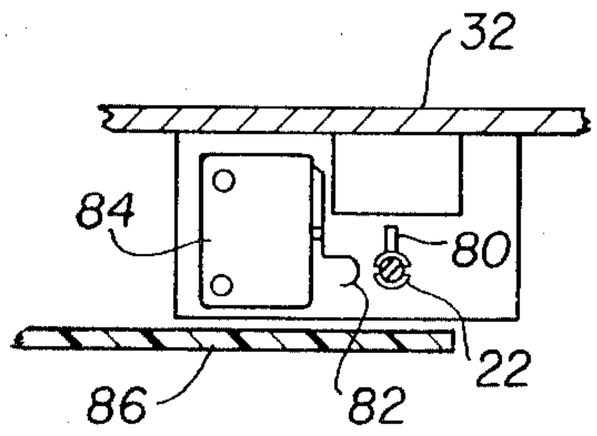


FIG.4

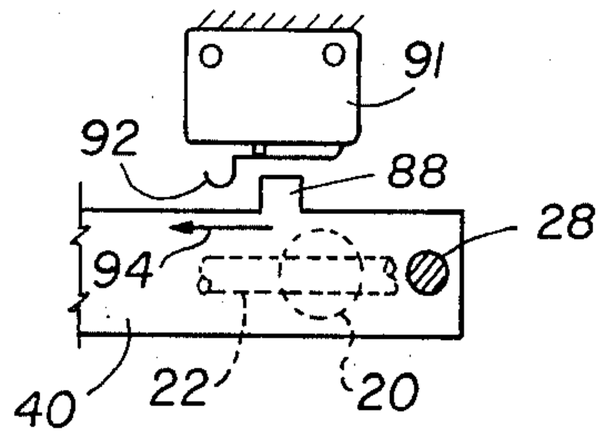


FIG.5

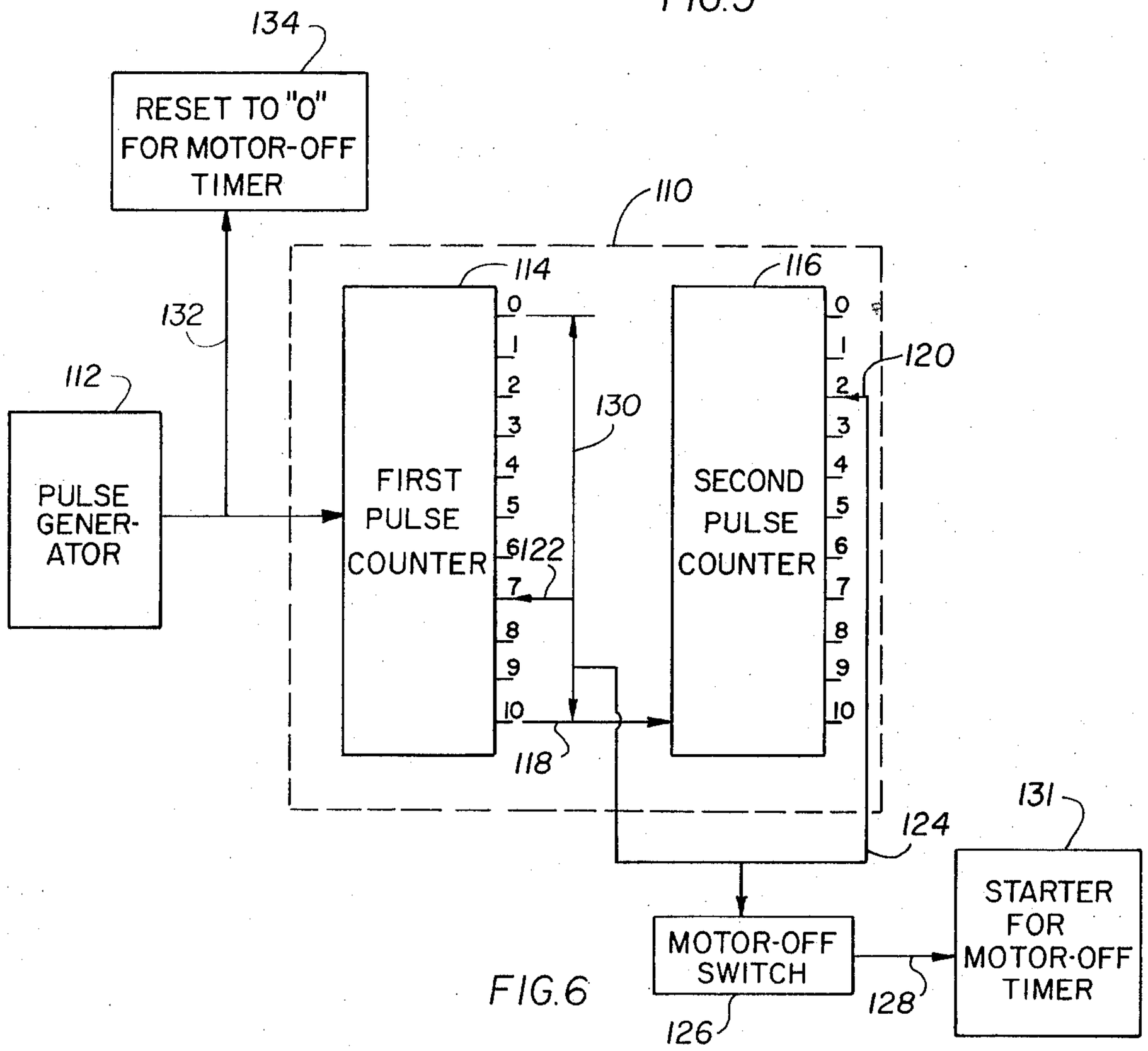


FIG.6

MEDICATION INJECTION DEVICE

The present invention relates to improvements in a medication injection device, and more particularly to an automatic medication-injecting or administering device readily capable of dispensing medication in accordance with any selected schedule of successive intervals of operation and non-operation of a syringe-driving or powering motor.

Motor driven syringes for medication injection service are already known, being described and illustrated in U.S. Pat. Nos. 3,456,649 and 3,623,474, as well as in other patents. None of these prior art devices are readily capable of repetitive deliveries of selected volumes of medication, i.e., of delivering 2 cc's of a medication every 2 hours for an 8-hour period, thereby performing four such deliveries, or otherwise operating on a schedule requiring repetition. Instead, each such prior art device is limited in service to a one-time delivery of a seclected volume of medication, during which a motor merely drives the syringe plunger entirely through a selected linear displacement causing exiting flow of the medication from the syringe barrel.

Moreover, any attempt to achieve repetitive performance from any of the aforesaid prior art devices would be extremely difficult because of the limited controls that they can accommodate. In the syringe device of U.S Pat. No. 3,456,649, for example, the mechanical components partake of linear movement during its operation and thus, to achieve repetitive service, there would be required limit switches or the like, adjustable in position along the path of said linear movement, to start and stop operation of the device as a function of engagement or physical contact that is established with these limit switches. This concept of control is expensive and complicated, and also vulnerable to malfunction in the event of failure to establish operating contact between a moving part and a control switch. This, in turn, could result in the delivery or administration of an overdose of medication, thereby endangering the patient's health.

Broadly, it is an object of the present invention to provide an improved medication injection device overcoming the foregoing and other shortcomings of the prior art. Specifically, it is an object to provide a motor driven syringe for medication injection or other delivery to a patient which is readily capable of repetitive service, is characterized by uniform performance in each said repeated cycle, and has a high degree of reliability in achieving these performance requirements.

A medication injection device demonstrating objects and advantages of the present invention includes a motor operated in rotation and operatively arranged to cause linear displacement, and thus a medication-injection stroke, in a syringe plunger, a pulse generating means effective to emit a pulse each rotational traverse of the motor during which said syringe plunger partakes of a known, uniform movement in its said stroke, and a pulse-counting means electrically connected to receive the transmission of each aforesaid pulse and operatively connected to cause the commencement of the operation of said syringe-driving motor and the continued operation thereof for the duration of the transmission thereto of a selected number of said pulses, whereby medication-dispensing service of said device is controlled as a function of the number

of rotational traverses of said motor as counted by said pulse-counting means.

The above brief description, as well as further objects, features and advantages of the present invention, will be more fully appreciated by reference to the following detailed description of a presently preferred, but nonetheless illustrative embodiment in accordance with the present invention, when taken in conjunction with the accompanying drawings, wherein:

FIG. **1** is a perspective view of a medication injection device according to the present invention;

FIG. **2** is a plan view of the device illustrating further structural features thereof, and also illustrating how the volume of the medication to be dispensed is related to an operating parameter of the device, namely electrical pulses emitted during its operation;

FIG. **3** is a side elevational view, taken in longitudinal section, illustrating internal structural features;

FIG. **4** is an end elevational view, in section taken on line **4—4** of FIG. **3,** illustrating structural features of a pulse generator used in the device hereof;

FIG. **5** is a partial plan view, in section taken on line **5—5** of FIG. **3,** illustrating further structural features; and

FIG. **6** is a block diagram illustrating the electrical components used in controlling the operation of the mechanical components of the device hereof.

Reference is now made to the drawings, and in particular to FIGS. **1–3,** which show the general organization of the mechanical parts of a medication injection device, generally designated **10,** demonstrating objects and advantages of the present invention. As the name implies, the contemplated use of the device **10** is to achieve the intravenous injection of selected volumes of medication, dispensed from a syringe **12,** according to a selected schedule. That is, there are many drugs which cannot be administered to a patient slowly and uniformly over a prolonged period, but rather must be administered within a prescribed comparatively short period, followed by a longer period, when it is not administered and the patient's body has an opportunity to react to the administered drug. For example, there are certain blood anti-coagulants that are best administered frequently, but at intermittant intervals, in order to produce the desired effect on the blood. Device **10** can be most advantageously used for this purpose.

As will be described in detail herein, any selected volume of medication can be dispensed from the syringe **12** through tubing **15** having at its end, although not shown, a syringe needle or other implement connected for intravenous delivery of the medication into the patient. Moreover, as just noted, the time interval, during which a selected volume of the drug or medication, such as 1 cubic centimeter or "cc", is to be delivered can be relatively short, e.g., in less than 1 minute, and the next administration of this same volume of medication can be arranged to occur in 2 hours, or after other such interval of time. Thus, assuming that syringe **12** is filled with 6 cc's of medication which has to be delivered 1 cc at a time every 2 hours, this is readily easy to achieve by proper setting of the controls of the device **10.** Naturally, the values selected in the previous example can be modified, and the invention is no way intended to be limited thereto, since it can be just as easily arranged that 2 cc's of medication be administered every 6 hours, et cetera. The significance of the mode of operation of device **10** is that it is operational or ef-

fective to dispense medication in accordance with a selected schedule of successive intervals of operation and non-operation.

In the preferred form of device **10** as illustrated in FIGS. **1–5**, the same includes, as previously noted, a syringe **12** of the type having a plunger **14**, the linear displacement of which dictates the amount of medication which is dispensed from the syringe chamber **12** through the tubing **15** to the patient. Arranged to cause linear displacement of the plunger **14** is an upstanding head **16** of a follower, generally designated **18**, which, as best shown in FIG. **3**, has a threaded member which is mounted, as at **20**, on a lead screw **22** which is powered in rotation by a motor **24**. That is, the motor **24** is operatively connected to power the lead screw **22** in rotation, said lead screw having threads **26** of of uniform pitch machined along its length and further being disposed substantially parallel to the path of linear displacement of the plunger **14**, in this instance being arranged below plunger **14** so that the pushing head **16** is readily adapted to be mounted on an upstanding rod **28** projected through a slot **30** in the top plate **32** of the device housing **34**. An elastomeric closure **36** with a central slit **38** is appropriately mounted across the slot **30** to prevent dust or other contamination of the interior of the housing box **34**.

Completing the construction of the follower **18**, and as is well understood to prevent rotation thereof simultaneously with rotation of the lead screw **22**, is a body element **40**, the forward end of which is prevented from partaking of rotative movement by being projected, as at **42**, through a bore or opening in a stationary depending mounting member **44** which also assists in supporting the previously noted motor **24**. In operation, lead screw **22** is driven in rotation and the threaded member **20** in meshing engagement therewith is therefore advanced along the length of the lead screw **22**. Naturally, in one direction of rotation of lead screw **22** member **20** is advanced toward the motor **24**, and in the opposite direction of rotation away from the motor **24**. Head **16** has movements corresponding to the member **20**, and one said direction of movement causes it, because of its pushing engagement as at **46** with the end of the plunger **14**, to cause linear displacement of this plunger within the syringe barrel **12** which, in an obvious manner, results in the dispensing of medication in accordance with said linear displacement from the internal chamber of the syringe **12**. To hold the syringe **12** against displacement while the plunger thereof is being operated by the follower head **16**, a laterally extending lip **48**, which normally functions as a finger grip, has a portion disposed in a holding recess **50** of a mounting plate **52** appropriately secured in place on the top plate **32**. An L-shaped rod **54** functions as a clamp to hold the syringe barrel against the mounting plate **52** and, in turn, is held in place by a lock screw **56** which, upon threaded adjustment, engages the flattened surface **58** of the clamp **54**.

Although the lead screw and follower drive arrangement has been used heretofore in producing linear displacement of a syringe plunger in automatic medication injection devices, in the device **10** hereof, the manner in which control is exercised over the operation of the lead screw and follower **22, 28**, respectively, is unique and is not known in the prior art nor is it suggested therein. Specifically, this control consists of using the rotational traverses of the lead screw **22** as the measure of the duration that the powering motor **24** is operational. As a consequence, serious prior art shortcomings are overcome. For example, if the powering motor in a prior art device is permitted to operate for a selected interval of time, this still would result in non-uniform volumes of medication being dispensed since, during the selected interval of time of motor operation, there could be variations in the line voltage utilized to energize the motor **24**. Also, the work load on the powering motor could be variable and this also would result in non-uniform volumes of medication being dispensed. Within any specified time interval, a prior art motor will cause the delivery of a greater volume of a less viscous medication than one with a greater viscosity, and thus to achieve uniform dispensing of medication with such a prior art device, it is necessary to make an adjustment in the control to account for the different viscosities of the medication being dispensed. Still further, after a prolonged period of use the bearings or other moving parts of a prior art device would experience wear that would in turn effect its operation during an interval of operation, and this variation in frictional resistance would also result in non-uniform volumes of medication being dispensed. In sharp contrast to the foregoing, it is therefore one of the unique aspects of the device **10** hereof that the interval of operation of the powering motor **24** is related to the number of rotational traverses that occur in the lead screw **22**, irrespective of the time that it takes to achieve these number of rotational traverses. Naturally, with each rotational traverse of the lead screw **22**, member **20** is advanced a uniform amount dictated by the pitch of the uniform threads **26**, and this uniform advancement of member **20** also occurs in the pushing head **16** and thus must, of necessity, also result in a uniform linear displacement in the syringe plunger **14**.

At this point in the description, it is appropriate to indicate how the volume of medication to be dispensed during each application is related to the number of rotational traverses of the lead screw **22**. As illustrated in FIG. **2**, marked along one edge of the top plate **32**, as along edge **60**, is a scale, generally designated **62**, which is laid out, starting from 0, in ascending numbers such that said numbers are located at distances from the starting point 0 which correspond to the distances of advancement that is produced by the uniform advance or thread pitch **26**, that results from that number of rotational traverses in the lead screw **22**. Thus, taking into account that with each rotational traverse of the lead screw **22**, member **20** will move the pitch of each thread **26** thereon, it follows that the linear distance **64** will be achieved with 10 rotational traverses, and twice that distance with 20 rotational traverses, and so on. Further, assuming that it is desired to dispense 2 cc's of medication during each injection period, as clearly illustrated in FIG. **2**, this will require approximately 27 rotational traverses since, by laying the syringe barrel **12** alongside the scale **62**, a 2-cc volume as laid out on the barrel **12** spans the distance from the 0 point on the scale **62** to a point therealong, designated **65**, which corresponds to point 27 of the scale.

Assuming further that it is desired to dispense these 2 cc's of medication every 2 hours, there are two timing controls embodied in the device **10** which are appropriately set to provide the schedule of medication administration indicated. From what has already been described, it should be readily appreciated that medica-

tion is administered or delivered to the patient only during operation of the powering motor **24.** The motor-on timer, generally designated **66,** includes, as best illustrated in FIG. **2,** two control knobs or selectors **68** and **70,** each being related to a circumferential display of numbers **72** from 1 to 10. In a manner which will be better understood subsequently, the 2 cc's of medication previously discussed which also, as previously discussed, is dispensed by 27 rotational traverses of the lead screw **22,** as thus imposed on the mode of operation of the device **10** by setting the selector **68** at numeral 2 and selector **70** at numeral 7, the combined effect being a selection of 27 as the number of rotational traverses which will occur in the lead screw **22** during each interval of operation of the powering motor **24.**

The other timing device, generally designated **74,** is the one which controls or times the motor-off interval, this timer also including a selector **76** within a circumferential arrangement **78** of numbers from 1 to 10. In the example being used to illustrate the mode of operation of device **10,** the interval of non-operation of the powering motor **24** is to be 2 hours between injections of the medication, and thus selector **76** is moved in proper relation to numeral 2 to provide this result. The manner in which this result is achieved will be explained subsequently.

Reference will now be had to FIGS. **4, 5,** in conjunction with FIGS. **1–3,** to best explain how the operation of device **10** is controlled in accordance with the rotational traverses of the lead screw **22.** Specifically, mounted on the end of the lead screw **22** remote from the powering motor **24** is a radially oriented striker **80** which is driven in rotation simultaneously with the lead screw **22.** As illustrated best in FIG. **4,** mounted adjacent the striker **80,** and more particularly, in the path of the rotational traverse thereof, is a switch contact arm against which actual physical contact is made by the striker **80** during each rotational traverse. This physical contact or abuttment against the switch contact **82** results in actuation of the switch **84.** More particularly, it will be understood that switch **84** is part of a pulse-generating circuit in that the actuation thereof is effective to complete this circuit and, in turn, cause the production and transmission of an electric pulse to a pulse-counting circuit which may be embodied on a printed circuit board **86** (see FIG. **3**).

As will be explained in greater detail in connection with the circuit diagram of FIG. **6,** the pulse-counting circuit **86** will be understood to be effective in causing the commencement of the operation of the powering motor **24** and in causing the continued operation thereof for the duration of the transmission to it of a selected number of said pulses, which in the example being discussed would amount to 27 pulses. This number of pulses or rotational traverses of the lead screw **22** will result, as already noted, in linear displacement of the syringe plunger **14** which will force out of the syringe barrel **12** 2 cc's of medication.

On the **27**th rotational traverse of the lead screw **22,** the electrical control components of the device **10** are effective in causing three conditions of operation. The first is the resetting of the motor-on timer **66** at the 0 setting. The second is the termination of the operation of the powering motor **24.** The third is the starting of the timing operation of the motor-off timer **74.** As in the case of the motor-on timer **66,** the timer **74** is also operated by the transmission to it of pulses and, in accordance with the example being discussed, will therefore receive whatever number of pulses generated, not by the rotation of the lead screw **22,** but by an oscillator of some other source, but which corresponds to the passage of 2 hours of time, this being the time interval selected for non-operation of the motor **24.**

At the expiration of this 2-hour time interval, the motor **24** will again commence its operation, and at that time striker **80,** by virtue of actuating switch **84,** will again cause a pulse-generating activity as a function of the rotational traverses of the lead screw **22** being powered in rotation by the motor **24.** When 27 pulses are again transmitted or counted by the pulse-counting circuit **26,** the operation of motor **24** which results in a medicine-injecting stroke in the syringe plunger **14** is again terminated. Ultimately, the final 2 cc's of medication is dispensed from the syringe barrel **12,** thus requiring the refilling thereof. To signal this condition, and as best illustrated in FIG. **5,** the follower body **40** has a laterally extending contact **88** which is arranged to actuate the limit switch **91** by physically abutting against the contact **92** thereof, thus indicating that the end of the medicine-injecting stroke **94** is reached.

In addition to the timing controls consisting of the motor-on timer **66** and motor-off timer **74,** device **10** also includes a control which overrides these timing devices and which results in the injection of medicine, even if not in accordance with the selective schedule. This permits the injection of medicine or medication in emergency situations. The control itself includes an accessible push-button **96** which, when depressed, is electrically effective to immediately start operation of the powering motor **24,** even if at that time the device **10** is under the control of the motor-off timer **74.** Device **10** also includes an off-on master switch **98.**

Also advantageously included as part of the controls for the device **10** is a visual signal in the form of a blinking light **100.** Light **100** is energized by each pulse successively transmitted to the timers **66** and **78,** and thus is effective in indicating operation of the device **10** during both motor-on and motor-off intervals.

Completing the device **10,** and as best illustrated in FIG. **3,** is a safety device feature which disconnects the drive between the motor **24** and lead screw **22** in the event of successive buildup of pressure which is transmitted in a reverse direction through the tube **15** into the barrel chamber **12** and against the syringe plunger **14.** This buildup of resistance pressure will of course be transmitted against the pushing head **16** and thus is manifested as a force tending to push lead screw **22** in a direction away from the motor **24.** In response to this force, a clutch **136** of a shaft coupling **90** will break its driving connection between its driving and driven elements and thus result in discontinuation of the driving connection between the motor **24** and the lead screw **22.** Clearance for this slight rearward movement of lead screw **22** is provided by compression of an internal spring **138** as a driving notch **140** in the end of the lead screw **22** moves relative to a driving pin **142.** The notch and pin drive **140, 142** will be recognized as providing simultaneous driving rotation of the striker **80** as powering motor **24** drives lead screw **22** in rotation.

Reference is now made to **FIG. 6** in which there is illustrated, in diagramatic form, an exemplary electronic circuit which will be understood to be laid out and otherwise appropriately embodied on the printed circuit

board **86.** The circuit of FIG. **6** will further be understood to function as the motor-on timer **66** and also as the motor-off timer **74,** in both instances providing a timing function which utilizes and appropriately reacts to the transmission to it of an electronic pulse. In effect, this portion of the circuit of FIG. **6,** generally designated **110,** provides the pulse-counting service or function for the device **10** in the manner previously described. This function, in turn, could be powered by batteries or by line voltage. That is, the device **10** can be used in strapped position on the arm of the patient, in which instance it will be portable and operated by batteries (not shown). Alternatively, it can be used at bedside, in which instance it would be powered by an ordinary electrical source. Assuming the latter, the power fed into the unit operates an electric oscillator or pulse generator **112.** This generator may be any one of several types, being generally a unit which reaches a selected peak voltage on a selected time basis and which emits a pulse. The output or pulse from the generator **112** is fed into the counting circuit **110.** This counting circuit also could be any one of several so-called decade counting circuits readily available from major firms such as RCA or the like.

For present purposes, it is suffice to note that operation of a decade counter, such as that denominated "First Pulse Counter" and designaged **114** in FIG. **6,** has 10 or more outputs identified by the numbering from 0 to 10. The operation of the pulse counter **114** contemplates activation of each of these outputs in succession with each cycle of operation, and then a repeat of this cycle of operation. Accordingly, output 0 is first activated, then output 1, then output 2, et cetera. When output 10 is activated, this completes an electrical connection to a second decade counter, designated "Second Pulse Counter" and identified by reference numeral **116,** which experiences the same mode of operation just described in connection with counter **114.** Meanwhile, the cycle of operation of counter **114** is repeated. In effect, therefore, it takes the completion of the succession of pulses through all of the 10 outputs of the first counter **114** to produce one pulse which is sent via conductor **118** to the succeeding counter **116.** In this manner, any number of pulses can be counted, it being understood that any selected number of counters **114, 116** and the like can be electrically connected to each other so as to function as a timing device, the two units **114, 116** being used as the motor-on timer **66** to measure the interval of time during which the powering motor **24** of the injection device **10** is operative. Naturally, a greater number of these units would be used in cooperative relation to provide the motor-off timer **74.**

Continuing with the illustrative example previously referred to, the selection of 27 pulses for the interval of operation of the powering motor **24** is thus achieved by arranging the selector **68** so that the wiper **120** thereof is electrically connected to output 2 of the second pulse counter **116** and that the selector **70,** and more particularly the wiper **122** thereof, is electrically connected to the output 7 of the first pulse counter **114.** While this may appear to be reversed, such arrangement provides for motor-on operation for an interval of 27 pulses. As already explained, to achieve energization of output 2 of the second pulse counter **116** requires the transmission to this counter of two pulses, each one of which, however, requires the energization or pulsing of all ten outputs of the first pulse counter **114,** or in other words 20 pulses. Thus, when the first pulse counter **114** starts on its third successive cycle of counting operation and when output 7 is energized on the seventh transmitted pulse, this results in electrical connection to the two outputs 2 and 7 electrically connected to the selectors **68** and **70.** This, in turn, completes a control circuit **124** which results in the transmission of a pulse to a motor-off switch **126** which results in termination of the powering operation of the motor **24.** It also results in the transmission of a pulse via a conductor **128** to a starter circuit **131** for the motor-off timer **74** which results in the start in operation of this timer.

It will of course be understood that the wipers associated with the selectors **68** and **70** could have been rotated to make electrical connection with other outputs other than the specific outputs indicated. This is illustrated in FIG. **6** wherein the range of wiper location is diagramatically illustrated by the path of wiper movement **130.**

It is also illustrated in FIG. **6** that pulse generator **112** also transmits a pulse via conductor **132** to a reset control circuit **134** which is effective to reset to 0 the motor-off timer **74** at the end of each interval of non-operation of motor **24.** This may be done in any number of ways. One way, for example, is to have the last pulse of this interval operate a flip-flop switch. Such switch is a standard part readily purchased in the open market from such firms as RCA and the like and operates, as generally noted, such that upon activation by said last pulse, it completes the circuit to the motor and at the same time resets the counting circuit at its original 0 setting. As a result, when the motor operation is terminated, the counting circuit **110** is in condition to start counting from 0 again.

It should be readily appreciated from the description of the mechanical components of the device **10** that the pulse generator **112** during the interval of operation of the motor **24,** is controlled in its pulse-emitting function by the striker **80** which, upon physical contact with the switch **84** during each rotational traverse of the lead screw **22,** produces a pulse which is counted by the motor-on timer **66.** However, during non-operation of the powering motor **24,** the pulse generator **112** is operated as an oscillator and transmits pulses also to a counting circuit, such as **110,** which performs the same function during non-operation of the motor as was performed during its operation. Since the time of non-operation of the powering motor **24** is considerably longer than the typical interval required for administration of medication, the pulse-counting circuit **110** will include more than just two pulse counters **114** and **116.** But at least the first two counters of an enlarged arrangement thereof can be counters **114, 116** to avoid duplication.

The primary use of the device **10** is, of course, for administering a predetermined volume of medication on a timed schedule. However, it is not strictly limited to this use, but also may be operated by monitoring equipment separate and apart from the timing devices **66** and **74** described herein. In other words, assume a cardiac patient has monitoring equipment to indicate when he is in medical difficulty. Such monitoring equipment could be used to provide a pulse which starts the motor **24** in operation and which causes the injection of the predetermined volume of medication to counteract the

condition sensed by the monitoring equipment as requiring said medication.

From the foregoing description, it should be readily appreciated that there has been described herein a unique medication injection device **10** which is capable of administering medication in accordance with a selected schedule of successive intervals of operation and non-operation of the powering motor **24.** Moreover, these intervals are controlled as a function of each rotational traverse, rather than strictly on a manually timed basis, as is the practice in the prior art. Thus, the device **10** hereof is not vulnerable to variations which affect performance during any selected unit of time, such as variations in voltage, in viscosity of the medication being dispensed, variations in the frictional resistance within the motor itself, to mention just a few, and other such factors which adversely affect and produce non-uniformity in the functioning of devices of the class herein described.

A latitude of modification, change and substitution is intended in the foregoing disclosure, and in some instances some features of the invention will be employed without a corresponding use of other features. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the spirit and scope of the invention herein.

What is claimed is:

1. A medication injection device comprising a syringe for dispensing medication in accordance with linear displacement of a plunger thereof, means secured to said syringe for connection to a patient for dispensing said medication to said patient, a rotatively mounted lead screw with threads of uniform pitch disposed in substantially parallel relation to the linear displacement path of said syringer plunger, pushing means mounted on said lead screw for advancement therealong in pushing engagement with said syringe plunger, a motor operatively arranged to power said lead screw in rotation to cause advancement of said pushing means and corresponding linear displacement of said syringe plunger, a radially oriented striker mounted on said lead screw, a pulse-emitting switch located adjacent said lead screw in the path of the rotational traverse of said striker so as to be engaged thereby to cause an emission of an electrical pulse during each rotation of said lead screw, and a pulse-counting means electrically connected to receive the transmission of each aforesaid pulse and operatively connected to permit the operation of said motor for the duration of the transmission thereto of a selected number of said ppulses, whereby medication is dispensed in accordance with the linear displacement of said syringe plunger as a function of the number of rotational traverses of said lead screw as counted by said pulse-counting means.

2. A medication injection device as defined in claim **1** including an additional timing means operatively connected to said motor to cause the commencement of the operation thereof after a selected interval of non-operation, whereby said medication is dispensed by said device in accordance with a selected schedule of successive intervals of operation and non-operation of said motor.

3. A medication injection device as defined in claim **2** including a clutch interposed in the drive connection between said motor and said lead screw, and including means mounting said lead screw for selected limited linear movement for disengaging the same from said clutch to thereby terminate the powering rotation of said lead screw by said motor, whereby said dispensing of medication by said device is capable of being terminated in an emergency situation.

4. A medication injection device as defined in claim **2** wherein said additional timing means is of the type operated by pulses transmitted to it as is also said pulse-counting means, and further including a visual signaling device connected to be operated by each pulse being transmitted to said additional timing means and to said pulse-counting means, whereby the operation of said visual signal device is effective in indicating the working condition of said medication injection device.

5. A medication injection device as defined in claim **4** including a scale calibrating linear displacement of said syringe plunger with an ascending number of pulses produced during said rotational operation of said motor, whereby the volume of medication to be dispensed can be readily related to a selected number of pulses as counted by said pulse-counting means.

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