United States Patent

Hill

[15] **3,670,926**

[45] **June 20, 1972**

[54] INTRAVENOUS FEEDING APPARATUS

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[73] Assignee: **Power Technology Corporation,** Ann Arbor, Mich.

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[52] **U.S. Cl.** **222/47,** 222/99, 222/101, 222/95, 128/214

[51] **Int. Cl.** **B67d 5/22**

[58] **Field of Search** ..... 222/47, 99, 96, 100, 101, 95, 222/23; 128/214, 214.1; 116/129 AB

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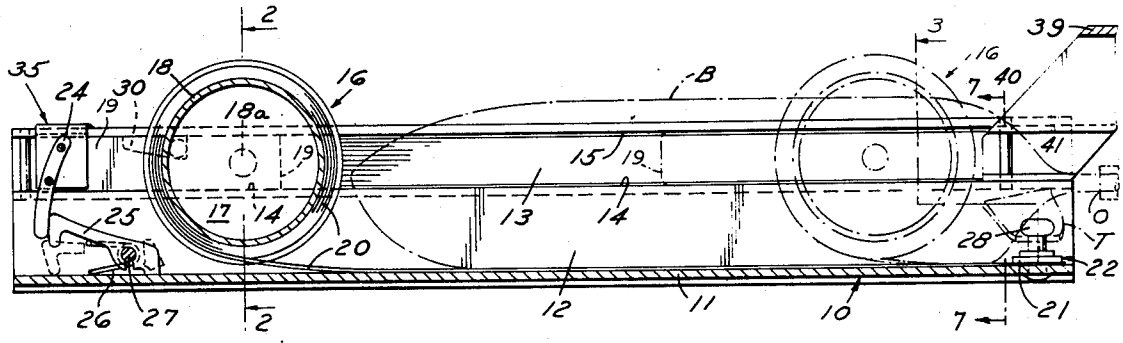
[57] **ABSTRACT**

An intravenous feeding device comprising a base, a drum movable along a track on said base and a constant tension coiled spring having one end thereof fixed to the drum and the other to the base so that when a collapsible container is positioned, the drum acts upon the collapsible container to dispense the contents of the container. A latch is provided for locking the drum with the spring in its extended position and acceleration and position responsive means are provided for locking the drum in the event that the drum is released during loading or in the event that the material is dispensed at excessive speed or in the event that one end of the base is elevated beyond a predetermined angle. Gauge means are provided for indicating the rate at which fluid is dispensed.

18 Claims, 8 Drawing Figures



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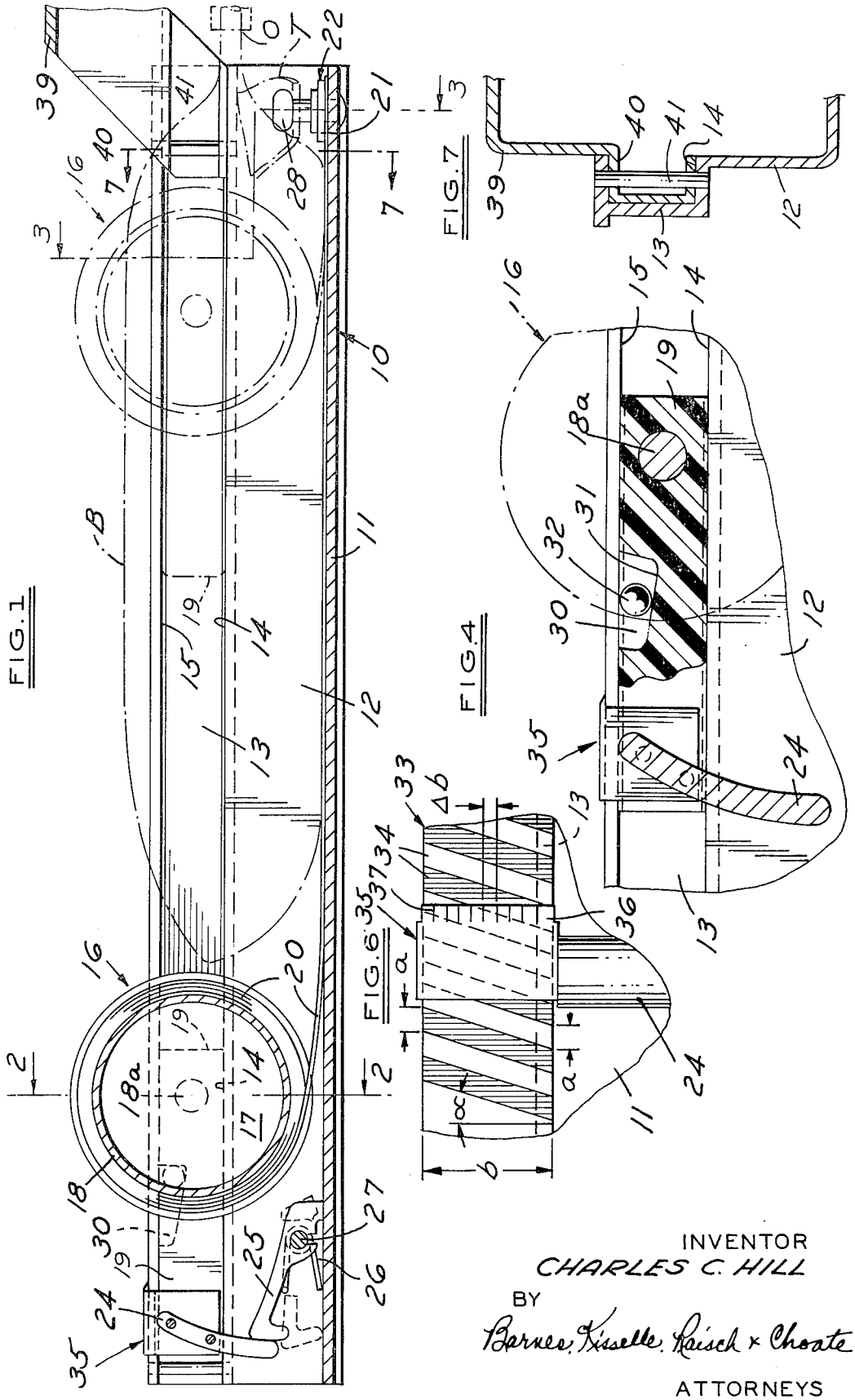

FIG. 1

FIG. 7

FIG. 4

FIG. 6

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FIG. 2

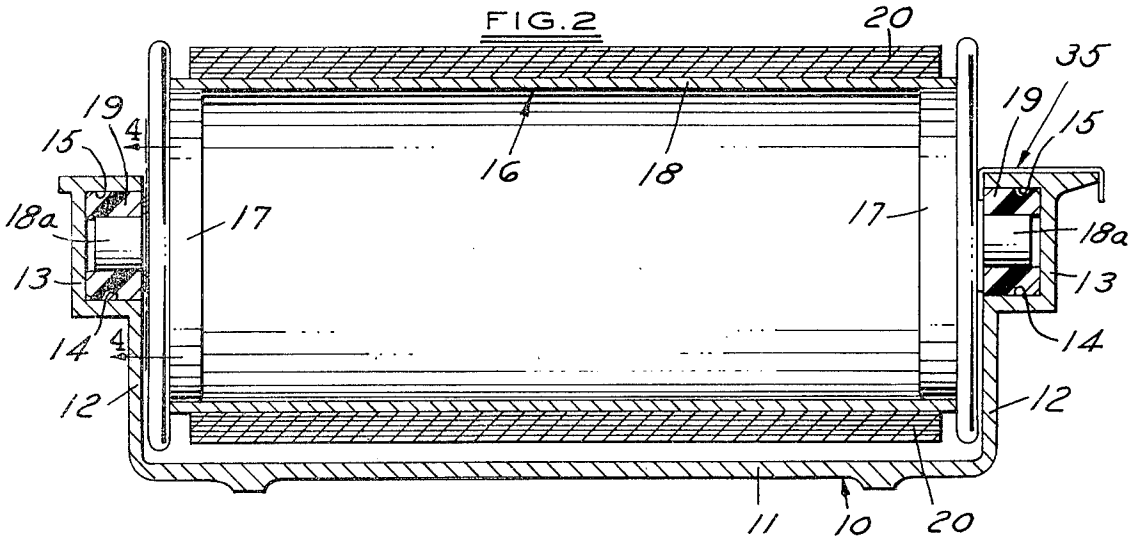


FIG. 3

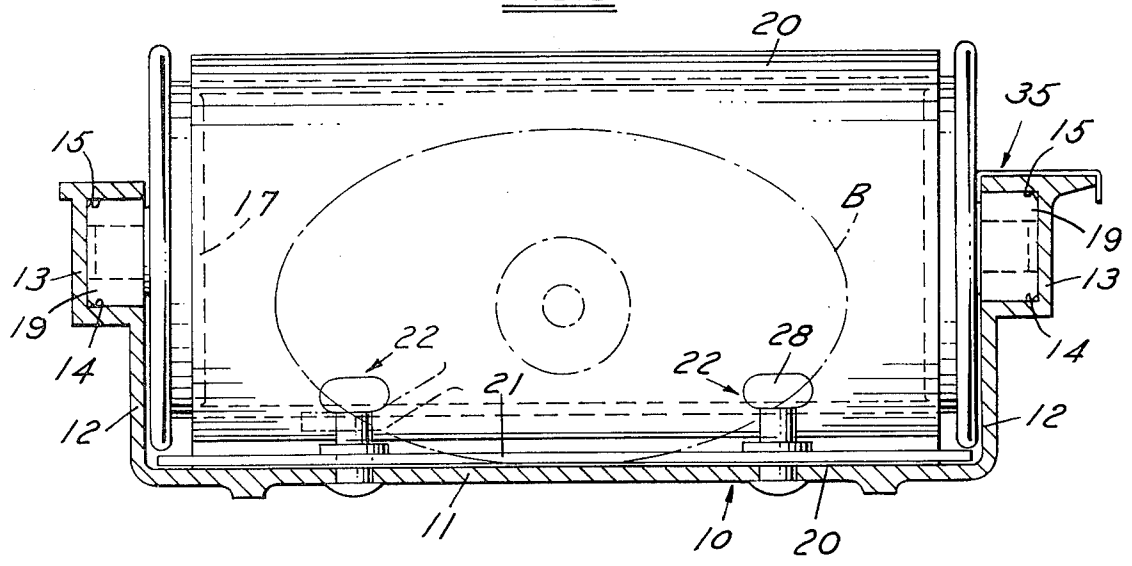


FIG. 5

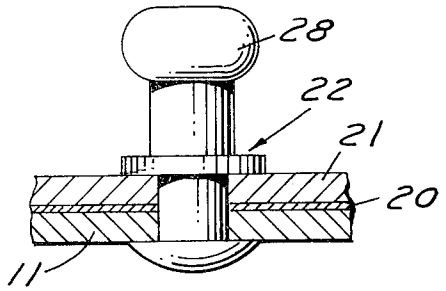
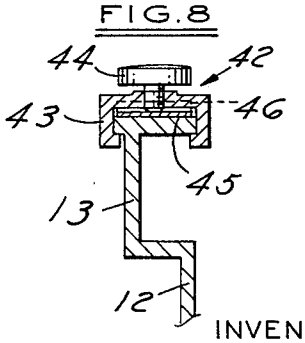


FIG. 8



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INTRAVENOUS FEEDING APPARATUS

This invention relates to an intravenous feeding apparatus.

Among the objects of the invention are to provide an intravenous feeding apparatus which will effectively dispense fluids and drugs from a collapsible container through a tube for feeding a patient intravenously; which can be readily loaded; which is operable upon excessive acceleration or dispensing to lock and prevent further dispensing; and which is operable upon being moved to a position that might tend to cause air to move toward the patient to prevent further dispensing; which can be readily manufactured and serviced; and which requires a minimum of maintenance.

SUMMARY OF THE INVENTION

An intravenous feeding device comprising a base, a drum movable along a track on said base and a constant tension coiled spring having one end thereof fixed to the drum and the other to the base so that when a collapsible container is positioned, the drum acts upon the collapsible container to dispense the contents of the container. A latch is provided for locking the drum with the spring in its extended position and acceleration and position responsive means are provided for locking the drum in the event that the material is dispensed at excessive speed or in the event that the end of the base is elevated beyond a predetermined angle. Gauge means are provided for indicating the rate at which fluid is dispensed.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal sectional view of an apparatus embodying the invention.

FIG. 2 is a sectional view taken along the line 2—2 in FIG. 1.

FIG. 3 is an end view of the apparatus shown in FIG. 1, taken from the right.

FIG. 4 is a fragmentary sectional view taken along the line 4—4 in FIG. 2.

FIG. 5 is a part sectional view of a portion of the apparatus.

FIG. 6 is a fragmentary partly diagrammatic view of a portion of the apparatus.

FIG. 7 is a fragmentary sectional view taken along the line 7—7 in FIG. 1.

FIG. 8 is a fragmentary transverse sectional view of a portion of the apparatus shown in FIG. 1.

DESCRIPTION

Referring to FIGS. 1 and 2, the intravenous feeding apparatus embodying the invention comprises a base 10 that includes a bottom wall 11 and side walls 12. The base is preferably made of a one piece aluminum extrusion. Each side wall 12 includes an integral track portion 13 defining track surfaces 14, 15.

A drum 16 including end members 17 and a body 18 is rotatably mounted in tracks 13 by pins 18*a* in openings in rectangular slide blocks 19 of low friction material such as nylon. A coiled constant tension spring 20 has one end thereof wrapped around the drum and the other end thereof clamped between a strip 21 and the bottom wall 11 of the base 10. Rivet assemblies 22 fix the plate in position.

A movable handle 24 extends between the slides 19 and is fixed thereto by pins. Handle 24 serves as a means for retracting the drum 16 against the action of the spring 20. A latch 25 is pivoted to the bottom wall 11 at the end of the wall opposite the strip 21 and is yieldingly urged upwardly by helical torsion springs 26 at opposite ends thereof that function about pivot pins 27. In the solid line position shown in FIG. 1, the latch 25 engages the handle 24 to prevent forward movement of the drum 16. By grasping the handle 24 and depressing the latch 25 by means of the fingers, the latch 25 will be moved out of the way of the handle 24 permitting the handle 24 and, in turn, the drum 16 to move forwardly.

The upper ends of rivet 22 are enlarged as at 28 for receiving holes in the tabs T of a collapsible plastic bag B such as is

conventionally used for dispensing fluid, drugs and blood plasma.

In practice, the handle 24 is pulled backwardly to pull the drum against the action of the spring unwinding the spring, then depressing the latch until the latch 25 springs up into position forwardly of the handle 24 to hold the handle 24 and, in turn, the drum in rearward retracted position. A fixed handle 39 is provided at the one end so that one hand can grasp fixed handle 39 and the other hand can grasp movable handle 24 for loading.

The plastic bag B is then placed in position with the openings therein engaging the enlargements 28.

Upon gradual release of the handle 24 in the manner described above, the drum 16 rolls forwardly pulling the slides 19 along the tracks and causing the periphery of the convolutions of spring 20 to engage the bag and squeeze the bag to dispense its contents through the tube O. The rate at which the contents are dispensed is controlled by means of a manually operated clamp (not shown) such as is conventionally used.

In order to prevent feeding or acceleration of the drum at an excessive rate, each block 19 is provided as shown in FIG. 4 with an upwardly facing groove 30 that has an inclined surface 31. Surface 31 is inclined upwardly and rearwardly with respect to the general movement of the drum 16 to dispense material. A ball or roller 32 is positioned in each groove 30.

In operation, normal forward movement of the slides 19 and in turn the drum 16 forwardly carries the ball 32 in the bottom of the groove 30. If, however, the slide moves for some reason at an excessive rate, such as may occur if inadvertently released without a bag in place or air bubbles or the like in the plastic bag, the inertia of the ball 32 will cause it to move less rapidly than the slide 19 thereby moving up the inclined surfaces 31 and jamming or wedging against the upper surface 15 of the track to lock the drum 16 against any further movement.

The same action will occur in the event that the forward end of the base 10 is elevated. This prevents any air bubbles in the bag from moving toward the outlet end of the bag which could be dangerous in the event that excessive air bubbles entered the patient.

On the other hand, the elevation of the rear end of the base or even the suspending of the apparatus from the rear end of the base does not interfere in any way with the action of the apparatus.

As shown in FIG. 6, indicator means are provided for indicating the rate of dispensing. A graduated scale 33 is provided on the upper surface of one wall 12 and comprises contrasting markings stripes 34 of equal width extending at an angle to the longitudinal and transverse axes. An indicator 35, which is generally U-shaped is supported between a block 19 and handle 24 and comprises a horizontal portion 36 which overlies the scale 33. Portion 36 has markings 37.

The relative displacement of the scale and indicator causes the "intersection" of the sloped lines on the scale and the perpendicular edge of the indicator to change and thus indicates displacement. The graduations on the indicator can be numbered if desired as can those on the scale.

The relationship of the stripes 34 and markings 37 can be represented by the expression

$$\tan \alpha = \frac{a}{b} = \frac{n\Delta a}{n\Delta b}$$

where

- a = Major increment width of stripes 34
- Δa = Least indicated increment
- n = The number of least indicated increments in a major increment
- $a = n\Delta a$
- Δb = Observed "intersection" movement for least indicated increment
- $b = n\Delta b$
- α = Slope of major increment lines.

The following example is given to indicate the application of the geometry described above to a particular problem. Say displacements of 0.010 inch (Δa) are to be observed with major increments of 0.100 inch (a) and $n = 10$. Say the Δb (indicator graduation) is desired to be 0.05 inch for ease of observation with the naked eye (this corresponds to a magnification of 5). The scale width (b) is:

$$b = n \Delta b = 10 \times 0.05 = 0.5 \text{ inch}$$

As shown in FIGS. **1** and **7**, handle **39** comprises an extrusion which includes portions **40** that slidingly engage the track portions **13**. Pins **41** extend through the track portions **13** and portions **40** to hold the handle in position. The portion of the handle thus serves as a stop for the drum **16**.

In order to permit feeding of a predetermined quantity of liquid from the bag B, an adjustable stop **42** is provided along one of the track portions **13** and comprises a C-shaped clamp **43** slidably engaging the upper flange of the track. A thumb screw **44** is threaded through the C-shaped clamp **43** and engages a pressure member **45** that is forced against the top of the channel **13**. The pressure member **45** has its ends turned upwardly as at **46** to retain the member **45** with relationship to the C-shaped clamp.

I claim:

1. In an intravenous feeding apparatus, the combination comprising
- a base,
- means on said base defining a track,
- a drum,
- said drum having portions thereof engaging said track,
- a constant tension spring having one end thereof connected to said drum and the other end thereof fixed to said base,
- means at one end of said base for locking said drum in position with said spring extended,
- means for releasing said locking means, whereby a collapsible container interposed between said drum and said base is progressively squeezed by the convolutions of said spring to dispense the contents thereof,
- means responsive to acceleration of said drum beyond a predetermined rate to lock said movement of said drum and thereby prevent further dispensing of the contents of a collapsible container in position.

2. In an intravenous feeding apparatus, the combination comprising
- a base,
- means on said base defining a track,
- a drum,
- said drum having portions thereof engaging said track,
- a constant tension spring having one end thereof connected to said drum and the other end thereof fixed to said base,
- means at one end of said base for locking said drum in position with said spring extended,
- means for releasing said locking means, whereby a collapsible container interposed between said drum and said base is progressively squeezed by the convolutions of said spring to dispense the contents thereof,
- means responsive to elevation of said one end of said base beyond the predetermined point to prevent movement of said drum toward said one end of said base.

3. In an intravenous feeding apparatus, the combination comprising
- a base,
- means on said base defining a track,
- a drum,
- said drum having portions thereof engaging said track,
- a constant tension spring having one end thereof connected to said drum and the other end thereof fixed to said base,
- means at one end of said base for locking said drum in position with said spring extended,
- means for releasing said locking means, whereby a collapsible container interposed between said drum and said base is progressively squeezed by the convolutions of said spring to dispense the contents thereof,
- means movable with said drum and responsive to the acceleration thereof and operable to engage said track when the acceleration exceeds a predetermined amount to thereby lock said drum to said track.

4. In an intravenous feeding apparatus, the combination comprising
- a base including a bottom wall and integral side walls,
- each said side wall having portions defining an inwardly facing track,
- low friction members slidable in said track,
- a drum rotatably mounted on said members,
- a constant tension spring having one end thereof fixed to said base,
- whereby a collapsible container interposed between said drum and said base is progressively squeezed by the convolutions of said spring to dispense the contents thereof,
- means responsive to movement of said drum beyond a predetermined rate to lock said movement of said drum and thereby prevent further dispensing of the contents of a flexible container in position or motion of the drum.

5. In an intravenous feeding apparatus, the combination comprising
- a base including a bottom wall and integral side walls,
- each said side wall having portions defining an inwardly facing track,
- low friction members slidable in said track,
- a drum rotatably mounted on said members,
- a constant tension spring having one end thereof fixed to said base,
- whereby a collapsible container interposed between said drum and said base is progressively squeezed by the convolutions of said spring to dispense the contents thereof,
- means responsive to elevation of said one end of said base beyond the predetermined point to prevent movement of said drum toward said one end of said base.

6. In an intravenous feeding apparatus, the combination comprising
- a base including a bottom wall and integral side walls,
- each said side wall having portions defining an inwardly facing track,
- low friction members slidable in said track,
- a drum rotatably mounted on said members,
- a constant tension spring having one end thereof fixed to said base,
- whereby a collapsible container interposed between said drum and said base is progressively squeezed by the convolutions of said spring to dispense the contents thereof,
- means movable with said drum and responsive to the acceleration thereof and operable to engage said track when the acceleration exceeds a predetermined amount to thereby lock said drum to said track.

7. The combination set forth in claim **3** wherein said last-mentioned means comprises
- a member slidable in said track and having an upwardly and rearwardly inclined slot,
- a roller in said slot,
- said roller being operable to move up said inclined surface upon acceleration of said drum beyond a certain rate to engage said track.

8. The combination set forth in claim **7** wherein said member comprises a block of low friction material.

9. The combination set forth in claim **1** including
- a scale extending longitudinally along said base,
- said scale including a plurality of markings thereon,
- said markings extending at an angle to a perpendicular to the longitudinal axis of said scale and comprising equally spaced major increments,
- and an indicator movable with said drum extending transversely of said scale and comprising a plurality of markings spaced at minor increments thereon.

10. The combination set forth in claim **9** wherein the width of said major increments is a multiple of said minor increments.

11. The combination set forth in claim 9 wherein said indicator is perpendicular to the longitudinal axis of said scale.

12. The combination set forth in claim 9 wherein said markings on said scale comprise contrasting stripes having a width equal to one said major increment.

13. The combination set forth in claim 9 wherein the angle which said markings of said scale make with a perpendicular to the longitudinal axis of said scale has the relationship of

$$\tan \alpha = \frac{a}{b} = \frac{n\Delta a}{n\Delta b}$$

where

a = Major increment
Δa = Least indicated increment
n = The number of least indicated increments in a major increment
a = $n\Delta a$
Δb = Observed "intersection" movement for least indicated increment
b = $n\Delta b$
α = Slope of major increment lines.

14. The combination set forth in claim 9 wherein said indicator overlies said scale.

15. The combination set forth in claim 9 wherein said indicator is mounted on a member slidable in the track with the drum.

16. The combination set forth in claim 6 wherein said last-mentioned means comprises

an upwardly and forwardly inclined slot in said member slidable in said track,

a roller in said slot,

said roller being operable to move up said inclined surface upon acceleration of said drum beyond a certain rate to engage said track.

17. In an intravenous feeding apparatus, the combination comprising

a base,

means on said base defining a track,

a drum,

said drum having portions thereof engaging said track,

a constant tension spring having one end thereof connected to said drum and the other end thereof fixed to said base,

whereby a collapsible container interposed between said drum and said base is progressively squeezed by the convolutions of said spring to dispense the contents thereof,

means responsive to movement of said drum beyond a predetermined rate to lock said movement of said drum and thereby prevent further movement or dispensing of the contents of a flexible container in position.

18. In an intravenous feeding apparatus, the combination comprising

a base,

means on said base defining a track,

a drum,

said drum having portions thereof engaging said track,

a constant tension spring having one end thereof connected to said drum and the other end thereof fixed to said base,

whereby a collapsible container interposed between said drum and said base is progressively squeezed by the convolutions of said spring to dispense the contents thereof,

means responsive to the position of said base operable to lock movement of the drum when the forward end of the base is elevated.

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