Oct. 6, 1964 P. M. SELFON 3,151,616

AUTOMATIC TRANSFUSION APPARATUS

Filed July 25, 1962

FIG. 1.

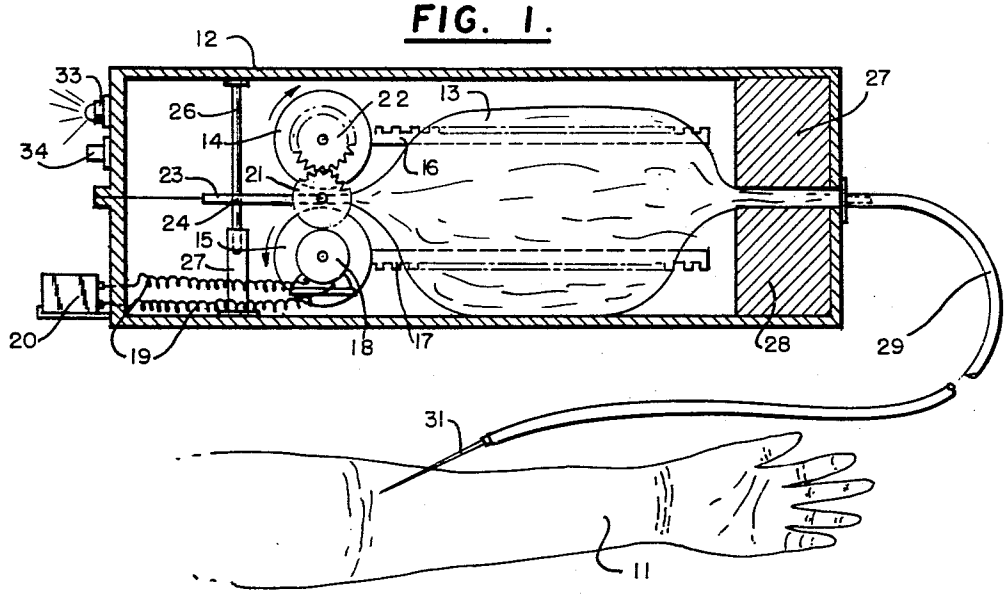


FIG. 2.

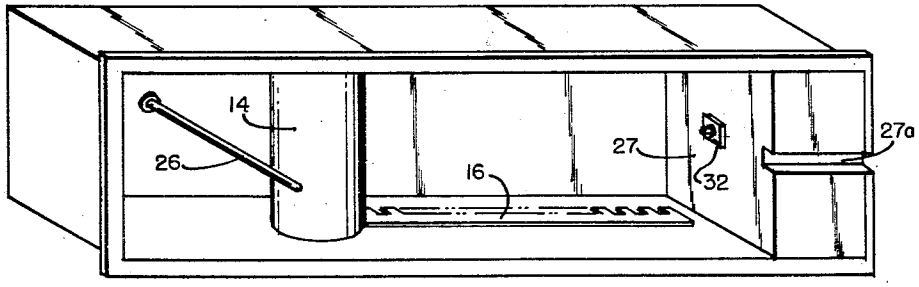
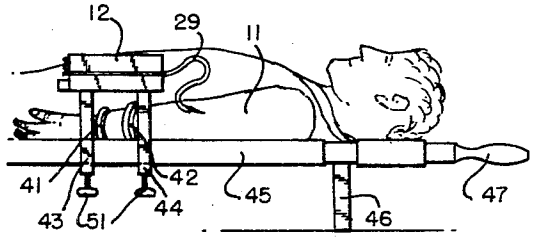


FIG. 3.



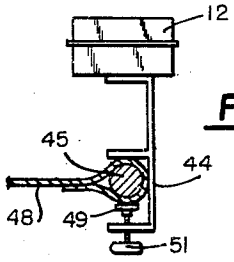


FIG. 4.

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AUTOMATIC TRANSFUSION APPARATUS

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This invention relates to automatic transfusion apparatus, and, more particularly, to apparatus which is portable, self-contained and automatic in its operation.

The classical method of injecting more than a few cubic centimeters of fluids intravenously into a patient is by gravity flow. To create a pressure head which is sufficient to force the fluid into the veins, the container is suspended from a rack or support mounted on a bed or table. It is important to maintain a substantially constant flow of fluid to prevent injury to the patient and sufficient time to ensure the proper absorption of the fluid into the body, and since the changes in the level of the fluid in the container as the injection proceeds are of the same order of magnitude as the difference in height of the container and the patient, the head on the fluid is continually changing and the entire procedure requires frequent checks to ensure proper operation. In addition, the container in such transfusion equipment is usually suspended and permitted to swing free. This presents little problem in a relatively empty room and when the patient is stationary, but the free swinging container does present a problem when the quarters are cramped and the container is subject to bumping or when the patient is being moved. There is a need for a substantially stationary, portable, forced feed transfusion apparatus which is automatic in its operation and can be moved without danger during the transfusion.

It is, therefore, an object of this invention to provide a new and improved transfusion apparatus.

It is another object of this invention to provide a new and improved transfusion apparatus which is automatic in its operation.

It is a further object of this invention to provide a new and improved apparatus for the injection of fluids into animal tissue in a safe and constant manner.

It is yet another object of this invention to provide a new and improved fluid injection apparatus which is portable, automatic in operation and safe, even in transit.

Other objects and advantages of this invention will become apparent as the following description proceeds, which description should be considered together with the accompanying drawings in which:

FIG. 1 is a sectional view of the transfusion apparatus of this invention;

FIG. 2 is a perspective view of a portion of the housing of the apparatus of FIG. 1;

FIG. 3 is a side view of the apparatus mounted for operation; and

FIG. 4 is an end view of a portion of the equipment of FIG. 3.

Referring now to the drawings in detail, the reference character **11** designates the arm of a patient being treated. The treatment apparatus is contained in a housing **12** supported over the arm **11**. Within the housing **12** is contained a flexible container **13** of plasma, whole blood or the like. The container **13** may be made of any suitable flexible, sterile and impermeable material such as a synthetic resin. Such containers are now quite common, and the particular material from which the container is formed does not form a part of this invention. Two rollers **14** and **15** are mounted for rotation within the housing **12** and along pairs of racks **16** and **17** supported within the housing **12** on either side wall in any desirable manner. An electric motor **18** is mounted coaxially with one of the rollers **15** and is connected by a pair of coiled

wires **19** to a stationary battery **20**, which may be mounted on the exterior of the housing **12** in a location conveniently accessible. The rollers **14** and **15** are connected together and to the motor **18** by any desirable operative means, such as by gearing, represented herein at **21** and **22**. Each roller **14** and **15** is provided with gears proper for meshing with the racks **16** and **17**. A tab **23** extends from the back end of the container **13** with a perforation **24** therethrough. The housing **12** is formed in two mating parts, each part carrying an internal stud **26** and **27**. The stud **27** is hollow and has an internal bore sufficiently large to accept an end of the stud **26**, which passes through the perforation **24** in the tab **23** of the container **13** and into the bore of the stud **27**. At the forward end of the housing **12** are two stop blocks **27** and **28**, one in each part of the housing **12**. A tube **29** extends from the forward end of the housing **13** in communication with the interior of the container **13**, and carries a hollow injection needle **31** at the end. A small switch **32** is mounted on one of the blocks **27** and is connected in any suitable manner with the battery **20**, a light **33** and a buzzer **34** which are mounted on the exterior of the housing **12**. The blocks **27** and **28** have a groove extending through each of them for the passage of the tubing **29**, or, if desired, to form a passage connecting the interior of the container **13** and the tubing **29**. As better shown in FIGS. 3 and 4, the housing **12** is mounted on the side rail **45** of a litter by clamps **43** and **44**. A pair of soft collars **41** and **42** surround the arm **11** to form a resilient cushion between the arm **11** and the housing **12**. The litter, comprising side rails **45**, patient supporting web **48**, legs **46** and handles **47**, actually bears the weight of the housing **12** and the equipment on the clamps **43** and **44**. A rubber cushion **49** is provided between each of the clamps **43** and **44**, and the clamps are connected to the side rail **45** by means of set screws **51**.

In operation, the housing **12** is separated and a fresh container **13** of the desired fluid is inserted therein. The two parts of the housing **12** are then reassembled with the end of the stud **26** passing through the perforation **24** in the tab **23** and into the lower stud **27**. This serves to fit the two parts of the housing **12** together properly and to anchor the container **13** against the forces acting upon it. The rollers **14** and **15** are either in the position shown in FIGS. 1 and 2 or are moved into that position before the housing **12** is assembled. The two parts of the housing **12** may be fastened together by any suitable means such as screws, latches, clips, or the like. The tubing **29** is connected to the housing **12** with the end of the tubing in communication with the interior of the container **13**. For this purpose, the end of the tubing **29** which enters the container **13** may be equipped with a perforating needle or the like. When the equipment is ready for operation, it is mounted on a stretcher, bed or litter by clamps **43** and **44**, the injection needle **31** is then inserted into the arm of the patient and the apparatus is turned on. Before the injection needle is inserted into the arm of the patient, the rollers **14** and **15** may be manually moved over the end of the container **13** to eject any air from the tubing **29** and the needle **31**. The housing **12** may have a switch also mounted on its exterior for connecting the motor **18** to the battery **20**. When the switch (not shown) is closed, the motor **18** is energized by the battery **20**, and begins rotating the rollers **14** and **15**. To reduce the size and weight of the overall apparatus, the motor may well be a small, high speed motor connected to the rollers **14** and **15** by a train of small reducing gears to ensure that the rollers rotate slowly. As the rollers **14** and **15** turn, they move toward the right as shown in FIG. 1 and gradually compress the container **13** between them. As the container **13** is compressed, its contents are gradually squeezed out through the tubing **29** and the needle

31 into the arm of the patient. By using a high gear ratio between the motor 18 and the rollers 14 and 15, the rollers may be caused to move very slowly at a constant rate. When the rollers 14 and 15 have at least reach the end of their travel as defined by the blocks 27 and 28, roller 14 contacts switch 32. The switch 32 opens the circuit between the battery 20 and the motor 18, and also closes the circuit between the battery 20 and both the light 33 and the buzzer 34. In this manner, the operation of the apparatus is terminated, and the completion of the injection is signalled to those in attendance. The buzzer serves to call the attention of the attendant, who may not be immediately by the patient when the apparatus stops, that the injection has been completed, and the light indicates which of several units in operation at the same time is through.

Of course, this specification describes but one form which the apparatus of this invention may assume. There are many other, equivalent structures. For example, the motor 18 is shown connected to the battery 20 by long, coiled wires. Other forms of connection between the two could just as well be used. Conductive tracks could be provided along one inside wall of the housing 12 to be connected to the battery 20, and the motor 18 could be provided with sliding brushes to contact the tracks. Manual means for moving the rollers 14 and 15 can also be provided projecting from the side of the housing 12 so that the rollers can be easily moved when necessary by hand. Further, instead of two rollers which squeeze the foil container 13 between them, a single roller compressing the container against a portion of the housing 12 may be used. As mentioned above, the blocks 27 and 28 are grooved to form a passageway for the tubing 29 or to form channels for the passage of the fluid being expelled from the container 13. Neither the buzzer 34 nor the light 33 are necessary, but they are a convenience, specially when the equipment is being used in a dispensary treating many individuals, such as a military field hospital. Since several patients may be simultaneously receiving injections of various fluids, and since the number of operating personnel is usually small, the signals, both aural and visual, are of value. The housing 12 is made of material which is light in weight and which may be subjected to standard cleansing and sterilizing techniques and materials without undo effect. Also, the complete unit is readily disassembled for cleaning. The racks 16 and 17 may be mounted so that the rollers 14 and 15 may be manually removed by turning, and the tubing 29 and the needle 31 may be detachable.

This specification has described a new and improved portable motorized injection apparatus for automatically injecting fluids into a living animal body. The apparatus of this invention may assume many forms, only some of which have been described herein. In view of the fact that the above descriptions may suggest to others in the art other forms for the invention without departing from the spirit thereof, it is intended that this invention be limited only by the scope of the appended claims.

What is claimed is:

1. Apparatus for injecting parenteral fluids into animal tissue automatically, said apparatus comprising a housing formed in two separable halves, each half having opposite side walls and end walls, track means supported on the opposite side walls of each of said halves, a pair of mating rollers within said housing, one roller of said pair being mounted on the track means in each half of said housing to be guided thereby, a readily collapsible container for parenteral fluid situated within said housing between said rollers so that said container is collapsed between said rollers as they move along said tracks, electric motor means for driving said rollers at a slow contant rate, tubing connected at one end to one end of said container for dispensing the parenteral fluid forced from said container, mating end walls of said two housing halves being formed to accommodate said tubing so that it freely passes through said housing, puncturing means connected to the other end of said tubing for penetrating the tissue into which the fluid is to be injected, said halves of said housing being arranged to be readily separated to permit the ready insertion and removal of said container and said tubing, said apparatus further including a self-contained electrical power supply for energizing said motor means, electrical signaling means coupled to said apparatus for signaling the end of the operation, and means for supporting said apparatus in a substantially fixed position adjacent the tissue into which the fluid is being injected.

2. The apparatus defined in claim 1 further including first electric switch means mounted on a wall within said housing, said first switch means being connected in series with said power supply and said electric motor, and second switch means mounted on a wall within said housing and connected between said power supply and said signaling means, each of said first and second switch means being actuated by a roller at the end of its travel to interupt the energization of said motor and to energize said signaling means.

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