Title
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ABSTRACT

A portable device for constant infusion of the ambulatory patient was constructed using mercury batteries, a light-weight low-gear motor, and spiral-drive cam mounted on a light-weight plastic cast. The entire device weighed 1 lb., 14 oz., and as designed, pushed the syringe barrel 1-1/2 inches in 12 hours. With the power supply used, the infusion could be continued for 3 or 4 days on a single pair of batteries. The patient was able to perform ordinary activities without great inconvenience.

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Occasionally in treatment with a drug when constant infusion is necessary but the patient would benefit from or be more comfortable being ambulatory, it is advantageous to have the infusion equipment portable. Certain improvements in routinely available equipment have made it possible to incorporate a lightweight constant-infusion device into a hinged cast which the patient can wear with very little inconvenience and which allows him to perform most routine activities.

The application of such a device is greatly simplified by the ready availability of indwelling polyethylene venous catheters which are free of tissue reaction.[1] The fabrication of such a device is facilitated by the use of disposable plastic syringes, the plunger of which can be driven at any rate without leakage and without jamming. Improvements in routinely available power units (mercury batteries and lightweight motors) have made it possible to keep the weight well within comfortable limits.

MATERIAL AND METHODS

The portable infusion pump was assembled on a lightweight plastic cast which was hinged so that it was easily put on and off. High-impact styrene plastic was moulded in a vacuum mould over a plaster of Paris cast of the human arm. A range of sizes can easily be made by making the first cast to the plaster mould and forming several others on top. In this

way each new cast (layer) is larger by the thickness of the plastic used (2.5 mm). High-impact styrene is sufficiently strong to bear the hinges, etc., and yet be lightweight. A flange was left on the lower half of the cast on which the syringe and motor drive were mounted, Figures 1 and 2.

The infusion device consists of a disposable plastic syringe (Tomac) and spiral-drive cam mounted to the top of the flange on the cast with the batteries (two Mallory type RM 12 R) and motor (Cramer, Model 800, shaft speed 1 revolution per 12 hours, 3 volts, direct current) mounted underneath. A block of Teflon served to anchor the syringe and guide the shaft of the plunger. The drive cam was mounted with a wing nut for easy adjustment of position. For use with solutions that might deteriorate at room temperature, plastic "ice cubes" that fitted over the syringe were made, Figure 2. Hollow shells of thin butyrate plastic were vacuum-formed to the contours of the syringe barrel and filled with water. The "ice cubes" were held in place by a spring and could be easily and frequently changed by the patient, several spares being kept in the nearest deep freeze. A handle was attached for use with a sling if desired.

RESULTS AND DISCUSSION

The entire infusion device and cast weighed 1 lb. 14 oz., and as designed pushed the syringe barrel 1-1/2 inches (0.7 ml. with a 1-ml. syringe and 11 ml. with a 20-ml. syringe) in 12 hours. The patient was able to carry on ordinary activities without great inconvenience. An office worker could continue working and perform most of his usual tasks. However, typing and driving a car were not possible. Most individuals did not care to support the device with a sling.

With the power supply used, the infusion could be continued for 3 or 4 days on a single pair of batteries. The indwelling venous catheter could be left in situ for several days in most patients, and occasionally for as long as 2 weeks withoug evidence of thrombophlebitis or local inflammation. When the infusion was discontinuous, the catheter was detached from the syringe, the needle socket sealed with a Teflon plug, the cast removed, and the catheter protected by a bandage. The catheter was always firmly secured by tape to avoid any possibility of its being lost into the vein.

FOOTNOTES

*Supported in part by the U. S. Atomic Energy Commission.

1. Adams Intramedic polyethylene tubing, PE 10, was used.

DESCRIPTION OF FIGURES

Fig. 1. The cast as it would be worn, with the drive cam and plastic syringe mounted to the top of the flange. The plastic "ice cube," which can be held over the syringe barrel by the metal spring, is shown detached.

Fig. 2. The cast from the botton, showing the battery case and motor.

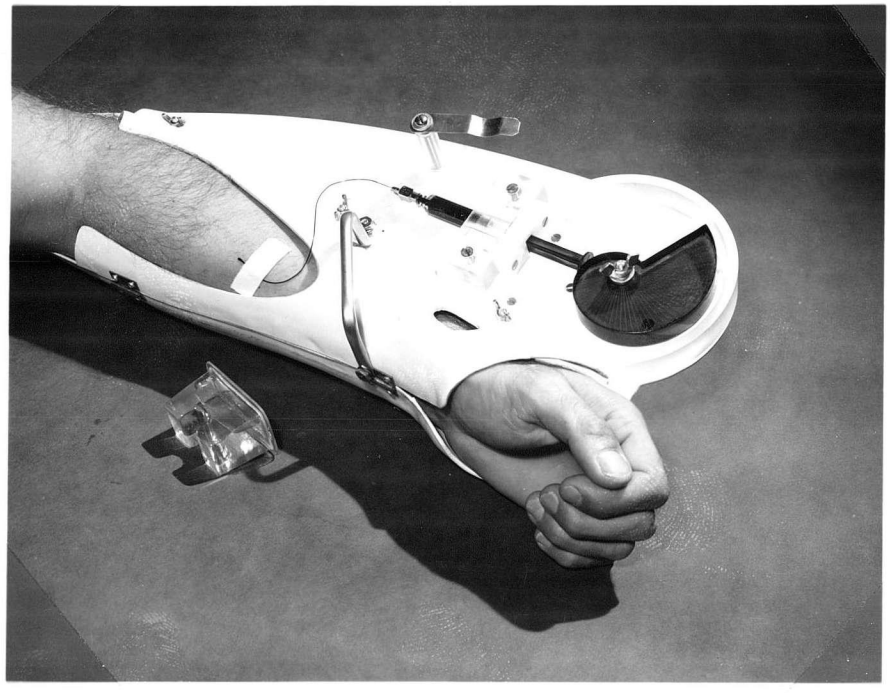

Fig. 1

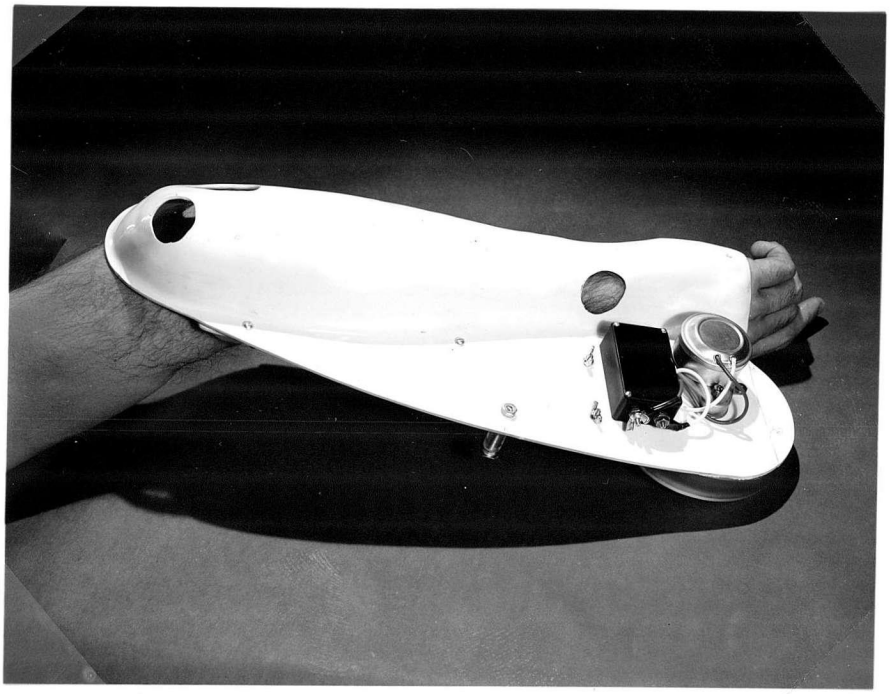

Fig. 2