A SEMI-AUTOMATIC BLOOD PRESSURE RECORDER

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In the recent past a number of blood pressure recorders for clinical use, and especially during anaesthesia, have been described (Molyneux and Pask, 1953; Simpson, 1956). It seemed, however, that these recorders had several disadvantages and that there was a place for an instrument that was cheap, simple and not a possible source of an explosion when used in the vicinity of explosive anaesthetic agents, provided that this could be done without too great a sacrifice of efficiency.

The instrument (fig. 1) described below enables records of systolic blood pressure to be obtained at frequent intervals though it is in fact sphygmomanographic in principle. It is also probably simple and cheap enough to be used alone as an aid to the taking of routine blood pressures during anaesthesia. By means of an inflating device a single blood pressure cuff with a brachial stethoscope beneath is inflated to a predetermined but variable level. Oxygen from the anaesthetic machine is used for this purpose. The oxygen escapes through two holes, one of fixed size, the other variable so as to achieve a more or less linear fall of pressure. On hearing the Korotkov sounds the operator reinflates the cuff and the cycle is repeated. The inflator is designed to be operated by the foot, thus freeing the hands for the giving of the anaesthetic or for performing such other manoeuvres as one wishes, for example, signalling events upon the recording drum.

DESCRIPTION OF THE INSTRUMENT

The cuff inflator is contained in a brass box measuring 16 x 8 x 8 cm. The lid is detachable and carries the operating pedal which works in a plain bearing lubricated, as are all moving parts, with a noninflammable grease. A rubber washer ensures an airtight fit between the lid and the box, as do fibre washers beneath the heads of the securing screws. It works as follows:

Depression of the foot pedal opens the oxygen tap. The tap is a modified M.I.E. injector sucker

Fig. 1

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A tap with a rubber instead of a Neoprene valve seat, and with a lighter spring. In addition to opening the oxygen tap, depression of the operating plunger allows the control rod to move forward into the slot A (fig. 2), thus holding the tap open. The control rod is attached to a metal bellows which is spring loaded. When the pressure inside the box and cuff rises the bellows is compressed and the control rod moves back, allowing the tap to close. This cut-off pressure is determined by the extent to which the spring is initially compressed by the screw seen on the right. The size of the bellows and its spring is not critical, a bellows from a bomb sight computer was used in the inflator shown.

The oxygen now escapes through the two holes. The variable hole can be seen on the front of the instrument. A gramophone needle soldered to a small metal bellows (also from a bomb sight computer) moves in and out of the hole as the pressure inside rises and falls, the inside of the small bellows being connected to the inside of the inflator. This ensures that the rate of fall of pressure is more or less constant. In addition, the fixed hole is provided with a tap so that the rate of fall can be adjusted. The inflator is connected to the sphygmomanometer cuff, to the recorder, and it is useful also to have in the circuit a mercury column so that the blood pressure can be read directly and the rate of fall checked.

The recorder consists of an ink writer on a movable arm, the arm being connected to a metal bellows, thus tracing the pressure cycle in the cuff. As the pressure rises each time the pedal is depressed on hearing the systolic sound, a tracing of the type shown in figure 3 results, the systolic pressure being at the lowest point of the pen travel. If desired, a record of both systolic and diastolic pressures, with or without a fall to zero of the pressure in the cuff, can be obtained.

DISCUSSION

Approximately 4 seconds is required to inflate the cuff to 200 mm of mercury, less for lower pressures. Any greater rate tends to operate the cut-off before the desired pressure is reached in the cuff due to inertia in the tubing.

The rate of fall is determined by the ease and certainty with which one can hear the Korotkov sounds and also by the pulse rate, a slower pulse rate giving a greater error for each missed sound. I find that the maximum rate of fall that can be used is about 10 mm per second.

In practice the control is set to blow off at some
level above the systolic blood pressure in order to give time to hear the sounds and also because friction in the control rod bearing prevents it from re-engaging in the slot immediately after it has blown off. The amount of fall required for this varies with the cut-off pressure. About 55 mm fall is required from 200 mm of mercury, about 30 mm from 140 mm of mercury. The actual level of the systolic blood pressure, therefore, also determines the number of readings that can be taken in a given time. As the blood pressure rises or falls the spring tension can be increased or decreased so that as little time as possible is wasted, having regard, of course, to the limitations mentioned above. Under good conditions it is possible to record the systolic blood pressure every 5 seconds.

The linear fall device is necessary so that the fall of pressure in the lower ranges will not be unduly slow—or unduly quick at high pressures, as would occur with a fixed orifice—and enables readings to be taken more frequently.

Events can be signalled on the drum with an ordinary sphygmomanometer bellows, which is given a smart squeeze while the pressure is falling. A notch is thus produced in the record.

If it is desired to record both the systolic and diastolic pressures then the systolic pressure can be signalled with the bellows and the diastolic by the lowest point of the trace as the pressure rises once more. Alternatively both systolic and diastolic pressure can be signalled with the bellows and the pressure allowed to fall to zero between each reading.

It is more satisfactory if one's whole time can be devoted to the recording of the blood pressure, but with a little practice recording can be done by the person giving the anaesthetic and readings taken during the course of intubation, for example.

SUMMARY

A blood pressure recorder of sphygmotonographic type is described.

It requires an operator but is simple, cheap and nonelectrical.

Under the best conditions the systolic blood pressure can be recorded every 5 seconds.

Both systolic and diastolic blood pressures can be recorded with or without a fall to zero pressure in the arm cuff.

ACKNOWLEDGMENTS

The apparatus was described at a meeting of the North of England Society of Anaesthetists on March 16, 1956.

I should like to acknowledge the encouragement of Dr. R. P. Harbord.

The prototype was made with minimal workshop facilities but the model illustrated was made for me by Newcastle Scientific Apparatus, 61 Tavistock Road, Newcastle upon Tyne, the cost being met by a grant from the Department of Anaesthesia of the University of Leeds.

REFERENCES
