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Failure of a Nitrous Oxide-Oxygen Proportioning Device

To the Editor:—Without vigilance, asphyxia may occur during the use of an anesthesia machine designed to prevent the delivery of a hypoxic gas mixture. The following occurred during use of an Ohmeda Modulus II Plus anesthesia machine.

While increasing the flow of nitrous oxide (N_2O) (to speed the delivery of an increased inspired concentration of volatile agent) the expected subsequent rise of the oxygen (O_2) flowmeter bobbin did not occur. Turning the O_2 flow control knob promptly increased the O_2 flow. Caution was advised in the use of the flowmeters when the anesthetist returned from break.

After completing the case, we found that the anesthesia machine's flowmeters could be set to deliver virtually 100% N_2O. The machine was removed from service until it was repaired by the manufacturer's service representative.

The Ohmeda Modulus II Plus, used extensively at Presbyterian-University Hospital, has a touch-coded O_2 flow control knob, delivers a mandatory minimum O_2 flow of approximately 200 ml/min, incorporates an O_2 analyzer with an audible alarm, and has an N_2O-O_2 proportioning device that delivers a nominal F_{IO_2} of 25%.[1]

Part of this N_2O-O_2 proportioning device consists of a 14-tooth sprocket (fig. 1, #11) affixed to the N_2O flow control knob stud (fig. 1, #4) that is linked by a chain to a 29-tooth sprocket (fig. 1, #5) that spins freely on the threaded stud of the O_2 flow control knob.[2] The O_2 flow control knob is secured to its stud by two recessed screws (fig. 2, #1). Adjustment of the N_2O or O_2 flow control knobs, such that the concentration of O_2 in the total flow decreases to 25%, causes a pin on the "freewheeling" 29-tooth sprocket (fig. 2, #5) to engage a pin on the O_2 flow control knob (fig. 2, #3).[3] The flow control knob spindles then turns in tandem to preserve a nominal O_2 concentration of 25%. The engagement of the pins is both audible (a metallic click) and palpable (a sudden increase in resistance to turning the flow control knob). These signs of pin engagement were absent as I watched the flowmeter bobbins while adjusting the N_2O flow.

The preoperative check recommended by Ohmeda detects this malfunction.[1] Its cause was quickly found and remedied by the Ohmeda service representative. The pins on the "freewheeling" sprocket and the O_2 control knob failed to engage because of malposition of the knob on its stud. Repositioning the knob closer to the sprocket, which

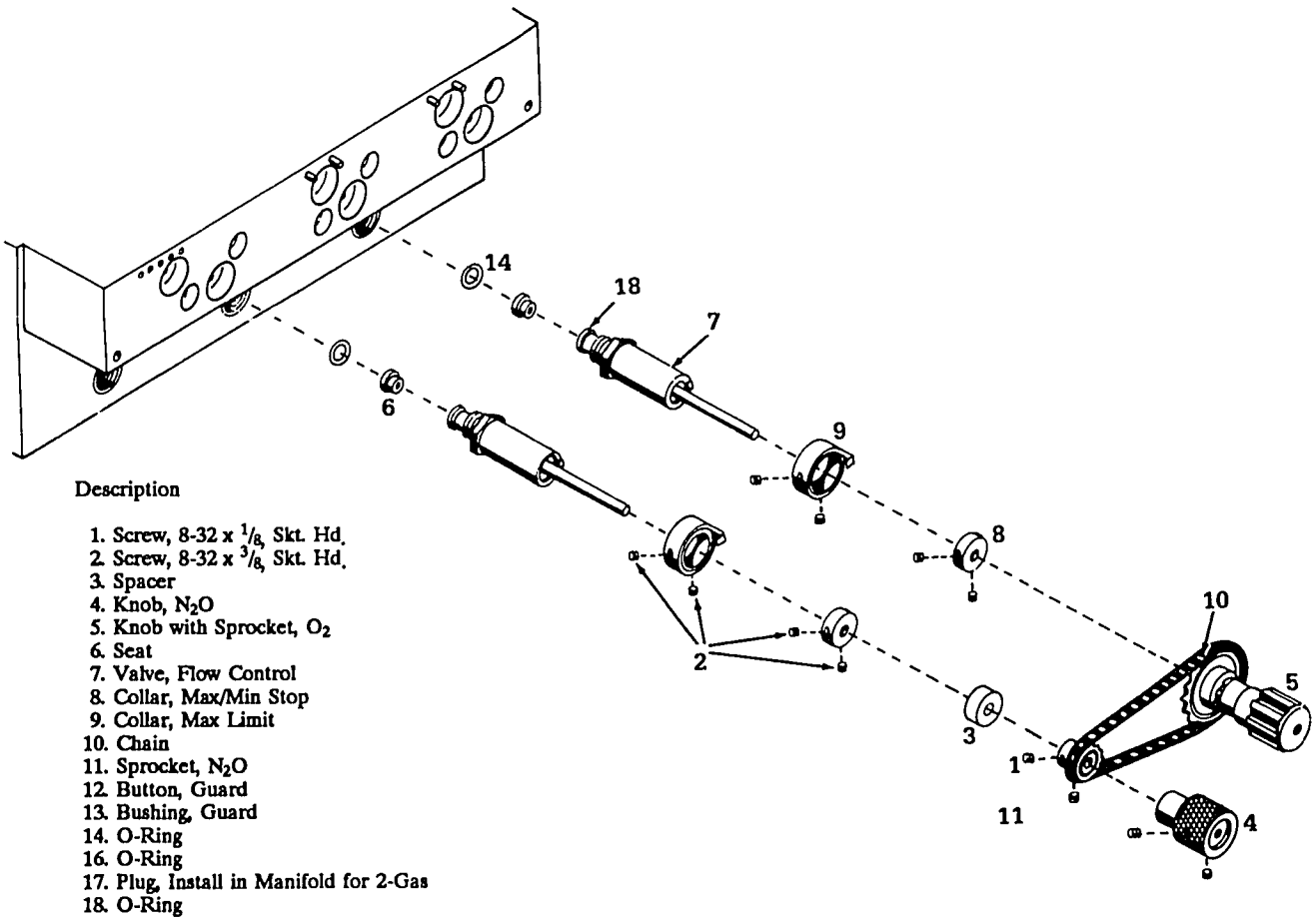

FIG. 1. Exploded diagram of the N_2O-O_2 proportioning device. Illustration courtesy of Ohmeda.[3]

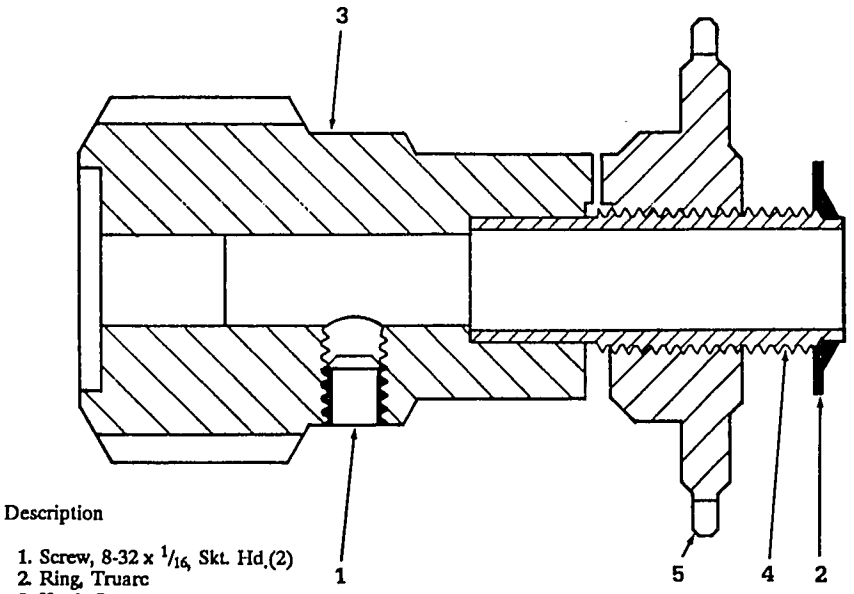

FIG. 2. Cross-sectional diagram of the relationship of the O_2 flow control knob (#3), its stud (#4), and the "freewheeling" sprocket (#5). The pins are in near-approximation at the top of the diagram. Illustration courtesy of Ohmeda.[3]

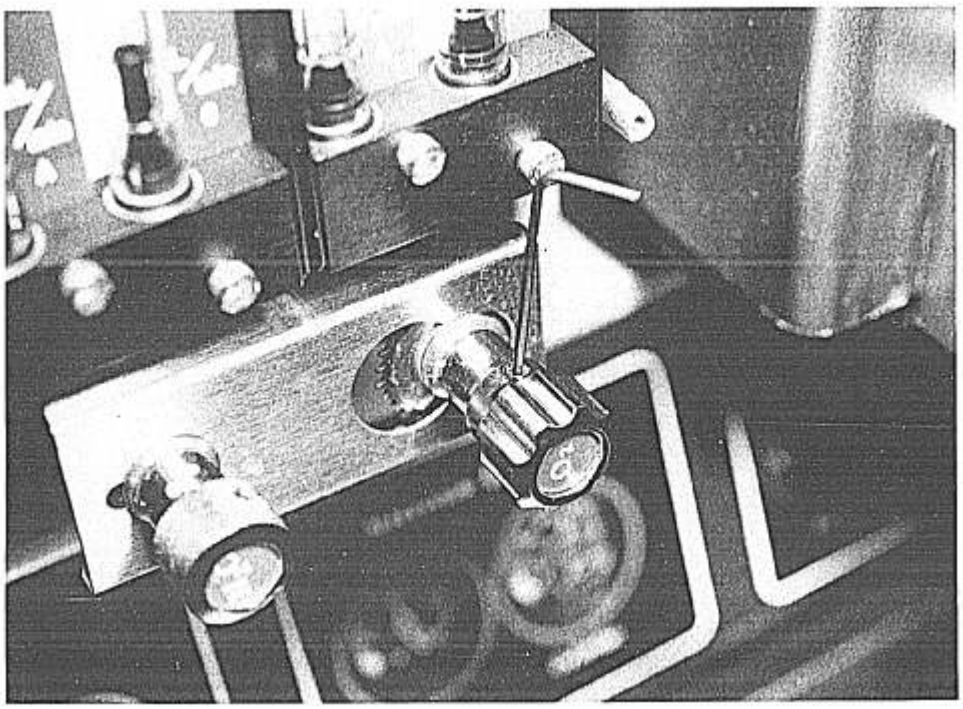

FIG. 3. Adjustment of the malpositioned O_2 flow control knob.

involved loosening and retightening each screw (fig. 3), restored the normal function of the proportioning system.

As a result of this episode, we now require the daily completion and posting of a preoperative checklist on each anesthesia machine. It serves two purposes. It encourages the uniform performance of a standardized inspection and communicates the condition of the anesthesia machine to the next person using the machine.

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One More Use of a Vinyl Glove: Ready-Made Protection for the Reusable Pulse Oximeter Monitoring Probe

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To the Editor:—Technical difficulties in obtaining reliable oxygen saturation (Sp_{O_2}) readings with the pulse oximeter are frequently encountered. These occur in patients in whom peripheral vasoconstriction is present or in patients with anatomic abnormalities (ear lobe) or severe injuries to the extremities.

In such circumstances, a clip-on probe can be positioned on the nasal septum, the lips, or the tongue[1] but there is unavoidable contact with the mucous membranes.

In these cases the question of hygiene and contamination arises together with the problem of disinfection if a reusable probe is being used.

Recently, Acherman[2] studied the effect of a vinyl glove interposed between the pulse oximeter probe and the finger and found no significant difference between the Sp_{O_2} readings of the gloved or ungloved finger.

To protect the oxygen saturation monitor probe from the mucous membranes, we use a 2–3 cm long piece from the finger of a vinyl glove, which easily fits over the probe (fig. 1).

Using the covered ear probe of the Ohmeda oximeter (Ohmeda, Boulder, CO) on the lips (fig. 2), Sp_{O_2} readings, even in patients with severe vasoconstriction correlated closely with arterial blood saturation measurements.

With this inexpensive, readily available protection, the maintenance of the probe is easier, the contamination less likely, and the lifetime of the probe can be prolonged.

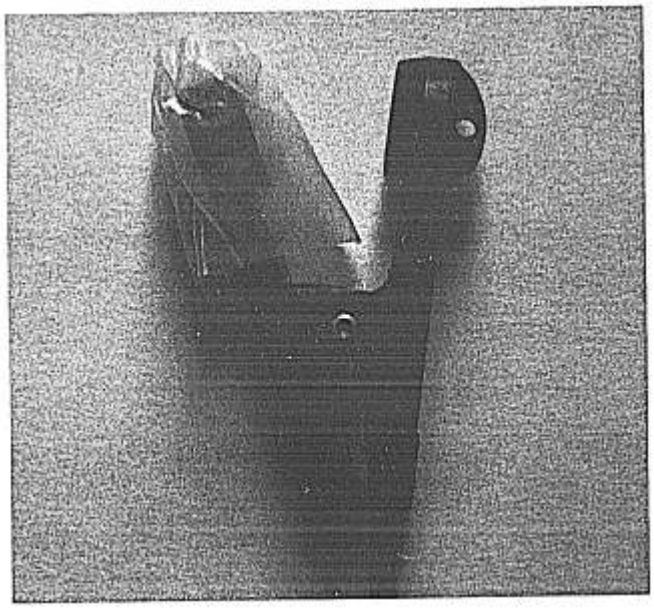

FIG. 1. Clip-on probe of oximeter with protective sheath.

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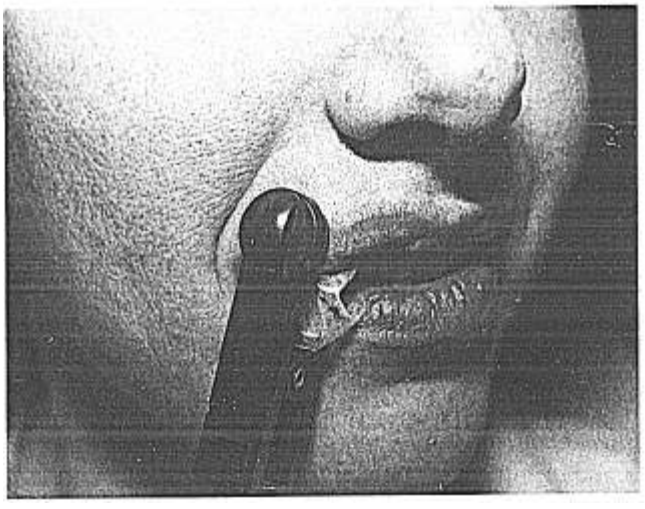

FIG. 2. Covered probe with protective sheath placed on the upper lip.