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Clean Air Operating Room Enclosures

SIR,—There is always a tendency to modify surgical inventions by surgeons and manufacturers and sometimes this results in loss of efficiency. The first alarm that my design of body exhaust system might not be functioning as it should was from reports that surgeons in different parts of the country were exhausted and drenched with sweat from intolerable conditions inside the clothing. My chagrin later was eased by hearing that the cause was obsolescent air conditioning in the main operating room, but imagine now my alarm when operating for the first time in my own hospital in the latest model of clean air enclosure, which has just been installed, to find the body exhaust clothing intolerable because of inadequate air extraction. The negative pressure inside the gowns in this new installation was hardly detectable compared with the three installations already in existence in which all our research in bacteriological matters has been based. The manufacturers had "set" the body exhaust rate and deliberately taken away the adjusting key so that we could not "fiddle" with it. When eventually the exhaust rate was raised to the level I have always been used to the system was satisfactory.

What I find alarming is the possibility that surgeons who do not understand the system may put pressure on the manufacturers and purely in the interests of their personal comfort may destroy the efficiency of the installation from the bacteriological point of view. In my view, the body exhaust system must function with a considerable margin over resting conditions so that deep expirations of a surgeon doing hard

physical work, combined with a bellows effect of the gown in certain movements of the arms, should not convert a negative internal pressure into a transient positive pressure with expulsion of contaminated air into the enclosure. For reasons of economy no attempt has been made in my design to achieve hermetic sealing round the windows of the mask, and the clothing functions by the "fail safe" effect of negative internal pressure making all leaks in the direction of environment to inside of gown. The Howorth operating enclosure uses a conventional operating room light so that there is air turbulence under the light and therefore close to the open wound. This situation is permissible only if the air in the enclosure is absolutely protected from contamination by emissions from the surgical team by a body exhaust system which is functioning with a margin above minimal requirements.

It is to be accepted that the rate of air extraction which absolutely will guarantee efficiency may produce a noise level inside the head piece which may be disconcerting for those who test it for no more than a few minutes. Inside the head piece this noise restricts communication to shouting and mimed signals, if a telephonic system is not used, but even so it is astonishing how this environment is forgotten once the surgeon becomes absorbed in the surgical procedure. In this unit I estimate that some 9,000 man hours are spent per year in these conditions, and we have no complaints from new residents or nursing staff and we do not use telephonic communication. New residents become completely accustomed to

the unusual conditions within the time of the first operation.

In my view, the correct rate of extraction from the gown should be such that it reduces the internal pressure in comparison with the environment by $\frac{1}{4}$ – $\frac{1}{2}$ in (6.4–12.7 mm) water gauge. This test is quite easily done (in non-sterile rehearsal) by passing a tube from a water gauge through the cuff and up the sleeve so that it reaches the interior of the head piece. Tests by expiration and bellows action of the gown should not cause a positive pressure. The danger in reducing the volume of air exhausted from the gown obviously will be increased if the gown leaks, so requests for a gown to be made to open down the back after the manner of conventional operating gowns (instead of being put on over the head as in the present design) are particularly dangerous. Even worse is the request that the head part of the gown should be made as a separate cowl in order that the surgeon may more easily turn his head from side to side. It is an essential feature of the present design that the head piece and the body of the gown share one continuous internal space, with no constriction round the neck to obstruct warm air rising from the body into the head piece where it is extracted. If a separate head cowl is used the internal volume will be small and the sudden expulsion of air from the lungs will seriously effect the internal negative pressure, and there will be no protection as a result of the large reservoir-effect of direct communication with the main volume of the inside of the gown.

As it has been developed and used for eight years at Wrightington the body exhaust system is a simple and economic