IMPROVED LOWER-LIMB NEGATIVE-PRESSURE EQUIPMENT
FOR THE REDUCTION OF CEREBRAL BLOOD
PRESSURE IN NEUROSURGERY

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Equipment has been described by James et al.\textsuperscript{1} which uses negative pressure to
effect pooling of the blood in the lower limbs, after the blood vessels have been
dilated by administration of drugs.

The units described in this note were designed and manufactured at the request
of the Neurosurgical Department of the Auckland Hospital, and have been in use
since 1953.

DESCRIPTION OF EQUIPMENT

1. Negative-Pressure Chambers. This unit comprises two “Perspex” cylinders (Fig. 1), one
fitting over each leg. It is designed this way for lightness, to facilitate setting up, and to
provide complete and unobstructed visibility of the legs. The open end of each tube is sealed
by a “Celeron” plastic end-plate, especially machined to take a short rubber sleeve with
which the seal around the legs is effected.

The tubes are 9 inches in diameter to give comparative freedom of foot movement, and
for convenience of manufacture are not tapered. The thickness of the wall is $\frac{1}{8}$ inch and the
over-all length is 3 feet. For purposes of design these tubes can be treated as short thin-
walled cylinders. Thus with the ultimate tensile strength of plasticised “Perspex” at 3
tons/sq. in. and the tubes subject to a maximum vacuum (15 lbs./sq. in.) the factor of safety
is well in excess of 6, the normal factor of safety for alternating load applications.

The longitudinal joint is tongued, grooved and cemented, and the closed end of the tube
is domed for extra strength. The tubes are strengthened at the points of connection by
cemented bosses. The points of connection can be seen in Fig. 2, the tubes being intercon-
ected by a preformed rubber bend.

In each tube a special port is provided, designed and positioned to facilitate rapid applica-
tion of a drip set to either leg.

2. Connectors. The connectors are screwed-brass rubber-tube adaptors of conventional
type. They are tightened by hand in the connector bosses, an “O” ring, recessed into the
adaptor, effecting the seal against the face of the boss. The connectors and the vacuum
gauge adaptor are readily interchangeable in the bosses. The dimension of the tube adaptor
permits an easy-push fit for 9/16 inch I.D. thick-walled rubber vacuum hose.

3. Tube and Leg Sealing End Plates (Fig. 2). These end plates are machined from $\frac{1}{2}$ inch
thick “Celeron,” a fabric-reinforced plastic sheet. They spigot into the “Perspex” cylinders,
the seal at this point being effected by a sponge-rubber ring, of rectangular cross section,
cemented to the plate. They are fastened to the cylinders by two diametrically opposed
quick-acting toggle clips. In Fig. 4 it may be seen that the aperture in the plate for the leg is
machined off-centre. This is to enable the leg to be more comfortably positioned as each plate
can be rotated to offer the least amount of pressure against the leg. This rotation does not
upset retention of the clip, for the groove in the plate in which the clip engages is continuous.
There are three sizes of end plates—5, 6 and 7 inch—and in each size the aperture for the
leg is offset so that the distance between the peripheries of the aperture for the leg and the
end plate remains the same.

695
The leg-sealing sleeves are 1/16 inch thick soft rubber 3 inches long, one inch less in diameter than the aperture for the leg and have a square section of rubber ring vulcanised to their outside surface at one end. This end is stretched over the lip of an annular ring machined concentric with the aperture in the end plate and is retained positively by a garter-type tension spring.

4. **Drip-Set Access Ports.** These ports, each equipped with a detachable lid, are 6½ inches I.D. to provide adequate access of the hand and also to enable a standard saline drip bottle to be passed through if necessary. As a precaution against loss, the lids are retained to their respective “Perspex” cylinder by a length of ball chain. The lid seal is effected by a sponge-rubber ring in the same manner as the end-plate seal. The drip-set tube seal is very simply effected, and is shown clearly in Fig. 3. The D-shaped sponge-rubber seal is slit to the hole for