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TITLE OF THE INVENTION

5 **MOUTH GAG FOR SWINE AND OTHER ANIMALS**

TECHNICAL FIELD OF THE INVENTION

10 The present invention relates to a mouth gag and a mouth gag/laryngoscope set for use in the intubation of animals and in particular swine. It also relates to a method of intubating animals.

15 BACKGROUND OF THE INVENTION

Swine are important experimental animals used in medical research. Their cardiovascular system, gastrointestinal tract, skin, and other anatomical features are very
20 similar to that of humans making them suitable experiment subjects. Swine research is generally carried out under anaesthesia. Tracheal intubation is necessary for the assisted ventilation of an anaesthetised swine and should be performed as quickly
25 as possible to avoid respiratory arrest, which may occur as a result of barbiturates and other anaesthetic agents used in anaesthesia. Intubation involves clamping apart the swine's jaws with a spring-loaded pivoting jaw device and physically pulling the tongue forward to
30 clear the oral cavity. An endotracheal tube is then able to be inserted into the trachea. Laryngoscopes are used to probe into the swine's larynx and elevate the epiglottis for insertion of the endotracheal tube.

35 However, swine are among the most difficult animals to intubate. Anatomically, swine have a deeply recessed and angled larynx and a large mass of tongue tissue

which obstructs view of the oral cavity. Access to the epiglottis with the bladed laryngoscope is therefore quite difficult. Furthermore, swine are prone to laryngeal spasms, excessive anaesthetic induced salivation and other anaesthesia related problems. This together with obstruction by the tongue makes the task of intubating swine laborious requiring at least two persons. Swine intubation can be traumatic for the animal itself and often results in ruptured animal tissue, damaged muscle and, occasionally, loss of the animal's life.

With the present invention it is intended to provide a device that will alleviate the problems associated with intubating swine and provide a speedy and uncomplicated swine intubating procedure.

SUMMARY OF THE INVENTION

According to the present invention there is provided a mouth gag for animals comprising: an elongate support member supporting two spaced and substantially parallel separation members, whereby the distance between the separation members is adjustable to, in use, separate the jaws of an animal; wherein the mouth gag has locking means to maintain separation of the separation members.

According to the present invention there is further provided an intubation set for intubating animals including: a mouth gag comprising an elongate support member supporting two spaced and substantially parallel separation members, whereby the distance between the separation members is adjustable to, in use, separate the jaws of an animal; wherein the mouth gag has locking means to maintain separation of the separation members; and a laryngoscope comprising a handle, an interchangeable blade and means for removing and

securing the interchangeable blade.

According to the present invention there is still further provided a method of intubating animals including: anaesthetising the animals; separating the jaws of an animal with a mouth gag having parallel adjustable separation members provided on an elongate support member by increasing the distance between the members; locking the separation members to maintain their separation and thereby maintaining jaw separation; inserting a laryngoscope having interchangeable blades into the animal's oral cavity and lifting the epiglottis; and inserting an venting tube into the animal's tracheal for assisted respiration.

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BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments, incorporating all aspects of the invention, will now be described by way of example only with reference to the accompanying drawings in which:

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Figure 1 is a perspective view of a mouth gag according to one aspect of the present invention;

Figure 2 is a perspective view of a tongue clamp used in conjunction with the mouth gag;

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Figure 3 is a side view of the adjusting mechanism of the mouth gag;

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Figure 4 illustrates the mouth gag as used in a swine's mouth;

Figure 5 is a side view of a laryngoscope used in a second aspect of the invention; and

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Figure 6 is a graph of swine body weight against depth

of epiglottis.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

5 The mouth gag 10 illustrated in Figures 1-3 is designed to be inserted into a swine's mouth to keep the jaws separated whilst intubating an anaesthetised swine. It is, however, understood that the mouth gag need not be exclusively used on swine but may be suitable to
10 separate the jaws of other animals.

The mouth gag comprises a toothed rack 11 supporting a fixed stainless steel blade 12 and a movable stainless steel blade 13. Moveable blade 13 is manually moveable
15 along rack 11 by way of an adjusting mechanism 14. Blades 12, 13 are inserted into a swine's mouth, one each against the upper and lower jaws to hold them open. Fixed blade 12 is fixed onto one end of rack 11 and cantilevered perpendicularly from the rack. Moveable
20 blade 13 is slideably attached to the rack by a blade sleeve 15 through which the rack extends. Moveable blade 13 is also cantilevered from sleeve 15 is extending perpendicularly from the rack. Both blades are slightly curved to conform with the contour of the inner
25 surfaces of a swine's jaw. Flexible tubes 20, made for example from silicon and having a diameter of 5 mm, are provided on each blade looping through two apertures 21 on each blade and having tied ends at the outer surfaces 22 of the blades. The tubes 20 are used to tie blades
30 12, 13 around the swine's respective jaw when the gag is inserted across the swine's mouth to assist in keeping the mouth gag in position. Figure 4 shows a flexible tube 20 on fixed blade 12 tied around the snout 23 whilst flexible tube on moveable blade 13 is tied around
35 the lower jaw 24 thereby preventing the mouth gag slipping out of the swine's mouth.

Attached in the same plane as moveable blade 13, but perpendicularly to it, is a curved plate that acts as a tongue holder 25. Tongue holder 25 extends from moveable blade 13 outwardly of the mouth and, together with tongue clamp 26, holds the tongue down against the inside of lower jaw 24. This provides an unobstructed view of the swine's oral cavity during intubation. Tongue clamp 26 resembles a safety pin in structure comprising two parallel padded arms 30 connected together at first ends by a spring coil 31 whilst second ends of the arms are latched together by way of an interconnecting hook and rod 32. The tongue holder 25 and swine's tongue 34 are inserted between the tongue clamp arms 30 and securely clamped together. The padding 33 on arms 30 comprises plastic sleeves which may include raised gripping segments 35. Other suitable material capable of encouraging grip of the tongue clamp against the swine's tongue 34 may also be used.

Adjusting mechanism 14 shown in figure 3 comprises a sliding sleeve 40 in coaxial connection with blade sleeve 15 and which therefore also slides along rack 11. Sliding sleeve 40 houses a pinion gear 41 that meshes with the gear teeth 42 on the toothed rack 11. Pinion gear 41 is driven by rotating knob 43 that is coaxially connected with pinion gear 41. Manually turning knob 43 moves the adjusting mechanism 14, and hence movable blade 13, along rack 11. A spring loaded levered ratchet 44 is biased to lock the adjusting mechanism at a desired point on the rack to thereby lock the blades at a desired separated distance. Ratchet 44 is centrally pivoted and has a hooked end 45 that catches between adjacent teeth on rack 11. To release pivoting ratchet 44 the handle 46 of the ratchet at the opposite end to hook 45, is pressed against the spring bias to disengage hooked end 45 from adjacent rack teeth.

The above described mouth gag is used together with a laryngoscope, which together form an intubation set. The laryngoscope 50 is illustrated in figure 5 and comprises a surgical stainless steel handle 51 having
5 circumferential grooves 52 at various portions along its length to assist in gripping the laryngoscope. The handle is pivotally attached to a straight long blade 53. Long blade 53 can be removed and interchanged with a blade of a different size by sliding an interchangeable
10 blade onto a mount 57 on the handle where a spring loaded ball bearing clip mechanism fastens with a hook to secure the blade to the handle. The tip 54 of the blade 53 has a slight outward curve tapering in the longitudinal direction of the blade to facilitate
15 elevation of the epiglottis from the soft palate. All edges of the blade are blunt and smoothened to prevent injury to tissue. The upper surface of the blade has a central raised portion 55 extending two thirds of the length of the blade from the distal end of the blade to
20 the tip. Raised portion 55 houses an electrical wire trunking (not shown). A battery source is located in the handle and, by means of the electrical wire trunking, it powers a small light bulb 56 located axially adjacent raised portion 55 approximately one third of the length
25 from the tip. The light shines towards the tip of the blade and clearly illuminates the epiglottis, lateral ventricle and vocal cord. Long blade 53 is interchangeable with other blade sizes that are selected according to the size of the swine.

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It has been found that conventional laryngoscopes have inappropriately short blade lengths making it difficult to probe the swine's long, narrow and angled larynx to elevate the epiglottis. This can lead to a protracted
35 intubation procedure, operator frustration and procedural complications. The designs of the present customised laryngoscope and mouth gag include dimensions

suitably selected according to the size and weight of the swine. Anatomical studies performed on the buccal structures of swine have revealed a linear correlation between swine body weight and depth of the larynx, and hence the position of the epiglottis from the frontal incisor teeth. The length of interchangeable blade 53 is determined according to the depth of the epiglottis in the larynx. Figure 6 is a graph illustrating the linear relation between the body weight of swine and depth of the swine's epiglottis. The graph shows that the average depth of the epiglottis for swine weighing between 15kg and 60kg differs by 6cm. A laryngoscope having a blade length appropriate for use on a 15kg swine therefore is inappropriate for use on a 60kg swine. With the present laryngoscope, the interchangeable blades of varying lengths enable the laryngoscope to suit any size of swine being intubated. With a handle length of approximately 17cm, it has been found that appropriate blade lengths for swine weight ranging from 15kg to 60kg is 16cm and 24cm. A 16cm blade is suitable for probing into the oral cavity of swine having a body weight of 15-30kg, whilst a 24cm blade is suitable for swine weights of between 31-60kg. Furthermore, the long and straight nature of the blade allows for manoeuvrability in the narrow, restricted oral cavity.

Similarly with the mouth gag, the mean mouth opening for swine having a body weight range from 15kg-60kg was found to be 7.25cm to 8.3cm. These measurements were taken of the vertical separation distance between the jaws at the point just behind the incisor teeth in the upper and lower jaws. Mean mouth opening values were taken at the optimal distance of jaw separation achievable without exerting any damaging stress on the joints and muscles of the swine's jaws. A calibration of jaw separation verses body weight is etched on the

mouth gag rack such that the operator has a clear indication at hand of the optimal distance to slide moveable blade 13 for jaw separation at a particular body weight.

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Anatomical data revealed the mean upper jaw width for swine weighing 15 to 60kg is 3.5cm to 5.45cm, whilst the mean lower jaw width is 3.14cm to 4.95cm. Jaw widths were measured at the junction of the respective jaw and
10 the tongue base in the mandible. The separation blades 12 and 13 are 12cm in length, and fit comfortably against the contoured hard palate of upper and lower jaws.

15 The mouth gag, and the mouth gag and laryngoscope set, enable tracheal intubation on swine to be performed by a single operator. Unlike traditional intubation procedures that require a second person to assist with holding the tongue down to provide an unobstructed view
20 of the larynx, the tongue clamp of the present mouth gag and separation blades allows the operator unobstructed viewing of the oral cavity and freedom to access the epiglottis with laryngoscope. A correctly executed intubation in this manner not only leads to an
25 uncomplicated medical procedure but also to a smooth recovery for the animal involved. The anaesthetised animal is subjected to minimal disturbance and therefore a reduced probability of laryngeal spasms, oedema, hypoxia or bleeding owing to improper intubation.
30 Additionally, there is less likelihood of over separation of the jaws and damaging stresses to the mandible joints and muscles. Laceration of the tongue by the swine's own incisor teeth is also less likely when the tongue is firmly clamped. The present
35 laryngoscope is designed to give the operator sufficient reach into the deeply recessed larynx of a swine. The interchangeable blades provide a selection of at least

two sized blades to maintain ease of reach notwithstanding the size of the animal. Illumination of the oral cavity by the globe mounted on the interchangeable blade provides an added convenience.

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It will be understood to persons skilled in the art of the invention that many modifications may be made without departing from the spirit and scope of the invention.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A mouth gag for animals comprising an elongate
5 support member supporting two spaced and
substantially parallel separation members, whereby
the distance between the separation members is
adjustable to, in use, separate the jaws of an
animal; wherein the mouth gag has locking means to
10 maintain separation of the separation members.
2. The mouth gag according to claim 1 wherein one
separation member is fixed to the support member
whilst the second separation member is moveable on
15 the support member to vary the distance between the
separation members.
3. The mouth gag according to claim 1 or 2 wherein the
separation members are cantilevered to the support
20 member.
4. A mouth gag according to claim 3 wherein the
separation members are blades adapted to extend in
and across an animal's mouth.
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5. A mouth gag according to claim 4 wherein the blades
are contoured to conform to the inner surface of an
animal's jaw.
- 30 6. A mouth gag according to claim 4 or 5 wherein at
least one blade has a tie adapted to tie around the
animal's jaw thereby securing the blade to the jaw.
7. A mouth gag according to claim 6 wherein both
35 blades are provided with ties.
8. A mouth gag according to any one of the preceding

claims wherein the elongate support member is a toothed rack.

- 5 9. A mouth gag according to claim 8 wherein the moveable separation member has an adjusting mechanism that includes a manually driven pinion that meshes with the rack to move the moveable member along the rack.
- 10 10. A mouth gag according to claim 9 wherein the locking means is a pivoting ratchet on the adjusting mechanism which engages with the toothed rack to lock the adjusting mechanism at increments along the rack.
- 15 11. A mouth gag according to claim 10 wherein the ratchet is spring-biased towards engagement with the rack.
- 20 12. A mouth gag according to any one of the preceding claims wherein the elongate member is provided with a scale for indicating suitable separation distances corresponding to animal size.
- 25 13. A mouth gag according to claim 12 wherein the mouth gag is for use on swine and the suitable separation distance of the jaws is approximately 7.0 to 8.5cm for swine having a body mass of between 15-60kg.
- 30 14. A mouth gag according to any one of the preceding claims wherein a tongue holding means is attached to one of the separation members.
- 35 15. A mouth gag according to claim 14 wherein the tongue holding means comprises a curved plate adapted to hold an animal's tongue against its lower jaw.

16. A mouth gag according to claim 15 further comprising a tongue clamp adapted to clamp the tongue to the plate.

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17. A mouth gag according to claim 16 wherein the tongue clamp is provided on the plate and has a safety pin-like mechanism having two clamp arms connected at first ends by a coil spring and having engageable second ends.

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18. A mouth gag according to claim 17 wherein the clamp arms have sleeves of padding to increase the grip of the clamp on the animal's tongue.

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19. A mouth gag according to any one of claims 14 to 18 wherein the tongue holding means is attached to the moveable member.

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20. An intubation set for intubating animals including a mouth gag comprising an elongate support member supporting two spaced and substantially parallel separation members, whereby the distance between the separation members is adjustable to, in use, separate the jaws of an animal; wherein the mouth gag has locking means to maintain separation of the separation members; and a laryngoscope comprising a handle, an interchangeable blade and means for removing and securing the interchangeable blade.

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21. An intubation set according to claim 20 wherein the laryngoscope has a light source.

22. An intubation set according to claims 20 or 21 wherein the set is used for intubating swine and the set includes two interchangeable blades.

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23. An intubation set according to claim 22 wherein the interchangeable intubation blades have a length of 16 and 24cm that are suitable for use on swine having a body weight of approximately 15-30kg and 31-60kg respectively.
24. An intubation set according to any one of claims 20 to 23 including the mouth gag defined in any one of claims 2 to 19.
25. A method of intubating animals including anaesthetising an animal; separating the jaws of an animal using a mouth gag having parallel adjustable separation members by increasing the distance between the members, the separation members being provided on an elongated support member; locking the separation members to maintain their separation and thereby maintaining jaw separation; inserting a laryngoscope having an interchangeable blade into the animal's oral cavity and lifting the epiglottis; and inserting a venting tube into the animal's trachea for assisted respiration.
26. A method according to claim 25 including holding the tongue down with a tongue plate provided on the mouth gag to prevent obstruction by the tongue of the oral cavity.
27. A method according to claim 26 including clamping the tongue to the tongue plate with a tongue clamp.
28. A method according to any one of claims 25 to 27 including tying the separation members one to each lower and upper jaw with a tie provided on each separation member.
29. A method according to any one of claims 25 to 28

including determining the distance of separation of the separation members by using a calibrated scale provided on the elongate member to indicate the optimum jaw separation for an animal having a particular weight.

30. A method according to any one of claims 25 to 29 including selecting an appropriate length of interchangeable blade depending on the size of the animal and attaching the blade to a handle of the laryngoscope.

31. A method according to any one of claims 25 to 30 including illuminating the oral cavity for viewing with a light provided on the laryngoscope.

32. A method according to any one of claims 25 to 31 including using the mouth gag defined in any one of claims 1 to 19.

33. A method according to any one of claims 25 to 32 including using a intubation set defined in any one of claims 20 to 24.