Histoire de la Ventilation

Module **LA VENTILATION MECANIQUE ET SES CONSEQUENCES PHYSIOLOGIQUES** Nom Pr Jesus Gonzalez-Bermejo
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Historique

1530

2018

La première idée de traitement

Paracelsus (1493-1541)

1530 À 1830

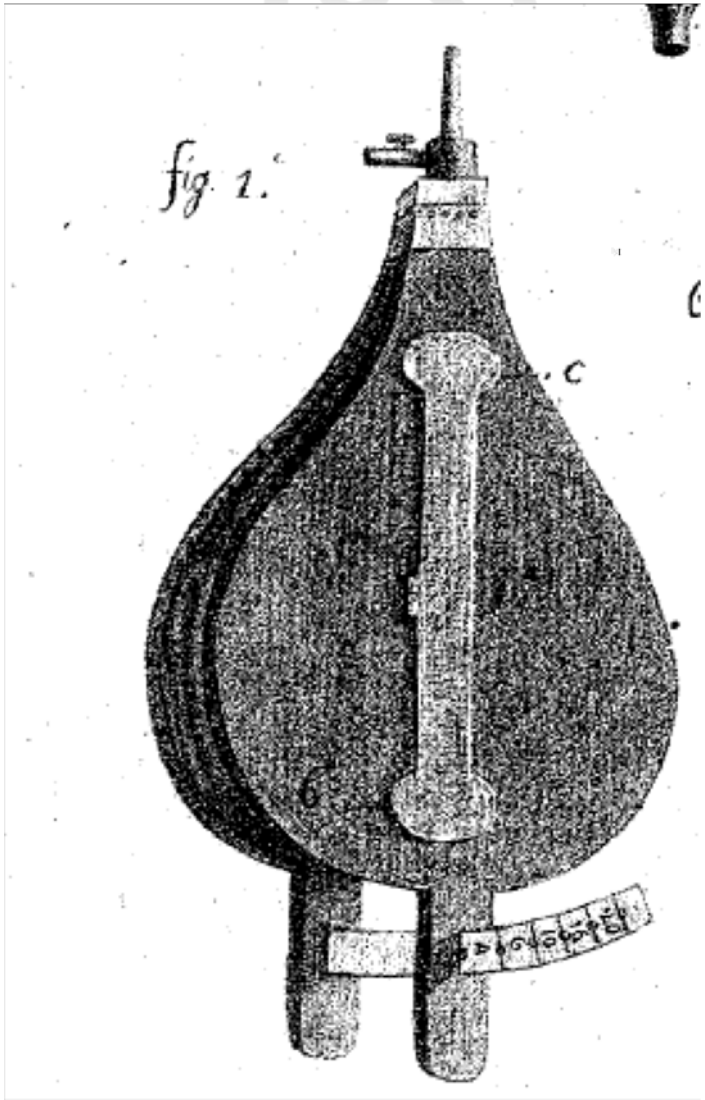
Adaptation au volume du malade

1827

RECHERCHES

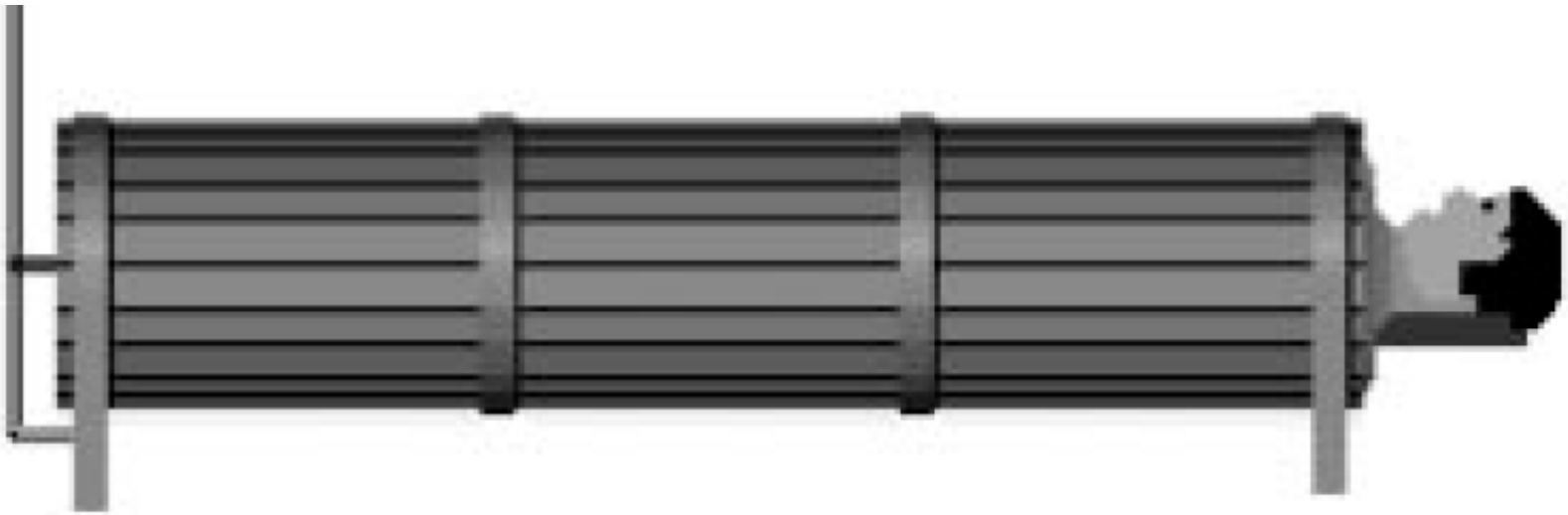
SUR L'ASPHYXIE,

PAR J. LEROY (D'ÉTIOLLE).



Le premier appareil : le SPIROPHORE 1876

Woillez, hôpitaux de Paris, développe un poumon à pression négative.



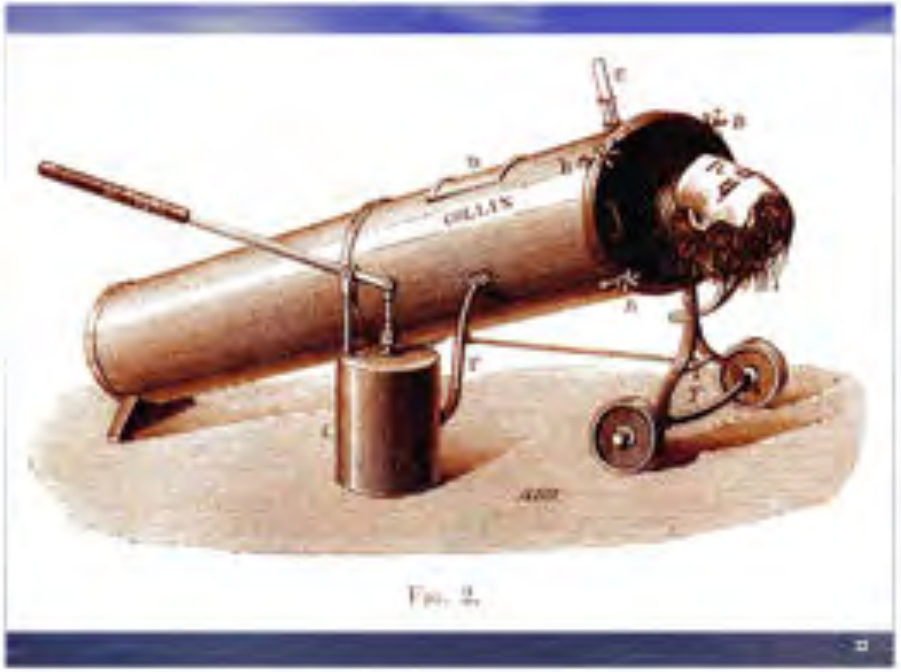
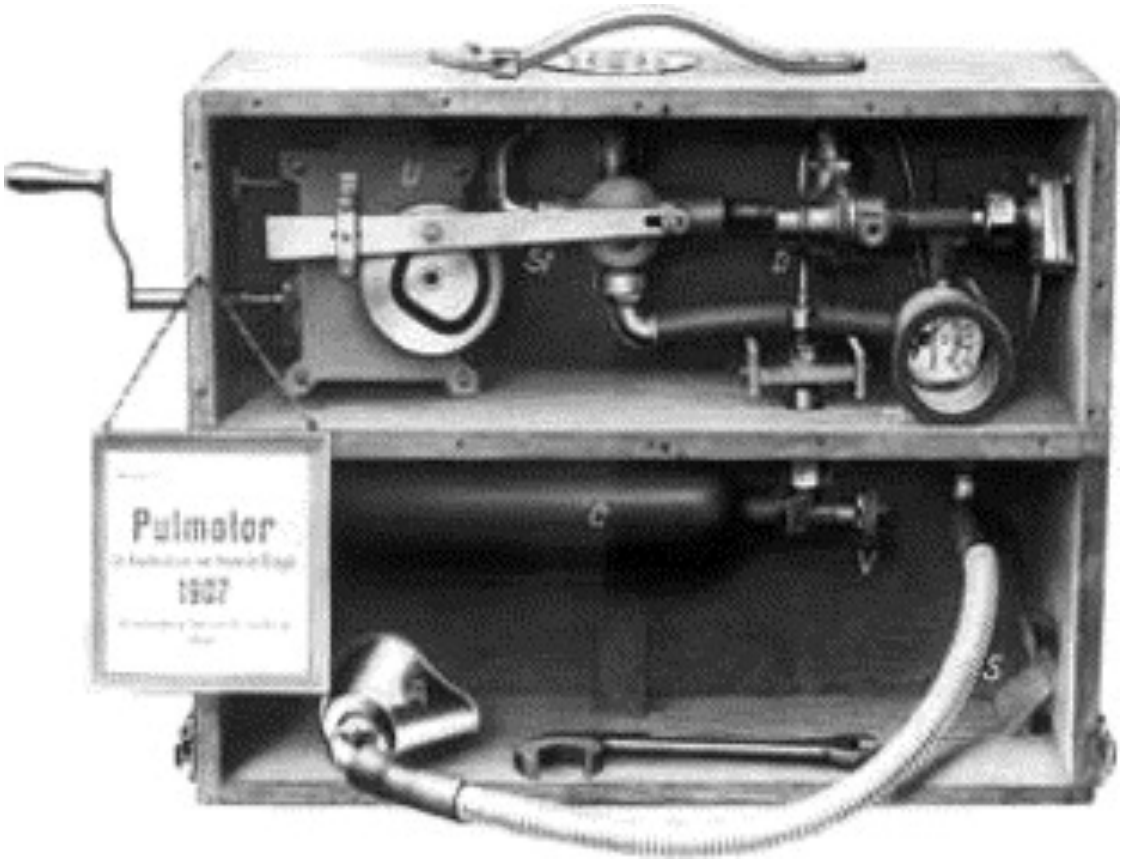
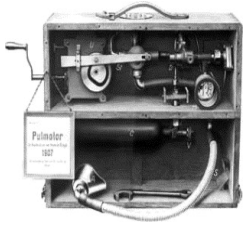


Fig. 2.

Le 2ème appareil…PULMOTOR **1907**



de H. Dräger,
Premier appareil **à pression** préréglée



1530

1907

Pression Positive

Pression négative

Fig. 1. – Schéma du Spirophore inventé par le Français Woilliez (1876).

1876

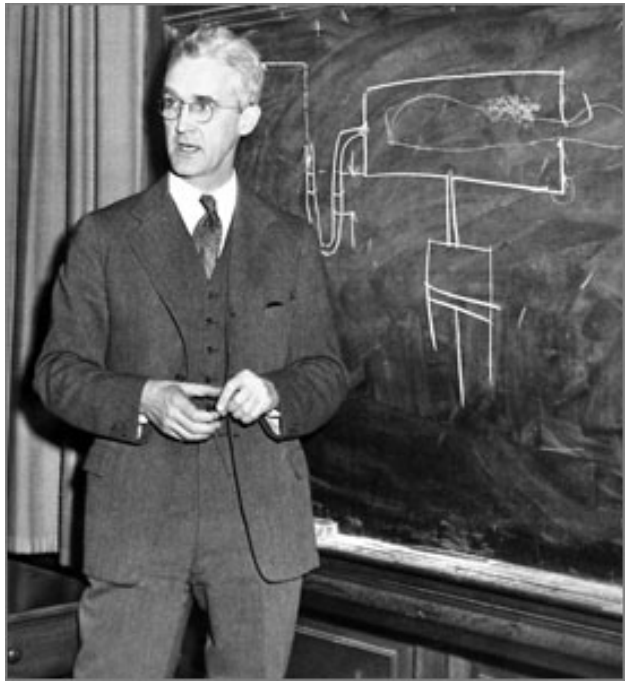
2018

1er ventilateur thérapeutique

1928

Pr Drinker , Children's Hospital de Boston

Miracle, il réveille un enfant de 8 ans avec polio hypercapnique et le maintient vivant 122 heures

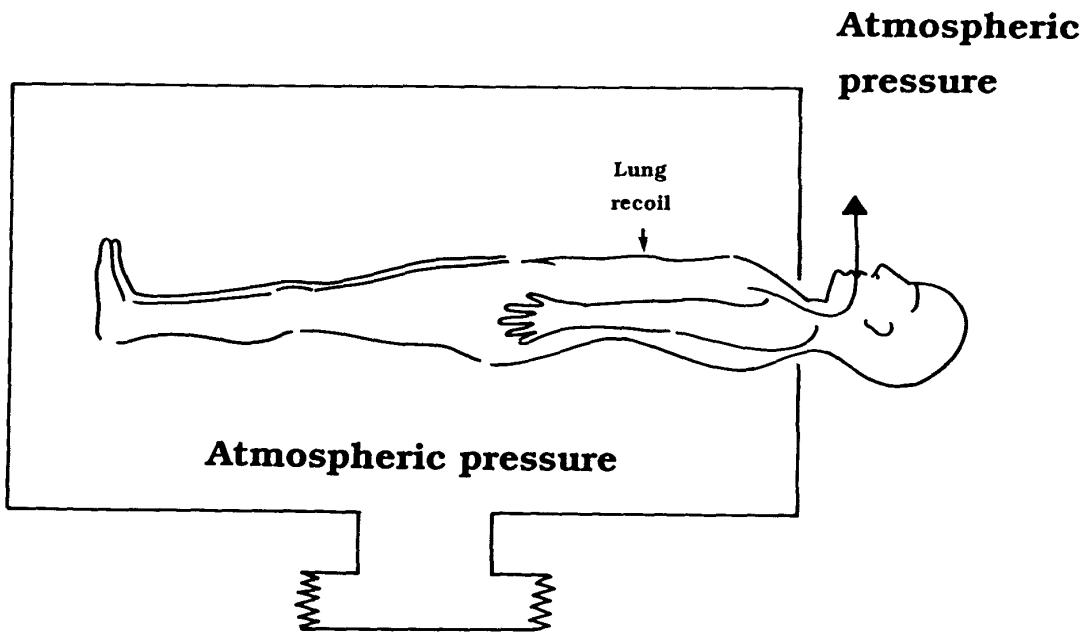


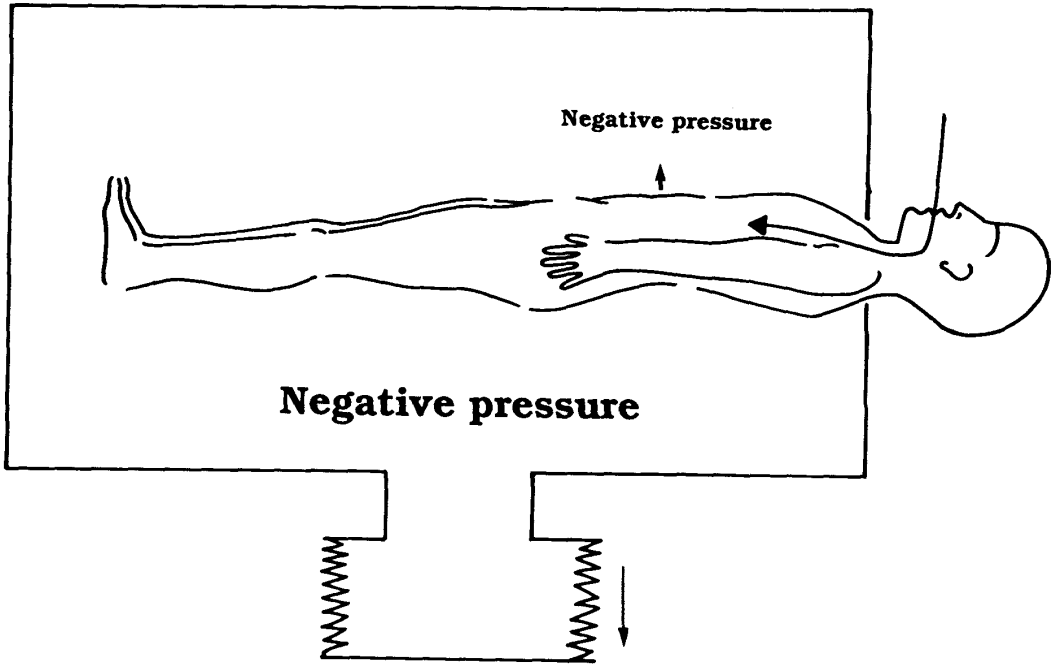
Mais Inconvénients:

Encombrant

Inconfort

Apnée Obstructive





La ventilation en pression négative

1876

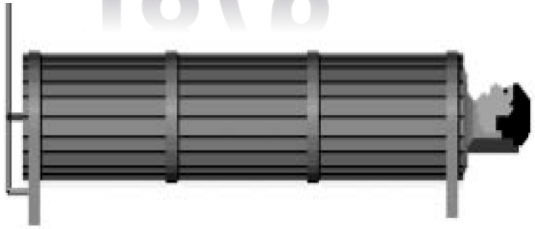


Fig. 1. - Schéma du Spirophore inventé par le Français Woilliez (1876).

1928

1er “poumon d’acier

1931

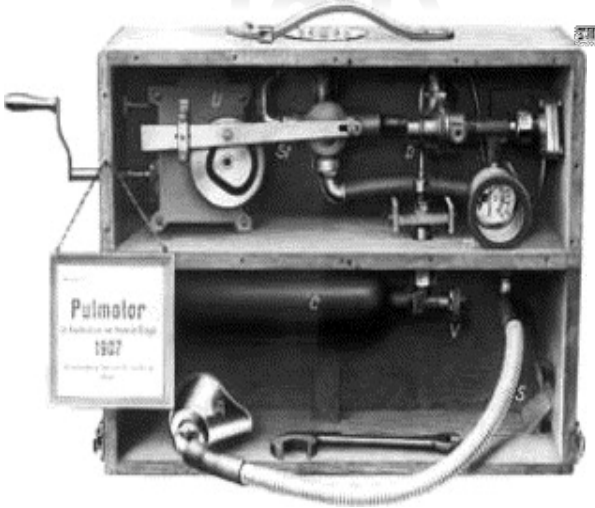
Emerson fabrique les premiers poumon d’acier

1939 : 935 poumon d’acier en Angleterre, les USA décident une production industrielle

Pendant ce temps…

la ventilation en pression positive prend un autre chemin

1907



1907: Le Pulmotor de H. Dräger,
Premier appareil à pression préréglée

1936

LEFT-SIDED HEART FAILURE WITH PULMONARY ŒDEMA

Spring attached to cover plate

Cross-piece A tapped to take screw

Screwed from here

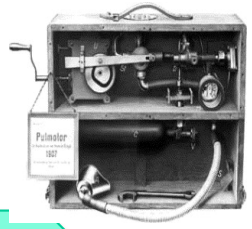
Tube to attachment to mask

Tube to manometer

PPC

1956

Relaxateur de pression



1530

1907

Pression Positive

1952
Epidemie Polio

2018

Pression négative

Fig. 1. – Schéma du Spirophore inventé par le Français Woilliez (1876).

1876

1931

L'épidémie mondiale de Polio

1952

France-soir

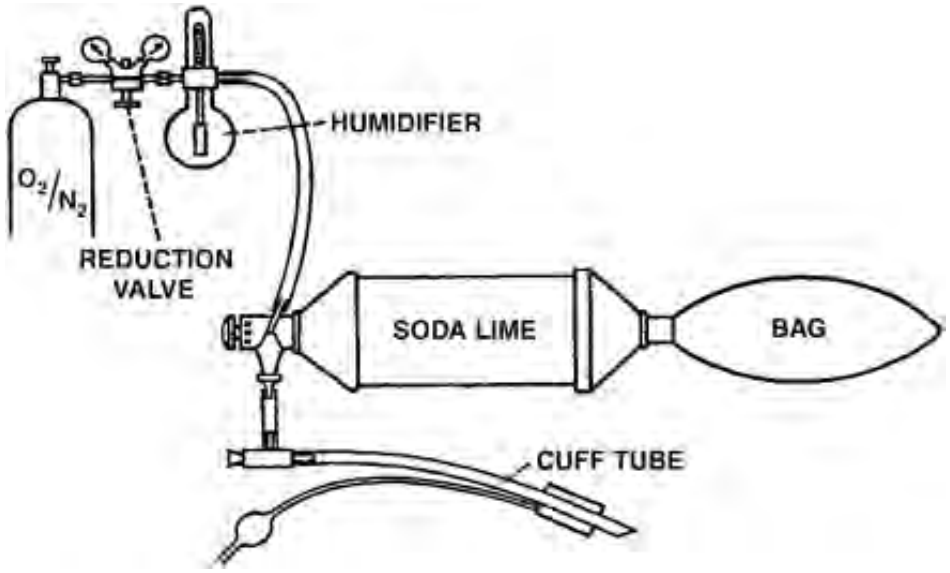
CORÉE Renforts européens chez les Sino-Coréens

Le général Ridgway a annoncé la présence, derrière les lignes rouges, de troupes « satellites » qui seraient prêtes à intervenir

A 25 KM. DE PARIS

Mystérieuse épidémie de poliomyélite à Jagny

Plus de 250 patients sous *bag ventilation*



Chaque jour plus de 200 étudiants se relevaient à tour de rôle

Passage en masse au poumon d'acier **1952**

….mais des malades restent malades! 1952

Miniaturisation des ventilateurs c’est parti!

Ventilation en Pression Négative par cuirasse

1956

Autres idées : Ventilation par « rocking bed »

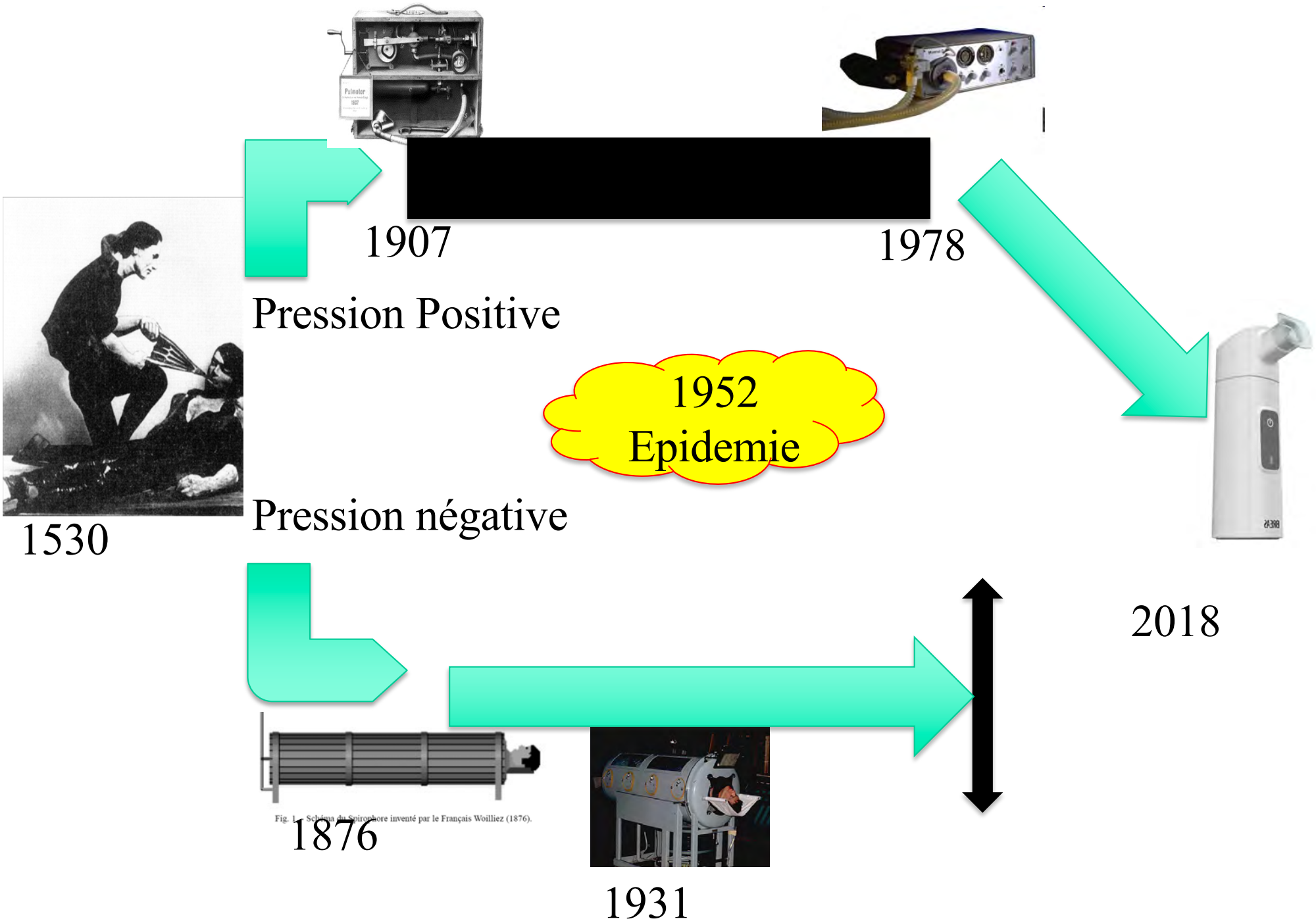
Retour de la ventilation en pression positive

1974

1) 1932 Trachéotomie : Wilson JL : Acute anterior poliomyelitis. N Engl J Med 1932

2) 1974 premier retour à domicile en France de malades trachéotomisés (Lyon, Garches ALLP et ADEP)

Ventilateur à soufflet RADCLIFE Et MONNAL en 1978


1907
1978
Pression Positive
1952
Epidemie
1530
Pression négative
2018
1876
1931

Fin des années 80

Essais de la VNI

D’abord par la bouche

MANAGEMENT OF END STAGE RESPIRATORY FAILURE IN DUCHENNE MUSCULAR DYSTROPHY

JOHN R. BACH, MD, JOHN O'BRIEN, MD, ROBERT KROTENBERG, MD, and AUGUSTA S. ALBA, MD

Le pionnier (en chronique) :
John Bach après son séjour en France

TRAITEMENT
PAR VENTILATION INSTRUMENTALE DE 100 CAS
D'INSUFFISANCE RESPIRATOIRE AIGUE SEVERE
($PaCO_2$ égale ou supérieure à 70 mmHg)
CHEZ DES PULMONAIRES CHRONIQUES

P. SADOUL, M.-C. AUG, R. GAY

A noter, le (vrai) pionnier
1964, Paul Sadoul…en aigu..

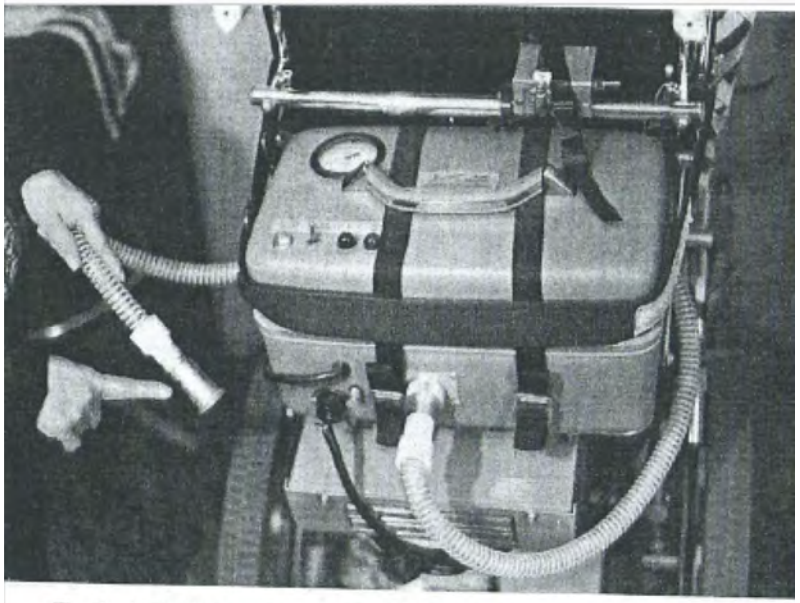
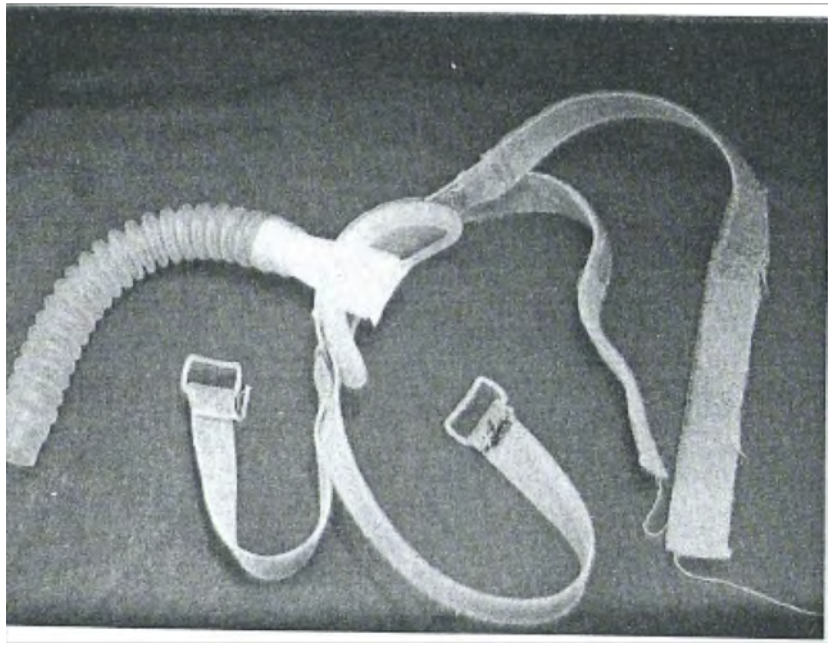


Fig. 2. Installation of portable ventilator and underlying charger.



D’abord par la bouche

MANAGEMENT OF END STAGE RESPIRATORY FAILURE IN DUCHENNE MUSCULAR DYSTROPHY

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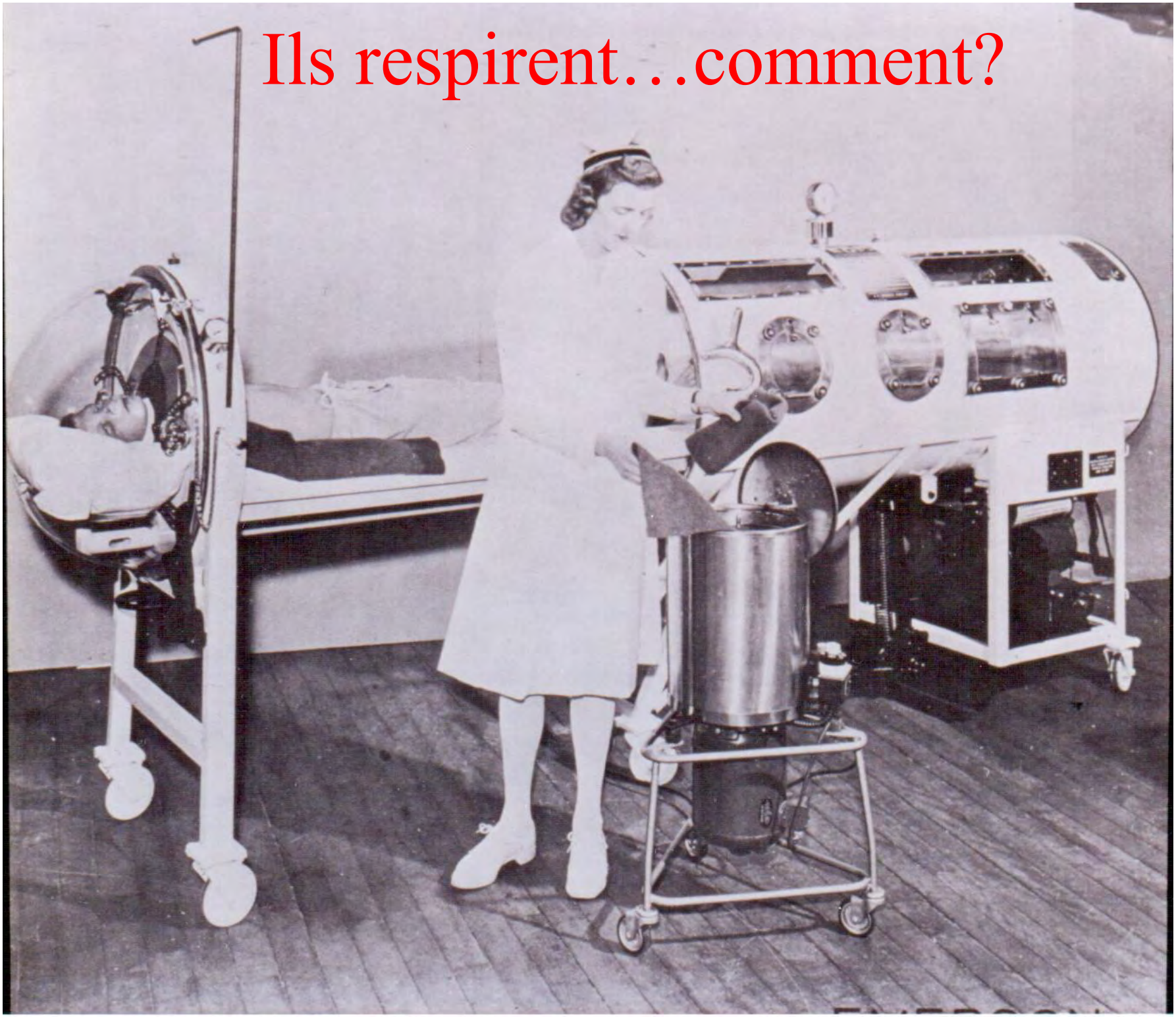
+ la respiration « FROG »

Ils respirent…comment?



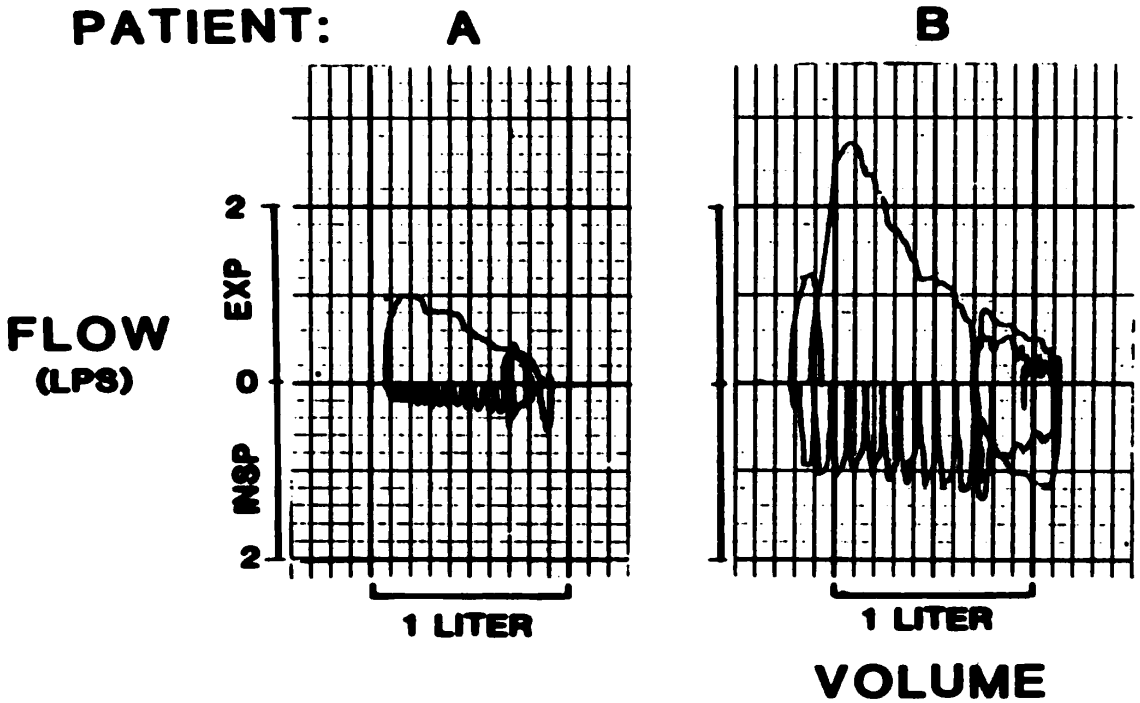
CHEST®

Official publication of the American College of Chest Physicians

The flow-volume loop during glossopharyngeal breathing

FG Mazza, AF DiMarco, MD Altose and KP Strohl

Chest 1984;85;638-640



SANS FROG AVEC FROG

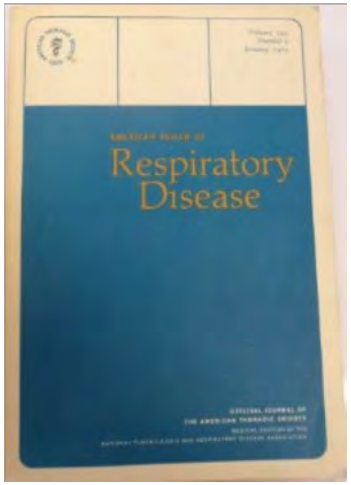
Et enfin…la vraie VNI

1987

Agressologie. 1987 Jun;28(7):737-8.

Early respiratory assistance by nasal route in Duchenne's muscular dystrophy.

Delaubier A.



Ellis ER, Bye PT, Bruderer JW, Sullivan CE. Treatment of respiratory failure during sleep in patients with neuromuscular disease. Positive-pressure ventilation through a nose mask.
. Am Rev Respir Dis. 1987 Jan;135(1):148-52.

1er malade chronique en VNI nasale **1987**

Intermittent positive pressure ventilation via nasal access in the management of respiratory insufficiency

JR Bach, A Alba, R Mosher and A Delaubier

Chest 1987;92;168-170

1er malade SLA en VNI Pancho

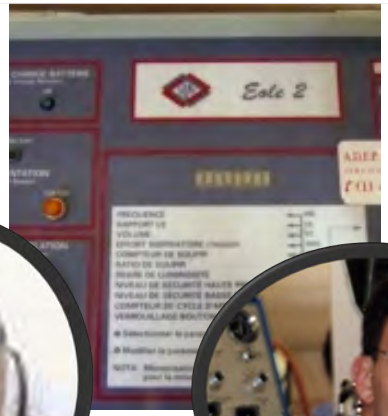
1987

Pr Similowski-Pr Meininger-Pr Dautzenberg, Hôtel-Dieu 1987, avec un poncho et un ventilateur du CARDIF

Puis 20 ans d'amélioration techniques

1964
rea

1978
Chron



1990
Rea

2000
Chron

Et…le ventilateur à turbine !! 1990

- Monnal D 1975
- Bipap ST D 1990

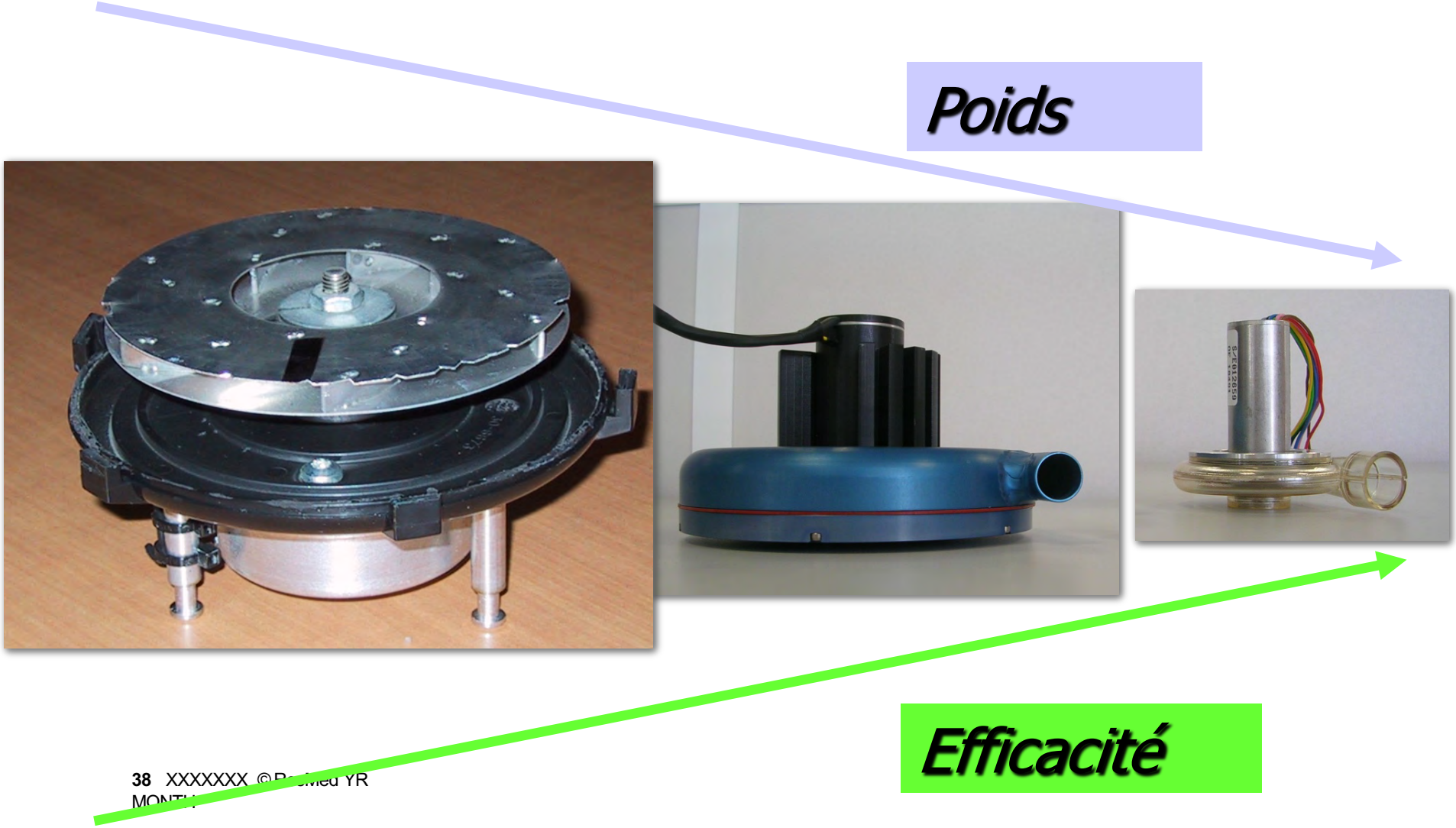
[The Monnal D respirator]
7. Robert D, Bidolet T.
Agressologie. 1984 Apr;25(4):445-8. French.
PMID: 6591829 [PubMed - indexed for MEDL

Obstructive Sleep Apnea Treated by Independently Adjusted Inspiratory and Expiratory Positive Airway Pressures via Nasal Mask* *(Chest 1990; 98:317-24)*

Physiologic and Clinical Implications

Mark H. Sanders, M.D., F.C.C.P.;† and Nancy Kern, C.R.T.T., R.PSG.T.

Mais la victoire des ventilateurs à turbine et à pression



Depuis 2000

Amélioration de l'utilisabilité

Amélioration de la compréhension Médecin/Machine

Miniaturisation

Amélioration de l'utilisation

2006

Eur Respir J 2006; 27: 1236–1243
DOI: 10.1183/09031936.06.00078805
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Evaluation of the user-friendliness of 11 home mechanical ventilators

J. Gonzalez-Bermejo*, V. Laplanche*, F.E. Husseini#, A. Duguet*, J-P. Derenne*# and T. Similowski*#

Résultats manifestes

2000

2015

SOMNOVNI
Groupe du GAV

Prs, Pepin, Janssens,Rodenstein
Drs Rouault, Rabec, Perrin, Langevin, Léger, Gonzalez-Bermejo

THORAX

Thorax 2010 et revue des maladies respiratoires 2013
(libre accès en pdf sur www.splf.org)

Review series

Non-invasive ventilation during sleep: time to define new tools in the systematic evaluation of the technique

Mark W Elliott

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Received 6 May 2010
Accepted 11 May 2010

ABSTRACT
Non-invasive ventilation (NIV) has been remarkably effective in the management of chronic respiratory failure, despite initially rudimentary equipment and limited understanding of what was actually happening, minute by minute when ventilation was applied. Modern ventilators, controlled by complex algorithms, and with integrated monitoring allow for sophisticated customisation of ventilatory support to an individual. However, if problems with ventilation are not recognised, and their significance understood, they cannot be fixed. Experience of monitoring during sleep from patients predominantly with sleep apnoea can be transferred and extended to patients receiving NIV. This article, the first in a series, explores the rationale for NIV and how its

through the ventilator itself or external stand-alone devices. Despite this, monitoring during NIV remains rudimentary. In a patient who is doing well and tolerating NIV, this is usually adequate. However, when the patient tolerates NIV poorly or does not derive symptomatic benefit, more sophisticated monitoring is required; if a problem cannot be identified it cannot be fixed. This is the first article in a series, which explores these issues in greater detail.

WHAT NEEDS TO BE FIXED BY NIV?
To understand how assisted ventilation helps patients, an understanding of the pathophysiology of ventilatory failure and the way in which venti-

Review series

Ventilator modes and settings during non-invasive ventilation: effects on respiratory events and implications for their identification

Claudio Rabec,[1] Daniel Rodenstein,[2] Patrick Leger,[3] Sylvie Rouault,[4] Christophe Perrin,[5] Jésus Gonzalez-Bermejo,[6] on behalf of the SomnoNIV group

[1]Service de Pneumologie et Réanimation Respiratoire, Centre Hospitalier et Universitaire de Dijon, Dijon, France
[2]Service de Pneumologie, Cliniques Universitaires Saint Luc, Université Catholique de Louvain, Bruxelles, Belgium
[3]Service de Pneumologie, Centre Hospitalier Lyon Sud, Lyon France

ABSTRACT
Compared with invasive ventilation, non-invasive ventilation (NIV) has two unique characteristics: the non-hermetic nature of the system and the fact that the ventilator-lung assembly cannot be considered as a single-compartment model because of the presence of variable resistance represented by the upper airway. When NIV is initiated, the ventilator settings are determined empirically based on a clinical evaluation and diurnal blood gas variations. However, NIV is

is generally applied at night, nocturnal monitoring seems the best way to assess its effects. Although nocturnal monitoring of continuous positive airway pressure (CPAP) has been codified in the treatment of patients with obstructive sleep apnoea syndrome,[6] this is not the case with NIV.[7 8] Nocturnal monitoring of NIV is far more difficult and unforeseen problems arise for many reasons: (1) sleep can induce profound ventilatory changes, in particular in patients with respiratory insuffi-

Review series

Nocturnal monitoring of home non-invasive ventilation: the contribution of simple tools such as pulse oximetry, capnography, built-in ventilator software and autonomic markers of sleep fragmentation

Jean-Paul Janssens,[1] Jean-Christian Borel,[2,3] Jean-Louis Pépin,[2] on behalf of the SomnoNIV Group

[1]Division of Pulmonary Diseases, Geneva University Hospital, Geneva, Switzerland
[2]Pole Rééducation et Physiologie et Laboratoire HP2, INSERM ERI 0017, Université Joseph Fourier, Grenoble, France
[3]Association médico-technique AGIR à dom, Meylan, France

ABSTRACT
Complex respiratory events, which may have a detrimental effect on both quality of sleep and control of nocturnal hypoventilation, occur during sleep in patients treated with non-invasive ventilation (NIV). Among these events are patient-ventilator asynchrony, increases in upper airway resistance (with or without increased respiratory drive) and leaks. Detection of these events is important in order to select the most

dioxide tension (P_{tcCO_2}). The latest generation of home ventilators[3] are often equipped with sophisticated built-in software capable of recording a wide range of parameters over several months, and thus offering information to the clinician on items such as compliance and leaks, among many other respiratory parameters.

This review describes the contributions, limits and caveats of non-invasive assessment of NIV

Review series

Proposal for a systematic analysis of polygraphy or polysomnography for identifying and scoring abnormal events occurring during non-invasive ventilation

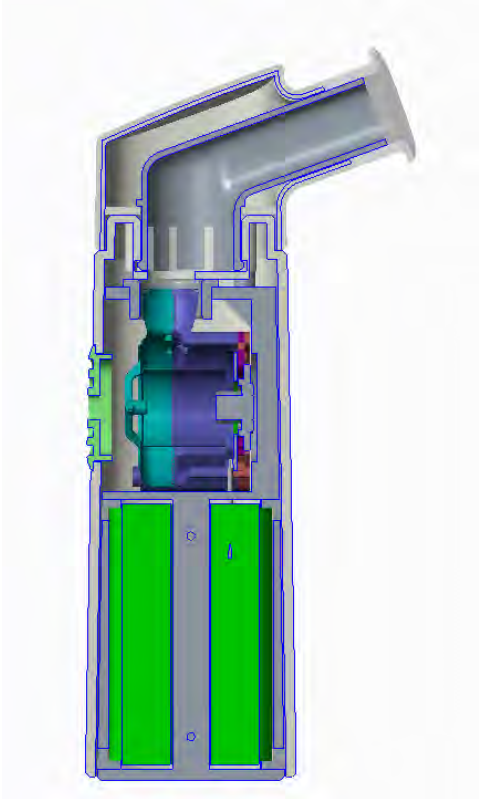
J Gonzalez-Bermejo,[1] C Perrin,[2] J P Janssens,[3] J L Pepin,[4] G Mroue,[5] P Léger,[6] B Langevin,[7] S Rouault,[8] C Rabec,[9] D Rodenstein,[10] on behalf of the SomnoNIV Group

[1]Service de Pneumologie et Réanimation Respiratoire, Hôpital de la Pitié-Salpêtrière, Assistance Publique-Hôpitaux de Paris, ER10 UPMC, France
[2]Service de Pneumologie, Centre Hospitalier de Cannes, Cannes, France
[3]Pulmonary Division, Geneva University Hospital, Geneva, Switzerland

ABSTRACT
Non-invasive ventilation (NIV) is recognised as an effective treatment for chronic hypercapnic respiratory failure. Monitoring NIV during sleep may be preferable to daytime assessment. This paper reports the findings of an international consensus group which systematically analysed nocturnal polygraphic or polysomnographic tracings recorded with either volume-cycled or pressure-cycled ventilators. A systematic description of nocturnal

polysomnography (PSG) or ventilatory polygraphy (PG) during NIV in some patients. However, appropriate analysis of PG or PSG recordings must take into account the type of ventilator used (volume- or pressure-cycled), ventilator settings (ventilatory mode, triggers) and choice of interface (nasal or full face mask)[12] (see paper by Rabec *et al*[13] in this series). Recent observations have shown that standard definitions for nocturnal respiratory

2018 Miniaturisation



Conclusion

un long chemin, mais qui reste depuis 200 ans dans le même paradigme…souffler dans un malade

1830

2018

L'Éternel Dieu forma l'homme de la poussière de la terre, il souffla dans ses narines un souffle de vie et l'homme devint un être vivant.
(Genèse 2,7)