

## The Percusioscope SPS

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### Abstract

As it has been known in the medical practice that completion of a complete medical examination for any patient in the examination room at the hospital by the physician, must pass the four stages of clinical examination namely :

1. Inspection, means looking to the patient to discover or note any abnormality.
2. Palpation, for any abnormality that can be felt by hands especially abdomen.
3. Auscultation, to hear sounds like intensity of breathing sounds, gases in abdomen, heart sounds.
4. Percussion, is a method of tapping on a surface to determine the underlying structure, and is used in clinical examinations to assess the condition of the thorax or abdomen. Here after completion of the above stages of clinical examinations and interpretation of our finding, we will know the full story of what the patient is suffering from and eventually we reach the diagnosis. So we conclude that auscultation has brought a significant success in the field of medical diagnostics. The other significant diagnostic procedure of clinical diagnosis is the percussion which has been done manually nowadays by using our hand fingers and this procedure is hard and not so precise, from here the idea and design of the percusioscope has been innovated to produce a diagnostic simple instrument that eliminates the manual procedure into a mechanical or electric one as will be explained in this abstract.

**Keywords:** Stethopercusioscope; Stethovibrascope; Stethopercussioivibrascope; Stethopercussioivibrascope.

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## 1- Auscultation

The stethoscope was invented in France in 1816 by René Laennec at the Necker-Enfants Malades Hospital in Paris [1,2,3]. Laennec called his device the "stethoscope"[4] (stetho- + -scope, "chest scope").

The ordinary medical stethoscope is an acoustic medical device for auscultation, or listening to the internal sounds of an animal or human body. It typically has a small disc-shaped resonator that is placed against the chest, and two tubes connected to earpieces. It is often used to listen to lung and heart sounds. It is also used to listen to intestines and blood flow in arteries and veins (figure 1).

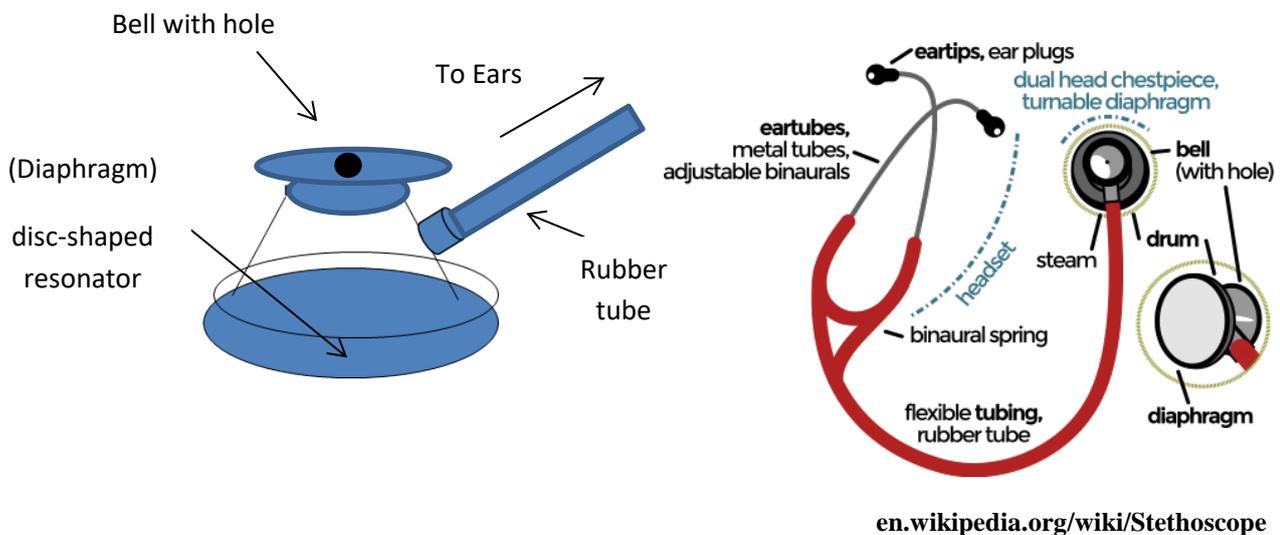


Figure 1: The ordinary medical stethoscope

## 2- Types of The ordinary medical stethoscope:

### 1. Acoustic stethoscope:

With the bell upwards Acoustic stethoscopes are familiar to most people, and operate on the transmission of sound from the chest piece, via air-filled hollow tubes, to the listener's ears.(figure 1).

### 2. Electronic:

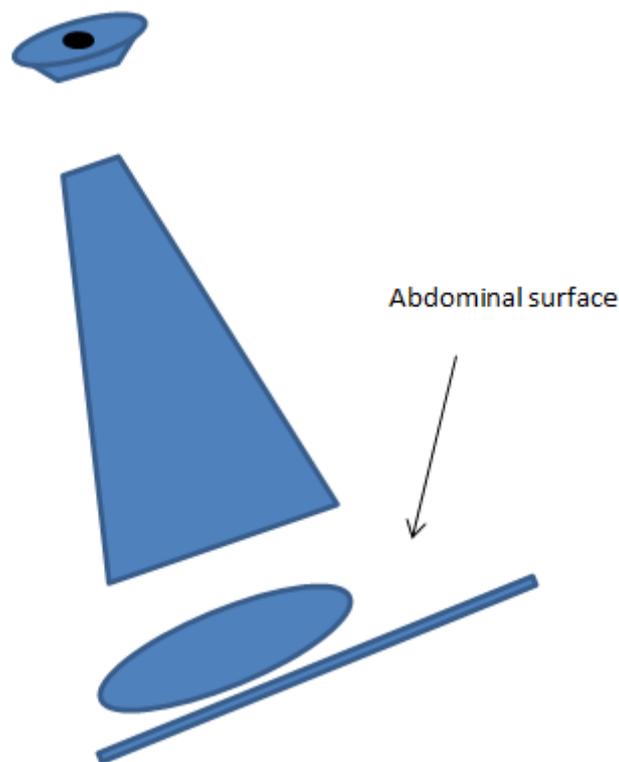
An electronic stethoscope (or stethophone) overcomes the low sound levels by electronically amplifying body sounds. However, amplification of stethoscope contact artifacts, and component cut-offs (frequency response thresholds of electronic stethoscope microphones, pre-amps, amps, and speakers) limit electronically amplified stethoscopes' overall utility by amplifying mid-range sounds, while simultaneously attenuating high- and low-frequency range sounds

### 3. Recording:

Some electronic stethoscopes feature direct audio output that can be used with an external recording device, such as a laptop or MP3 recorder. The same connection can be used to listen to the previously recorded auscultation through the stethoscope headphones, allowing for more detailed study for general research as well as evaluation and consultation regarding a particular patient's condition and telemedicine, or remote diagnosis [5].

#### 4. Fetal

A fetal stethoscope or fetoscope is an acoustic stethoscope shaped like a listening trumpet. It is placed against the abdomen of a pregnant woman to listen to the heart sounds of the fetus.[6] The fetal stethoscope is also known as a Pinard horn after French obstetrician Adolphe Pinard (1844–1934). (figure 2) :



**Figure 2:** acoustic stethoscope shaped like a listening trumpet

#### 3- Percussion:

Percussion is a method of tapping on a surface to determine the underlying structure, and is used in clinical examinations to assess the condition of the thorax or abdomen. It is one of the five methods of clinical examination, together with inspection, palpation, auscultation, and inquiry. It is done with the middle finger of one hand tapping on the middle finger of the other hand using a wrist action figure 1. ( The ideal Method). The nonstriking finger (known as the pleximeter) is placed firmly on the body over tissue. When percussing bony areas such as the clavicle the pleximeter can be omitted and the bone is tapped directly such as when percussing an apical cavitory lung lesion typical of TB [7].

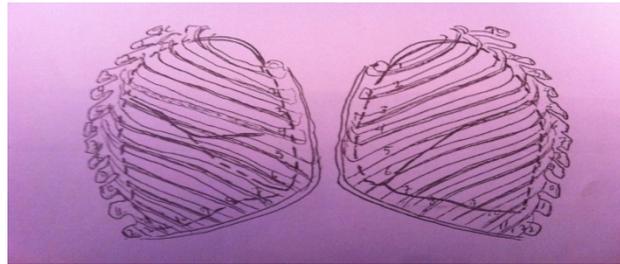
There are two types of percussion: direct, which uses only one or two (fingers 3,4), and indirect, which uses the middle/flexor finger. There are four types of percussion sounds: resonant, hyper-resonant, stony dull or dull. A dull sound indicates the presence of a solid mass under the surface. A more resonant sound indicates hollow, air-containing structures. As well as producing different notes which can be heard they also produce different sensations in the pleximeter finger figure 3. Also used to distinguish between ascites and tympanites [8]

Practicing percussion on clinical fields is very important action for the diagnosis of a wide Range of diseases especially chest and abdomen.

In Thorax, figure (1,2,3,4,5,6) [9]. It is used to diagnose pneumothorax, emphysema and other diseases on the main sites as shown in (figure . It can be used to assess the respiratory mobility of the thorax.

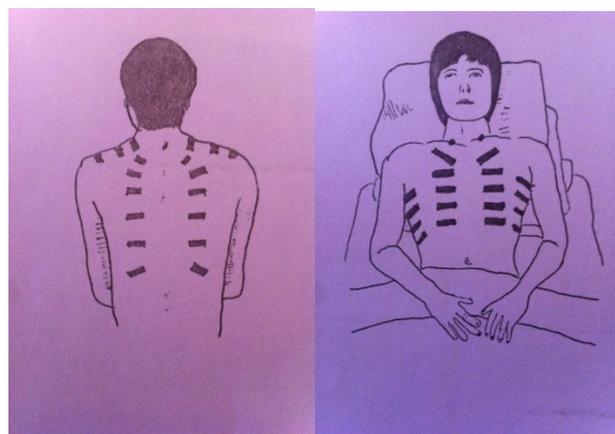
In Abdomen, It is used to find whether any organ is enlarged and similar (assessing for organomegaly). It is based on the principle of setting tissue and spaces in between at vibration. The sound thus generated is used to determine if the tissue is healthy or pathological.

#### **The Thoracic Cage Where Percussions Typically applied:**

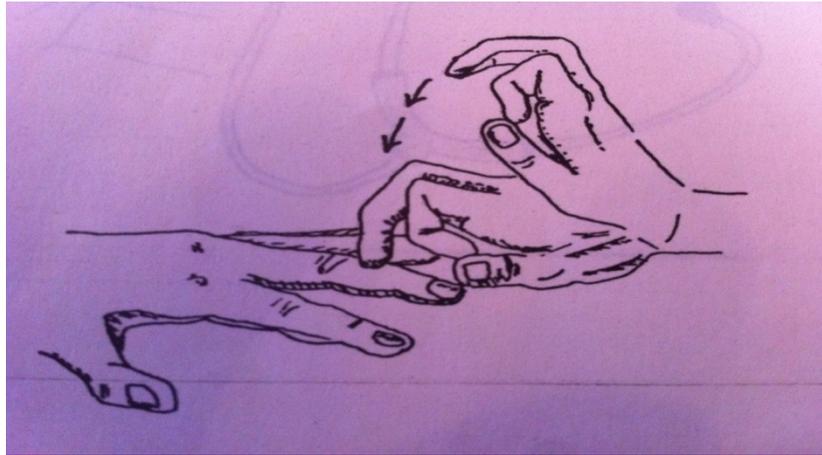


**Figure 3:** Adapted from John Macleod. John Munro. Clinical Examination, Seventh Edition.

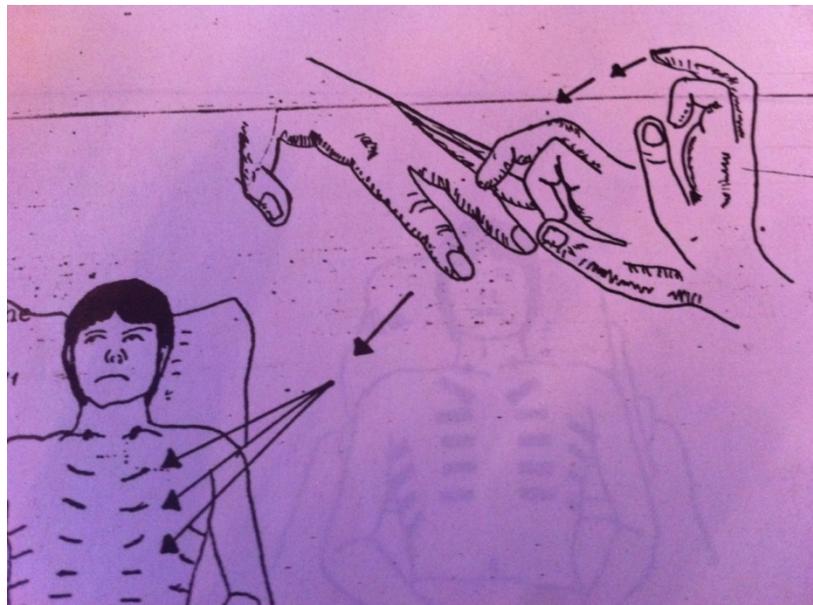
#### **Main Sites of chest Percussion:**



**Figure 4:** The Clinical Percussion Manoeuvre



**Figure 5:** The ideal Method of Clinical Percussion



**Figure 9:** adapted from John Macleod. John Munro. Clinical Examination, Seventh Edition [10].

**Interpretation of received sounds:**

Based on the auditory and tactile perception, the notes heard can be categorized as: [11]

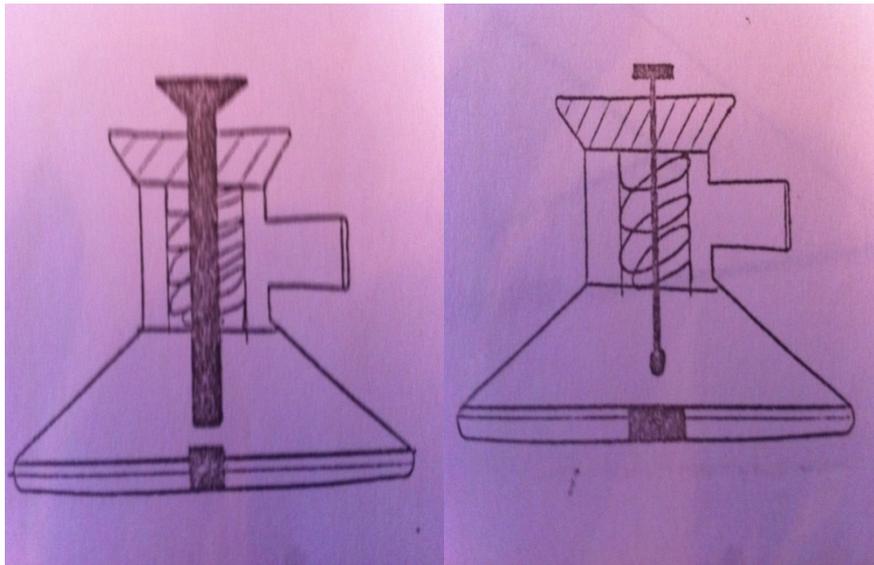
Tympanitic, drum-like sounds heard over air filled structures during the abdominal examination [12].

Hyper resonant (pneumothorax) said to sound similar to percussion of puffed up cheeks.

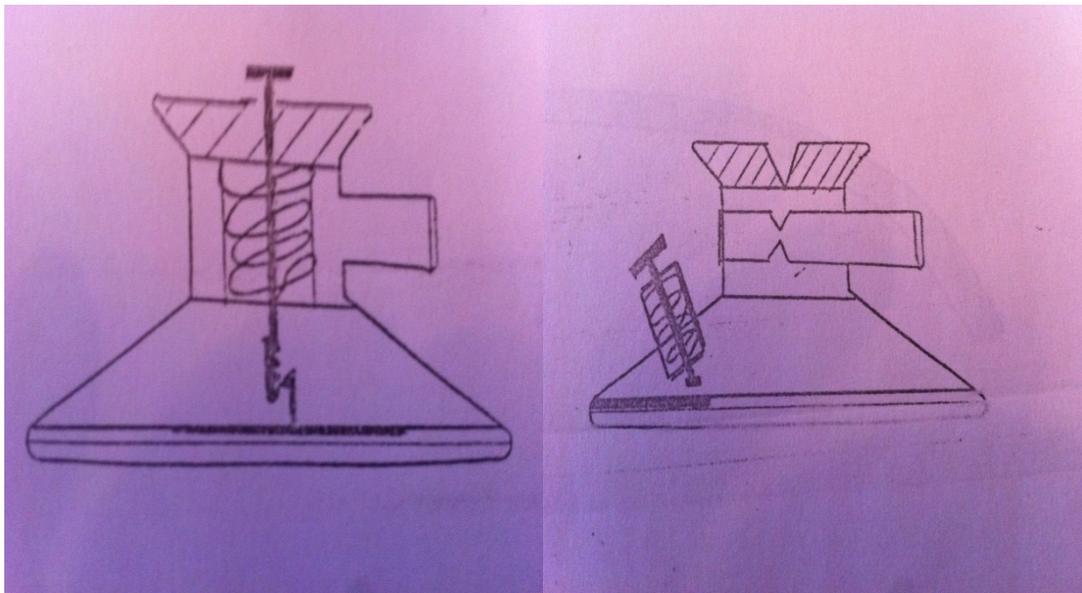
Normal resonance/ Resonant the sound produced by percussing a normal chest.

Impaired resonance (mass, consolidation) lower than normal percussion sounds.

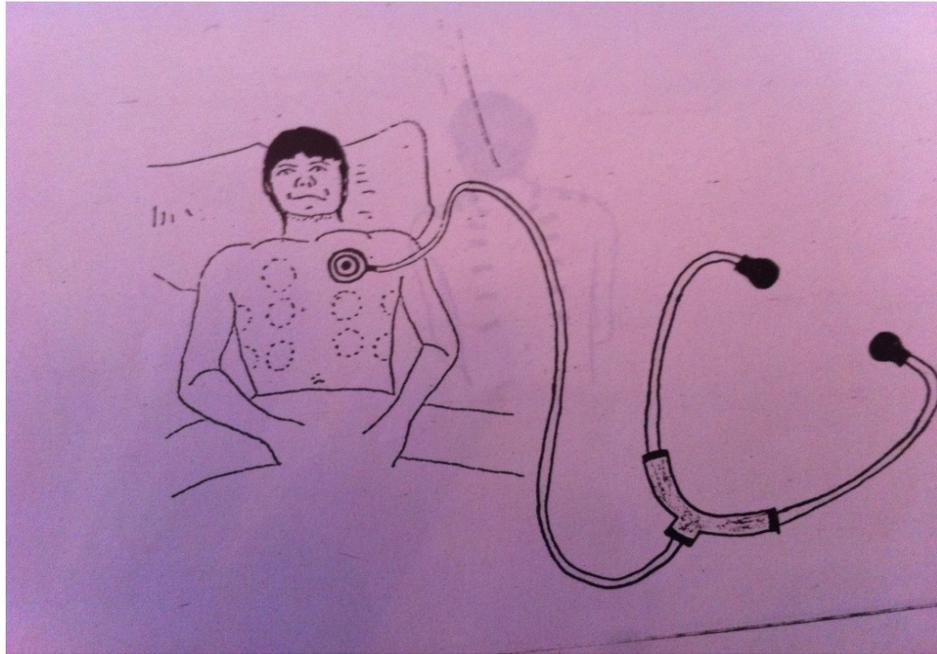
Dull (consolidation) similar to percussion of a mass such as a liver. Stony dull the sounds produced on percussion from the pleximeter with no contribution from the underlying area. Percussion may induce pain, this is often also noted as it can indicate underlying pathology. As we know that the percussion is an important clinical method applied on the patient's body by the physician's fingers for diagnosis of certain diseases especially the lung diseases, by tapping the patient body (percussion) the percussion note will be transmitted back through the air then interpreted by the physician's own ears. So Percusioscope is a new modern design for modification and upgrading of the commonly practiced ordinary medical stethoscope, (figure 6,7) .



**Figure 6:** Different Manual Percusioscope Designs



**Figure 7:** Practicing of Percussion on the Patient :



**Figure 10**

**The above manoeuvre can be replaced by:**

Mechanical Stethopercusioscope (SPS) as shown below (figure4,56) operated by pressing the hammer downwards and its metallic bar will hit the metallic or plastic plate on the membrane of the stethoscope and returned back by the power of the spiral spring and so forth, here the percussion note will be transmitted along the stethoscope through the external pipe to the ears and then interpreted by the physicians, here auscultation and Percussion can be performed at the same time.

**Advantages of the Stethopercusioscope:**

1. Simple to use.
2. Auscultation and Percussion can be done at the same time.
3. More precise and nicety.
4. Keeping the patients comfortable with less pain from manual percussion.
5. Direct contact to the patient and elimination of the surrounding media.

**4. The Manual Design:**

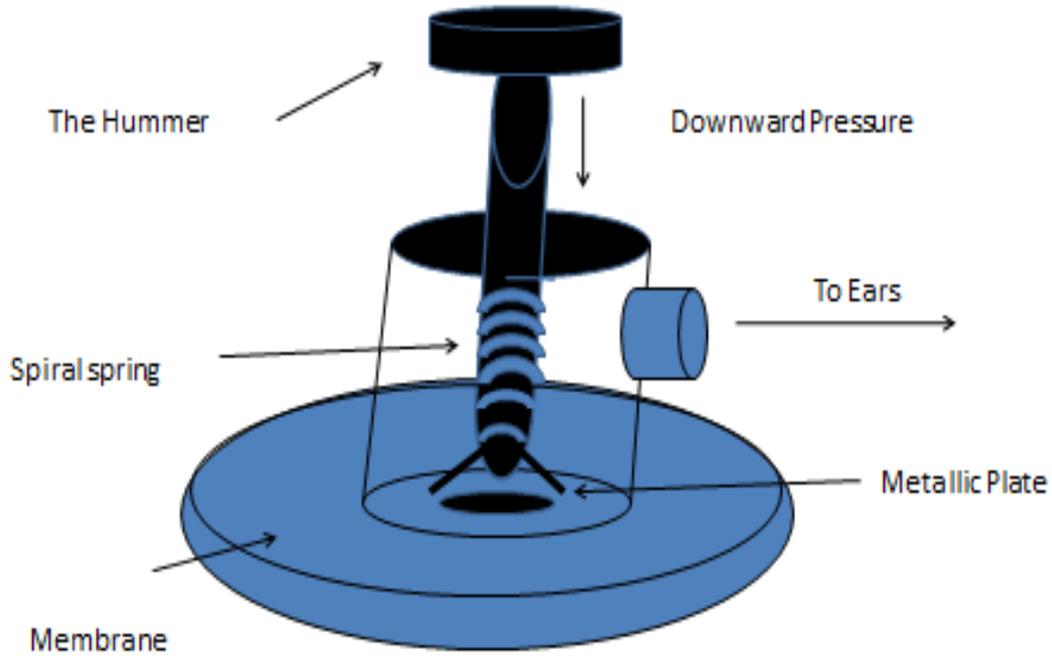
By Stethopercusioscope (figure 8), becomes easy to hear sounds in lung, heart and abdomen which is

The function of the ordinary stethoscope as well as at the same time we hear the percussion note which gives

a clue regarding the underlying pathology and subsequently a full story is then obtained.

As we know the mechanism of action, we could manufacture the Stethopercusioscope mechanically or electronically by different designs using batteries.

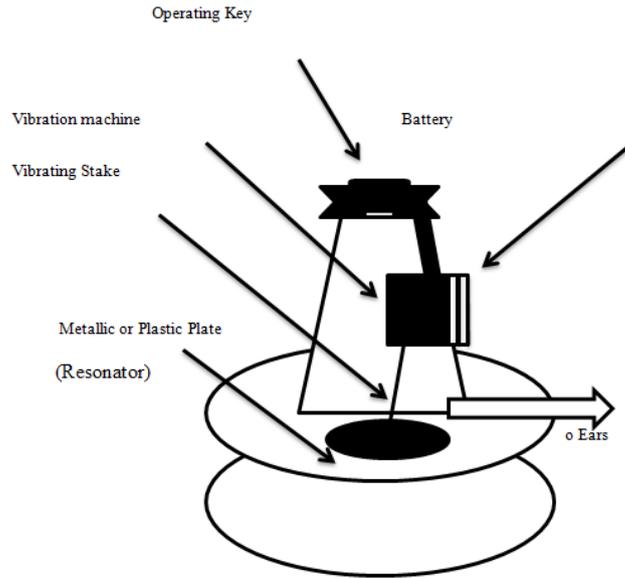
(SPS)



## SPS

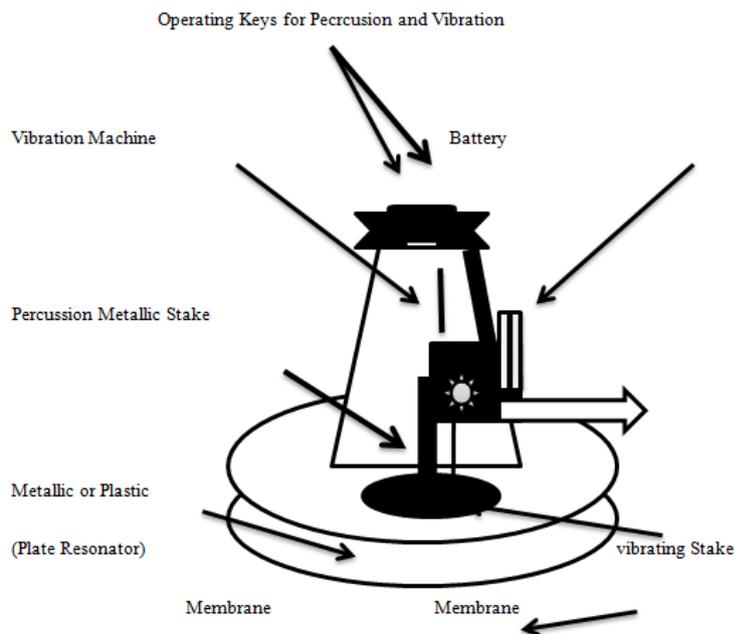
**Figure 8:** Stethopercusioscope

We could also receive a vibration sound by using a small vibration machinery instead of the percussion note, then our machine will be called Stethovibrascope SVS, (figure 7) , this is A more sophisticated operating machine could be used for the same purpose explained above, look to the figure below :



**Figure 7:** Sthetovibrascope. ( SVS )

By the way, there is a so much sophisticated design (Sthetopercussioivibrascope) SPVS, (figure 8), if we combine the three methods in one practice that means 3 in 1, namely Stethoscope, Percusioscope and Vibroscope, that is to say we hear or auscultate sounds, percussion notes and vibration sense or notes which were operated by a fixed machine that transmitted through the pipe to our ears for interpretation, look below (SPVS).



**Figure 8:** Sthetopercussioivibrascope

## 5. Significance on the study:

1. Up grading of the ordinary medical stethoscope.
2. To combine the ordinary medical stethoscope with other techniques.
3. Direct contact with the patient and elimination of the surrounding media (SPS).
4. Beating of three birds by a single stone (SPVS).

## 6. Recommendations

Our work shows the invention of the Percussioscope and at the same time has shown to be an upgrading the ordinary stethoscope to be a combined with the percussion at the same time. Here the manual manoeuvre which has been used by hands is replaced mechanically as well as electrically and I am sure that these designs after being manufactured by expert engineers in some of the world well-recognised companies will succeed and will produce a potential progress in clinical diagnostics backgrounds. And every physician in the world will possess one of these designs which will be used in hospitals clinical application and I am very enthusiastic for any company around the globe to join me for manufacturing of this wonderful modern designs which will be definitely a doctor concomitant elsewhere very soon. Despite the invention is being simple but the main purpose is hidden within its idea.

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