

The stethometer : an instrument for ascertaining the difference in the mobility of opposite sides of the chest, and thus facilitating diagnosis / by Richard Quain.

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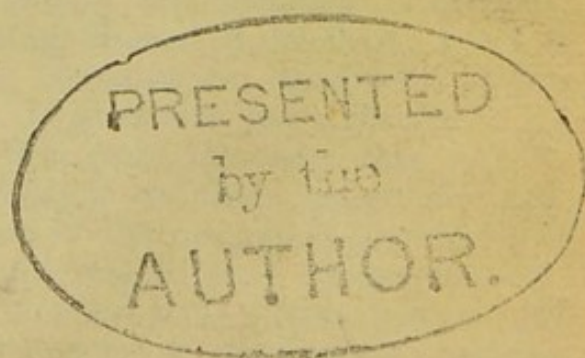
THE
STETHOMETER:

AN INSTRUMENT FOR ASCERTAINING THE
DIFFERENCE IN THE MOBILITY OF
OPPOSITE SIDES OF
THE CHEST,

And thus facilitating Diagnosis.

BY RICHARD QUAIN, M.D.

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STETHOMETER.

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LONDON:
RICHARDS, PRINTER, 100, ST. MARTIN'S-LANE.

AND THIS INVENTION IS REGISTERED.

BY RICHARD RICHARDS, M.D.

THE STETHOMETER:

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OF OPPOSITE SIDES OF THE CHEST.

It is well known, that the movements of the walls of the chest, during respiration, correspond to, and are influenced by, the state of the organs placed within or beneath them. Hence, then, in our investigations of the diseases of these organs, we invariably, and frequently in the first instance, examine these movements. In many cases, the modifications produced by disease are so great as to be at once evident to the eye, or to the eye assisted by the hand. In other, and much more numerous cases, the eye and hand cannot detect these alterations. Indeed, nothing is more common than to find observers, at the same moment, differing in opinion as to the greater or less mobility of a portion of one or other of the sides of the chest. Even the indefinite terms here used, "greater" or "less", become sources of fallacy and doubt. It is, therefore, very desirable that a mode of investigation, admitted by all to be most important, should be exact for observation, and definite for description. I felt this more particularly some years ago, when engaged in clinical demonstrations to students, of the different modes of investigating diseases of the chest; and I at that time endeavoured by various contrivances, constructed chiefly on the principle of the callipers, to surmount the difficulty. My friend, Dr. Sibson, was, however, then more successful than myself; and he introduced an instrument which, in his hands, has afforded very important results in the investigation of the respiratory movements of the chest and abdomen, both in health and disease.¹ Subsequent consideration led me to believe that an instrument, simple, portable and economical, capable of ready application and of affording very valuable

¹ Medico-Chirurgical Transactions, vol. xxxi.

information, might be constructed, on a different principle to any which I had previously seen. I explained my requirements to Mr. Delolme, chronometer maker, whose ingenuity has supplied many ingenious and beautiful contrivances of an analogous kind. The result has been the little instrument which I am now going to describe, and which has, in the hands of those who have used it, as well as in my own, been found very efficient for the intended object: viz., to measure the comparative mobility of opposite sides of the chest. It is susceptible of many other applications, to some of which I shall again refer, and which will, no doubt, suggest themselves to those into whose hands it may fall.

DESCRIPTION. The little instrument (see fig. 1¹) consists of a flat

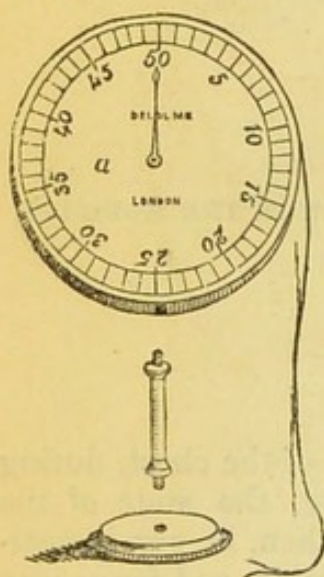


Fig. 1.

case, not unlike a watch-case: on its upper surface is a graduated dial and an index, which stands at a maximum number, that may be considered a "zero." This case contains a very simple movement, by means of which the index can be acted on. A silk cord, which may be of a sufficient length to surround one-half, or the whole circumference of the chest, passes through an aperture in one side of the case. This cord acts on the index. When the cord is drawn out, or extended for the space of one quarter of an inch, it will be observed that the point of the index will once traverse the circumference of the graduated dial. In other words, when the index has gone once round, it shows that the cord has been extended one fourth of an inch. It will be further seen, that the dial is

graduated, or divided, into fifty equal parts. Each of these parts is, therefore, equal to the fiftieth part of a quarter of an inch; that is, to the 1-200th of an inch.² The index is further capable of going round a second time, on an additional quarter inch of the cord being drawn out. Hence, two revolutions of the index are equal to half an inch of movement—an extent of motion sufficient for all practical purposes. The pedestal and circular foot, shown in the same figure, will be subsequently referred to.

MODE OF APPLICATION. It is quite evident, that if the instrument be so placed that extension be made on the cord, the amount of the extension will be shown by the movement of the index on the dial. For example (as in fig. 2) if the instrument is laid flat on the spine, and held in its place by the first and second fingers of the left hand, whilst the cord is carried round the chest, and pressed on one of the ribs, or the sternum, by the fingers of the right hand, then, when the individual under examination expands the chest during inspiration, the amount of expansion will be communicated to the cord, and thus indicated on the dial. The cord may then be directed around the opposite side of the

¹ The instrument is reduced in this sketch to half size.

² In making and recording observations with this instrument, I am in the habit of expressing a fact thus: right apex, 30; left, 15. It will be understood that the motion is as 15 to 30, without reference to these figures being eighths, fiftieths, or two hundredths.

chest, and thus will be at once seen any difference which exists in the relative mobility of the two at the point under examination. It will, of course, be absolutely necessary in every examination, such as this, that corresponding parts of the chest be compared. For all useful purposes it may be said, that the movements of the opposite sides of the chest, in health, are identical—the difference which exists over the region of the heart, at the left side, is too immaterial to interfere with practical conclusions. The instrument may be applied to any part of the chest in the mode here described. In figure 3 it is shown as applied on the sternum, and beneath one of the clavicles. The latter position is one of considerable importance, from its connexion with the deposition of tubercle towards the summit of the lung. I find that on applying the instrument here the cord may, in this instance, be directed towards the arm more conveniently than in any other direction,

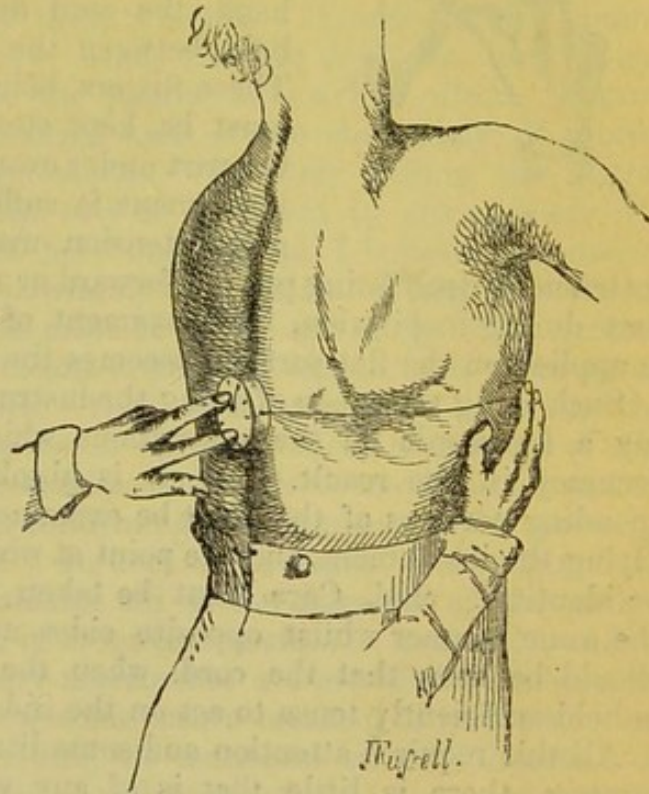


Fig. 2.

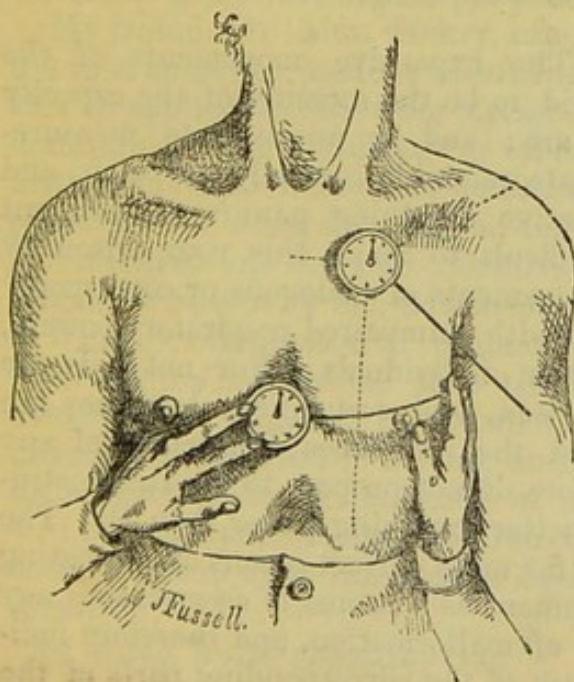


Fig. 3.

as shown by the black line, and pressed against a point near the insertion of the deltoid muscle. The cord may also be directed downwards, or outwards, and upwards, or inwards, (as shown by the dotted lines,) and retained on any fixed point. Nor, as is evident, need this point be a part of the body. It may be on the bed, or on a chair, etc., always providing that the direction of the cord be such as to receive the impression of the movement of the part of the body under examination, and that its position be symmetrical at both sides.

The use of the pedestal, which can be fixed in the side of the case with the foot attached, is shown in Figure 4. The instrument

thus used is intended to ascertain the modifications of the movements over a limited or circumscribed spot.

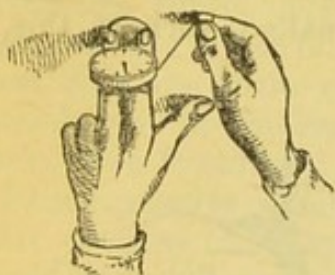


Fig. 4.

On this spot, the foot is placed and held, (as shown in the figure,) by the fingers of the left hand, the cord directed towards this point is held between the fingers of the right hand. These fingers, being thus made the fixed point, must be kept steady and not allowed to touch the part under examination. The spring in the instrument is sufficiently strong to resist the gentle tension made by the fingers, and the

instrument itself being pushed forward or raised by the elevation of the part during inspiration, the movement of the index, as when the case is applied on the flat surface, becomes the measure of this elevation.

Such being the mode of using the instrument, it will be necessary to say a few words on the precautions which are required in securing accuracy in the result. 1st. It is absolutely imperative that corresponding portions of the chest be examined, and that the mode of applying the instrument, and the point at which it is applied at each side, be identical. 2nd. Care must be taken that the patient breathes in the same manner whilst opposite sides are being examined. 3rd. It should be seen that the cord, when the observation is commenced, is held sufficiently tense to act on the index.

All this requires attention and some little effort; for, as in all other matters, there is little that is of any value which can be obtained without some labour. Though to some few patients these carefully conducted examinations may be irksome, yet to the vast majority they are far otherwise. In the latter, they beget confidence in the medical attendant, and frequently at once inspire a feeling which renders all future intercourse not less pleasing than it is conducive to successful treatment.

USES OF THE INSTRUMENT. The expansive movements of the chest during inspiration may be said to be the measure of the capacity of the lungs for air. So they are; and by an accurate measurement of the one, we might estimate tolerably correctly the other, and thus be able to compare the relative breathing powers of different individuals. It is exceedingly difficult to make this comparison by external measurement; for the movements of analogous or corresponding parts of the chest, even in those with unimpaired respiratory powers, are remarkably different in different individuals. For not only are such movements modified by age, sex, and occupation, but they are influenced by peculiarities beyond the influences apparently of any fixed or recognized rule. I therefore do not propose to use this instrument in testing whether A has a better breathing power than B. The spirometer of Dr. Hutchinson is a far more correct means of estimating this quality. I propose my instrument as a means of ascertaining any want of symmetry, independently of malformation, and therefore indicative of disease, in the movements of the corresponding parts of the same chest. It is not my intention to discuss here the various conditions, under which this want of symmetry may occur. Obstruction, for example, of a bronchus by a foreign body in, or by a tumour press-

ing on it, will interfere with the movements of the side of the chest containing the lung to which such bronchus is distributed. Disease of the substance of the lung, tuberculous, malignant, or inflammatory, and emphysema affecting the air-cells, also prevent the free expansion of the lungs or parts of them affected. Diseases of the pleura, viz., acute or chronic pleurisy; bands binding down the lung; pleuritic effusions or tumours in the pleura, have a like effect. Pleurodynia, and diseases of the external walls of the chest, may, of course, interfere with their free movements. However trifling the degree of limitation of motion, which may be produced by any of these diseases, or by many others not here enumerated, I believe this instrument, if properly used, will inevitably indicate it. When such limitation is thus observed, recourse must be had to the study of the general symptoms, and to the other means of physical diagnosis, to discover on what the irregularity depends. Thus, then, attention may be, in the first instance, directed by the use of the instrument to the seat of disease; or, when disease has been suspected or discovered by other means, mensuration will be useful in confirming the diagnosis, and expressing the extent of the local lesion. In both these senses, I have found the instrument an exceedingly valuable aid in the diagnosis of the earlier stages of phthisis. Indeed, it is quite remarkable how early, and to what an extent, the respiratory movements are modified by tubercular deposit. I hope, however, on some future occasion to return at some length to this and some allied subjects connected with the disease. It will, of course, be evident that if both sides of the chest are equally diseased, we lose the means of comparing them; but such an event is one of very rare occurrence. The instrument can also be used in investigating the movements of diaphragmatic or abdominal respiration, and in taking notice of any irregularity which may be produced in it by disease of any of the organs placed beneath the diaphragm.

My friend, Dr. Alex. Henry, has suggested to me, that not only can the instrument be used for measuring dynamical movements, but it can also be applied in following changes of volume, whether of increase or diminution, in solid tumours or other swellings. For this purpose, the instrument should, on every occasion of an examination being made, be placed on the same spot, and a definite length of cord should be used in encompassing the part examined; any increase of volume will, of course, be shown by the movement of the index. When it is required to follow a diminution of volume, the index, being made to revolve once or twice, should be thus retained, when the examination is commenced; the stages of its return to the zero point will be then the measure of decrease. Having thus given a brief description of this little instrument, of its mode of application, and of its uses, I present it to my professional brethren, with the desire that it may prove as useful to them as it has been to myself, and to those who have already used it.¹

23, Harley Street, September 1850.

¹ The instrument must have a name, and I have therefore called it a Stethometer. (*Στήθος*, the chest, *Μετρέω*, I measure.) It may be procured from Mr. Coxeter, surgical instrument maker, 23, Grafton-street East, Fitzroy-square, London

