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ORIGINAL COMMUNICATIONS.

A METHOD OF DETERMINING THE INTERNAL DIMENSIONS, CONFIGURATION AND INCLINATION OF THE FEMALE PELVIS.*

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(With fifteen illustrations.)

THE desirability of a knowledge of the configuration and dimensions of every contracted pelvis is to-day recognized by all obstetricians. This holds good even though the pelvis be but slightly deformed, on account of the bearing of form and size of the pelvis upon the mechanism of labor and the weight to be attached to them when determining the selection of the appropriate operative procedure when such be indicated.

Heretofore accuracy in the diagnosis of pelvic formation has been almost entirely dependent upon the examiner's personal experience and versatility in manual exploration of deformed pelves.

In his history of pelvimetry Skutsch records the efforts of Germann, Kiwisch, Martin and Kuestner in graphically reproducing in a more or less exact way either the course of the pelvic canal or the contour of the pelvic inlet. The methods were never exploited, either because it has been impossible to apply them in the living, or

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because the necessary apparatus has been too bulky and complicated. Undoubtedly the reasons are similar why the attempts have failed to reconstruct the natural size and shape of pelves from X-ray photographs.

Regarding the measurement of the internal dimensions of the female pelvis in the living the interesting fact may be stated that within the last eighty or ninety years efforts toward finding better methods have been almost limited to improvements upon the principle of Wellenbergh. As you know, his method briefly consists in the following procedure: The distance is measured between the middle of the promontory and the middle of the upper edge of the anterior surface of the symphysis. Then the thickness of the symphysis is determined and subtracted from the first mentioned distance. The three instruments at present most favored in internal pelvimetry are those constructed by Van Huevel, Skutsch and Hirst, and are based upon the method invented by Wellenbergh.

The mode of pelvimetry to be demonstrated to-night is characterized by the introduction of an absolutely new principle. It advances the possibility of determining the internal dimensions, the configuration and the inclination of the female pelvis in the living.

The method is executed in practice by means of two instruments invented by Dr. J. Neumann of Vienna, and myself, which have been called by us the Pelvigraph and the Kliseometer.

Since the principle underlying the construction of these instruments and the required manipulations have been described in detail in a number of the Monatsschrift fuer Geburtshilfe und Gynaekologie, which appeared as a Festschrift in honor of our

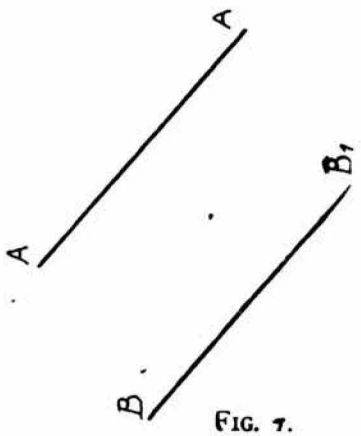

FIG. 7.

former chief, Professor F. Schauta of Vienna (vol. XI. No. 1.) I shall limit myself at this occasion to but a brief explanation of the most characteristic features of this new mode of pelvimetry.

If I draw from point A a straight line in any given direction,

and draw another straight line of the *same* length from point B in the same direction, (*i. e.*, parallel to the first), the distance between the end points of these two lines, the points A'B', is equal to the distance between the points A and B.

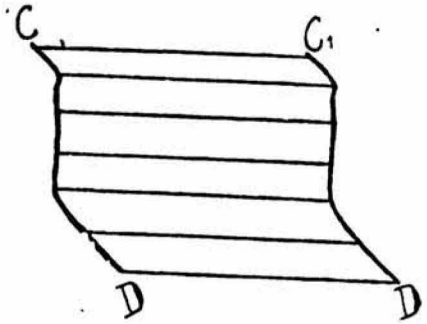

FIG. 2.

If I draw numerous straight lines of the *same* length, parallel to each other, in any given direction from numerous points of the given line C D, a line connecting the end points of all these parallels, C' D', will be a duplicate of line C D.

Imagine this line C C' (Fig. 2), replaced by a straight rigid rod. You will observe that its end C', if appropriately equipped with a marker, will create the line C' D', as a duplicate of line C D, provided that when this rod is moved, its end C remains in touch with line C D, and that in all points of its course it is kept parallel to its first position.

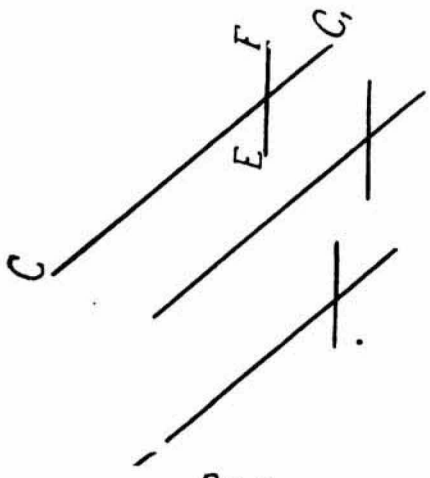

FIG. 3.

The question arose how to carry out in practice such a movement of the rod in parallels. A spirit level attached to the rod proved the solution of this difficulty.

Fig. 3 will illustrate the arrangement.

E F represents the spirit level which is fixed to the rod C C' at an arbitrarily chosen angle. If I move this apparatus, within a

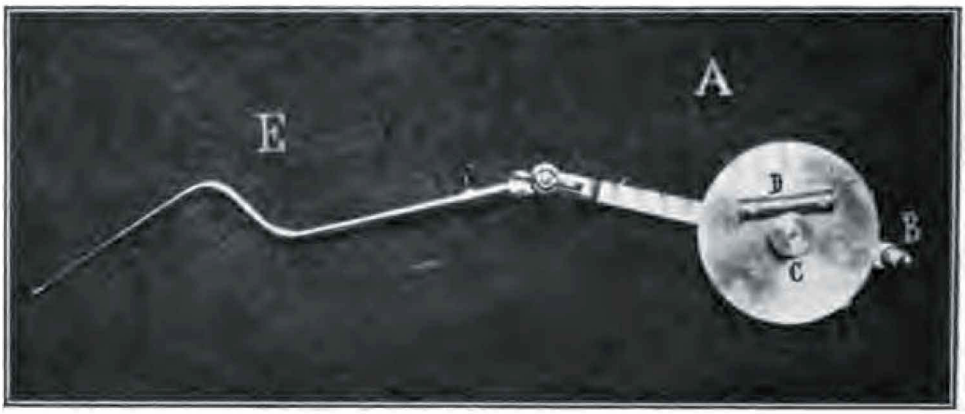

Fig. 4.—Pelvigraph.

vertical plane, so that the spirit level marks constantly horizontal, then necessarily the rod C C' will in every position be parallel to

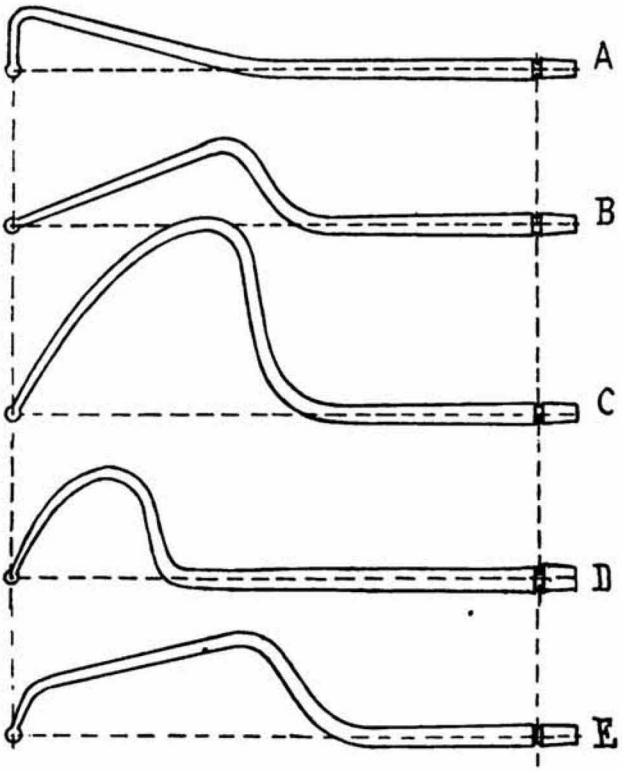

Fig. 5.

its first position, since it stands in every position under the same angle to the horizon.

This represents the principle underlying the construction of the Pelvigraph, the instrument which I desire to demonstrate first.

For convenience sake we have divided the instrument into two parts, each of which serves a special function.

The one portion (A, Fig. 4), used for registering purposes, carries at its end a marker (B). In front of this is a rotary disk, which can be fixed at any desired position by means of the thumb screw C. A spirit level (D) is attached to this disk. The other end of this registering arm has a cylindrical bore into which fits the exploring arm E.

A division of the instrument into two sections, a registering and an exploring arm, was found necessary for several reasons. The exploring arm is introduced into the vagina, and must, therefore, be capable of sterilization. The limited space of the vagina does not permit of a motion in parallels of a *straight* rod to any practicable extent. In order to reach all portions of the posterior and anterior pelvic wall, while the axis of the instrument remains parallel to the first chosen direction, we have constructed five differently curved arms, all fitting into the one registering arm.

As Fig. 5 shows, these five rigid steel arms have exactly the same length, and the knobs terminating the one end lie in the axis of the instrument. The arms may, therefore, be exchanged ad libitum, because whichever may be inserted into the registering arm, the axis and the absolute length of the instrument (that is the distance between the knob of the exploring arm and the marker of the registering arm), will remain unaltered.

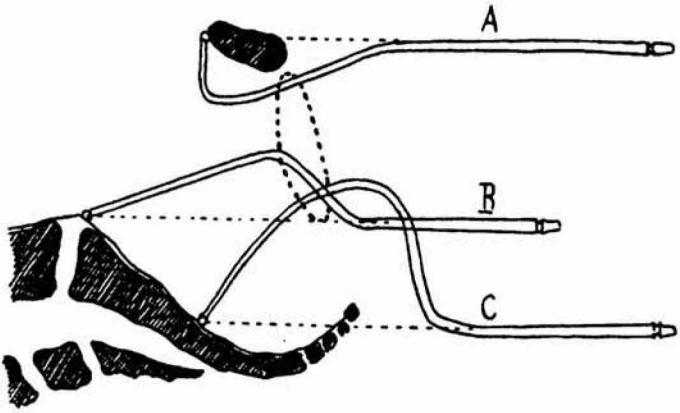

FIG. 6.

The next illustration (Fig. 6) gives an idea how it is possible with the help of these peculiarly shaped arms to touch various points of the sacrum and symphysis, the axis of the instrument moving in parallels. This illustration shows, furthermore, that arm A is designed for the symphysis, arm B for the promontory

and the upper portion of the sacrum, arm C for the middle and lower portion of the sacrum. Where a rigid perineum is encountered the use of arm D for the lower end of the sacrum and the coccyx may become necessary. Arm E is devised for the measurement of the transverse diameters of the inlet.

How this instrument is used in the living in order to measure the distance between any two points within the pelvis, or to obtain, in actual size, an exact outline of the median section through the pelvic canal, is shown in the next illustration (Fig. 7) and will be demonstrated by me on this skeleton pelvis.

The woman lies flat on her back on an operating table or examining chair. Her feet are placed in some of the usual crutches or stirrups.

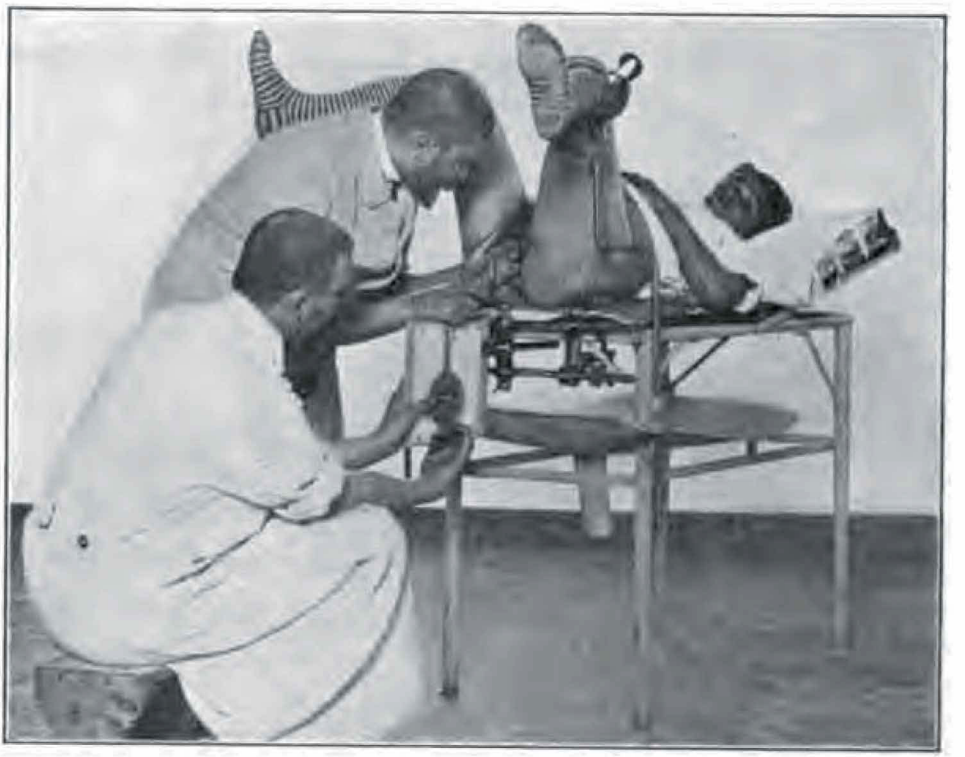

FIG. 7.—Measuring true conjugate with pelvigraph.

In a symmetrical pelvis in this position the sagittal plane of the pelvis, lying between symphysis and mid-line of the sacrum, is vertical.

To the table we have attached a draughting board, 25x25 cm., which stands vertical, can be moved to either side and fixed in any desired position.

Now suppose we wish to determine the length of the true conjugate.

Under the direction of two fingers in the vagina, the end button of sterilized arm A is brought into contact with the middle of the upper edge of the posterior surface of the symphysis. An assistant takes charge of the registering end of the instrument. He adjusts the disks, carrying the spirit level, at a suitable angle, places the instrument flat against the draughting board, brings the spirit level to the horizontal by raising or lowering the free end of the instrument. So soon as the spirit level is found to be horizontal, he registers this point with the marker on a sheet of paper which has been attached to the draughting board.

The instrument is now withdrawn, exploring arm B attached, and the end button of this arm, in the same manner as before described, placed in contact with the middle of the promontory. Again by raising or lowering of the registering arm the spirit level is brought to the horizontal, and the position again marked.

The two pinholes thus produced on the paper represent the actual distance between the middle of the promontory and the upper mid-edge of the symphysis, that is the length of the true conjugate. It may then be accurately measured with a rule.

I can, of course, in the same manner, project many more points of the pelvic interior upon the draughting board. If I thus, for

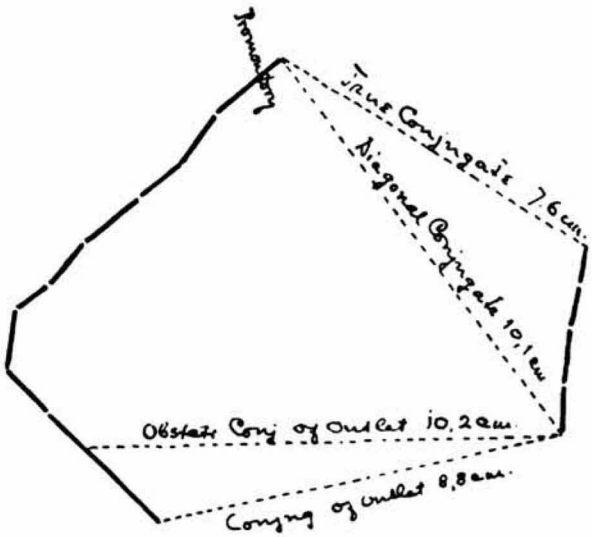

FIG. 8.—Generally contracted rachitic pelvis.

instance, proceed to map out points along the middle line of both the sacrum and the symphysis, I shall obtain an accurate likeness,

in natural size, of the vertical median section through the pelvis, that is, a picture of the pelvic canal.

I shall give here but three such diagrams, produced with the Pelvigraph from patients of Professor Schauta's clinic. They illustrate some of the typical forms of pelvic deformity, and will best demonstrate the efficiency and advantage of the instrument.

This is the diagram of a generally contracted rachitic pelvis, and shows all the characteristics of a rachitic pelvis in an unmistakable way; the flatness of the sacrum, the sharp bend in its lower portion, and the relatively large outlet as compared to the narrowed inlet.

Fig. 9 is the tracing of another patient. It represents a generally contracted, but non-rachitic pelvis.

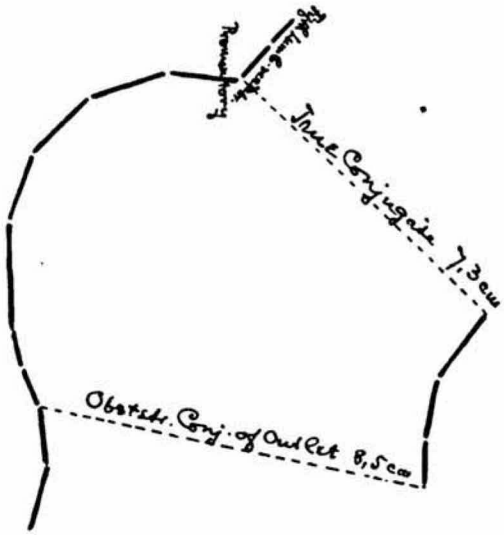

FIG. 9.—Generally equally contracted non-rachitic pelvis. Transverse diameter of Brim 11.7 cm.

This last diagram demonstrates the characteristics of a funnel-shaped pelvis.

It is obvious that the accuracy in the reproduction of the pelvic canal is dependent upon the number of different points projected upon the draughting board. A scrutiny of such diagrams in our possession, taken from patients, shows that we have projected on an average 4 to 5 points of the contour of the symphysis, and 10 to 15 points of the sacrum and coccyx. In some instances it is possible to reach the last lumbar vertebra as is shown in Figs. 9 and 10.

In order to be able to find in the diagrams (for a purpose to be mentioned later), the conjugate of the obstetrical outlet, the point

representing the junction between sacrum and coccyx is specially marked at the time this point is projected.

Since the surface of the pelvic canal in the living is covered with soft, movable and compressible tissues repeated measurements are

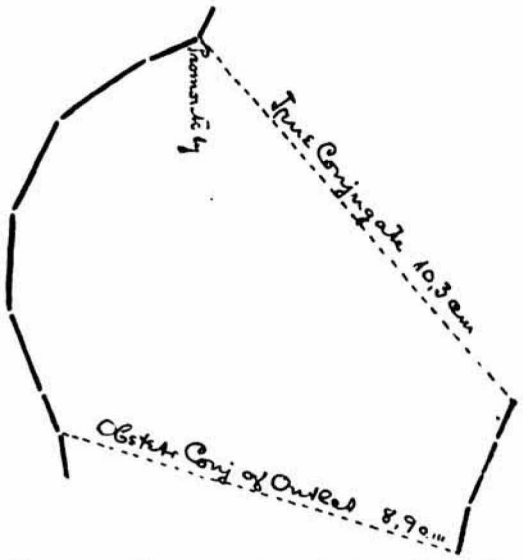

FIG. 10.—Kyphotic funnel-shaped pelvis.

bound to show slight differences in the result, in particular because of the mathematical exactness with which the position of the knob of the exploring arm is registered by the marker.

Indispensable factors for the performance of exact measurements or the production of reliable tracings are the following: The possibility of manual exploration of the pelvis, an exact instrument and absolute quietude on the part of the patient. Regarding the latter point I may add that it can ordinarily be obtained without the use of any fixation bandages, simply by careful handling of the patient; if the need arise, an anesthetic may be employed.

The transverse diameters may be measured after the same method. In this case the patient is brought into a lateral position, so as to bring the transverse diameters vertical to the table. Arm E (Fig. 5), is used for this measurement.

Such diagrams form a very valuable aid for purposes of clinical teaching. Demonstrated simultaneously with the patients from whom they were taken, they are of considerable assistance to the student who is but little experienced in manual exploration of the pelvis.

These tracings show the direction of the pelvic axis, the length of the sacrum, the difference in the length of the diagonal and true

conjugates and other points of scientific interest, they will afford valuable information regarding the changeableness in the form of the pelvis, if taken in different position of the woman, e.g. in lithotomy and Walcher's position.

The Kliseometer, another instrument invented by Dr. J. Neumann and myself, is simpler in its construction. It is used to determine the inclination of the pelvis.

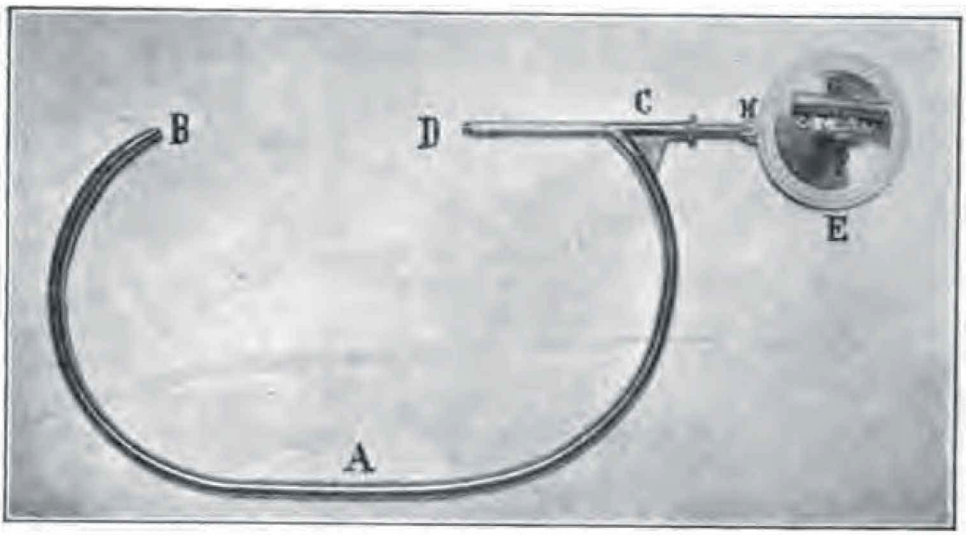

FIG. 11.—Kliseometer.

The Kliseometer consists of a rigid arch A (Fig. 11), which terminates at one extremity in a knob (B), and at its other extremity in a cylindrical carrier (C). The latter is attached in such fashion that a rod, sliding through this carrier, will always move upon an axis running through the centers of the cylindrical carrier and the distal knob. The internal end of this rod terminates in a knob (D), to the external end a disk (E) is attached. This disk is rotary and can be fixed in any desired position by means of a thumbscrew (F). Its circumference is divided into degrees, and to its surface is attached a spirit level (G). The arrangement is such, that a small pointer (H), slightly overlapping the disk, will designate zero, if the axis of the instrument, represented by a line through the centres of the two knobs, be horizontal.

If we bring the instrument to any angle with the horizon, we can readily define this angle by turning the disk, until the spirit level registers horizontal; in this position the pointer indicates on the scale the angle of inclination.

How this instrument is used on the living may be seen in this photograph.

FIG. 12.—Inclination of external conjugate determined with Kliseometer.

The two end points of the external conjugate are marked on the skin. Then the woman is placed in the so-called "normal position of Meyer," in which both the large toes and the heels are held in close approximation. The two knobs are brought into contact with the two previously marked points, the rigid arch of the instrument best held between the legs of the woman. The help of an assistant is necessary. Now the disk is rotated until the spirit level indicates horizontal. The pointer then shows the angle formed by the external conjugate and the horizon.

In this way our Kliseometer offers a simple means of measuring in a reliable manner the inclination of the external conjugate.

I shall conclude my paper with a short explanation how the combined use of both instruments, the Pelvigraph and the Kliseo-

meter, permits of the determination of the inclination of the *true* conjugate. As you know, this inclination represents in reality the inclination of the pelvis. But up to date the inclination of the *external* conjugate has been substituted, and had to be substituted, for it has been as yet impossible to determine the inclination of the true conjugate in the living.

As I have demonstrated, we are able to produce with the Pelvigraph an exact tracing of a vertical section through the pelvic canal. In order to secure an entirely satisfactory and intelligent conception of the obstretic features of a pelvis it is necessary to also ascertain the position of the pelvic canal in the upright woman. It seemed obvious to use the inclination of the external conjugate for this purpose, but this would be too inaccurate since we know that in only a very small percentage of cases does the external conjugate really constitute an extension of the true conjugate. Usually they form an angle of varying size, which in certain forms of pelves may be as large as 20 degrees.

In the tracings passed around (Figs. 8, 9, 10), you see that we always can find the conjugate of the obstetrical pelvic outlet, that is the distance between the sacro-coccygeal articulation and the lower end of the symphysis. We make use of this line as a basis to determine the real position in the upright. It is an easy thing to measure with the Kliseometer the inclination of this conjugate of the outlet. So soon as this angle is defined the real inclination of the pelvis can be ascertained by the employment of a simple construction. The lines representing in the diagram the conjugates of the inlet and obstetrical outlet are extended until they meet (Fig. 13). At the point of intersection we construct with the help of a protractor, the angle determined by the Kliseomotor as the inclination of the conjugate of the obstetrical outlet. The line thus found constitutes a base line, representing the horizon. I can now find the angle of the inclination of the true conjugate, that is, the inclination of the pelvis, by measuring the angle between this base line and the line indicating the true conjugate.

I give here once more the three diagrams, taken from the living, in which in the manner just described the inclination of the pelvis has been determined.

These drawings are so turned as to bring the line marked "Horizon" to the level, and in this way offer a very instructive conception of the actual positions assumed by these pelves in the upright women.

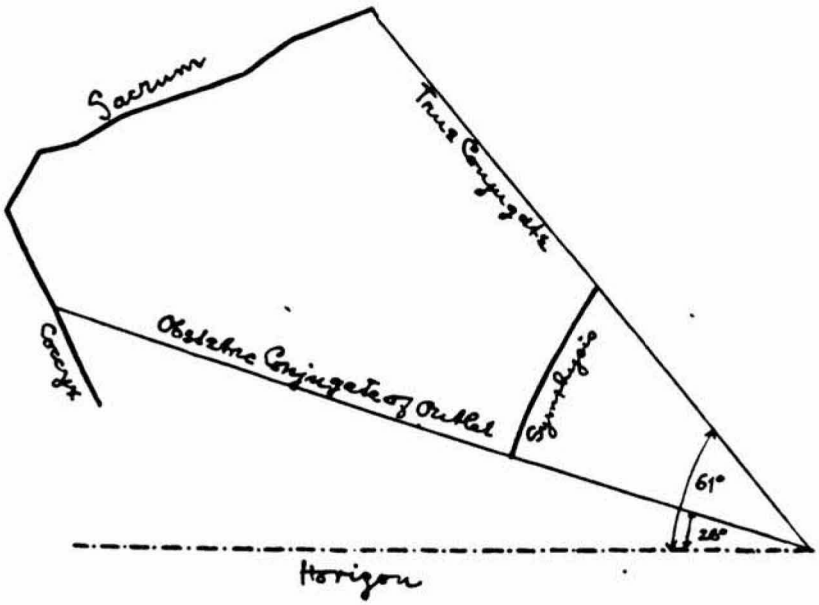

FIG. 13.—Generally contracted rachitic pelvis. Inclination of ext. conj. 64°. True conj. 61°. Obst. conj. of outlet 26°.

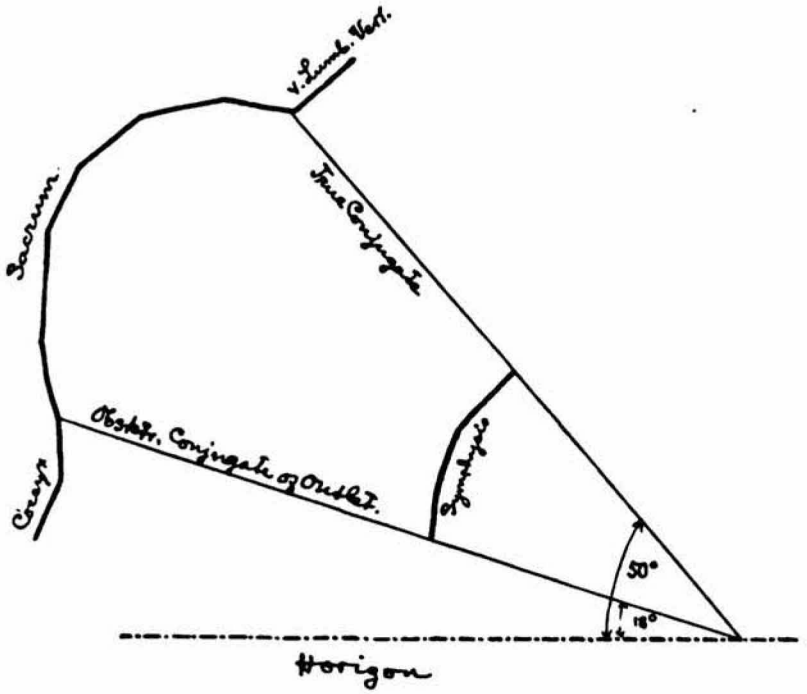

FIG. 14.—Generally equally-contracted non-rachitic pelvis. Inclination of ext. conj. 54°. Inclination of true conj. 50°. Inclination of obst. conj. of outlet 18°.

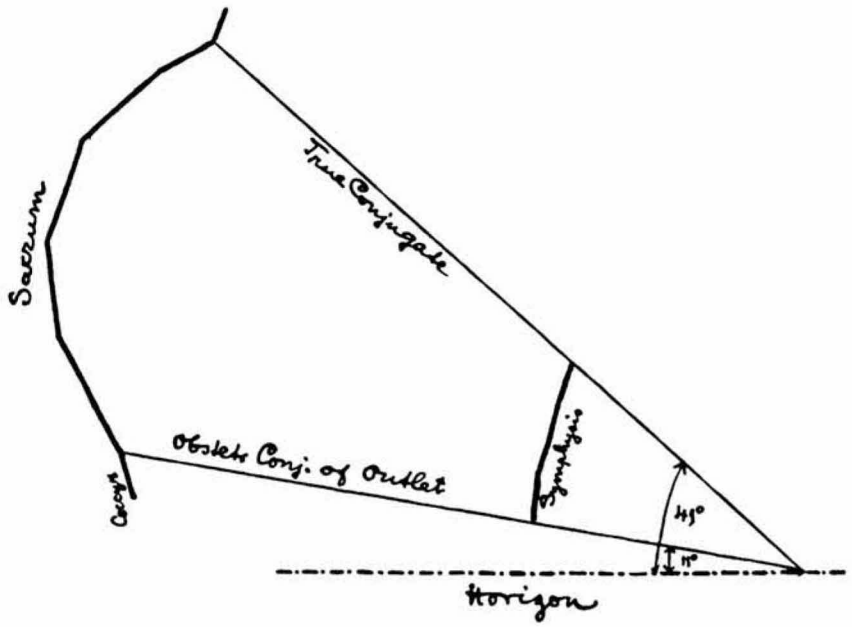

FIG. 15.—Kyphotic funnel-shaped pelvis. Inclination of ext. conj. 51°. Inclination of true conj. 41°. Inclination of obst. conj. of outlet 11°.

I feel justified in stating in conclusion that these two instruments afford the possibility of graphically reproducing the form and exact dimensions of the most important sections through the pelvis, and of permitting measurement of its real inclination.

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