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on

THE MECHANISM
of the
SECOND STAGE OF HUMAN PARTURITION

by

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APPENDIX A.

EXPERIMENTS.

APPENDIX A.

The following pages contain a description of some experiments bearing on the mechanism of labour. The scope and character of the experiments is outlined in the table of Contents which precedes the descriptive part. As a matter of convenience, and as far as possible to avoid confusion the ordinary obstetrical nomenclature and orientation is employed.

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I. EXPERIMENTS WITH MODEL HEAD.

a. ON RIGID SHEET OF RUBBER.

A square sheet of thin rubber was stretched tightly across the mouth of a box, in such a manner that the rubber was fixed firmly at the sides and left free at one end - the anterior end.

A model was prepared approximating as closely as possible to the shape of the head. On a wooden base, ovoid in outline, 116 mm. long, 92 mm. broad bi-parietally, and 82 mm. broad bitemporally, the head proper was moulded of paper and wool which was bound up tightly with twine, and covered smoothly with very thin oilcloth. A wooden rod was attached by a ball-and-socket joint to a point on the base marking the centre of the occipital arc. The rubber-sheet was carefully levelled, and it, as well as the head, was greased with black soap.

EXPERIMENT I.

Raised the head by means of the wooden rod, whereupon the head became extended as far as the mobility of the ball-and-socket joint allowed.

Lowered head, holding the rod vertically, on to the rubber-sheet and made slight pressure through the rod. The head flexed itself, and the area of contact was shifted from an area surrounding the termination on surface of head of the vertical axis/

axis passing through the joint, to an area on the occiput nearer the occipital pole, the centre of the new area being then in line with the axis of the rod.

Found that when the angle formed by the axis of the rod with the plane of the base of the head was 90° of arc or less, the pressure transmitted through the rod had a constant tendency to flex the head; and conversely, when the angle exceeded 90° of arc the pressure extended the head on the rod.

EXPERIMENT II.

Lowered the head on the rubber-sheet in such a way that the two lateral halves of the occiput rested equally on the sheet, and made pressure evenly downwards and forwards through the rod, taking care that the rod was held strictly in one antero-posterior plane. Tried this experiment on the centre of the rubber-sheet, and also, close to one of its lateral attachments.

No tendency to rotate was discovered. The head moved slowly forwards over the rubber-sheet until it reached the free edge.

Found that, when the angle formed by the axis of the rod with the plane of the base of the head lay between 50 and 55 degrees of arc, the forward movement took place most readily.

EXPERIMENT III.

Repeated Experiment II. with much stronger pressure, so that the occiput sank into, and distended the rubber-sheet to the latter's limit of elasticity.

No tendency to rotation manifested itself, and the sinciput remained clear of the sheet as much as to allow the little finger to be passed between the sinciput and the rubber at the time of greatest pressure.

EXPERIMENT IV.

Lowered the head on to the rubber-sheet with the long axis of the head coinciding with an oblique diameter of the sheet, and with the occiput directed towards the free edge. Directed pressure through the rod at right angles to the rubber-sheet, and in such a manner that centre of pressure was situated in the posterior half of the occiput, which alone was in contact with the rubber.

Found that as long as pressure was directed at right angles to the sheet no tendency to advance or rotate occurred. Under continued pressure distension of the rubber was produced but no rotation.

EXPERIMENT V.

Lowered/

Lowered head on to rubber with the long axis of the head coinciding with an oblique diameter of the sheet, and with the occiput directed towards the free edge (left occipito-anterior position.) Directed pressure downwards and forwards through the rod in such a manner that the centre of pressure was situated in the posterior half of the occiput. Maintained steady pressure. The head slid forwards over the rubber, and at the same time rotated into a nearly antero-posterior position. It continued to slide forwards without further rotation until it reached the free edge of the rubber-sheet.

EXPERIMENT VI.

Repeated <u>Experiment V</u>, but in such a way that centre of pressure was situated in the anterior half of the occiput. Under steady pressure the head moved forwards over the rubber, and at the same time rotated into a transverse position which it maintained until it reached the free edge of the rubber sheet.

EXPERIMENT VII.

Repeated <u>Experiment 5</u>, but in such a way that axis-pressure was directed from and not towards the occipital pole, with the pressure as before on/

on the posterior half of the occiput, the head moved backwards over the sheet, and rotated into the transverse position.

EXPERIMENT VIII.

Repeated Experiment 6, but in such a way that the axis of pressure was directed from and not towards the occipital pole. With the pressure as before acting on the anterior half of the occiput, the head moved backwards and rotated into the antero-posterior position.

EXPERIMENT IX.

Repeated Experiments V and VI in such a way that centre of pressure was very little in advance of the transverse plane of the vertical axis of the head passing through the universal joint, and arranged respectively on the posterior and anterior halves of the occiput. At the same time reduced the down-bearing pressure to the least possible quantity consistent with the forward motion and rotation of the head, and also to avoid as far as possible any distension of the rubber-sheet. These measures resulted in a continuous rotation of the head along the path of a closed curve and led to the conclusion that, given some means of preventing or arresting a tendency/

tendency of the head to roll under the axis of pressure. the head would rotate or spin round and round indefinitely as long as pressure was maintained.

Found that a considerable increase of pressure arrested the rotation by distending the rubber-sheet, that arrest of rotation occurred if the direction of pressure did not travel with the head in a closed curve.

EXPERIMENT X.

Arranged so that there was a slope extending downwards from one side of rubber-sheet to the other. Arranged head on rubber in oblique diameter so that sinciput was placed near to the higher border of the rubber. and made pressure downwards and forwards on the posterior half of the occiput.

Found that less pressure was required to start and maintain rotation than on a level rubber-sheet.

EXPERIMENT XI.

Arranged the head on the level rubber-sheet. in an oblique diameter with the occiput posterior (right occipito-posterior position).

Directed/

Directed pressure on the posterior half of the occiput, yet still bearing downwards and forwards. Found that pressure had to be much greater (this proved to be incorrect. See EXPERIMENTS 31-44), and maintained for a longer time than in EXPERIMENT 5. (left occipito-anterior position), in order to produce advance and rotation forwards (long rotation); that the axis of pressure had to be directed more towards the occipital pole than in EXPERIMENT 5. in order to produce greater flexion.

Found that the angle, made by the rod to the plane of the base of the head, had to be reduced to 35 to 30 degrees of arc, in order to start rotation (occipito posterior position), as compared with an angle of 55 to 50 degrees in EXPERIMENT 5. (occipito anterior position).

EXPERIMENT XII.

EXPERIMENT XII.

Repeated Experiment 11, but directed axis of pressure to a point anterior to transverse plane of vertical axis of head, thereby placing the pressure nearer the sinciput and extending the head. When pressure was directed on the posterior half of the sinciput, the sinciput rotated forwards, (short rotation). Less pressure maintained for a shorter time was required for this short rotation than for the long rotation, and was equivalent in quantity and period to that required for the occipito-anterior position. (For the quantity of pressure see Experiment 31-44).

EXPERIMENT XIII.

The Experiments in the occipito-anterior and occipito-posterior positions were repeated a number of times with at each trial a marked degree of distension of the rubber, the pressure being removed gradually at various periods during the process of rotation from its beginning to its end, with a view to noting what effect, if any, the recoil of the rubber had on the positions. It was not found to be possible to show either that the recoil increased the amount of rotation if it were/

were not completed, or that the recoil restored, or partially restored, the original position. The head remained, during the recoil, at whatever stage of rotation it was in at the end of the period of pressure, and no further rotation occurred until the next period of pressure.

EXPERIMENT XIV.

Inclined rubber-sheet longitudinally at an angle of 15° to the horizon. Arranged head on rubber in LOA flexed position near free edge of sheet. Made pressure parallel to a plumb-line, the direction of pressure being comparable to a direction at right angles to plane of brim.

Found that rotation forwards and inwards occurred when rubber sheet was inclined by the pressure at an angle of 55-65 degrees to the horizon, the pressure being necessarily much greater than in previous experiments.

EXPERIMENT XX.

Repeated preceding Experiment 14 with head extended.

Found that sinciput rotated forwards and inwards in long rotation at about the same angle of depression of the rubber-sheet.

EXPERIMENT XXI.

Repeated/

Repeated Experiment 15 with head in ROP flexed position.

Found that occiput rotated forwards and inwards in long rotation at about the same angle of depression of the rubber-sheet.

EXPERIMENT XVII.

Repeated preceding Experiment 16 with head extended.

Found that sinciput rotated forwards and inwards in short rotation at about same angle of depression of rubber-sheet.

EXPERIMENT XVIII.

Arranged head in ROP flexed position under pressure on the rubber sheet which was depressed at an angle of 55^o-65^o to the horizon. Made pressure downwards and backwards at an angle of 15^o-20^o to the plumb-line.

Found that the pressure had to be greatly increased; that the rubber became distended to the limits of its elasticity; that no linear movement backwards occurred owing to folding of the rubber behind the head; that rotation backwards and inwards was eventually produced with the copious use of glycerine; that the head in a symmetrical position/

position underwent extreme flexion, and then moved very slowly and under severe pressure forwards towards the free edge of the rubber-sheet.

B. ON RIGID SHEET OF RUBBER BEHIND HORIZONTAL BAR.

For the next four experiments a fixed horizontal bar was arranged across and above the free and anterior margin of the level rubber-sheet. It was well greased.

EXPERIMENT XIX.

Repeated EXPERIMENT 4. with occiput resting against transverse bar, taking care as before that pressure was made at right angles to the rubber-sheet.

Found that descent took place behind the anterior bar and without rotation; that after the head had descended lower than the bar no forward movement and no rotation occurred, the head under continued pressure distending the rubber to its utmost limit, without rotation being produced.

EXPERIMENT XX.

Repeated EXPERIMENT 5 and 6. with occiput resting against transverse bar from the beginning of the experiments.

Found/

Found that much greater pressure was required to bring about rotation, than was necessary in the absence of a transverse bar; that rotation did not occur until occiput had so far distended the rubber as to be on the point of escaping forwards under the transverse bar, when rotation took place into the antero-posterior and transverse positions respectively.

EXPERIMENT XXI.

Placed head on rubber-sheet in right occipito-posterior position, with edge of sinciput resting against transverse bar. Made pressure to bear downwards and forwards on posterior half of occiput.

Found that occiput moved forwards until in contact with transverse bar, thus placing head in transverse position. Found that no further rotation took place until occiput had distended rubber sufficiently to escape forwards under the transverse bar, when rotation into the antero-posterior position took place, - long rotation.

EXPERIMENT XXII.

As in previous experiment, but arranged that down-bearing pressure should act more towards the/

the sinciput. This produced extension of the head. No rotation occurred until the sinciput had distended the rubber sufficiently to escape forwards under the transverse bar, when rotation took place into the antero-posterior position - short rotation.

C. ON RELAXED SHEET OF RUBBER.

In the following experiments the rubber-sheet was not stretched tightly between the lateral walls of the box, but was allowed to hang loosely as a transversely placed festoon.

EXPERIMENT XXIII.

Lowered head in left occipito-anterior position on to rubber sheet, so that posterior half of occiput made contact with rubber and axis-pressure was directed downwards and forwards through the same quarter.

Internal rotation into antero-posterior position took place with some ease during advance. Under the conditions of the experiment a broad band of the lower surface extending from the posterior half of the occiput to the anterior half of the sinciput was in contact with the rubber-sheet.

EXPERIMENT XXIV.

Lowered head in left occipito-anterior position on to rubber-sheet with occiput pressing/

pressing on rubber-sheet, and axis pressure acting downwards and forwards mesially through head.

Internal rotation into antero-posterior position took place with advance, with considerable ease. Under the conditions of this experiment the whole of the lower surface of the occiput and the anterior half of the sinciput were in contact with the rubber-sheet.

EXPERIMENT XXV.

Lowered head in left occipito-anterior position on to rubber-sheet, with anterior half of occiput pressing on rubber-sheet, and with axis-pressure directed downwards and forwards through anterior portion of occiput.

Internal rotation into antero-posterior position took place with advance, with some ease. Under the conditions of this experiment the anterior half of the occiput and the anterior half of the sinciput were firmly in contact with the rubber-sheet.

EXPERIMENT XXVI.

Repeated Experiments 23-25 with the head in the right occipito-posterior position with marked flexion, i.e. with axis of pressure acting through the occiput, and obtained similar results.

In/

In all cases a longer time was required to produce rotation.

EXPERIMENT XXVII.

Arranged the flexed head in the left occipito-anterior position, and made pressure downwards and backwards through posterior half of occiput.

Found that long rotation took place into a direct occipito-posterior position, flexion being most acute as head passed through the transverse position.

EXPERIMENT XXVIII.

Arranged the flexed head in the left occipito-anterior position, and made pressure downwards and backwards through anterior half of occiput. Found that long rotation took place into a direct occipito-posterior position.

EXPERIMENT XXIX.

Arranged the flaccid rubber-sheet as a semi-festoon, the left side being curved upwards and the right side flat. Lowered the head in the left occipito-anterior position, and directed pressure downwards and forwards through the posterior, mesial, and anterior portions of the occiput in turn.

Rotation/

Rotation did not take place, the head slid obliquely towards the right or flat side.

EXPERIMENT XXX.

Arranged the flaccid rubber-sheet as a semi-festoon, the right side being curved upwards and the left side flat. Lowered the head in the left occipito-anterior position, and directed pressure downwards and forwards through the posterior, mesial and anterior portions of the occiput in turn.

Rotation did not take place. The head slid obliquely towards the left of flat side.

D. RELATIVE VALUES FOR PRESSURES REQUIRED UNDER VARIOUS CONDITIONS.

Determination of Angular Distances and of Position of Centre of Pressure on a Curved Surface.

For the next series of experiments the square sheet of rubber was attached by two sides to strips of wood. To each end of each double strip of wood two cords were attached, the one acting over a vertical pulley, the other over a horizontal pulley, counterbalancing weights were attached to the cords in such a manner that four equal weights tended to pull the rubber upwards and four equal weights tended to pull the rubber horizontally outwards. By these means the rubber was prevented

from/

from sinking bodily and its tension was maintained. A platform to support weights was attached to the free end of the rod actuating the head. The rubber and the head were greased well with soft soap. In the course of the experiment care was taken that no visible descent or distension of the rubber-sheet was allowed to occur, and that the weight acted on the head in the axis, already determined to be the most suitable in the left occipito-anterior position, with the centre of pressure between the antero-posterior plane of the rubber-sheet and the mesial plane of the head, and with the posterior half of the occiput resting in contact with the rubber-sheet, unless otherwise stated.

EXPERIMENT XXXI.

Weight on vertical pulleys = 44 ounces.
Weight on horizontal pulleys= 32 ounces.
Weight of rubber,wood and cords = $3\frac{1}{4}$ ounces.

Weight of head = 7 ounces.

Found that a weight of 4 ounces acting at an angle of 55 to 50 degrees to the plane of the base/

base of the head was sufficient to start and maintain rotation with advance, when the rubber was stretched and absolutely level.

Found that this weight was not operative when the pressure was directed through a vertical axis, and did not produce a visible result until the angle of 55° was reached.

Total weight operating = 11ounces
Total weight resisting = $79\frac{1}{4}$ ounces.
Ratio 1 in 7.

EXPERIMENT XXXII.

Weight on vertical pulleys = 36 ounces.
Weight on horizontal pulleys = 32 ounces.
Weight of rubber, wood and cords = $3\frac{1}{4}$ ounces.
Weight of head = 7 ounces.

Found that a weight of 3 ounces acting at an angle of 55 to 50 degrees to the plane of the base of the head was sufficient to start and maintain rotation with advance when the rubber was stretched /

stretched and absolutely level.

Total weight operating = 10 ounces.

Total weight resisting = 71¼ ounces.

Ratio 1 in 7.

EXPERIMENT XXXIII.

Weight on vertical pulleys = 22½ ounces.

Weight on horizontal pulleys = 32 ounces.

Weight of rubber, wood and cord = 3¼ ounces.

Weight of head = 7 ounces.

Found that a weight of 1½ ounces acting at an angle of 55 to 50 degrees to the plane of the base of the head was sufficient to start and maintain rotation with advance when the rubber was stretched and absolutely level.

Total weight operating = 8½ ounces.

Total weight resisting = 57¾ ounces.

Ratio 1 in 7.

EXPERIMENT XXXIV.

Weight on vertical pulleys = 44 ounces

Weight on horizontal pulleys = 32 ounces

Weight of rubber, wood and cords = 3¼ ounces

Weight of head = 7 ounces.

Made pressure through posterior half of occiput which alone was in contact with rubber-sheet.

Found that a weight of 6 ounces was sufficient to produce rotation with advance.

Total weight operating = 13 ounces.

Total weight resisting = 79¼ ounces

Ratio 1 in 6.

EXPERIMENT XXXV.

Weight on vertical pulleys = 44 ounces

Weight on horizontal pulleys = 32 ounces

Weight of rubber, wood and cords = 3¼ ounces

Weight of head = 7 ounces

Made pressure through anterior half of

occiput/

occiput with posterior half in contact with rubber (Sufficient support was given to right lateral aspect of occiput to make this possible.)

Found that a weight of 4 ounces was required to produce rotation with advance.

Total weight operating = 11 ounces.

Total weight resisting = 79¼ ounces.

Ratio 1 in 7.

EXPERIMENT XXXVI.

Repeated Experiments 34 and 35 with the head in the right occipito-posterior position with marked flexion, i.e. with axis of pressure acting through the occiput, and obtained similar results. In both cases a longer time was required to produce rotation.

The fixed horizontal bar was again requisitioned. It was placed in an immovable position, the rubber being allowed to move freely behind it. It was now necessary to allow the rubber to be distended, but no bodily descent was permitted.

EXPERIMENT XXXVII.

weight on vertical pulleys = 44 ounces.
Weight on horizontal pulleys = 32 ounces.
Weight of rubber, wood and cord = $3\frac{1}{4}$ ounces.
Weight of head = 7 ounces.

Found that a weight of 32 ounces acting at an angle of 55 to 50 degrees to the plane of the base of the head was insufficient to cause descent of head behind horizontal bar.

Total weight operating 39 ounces.
Total weight resisting = $79\frac{1}{4}$ ounces.

EXPERIMENT XXXVIII.

Weight on vertical pulleys = 36 ounces.
Weight on horizontal pulleys = 32 ounces.
Weight of rubber, wood and cord = $3\frac{1}{4}$ ounces.
Weight of head = 7 ounces.

Found that a weight of 32 ounces acting at an angle of 55 to 50 degrees to the plane of the base of the head was sufficient to start and maintain slow descent until occiput escaped forwards under/

under horizontal bar, and rotated into antero-posterior position.

Total weight operating = 39 ounces.
Total weight resisting = 71¼ ounces.
Ratio 1 in 1·83.

EXPERIMENT XXXIX.

Weight on vertical pulleys = 22½ ounces
Weight on horizontal pulleys = 32 ounces
Weight of rubber, wood and cord = 3¼ ounces

Weight of head = 7 ounces.

Found that a weight of 20 ounces acting at an angle of 55 to 50 degrees to plane of the base of the head was sufficient to start and maintain descent until occiput escaped forwards under the horizontal bar, and rotated into the antero-posterior position.

Total weight operating = 27 ounces
Total weight resisting = 57¾ ounces
Ratio 1 in 2·14.

EXPERIMENT XL

Repeated EXPERIMENTS XXXII-XXXV and XXXVII-XXXIX with head in right occipito-posterior position.

Found that the same weights were sufficient to start and maintain advance (or descent) and rotation; that long rotation took much longer to accomplish than short rotation which occupied a time similar to that required to produce rotation in the occipito-anterior position; that the foregoing held good whether rotation took place on the rubber free of external restraint, or with the horizontal bar in position.

EXPERIMENT XLI.

Weight on vertical pulleys = 36 ounces
Weight on horizontal pulleys = 32 ounces
Weight of rubber, wood & cords = $3\frac{1}{4}$ ounces
Weight of head = 7 ounces.

Found that a weight of 8 ounces acting at an angle of 55°- 50° to the plane of the base of the head and acting through the anterior half of the occiput/

occiput which half was alone in contact, was sufficient to start and maintain rotation with advance when the rubber was stretched and absolutely level.

Total weight operating = 15 ounces.

Total weight resisting = $71\frac{1}{4}$ ounces.

Ratio 1 in 4 73.

EXPERIMENT XLII.

Weight on vertical pulleys = 36 ounces

Weight on horizontal pulleys = 0

Weight of rubber, wood & cords = $3\frac{1}{4}$ ounces

Weight of head = 7 ounces

Found that a weight of 8 ounces acting at an angle of 55°- 50° to the plane of the base of the head and acting through the anterior half of the occiput the right half of occiput and the right half of the sinciput being in contact, was sufficient to start and maintain rotation with advance, the rubber being relaxed.

Total weight operating = 15 ounces

Total weight resisting = $39\frac{1}{4}$ ounces

Ratio 1 in 2·60

<u>Note</u>:- In EXPERIMENT 41 more weight was required to produce rotation with advance than was necessary in EXPERIMENTS 31, 32, and 33, because/

because in EXPERIMENT 41 the centre of pressure coincided with the area of contact, and rotation took place into the transverse position.

In EXPERIMENT 42 the weight required still remained great owing to the sinciput tending to rotate backwards and inwards, and having to overcome the tendency of the occiput to rotate forwards and to the left. That is to say, the occiput, if acting alone, would have led the head into a transverse position, but the sinciput, coming into operation, received a thrust which, when translated to the centre of pressure, proved the greater and led to rotation of the head into an antero-posterior position.

EXPERIMENT XLIII.

Determination of Angular Distances.

Found by using a graduated arc that axis of pressure on head, under the best conditions for producing rotation, formed an angle of 10-15 degrees of arc with the elevation-plane of the pubis i.e. with the axis of the inlet, assuming the plane of the pubis to lie at right angles to the plane of the/

the inlet; an angle of 50-55 degrees with the plane of the base of the head in the left occipito-anterior position, and an angle of 30-35 degrees in the right occipito-posterior position; and an angle of 75-80 degrees with the plane of the rubber-sheet, assuming the latter to lie at right angles to the elevation-plane of the pubis. But the whole conditions were improved by making the angle formed by the axis of pressure with the plane of the rubber-sheet 70-75 degrees of arc, thereby making the angular distance between the sheet and the pubis 80-85 degrees of arc.

FIG. I.

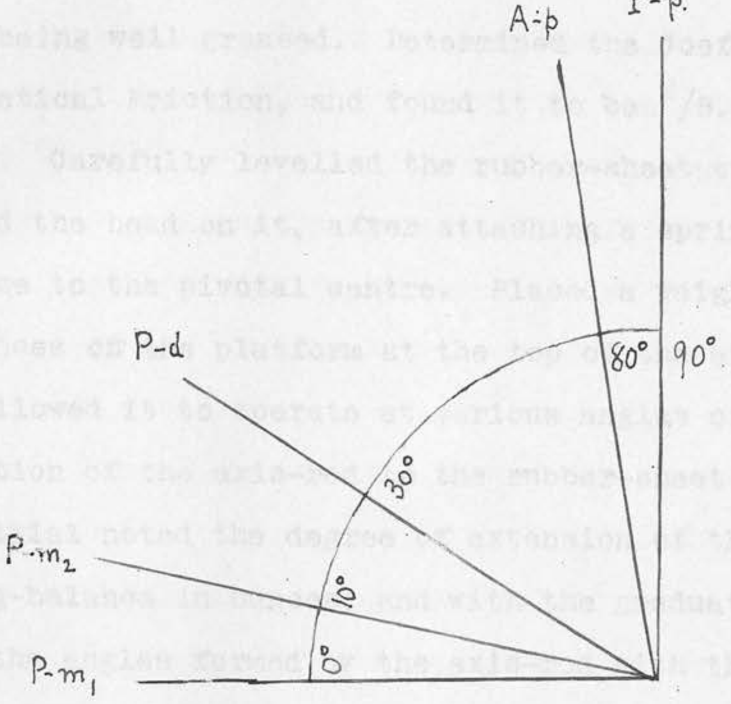


DIAGRAM to ILLUSTRATE DETERMINATION of ANGULAR DISTANCES.

P-p = Assumed plane of symphysis.

A-p = direction of axis of pressure.

P-d = plane of base of head (L.O.A.).

P-m 1-2 = planes of rubber-sheet.

A-p + P-d + P-m 2 represents nearly the best combination.

EXPERIMENT/

EXPERIMENT XLIV.

Arranged the suspended rubber-sheet as in EXPERIMENT 31. Placed the model head on the sheet, both being well greased. Determined the Coefficient of Statical Friction, and found it to be $^2/5$.

Carefully levelled the rubber-sheet and placed the head on it, after attaching a spring-balance to the pivotal centre. Placed a weight of 16 ounces on the platform at the top of the axis-rod, and allowed it to operate at various angles of inclination of the axis-rod to the rubber-sheet. At each trial noted the degree of extension of the spring-balance in ounces; and with the graduated arc read the angles formed by the axis-rod with the base of the head and with the rubber-sheet, and the angle formed by the lower surface of the head with the rubber-sheet, the angle of incidence being taken as the angle formed by the axis-rod with the lower surface of the model head. The angular distance between the plane of the base and the chord of the lower surface was found to be about 24°.

With the pressure acting at an angle of 12° behind/

behind the plane of the vertical, and at an angle of 51° of inclination to the plane of the base, the pull on the scales was 7 ounces. If the pressure had been normal to the chord of the surface the ratio of the advance or pull to the pressure (16 ounces) would have been as the sine of 27° to the cosine of 27° or $\frac{\cdot 45 \times 16}{\cdot 89} = 8\cdot 1$ ounces; but this slightly exceeds the pull on the scales. Therefore it is evident that the average pressure is not normal to the chord of the surface, but is so far inclined towards the front.

The experiment was repeated with the pressure acting at an angle of 24° behind the plane of the vertical, and at an angle of 60° of inclination to the plane of the base. The pull on the scales was found to be 8 ounces. With the pressure normal to the chord, the advance or pull would have been to the pressure (16 ounces) as the sine of 36° to the cosine of 36° or $\frac{\cdot 59 \times 16}{\cdot 81} = 11\cdot 6$ ounces. As the pull was found to be only 8 ounces, it is evident that the tangential force is much less able to overcome resistance than in the former case.

The experiment was repeated with the pressure/

pressure acting at an angle of 9° behind the plane of the vertical, and at an angle of 54° of inclination to the plane of the base. The pull on the scales was found to be 6½ ounces. With the pressure normal to the chord of the surface, the advance or pull would have been to the pressure (16 ounces) as the sine of 30° to the cosine of 30° or $\frac{\cdot 50 \quad 16}{\cdot 87} = 9.2$ ounces. As the pull was found to be only 6.5 ounces it is evident that the tangential force is as inefficient as it was in the case immediately preceding this one. Further, in both the second and third cases some degree of extension of the head was produced. Therefore, so far as could be seen experimentally, an angle of about 12° behind the plane of the vertical formed the most suitable angle of inclination of the axis of pressure. And, seeing that the rubber-sheet could vary in angular distance through nearly 24° without affecting the experimental ratios, it seemed probable that the vertical plane of the experiments and the elevation-plane of the pubis could be regarded as convertible terms assuming that the elevation-plane of the pubis lies at right angles to the plane of the brim. On this basis, then, there exists some reason/for reason for believing that the uterine pressure must act most efficiently at an angle of approximately 12° of arc behind the axis of the pelvic inlet.

The distinction of discovering the existence of a tangential force acting on a curved surface belongs to Lilienthal, and after many vicissitudes the fact was confirmed by the classic experiments of Wilbur and Orville Wright. The practical result was reached in the conclusion that a curved surface is better adapted than a plane surface to overcome a resistance, owing to the existence of this tangential force. In a plane surface, however the pressure may be inclined, the average pressure always acts at the true centre of the surface: in a curved surface the average pressure is not then normal to the chord of the surface, but is inclined towards the front or the rear. That is to say, the centre of pressure on an inclined curved surface is always excentric to the true centre of the curved surface of contact. In this factor rests the superior adaptability of a curved surface to the purpose for which it is intended.

(I have adapted the Wright experiments to the present purpose, though objections may be raised to doing/

doing so. Comparison with the original will show that I have followed the plan of the famous experiments very closely, making only those changes which are necessary under the different circumstances.)

E. ON RIGID SHEET OF RUBBER BEHIND A CURVED WALL.

For the next experiment, the rubber-sheet stretched tightly across the mouth of a box was again used. A strip of linoleum was moulded to the curve of the occiput and fixed in position over the rubber-sheet, in such a manner that the middle line of the curved piece of linoleum was in the same vertical plane as the anterior free border of the rubber-sheet, at right angles to the plane of the rubber-sheet, and so that the concavity of the curve was directed backwards.

EXPERIMENT XLV.

Lowered head in left occiput-anterior position so that occiput filled the curve of the linoleum.

Found that under great pressure directed downwards and forwards through the anterior half of the/

the occiput and with the posterior half of the occiput pressing on the rubber sheet rotation of the head into antero-posterior position took place during descent and distension of the rubber-sheet, i.e. before escape forwards under the linoleum took place.

EXPERIMENT XLVI.

Repeated EXPERIMENT XLV. with curved linoleum so arranged that its middle line was directed downwards and backwards towards the plane of the rubber-sheet.

Found that this arrangement increased the flexion of the head and made the production of rotation less difficult.

EXPERIMENT XLVII.

Repeated EXPERIMENT XLV. but in such a way that Axis-pressure was directed downwards and forwards through posterior half of occiput.

Found it impossible to produce rotation under the limitations of the experiment.

EXPERIMENT XLVIII./

EXPERIMENT XLVIII.

Repeated EXPERIMENTS XLV. - XLVII. with the head in the right occipito-posterior position with marked flexion, i.e. with axis of pressure acting through the occiput, and obtained similar results. A longer time was required to produce rotation in the repetition of EXPERIMENTS XLV. and XLVI.

EXPERIMENT XLIX.

The rubber sheet was arranged so as to make less than a right angle with the curve of linoleum in the relative planes.

Found that head lowered in the already determined axis of pressure struck the rubber-sheet first of all by the posterior half of the occiput, whether it was in the left occipito-anterior or right occipito-posterior position, and in an attitude of flexion.

F. IN MODEL CANAL.

EXPERIMENT L.

Arranged/

Arranged a sheet of cardboard in an antero-posterior plane so that it sloped downwards and inwards towards an imaginary middle line. Lowered head by the rod in the left occipito-anterior position vertically downwards and on the left side of the cardboard, so that when the head reached the lower edge of the cardboard the occiput should still be clear of it, but the sinciput during its descent should overlap the plane of the cardboard.

During descent the sinciput was rotated inwards by the cardboard, while the occiput spun round its axis, as a consequence of the sincipital movement. The head was rotated into the antero-posterior position.

For the next series of experiments a model was made in sheet-tin to represent the form of the pelvic canal with the soft parts in position, or, to be exact, to represent my conception of the form of the essential parts of the normal pelvic canal, during the second stage of labour and without the pelvic floor which was not wanted. Owing to the difficulties peculiar to working with a metal, it was found to be impossible to imitate the forward curve of the lower part of the sacrum, so that a large gap had to be left/

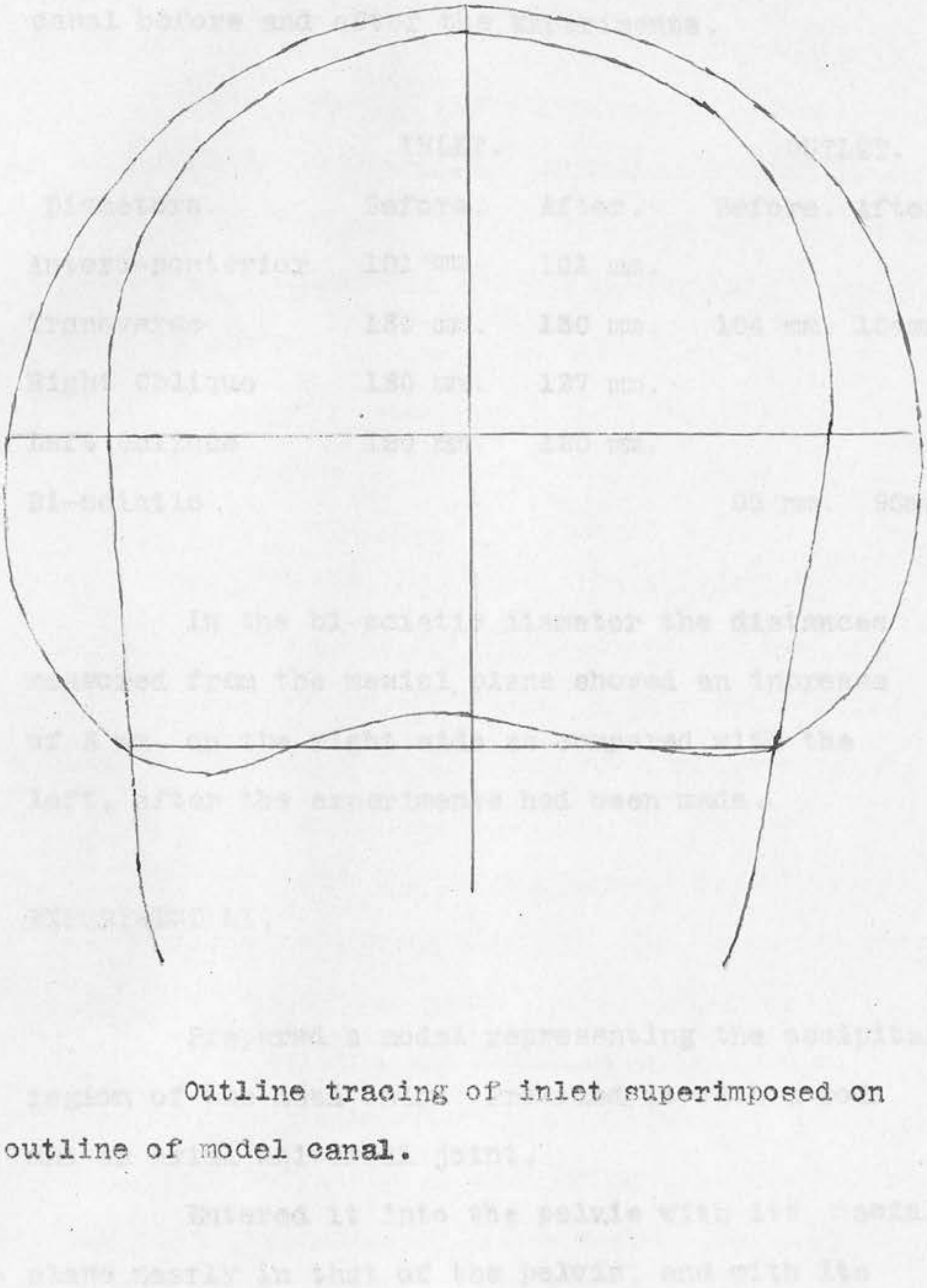
left in the posterior portion of the outlet. As things turned out, the defect did not interfere, as far as I could see, with the experiments, and in some respects it proved to be an advantage rather than otherwise. For a similar reason, the supero-inferior plane of the region of the pubic bones lay behind, to some extent, its apparent position in the pelvic canal; and the circumference of the inlet had to be reduced about an inch below the normal in order to keep the diameters as nearly true as possible. A diagram is appended of the outlines of the inlet and outlet, and a table of the important measurements is given, to which may be added the vertical height at the symphysis pubis (50mm.), and the vertical height in the region of the ischial tuberosities (89mm.)

It will be seen that I allowed a fairly roomy canal for the model head which I had used in the perineal experiments, and which I intended still to use. But in this matter, after due consideration of what was intended to be done, a compromise had to be made between the hard unyielding nature of the model and a head which could alter its shape very little after it entered the pelvic canal. In another respect, however, the relative under-proportions of the/

the model head and canal were an advantage. It became possible to demonstrate the mechanism of pelvic rotation under disadvantageous conditions, for the model head was not of a large size while the model canal had the dimensions of the average bony pelvis.

The diagram given on the next page is a tracing of the internal form in outline of the inlet superimposed on the outlet of the model pelvis. All the measurements are slightly reduced by the method of tracing. It was taken at the conclusion of the experiments and shows the marked distortion of the pelvis on the right side. (The diagram is a reversed picture.) The distortion is due to most of the experiments having been made in the right oblique diameter. Unfortunately I did not take a tracing before the experiments were begun, but the series of measurements taken before and after sufficiently bring out the change of feature.

FIG. 2.



Outline tracing of inlet superimposed on outline of model canal.

Table of Measurements of the Model Pelvic canal before and after the Experiments.

	INLET.		OUTLET.	
Diameters.	Before.	After.	Before.	After.
Antero-posterior	101 mm.	101 mm.		
Transverse	130 mm.	130 mm.	104 mm.	104mm.
Right Oblique	120 mm.	127 mm.		
Left Oblique	120 mm.	120 mm.		
Bi-sciatic			95 mm.	95mm

In the bi-sciatic diameter the distances measured from the mesial plane showed an increase of 3 mm. on the right side as compared with the left, after the experiments had been made.

EXPERIMENT LI.

Prepared a model representing the occipital region of the head only. Provided it with a rod and an axial universal joint.

Entered it into the pelvis with its mesial plane nearly in that of the pelvis; and with its anterior/

anterior surface in contact with the anterior wall of the pelvis.

Made pressure downwards and forwards mesially to the head. The occiput travelled downwards behind and in continuous contact with the anterior wall. It underwent no rotation and was delivered in the axis of pressure.

EXPERIMENT LII.

Lowered the head into the pelvis in the left occipito-anterior position. Kept the rod as nearly as possible in the mesial plane of the pelvis and the mesial plane of the head made pressure downwards and forwards.

Found that the head entered the brim with a very moderate degree of flexion; the axis-pressure was still in the mesial plane of the pelvis; the occiput rested against the anterior wall of the pelvis; on making down-bearing pressure at a certain angle flexion increased as occiput descended more rapidly than sinciput, the occiput remained in apposition to the anterior wall of the pelvis; during descent the sinciput swung inwards until the mesial plane/

plane of the head nearly coincided with the mesial plane of the pelvis, the occiput at the same time performing a true spinning motion about its own axis; as rotation ended the head became less flexed; the occiput emerged from the pelvic canal, in contact with the anterior wall to the last moment and still travelling in the direction of the axis of pressure.

EXPERIMENT LIII.

Found in the left occipito-anterior position that at the onset of internal rotation the greatest resistance is developed by the pelvic wall against the left lateral inferior aspect of the occiput and the right lateral inferior aspect of the sinciput.

EXPERIMENT LIV.

Repeated EXPERIMENT LII. but directed pressure downwards parallel to the axis of the inlet i.e. at right angles to the plane of the brim.

Found that descent took place with flexion which eventually became so extreme as to allow of the head emerging from the pelvic canal in the non-rotated/

rotated position. In the following experiment pressure was reduced so that descent took place more slowly.

EXPERIMENT LV.

Arranged head in L.O.A. flexed position in brim of model canal. Made pressure gently and intermittently at right angles to plane of brim.

Found that head rotated during descent into an antero-posterior position with the occiput in front, but that flexion was more extreme than is the case when pressure is made downwards and forwards, and a tendency towards impaction in the oblique diameter was discovered.

EXPERIMENT LVI.

Repeated EXPERIMENT LII. but directed the pressure downwards and backwards. Found that the occiput was driven through the pelvic cavity downwards and backwards and away from the anterior wall; during descent the sinciput was rotated to the front, the occiput spinning about its own axis to correspond with the motion of the sinciput. Sometimes the head became jammed in the transverse position, from which

release/

release occurred only on advancing the descent of the occiput, thereby increasing flexion and moving the sinciput to the front of the pelvis.

EXPERIMENT LVII.

Lowered the flexed head into the pelvis in the right occipito-posterior position. Made pressure downwards and forwards.

Found that flexion had to be much greater than in the left occipito-anterior position, not only to get the head past the brim but also to keep the axis of pressure in the mesial plane of the pelvis. In the cavity of the pelvis the occiput moved forwards until it came into contact with the anterior wall of the pelvis in the transverse position. At this stage resistance became severe and flexion was much increased as the occiput was forced downwards. The downward movement of the occiput was made easier by applying pressure in short and sharp bouts, with a marked recoil in each interval. On further descent of the occiput and the increase of flexion, the sinciput rotated posteriorly and flexion was greatly reduced. The occiput was delivered in the direction of/

of the axis of pressure.

EXPERIMENT LVIII.

Arranged head in Right occipito-posterior position in brim of model canal. Made pressure at right angles to plane of brim.

Found that during descent head rotated into an antero-posterior position, the occiput remaining behind.

EXPERIMENT LIX.

Lowered the extended head into the pelvis in the right occipito-posterior position. Made pressure downwards and forwards.

Found that extension had to be well-marked to keep axis of pressure in the mesial plane of the pelvis. The occiput fitted the postero-lateral portion of the inlet badly, and the sinciput made an equally bad fit behind the anterior wall of the pelvis. During descent sinciput never left the anterior wall of the pelvis, the occiput rotated posteriorly into the hollow behind, and the sinciput was delivered in the direction of the axis of pressure. Rotation was as/

as easily accomplished as in the occipito-anterior positions.

EXPERIMENT LX.

Repeated preceding EXPERIMENT LIX. with head extended.

Found that head rotated during descent into the antero-posterior position with the sinciput anterior, but that extension was more extreme than is the case when pressure is made downwards and forwards, and a marked tendency towards impaction in the oblique diameter was discovered.

EXPERIMENT LXI.

Lowered the extended head into the pelvis in the left occipito-anterior position. Made pressure downwards and forwards.

Found that extension had to be well marked to keep the axis of pressure in the mesial plane of the pelvis. During descent the sinciput moved downwards and forwards until it came into contact with the anterior wall of the pelvis, the head then being in the transverse position. During the further descent, resistance was very severe until the occiput had/

had rotated into the hollow behind. The sinciput spun round its own axis to correspond with the occipital movement, and it was delivered in the direction of the axis of pressure.

EXPERIMENT LXII.

Repeated EXPERIMENT LXI., but made pressure at right angles to plane of brim.

Found that extension became much more severe; that sinciput descent rotated backwards and inwards, the head being delivered in antero-posterior position with occiput in front.

EXPERIMENT LXIII.

Arranged aftercoming head on the top of the brim of the pelvis, in the left occipito-anterior position. Made pressure on the summit of the occiput (equal in foetus to a point half an inch anterior to the posterior fontanelle).

Found that the head flexed itself and entered the brim. Continued to make pressure downwards and forwards between the mesial planes of the head and the pelvis. Flexion was maintained. The occiput moved downwards behind and pressed on the anterior wall of the pelvis. In the cavity of the pelvis /

pelvis the sinciput rotated backwards, while the occiput spun round its own axis, until the mesial plane of the head was nearly in the mesial plane of the pelvis. The occiput was born in the direction of the axis of pressure.

EXPERIMENT LXIV.

Re-arranged EXPERIMENT LXIII. when the non-rotated flexed head was in the cavity of the pelvis pulled downwards and forwards on the rod attached to the head.

Found that flexion was maintained, and that rotation took place as before.

EXPERIMENT LXV.

Performed EXPERIMENT LXIV. again, but pulled downwards and backwards. Found that head became extended and eventually jammed. The occiput was pulled away from the anterior wall of the pelvis and the sinciput worked upwards. The plane of obstruction lay at a narrow angle with the plane of the base.

EXPERIMENT LXVI./

EXPERIMENT LXVI.

Arranged the extended aftercoming head on the top of the brim in the left occipito-anterior position. Made pressure on the sinciput, or pulled on the traction rod downwards and forwards, in the mesial plane of the pelvis. Found, as descent took place, that sinciput moved downwards and forwards to behind the anterior wall, and the occiput rotated into the hollow behind. The sinciput was delivered in the axis of pressure.

EXPERIMENT LXVII.

Arranged flexed aftercoming head on the brim of the pelvis in the right occipito-posterior position. Made pressure on the summit of the occiput downwards and forwards in the mesial planes of the head and the pelvis. Found that to pass the brim and to keep the axis of pressure in the mesial plane of the pelvis flexion had to be greater than in the occipito-anterior position. Under pressure the occiput moved downwards and forwards to a position behind and in contact with the anterior wall of the pelvis/

pelvis, the head assuming the transverse position. After some difficulty as already described for the normal occipito-posterior position, the sinciput rotated to the hollow behind, and the head nearly assumed the antero-posterior position. The occiput was born in the direction of the axis of pressure.

EXPERIMENT LXVIII.

Rearranged EXPERIMENT LXVII. When the flexed head was in the cavity of the pelvis, traction on the rod attached to the head and in a direction downwards and forwards maintained flexion; pulled the occiput downwards and forwards to a position behind and in contact with the anterior wall; and, by dint of short quick pulls and sharp recoils, produced long rotation of sinciput, and delivery of the axis of pressure (or traction).

EXPERIMENT LXIX.

Arranged the head greatly extended in the right occipito-posterior position at the brim. Made pressure downwards and forwards in the sinciput, or pulled/

pulled downwards and forwards on the traction rod in both instances between the mesial planes of the head and the pelvis. Found that sinciput moved downwards and forwards behind anterior wall of the pelvis, and occiput rotated into the hollow behind. The sinciput was delivered in the direction of the axis of pressure or traction.

EXPERIMENT LXX.

During the process of rotation in occipito-anterior and posterior positions well-marked recoils were produced in the intervals of intermittent axis-pressures.

Found that a restitution of position occured, mainly by pressure of the region of the promontory on the appropriate lateral aspect of the head. Found that on drawing up the head to the brim from any part of the period of rotation the original position could be restored except in a completely long rotated occipito-posterior which was converted, on retraction to the brim into the right or left occipito-anterior position. Care was taken that the retraction was made in the axis of pressure.

EXPERIMENT LXXI.

Determined by trial in all positions that the axis of pressure should be approximately in the mesial plane of the pelvis.

When there is marked lateral displacement of the axis of pressure, the passage of the head through the pelvis is not so smooth, and anomalous attitudes of the head are apt to arise.

EXPERIMENT LXXII.

Determined by trial in all the positions that the axis of pressure should lie as nearly as possible in the mesial plane of the head. A marked displacement of the axis of pressure outside the mesial plane of the head produces lateral obliquity during the passage of the head through the pelvic cavity, with well marked difficulty and delay.

Found that even with axis of pressure lying strictly or apparently so in the mesial plane of the head Naegele's obliquity was apt to develop at the brim.

DETERMINATION OF ANGULAR DISTANCES FOR MODEL CANAL.

EXPERIMENT LXXIII.

Determined by trial in all the positions that the axis of pressure must lie as nearly as possible at an angle of 10-15 degrees of arc behind the supero-inferior plane of the pubis, assuming the latter to lie at right-angles to the plane of the brim. Within these limits rotation takes place most readily, and the presenting part keeping closely behind the anterior wall of the pelvis makes a straight journey in the direction of the axis of pressure from inlet to outlet.

EXPERIMENT LXXIV.

Determined by trial in all the positions that the cephalic plane of engagement was the sub-occipito-frontal and the plane of rotation the occipito-frontal. The former makes an angle of 20-25 degrees of arc with the latter, and also with the plane of the base of the head.

EXPERIMENT LXXV.

Determination/

Determination of angular distances in left occipito-anterior position.

At the brim the plane of the base of the head makes an angle with the plane of the brim of 20-25 degrees of arc, an angle of 50-55 degrees of arc with the axis of pressure, and an angle of 65-70 degrees of arc with the supero-inferior plane of the pubes, assuming the latter to be at right angles to the plane of the brim. At the period of greatest flexion in the cavity, the plane of the base of the head makes an angle of 35-45 degrees of arc with the axis of pressure.

EXPERIMENT LXXVI.

Determination of angular distances in the flexed right-occipito-posterior position.

At the brim the plane of the base of the head makes an angle of 40-45 degrees of arc with the plane of the brim, an angle of 35-40 degrees with the axis of pressure, and an angle of 45-50 degrees of arc with the supero-inferior plane of the pubes, assuming the latter to lie at right angles to the plane of the brim.

EXPERIMENT LXXVII.

Determination/

Determination of angular distances in the extended left-occipito-anterior and right occipito-posterior positions.

Found that angle formed by the axis of pressure with the plane of the base amounted to 120-130 degrees of arc.

H. IN MODEL CANAL WITH SHEET OF RUBBER TO FORM A FLOOR.

1. With a rigid rod actuating head.
2. With a flexible rod actuating head.

For the next series of experiments I attached a broad sheet of rubber to the brim posteriorly and laterally by one end, and by the other to the region of the ischial tuberosities of the model canal, the arrangements being such that the rubber nearly reached the limit of its elasticity posteriorly at a level corresponding nearly to that of the lower end of the third sacral vertebra. The canal was than lubricated with glycerine.

EXPERIMENT LXXVIII.

Arranged head in L.O.A. flexed position in brim. Made pressure downwards and forwards at an angle of 10°-15° of inclination towards a perpendicualr drawn to the plane of the brim.

Found that occiput descended behind anterior wall of canal, that flexion increased up to moment of/

of rotation, that occiput began to press on rubber at beginning of rotation, that occiput rotated forwards and inwards and head was readily delivered.

EXPERIMENT LXXIX.

Repeated EXPERIMENT LXXVIII. with head in R.O.P. flexed position.

Found that long rotation occurred during descent, the occiput pressing on rubber sheet before rotation began, and performing its transit through the plane of the widest diameters before true rotation began.

EXPERIMENT LXXX.

Repeated EXPERIMENT LXXIX. with head extended.

Found that sinciput rotated forwards and inwards and that it made contact with the rubber sheet during its descent, before and during short rotation.

EXPERIMENT LXXXI.

Repeated EXPERIMENT LXXVIII. but made/

made pressure at right angles to the plane of the brim.

Found that the results of EXPERIMENT LXXVIII were repeated, but under greater pressure and with more delay.

EXPERIMENT LXXXII.

Repeated EXPERIMENT LXXXI. with head in R.O.P. flexed position.

Found that occiput did not make its transit until it pressed deeply on rubber-sheet, that long rotation occurred slowly and with great difficulty, the rubber sheet being excessively strained.

EXPERIMENT LXXXIII.

Repeated experiment 82 with head extended.

Found that short rotation of sinciput forwards and inwards occurred under great pressure and slowly, that sinciput was not pressed firmly against anterior wall of the canal until it had distended the rubber-sheet.

EXPERIMENT/

EXPERIMENT LXXXIV.

Arranged head in L.O.A. flexed position in brim, and made pressure downwards and backwards, at an angle of 10° - 15° before a perpendicular to the plane of the brim.

Found that occiput swung backwards through plane of widest diameters and struck rubber-sheet in L.O.P. position. Resistance became severe; head rotated into an antero-posterior position with occiput behind. Head then became much flexed, and travelled slowly forwards over the rubber-sheet which was strained to the limits of its elasticity.

EXPERIMENT LXXXV.

Repeated EXPERIMENT LXXXIV. with head in R.O.P. position and flexed.

Found that, as head was pressed on to the rubber sheet, it rotated slowly and with great difficulty into an antero-posterior position with occiput posterior; that flexion then became extreme so that back of head became opposed to the tense rubber-sheet; and that when this happened occiput moved/

moved forwards over the rubber sheet towards the outlet in a state of extreme flexion, under severe pressure which was still maintained downwards and backwards, and on a rubber sheet on the point of rupture.

EXPERIMENT LXXXVI.

Repeated EXPERIMENT LXXXV. with head extended. Found that sinciput moved backwards across the plane of widest diameters, and struck rubber-sheet with the head nearly in the R.O.A. position, that under severe pressure sinciput rotated backwards and inwards, and on extension becoming more severe moved slowly forwards towards the outlet.

Found in EXPERIMENTS LXXVIII-LXXXVI. that, if rubber-sheet were so tightened that further distension became impossible, a deadlock occurred, the head neither rotating nor moving in a linear direction over the rubber-sheet; more especially in those experiments in which pressure was made at right angles to, or inclined backwards towards the plane of the brim.

For the following experiments a flexible leather rod was attached to the ball and socket joint at the base of the head. The model pelvic canal with rubber-sheet attached was used (CF. Jones 1906)

EXPERIMENT LXXXVII.

Inserted head in L. O. A. flexed position into canal and made pressure downwards and forwards through leather rod and repeated EXPERIMENT. with pressure at right angles to plane of brim.

Found that under pressure rod bent forwards in direction of outlet; that the processes of descent, internal rotation, and extension at outlet occurred as in preceding experiments without appreciable difference.

EXPERIMENT LXXXVIII.

Repeated preceding EXPERIMENT with head deeply in outlet, and made pressure downwards and backwards.

Found that leather rod bent forwards as in last experiment; and that during extrusion at outlet sinciput dipped heavily, thus showing that the direction of a force through a solid body cannot be altered by bending the body.

EXPERIMENT LXXXIX.

Repeated EXPERIMENT LXXXVII, making

pressure/

pressure downwards and backwards.

Found that leather rod bent forwards as before but occiput travelled backwards and became persistent occipito-posterior.

EXPERIMENT XC.

Arranged head in brim in R.O.P. flexed position. Made pressure through leather rod, first at right angles to brim and secondly downwards and forwards.

Found that rod bent forwards, long rotation occurred with delivery as in EXPERIMENT LXXXVII.

EXPERIMENT XCI.

Repeated EXPERIMENT XC. making pressure downwards and backwards.

Found that leather rod bent forwards; that short-rotation occurred; that the subsequent movement forwards of occiput to outlet was facilitated by the bending of the rod which allowed more readily of the development of extreme flexion; but that the pressure downwards and backwards on the rubber-sheet was not diminished.

EXPERIMENT/

EXPERIMENT XCII.

Repeated EXPERIMENTS LXXXVII. and XCI. with head extended.

Found that the mechanisms were not affected by the substitution of a flexible for a rigid rod, excepting that, when forehead was posterior at outlet, the flexibility of the leather rod made the movement of extension more easy.

EXPERIMENT/

II. EXPERIMENT WITH MODEL BREECH AND SHOULDERS,

A. ON RIGID RUBBER-SHEET.

For the next series of experiments models were prepared of the shoulders and the breech. They were built up after the manner of the head, and were shaped as far as possible according to nature. The shoulders had a bisacromial diameter of 120 mm. a dorso-sternial diameter of 89 mm. and a circumference of 312 mm. The ball-and-socket joint of the pressure-rod was fixed to the base 31 mm. from the margin of the back, and in the middle line. The breech had a transverse diameter of 102 mm. and an antero-posterior diameter of 70 mm. The ball-and-socket joint of the pressure-rod was fixed to the base 25 mm. from the margin of the back and in the middle line.

EXPERIMENT XCIII.

Lowered breech in left sacro-anterior position on to stretched rubber-sheet, in such a way that posterior hip made contact with the rubber. Directed pressure downwards and forwards.

Found that rotation took place into a transverse position during advance; that breech then/

then continued to advance without further rotation.

EXPERIMENT XCIV.

Lowered breech in left sacro-anterior position on to stretched rubber-sheet in such a way that whole breech made contact with the rubber. Directed pressure downwards and forwards.

Found that no roation took place during advance which was made obliquely to the left.

EXPERIMENT XCV.

Lowered breech in left sacro-anterior position on to stretched rubber-sheet in such a way that anterior hip made contact with the rubber. Directed pressure downwards and forwards.

Found that rotation took place into an antero-posterior position during advance; that breech then continued to advance without further rotation.

EXPERIMENT XCVI.

Lowered breech in left sacro-anterior position on to stretched rubber-sheet, in such /

such a way that posterior hip made contact with the rubber. Directed pressure downwards and backwards.

Found that rotation took place into an antero-posterior position during retreat; that breech then continued to retreat without further rotation.

EXPERIMENT XCVII.

Lowered breech in left sacro-anterior position on to stretched rubber-sheet, in such a way that both hips made contact with the rubber. Directed pressure downwards and backwards.

Found that no rotation took place during retreat, which was made obliquely towards the right.

EXPERIMENT XCVIII.

Lowered breech in left sacro-anterior position on to stretched rubber-sheet, in such a way that anterior hip made contact with the rubber. Directed pressure downwards and backwards.

Found that rotation took place into a transverse position during retreat, that breech then continued/

continued to retreat without further rotation.

EXPERIMENT XCIX.

Lowered breech in right sacro-posterior position on to stretched rubber-sheet, in such a way that posterior hip made contact with the rubber. Directed pressure downwards and forwards.

Found that rotation took place into a transverse position during advance; that breech then continued to advance without further rotation.

EXPERIMENT C.

Lowered breech in right sacro-posterior position onto stretched rubber-sheet in such a way that both hips made contact with the rubber. Directed pressure downwards and forwards.

Found that no rotation took place during advance; that breech moved obliquely towards the left.

EXPERIMENT CI.

Lowered breech in right sacro-posterior position onto the stretched rubber-sheet, in such/

such a way that anterior hip made contact with rubber. Directed pressure downwards and forwards.

Found that rotation took place into an antero-posterior position during advance; that breech then continued to advance without further rotation.

EXPERIMENT CII.

Lowered breech in the right sacro-posterior position onto the stretched rubber-sheet, in such a way that posterior hip made contact with rubber. Directed pressure downwards and backwards.

Found that rotation took place into an antero-posterior position during retreat; that breech then continued to retreat without further rotation.

EXPERIMENT CIII.

Lowered breech in the right sacro-posterior position on to the stretched rubber-sheet, in such a way that both hips made contact with the rubber. Directed pressure downwards and backwards.

Found that no rotation took place during retreat; that the breech retreated obliquely towards/

towards the right.

EXPERIMENT CIV.

Lowered breech in right sacro-posterior position onto the stretched rubber-sheet, in such a way that anterior hip made contact with the rubber. Directed pressure downwards and backwards.

Found that rotation took place into a transverse position during retreat; that breech then continued to retreat without further rotation.

B.. ON RELAXED RUBBER-SHEET.

EXPERIMENT CV.

Lowered breech in left sacro-anterior position onto relaxed rubber-sheet, in such a way that posterior hip made contact with the rubber. Directed pressure downwards and forwards.

Found that rotation took place into an antero-posterior position during advance; that breech then continued to advance without further rotation.

EXPERIMENT CVI.

Lowered/

Lowered breech in left sacro-anterior position onto relaxed rubber-sheet, in such a way that both hips made contact with the rubber. Directed pressure downwards and forwards.

Found that rotation took place into an antero-posterior position during advance; that breech then continued to advance without further rotation.

EXPERIMENT CVII.

Lowered breech in left sacro-anterior position onto the relaxed rubber-sheet, in such a way that the anterior hip made contact with the rubber. Directed pressure downwards and forwards.

Found that rotation took place into an antero-posterior position during advance; that breech then continued to advance without further rotation.

EXPERIMENT CVIII.

Lowered breech in left sacro-anterior position onto the relaxed rubber-sheet, in such/

such a way that posterior hip made contact with the rubber. Directed pressure downwards and backwards.

Found that rotation took place into an an antero-posterior position during retreat; that breech then continued to retreat without further rotation.

EXPERIMENT CIX.

Lowered head in left sacro-anterior position onto the relaxed rubber-sheet in such a way that both hips made contact with the rubber. Directed pressure downwards and backwards.

Found that rotation took place into an antero-posterior position during retreat; that breech then continued to retreat without further rotation.

EXPERIMENT CX.

Lowered breech in left sacro-anterior position onto the relaxed rubber-sheet, in such a way that anterior hip made contact with the rubber. Directed pressure downwards and backwards.

Found that rotation took place into an antero-posterior position during retreat; that breech/

breech then continued to retreat without further rotation.

EXPERIMENT CXI.

Lowered breech in right sacro-posterior position onto the relaxed rubber-sheet, in such a way that posterior hip made contact with rubber. Directed pressure downwards and forwards.

Found that rotation took place into an antero-posterior position during advance; that breech then continued to advance without further rotation.

EXPERIMENT CXII.

Lowered breech in right sacro-posterior position onto the relaxed rubber-sheet, in such a way that both hips made contact with the rubber. Directed pressure downwards and forwards.

Found that rotation took place into an antero-posterior position during advance, that breech then continued to advance without further rotation.

EXPERIMENT CXIII.

Lowered/

Lowered breech in right sacro-posterior position onto the relaxed rubber-sheet, in such a way that anterior hip made contact with rubber. Directed pressure downwards and forwards.

Found that rotation took place into an antero-posterior position during advance; that breech then continued to advance without further rotation.

EXPERIMENT CXIV.

Lowered breech in right sacro-posterior position onto the relaxed rubber-sheet, in such a way that posterior hip made contact with the rubber. Directed pressure downwards and backwards.

Found that rotation took place into an antero-posterior position during retreat; that breech then continued to retreat without further rotation.

EXPERIMENT CXV.

Lowered breech in the right sacro-posterior position onto the relaxed rubber-sheet, in such a way that both hips made contact with the rubber. Directed pressure downwards and backwards.

Found that rotation took place into an antero-posterior position during retreat; that breech/

breech then continued to retreat without further rotation.

EXPERIMENT CXVI.

Lowered breech in right sacro-posterior position onto the relaxed rubber-sheet, in such a way that anterior hip made contact with the rubber. Directed pressure downwards and backwards.

Found that rotation took place into an antero-posterior position during retreat; that breech then continued to retreat without further rotation.

C. ON RIGID RUBBER-SHEET BEHIND A CURVED WALL.

For EXPERIMENTS CXVII to CXXXV a curved bar, well greased, was arranged in a position to represent the anterior wall of the pelvis, above the free anterior margin of the rubber-sheet.

EXPERIMENT CXVII.

Lowered breech in left sacro-anterior position onto the rubber-sheet in such a way/

way that posterior hip made contact with the rubber. Directed pressure downwards and forwards.

Found that in the absence of special precautions, no rotation took place without distension of the rubber, that the distension produced by the breech was more acute than that produced by the head, that rotation took place into an antero-posterior position during descent; that the breech then continued to descend without further rotation; that breech did not move away from anterior bar. Pressure had to be more severe behind the anterior bar than on the free rubber-sheet.

EXPERIMENT CXVIII.

Lowered breech in left sacro-anterior position onto the rubber-sheet, in such a way that both hips made contact with the rubber. Directed pressure downwards and forwards.

Found that rotation took place into an antero-posterior position during descent; that breech then continued to descend without further rotation; that breech did not move away from anterior bar.

EXPERIMENT CXIX.

Lowered/

Lowered breech in left sacro-anterior position onto the rubber-sheet, in such a way that anterior hip made contact with the rubber. Directed pressure downwards and forwards.

Found that rotation took place into an antero-posterior position during descent; that breech then continued to descend without further rotation; that breech did not move away from anterior bar.

EXPERIMENT CXX.

Lowered breech in left sacro-anterior position on to the rubber-sheet, in such a way that posterior hip made contact with the rubber. Directed pressure downwards and backwards.

Found that rotation took place into an antero-posterior position during descent; that breech then continued to descend without further rotation; that breech always moved away from anterior bar.

EXPERIMENT CXXI.

Lowered breech in left sacro-anterior position on to the rubber-sheet, in such a way that both/

both hips made contact with the rubber. Directed pressure downwards and backwards.

Found that rotation took place into an antero-posterior position during descent; that breech then continued to descend without further rotation; that breech always moved away from anterior bar.

EXPERIMENT CXXII.

Lowered breech in left sacro-anterior position on to the rubber-sheet, in such a way that anterior hip made contact with the rubber. Directed pressure downwards and backwards.

Found that rotation took place into an antero-posterior position during descent; that breech then continued to descend without further rotation; that breech always moved away from anterior bar.

EXPERIMENT CXXIII.

Lowered breech in left sacro-anterior position on to a very rigid rubber-sheet, in such a way that posterior hip made contact with the rubber. Directed pressure downwards and forwards behind anterior bar, so as to distend rubber as little as possible.

Found/

Found that rotation took place into a transverse position behind anterior bar, that breech then descended without further rotation.

EXPERIMENT CXXIV.

Lowered breech in right sacro-posterior position on to the rubber-sheet, in such a way that posterior hip made contact with the rubber. Directed pressure downwards and forwards.

Found that in the absence of special precautions, no rotation took place without distension of the rubber, that the distension produced by the breech was more acute than that produced by the head; that rotation took place into an antero-posterior position during descent; that breech then continued to descend without further rotation; that breech did not move away from anterior bar. Pressure had to be more severe behind the anterior bar than on the free perineum.

EXPERIMENT CXXV.

Lowered breech in right sacro-posterior position on to the rubber-sheet, in such a way that both hips made contact with the rubber.

Directed/

Directed pressure downwards and forwards.

Found that rotation took place into an antero-posterior position during descent; that breech then continued to descend without further rotation; that breech did not move away from anterior bar.

EXPERIMENT CXXVI.

Lowered breech in right sacro-posterior position on to the rubber-sheet, in such a way that anterior hip made contact with the rubber. Directed pressure downwards and forwards.

Found that rotation took place into an antero-posterior position during descent; that breech then continued to descend without further rotation; that breech did not move away from anterior bar.

EXPERIMENT CXXVII.

Lowered brech in right sacro-posterior position onto the rubber-sheet, in such a way that posterior hip made contact with the rubber. DDirected pressure downwards and backwards.

Found that rotation took place into an antero-posterior position during descent; that breech then/

then continued to descend without further rotation; that breech moved away from anterior bar.

EXPERIMENT CXXVIII.

Lowered breech in right sacro-posterior position on to the rubber-sheet, in such a way that both hips made contact with the rubber. Directed pressure downwards and backwards.

Found that rotation took place into an antero-posterior position during descent; that breech then continued to descend without further rotation; that breech moved away from anterior bar.

EXPERIMENT CXXIX.

Lowered breech in right sacro-posterior position on to the rubber-sheet, in such a way that anterior hip made contact with the rubber. Directed pressure downwards and backwards.

Found that rotation took place into an antero-posterior position during descent; that breech then continued to descend without further rotation; that breech moved away from anterior bar.

EXPERIMENT CXXX.

Lowered/

Lowered breech in right sacro-posterior position on to a very rigid rubber-sheet, in such a way that posterior hip made contact with the rubber. Directed pressure downwards and forwards, so as to distend rubber-sheet as little as possible.

Found that breech rotated into transverse position behind anterior bar; that breech then continued to descend without further rotation.

EXPERIMENTS XCIII. to CXXX. were repeated, one by one, with the shoulders and with the aftercoming shoulders, and were found to be equally true for both of them as for the breech. It is not necessary, therefore, to repeat the description of each experiment in writing. Shoulders should be read for breech, left dorso-anterior, right dorso-posterior, and also these definitions preceded by the epithet aftercoming, for left sacro-anterior and right sacro-posterior respectively.

D. IN MODEL CANAL.

The model pelvic canal was used in EXPERIMENTS CXXXI. to CXLIV.

EXPERIMENT CXXXI.

Lowered shoulders into the model pelvis in the left dorso-anterior position. Made pressure at about an angle of 15° degrees of arc behind the plane of the pubis.

Found that shoulders entered and passed brim best when nearly in transverse position, and with axis of pressure nearly in mesial plane of pelvis; that in the cavity of the pelvis the shoulders jammed in a nearly transverse position, owing mainly to them not fitting behind the curved anterior wall; that enough space then existed between the shoulders and the anterior wall to be filled later by one shoulder without transition of axis backwards; that under great pressure rotation took place into an antero-posterior position, that the direction of rotation was fixed by the relative areas of contact of the two shoulders with the pelvic wall, that shoulder passing forwards which was in contact posteriorly with lateral pelvic wall; that rotation was a true spinning, the axis of rotation not shifting backwards; that anterior shoulder comfortably filled the space ready for it; that the descent during rotation was relatively small;.that shoulders were delivered in the direction of axis pressure.

EXPERIMENT/

Repeated EXPERIMENT CXXXI. but made pressure downwards and backwards.

Found that rotation took place into an antero-posterior position, in the same direction of rotation as in EXPERIMENT CXXXI. that during descent the shoulders moved away from the anterior wall of the pelvis.

EXPERIMENT CXXXIII.

Lowered shoulders into the model pelvis in the right dorso-posterior position. Directed pressure at an angle of about 15 degrees of arc behind the plane of the anterior wall.

Found that as in EXPERIMENT CXXXI. rotation took place during descent into an antero-posterior position; that the stages and conditions of the descent were similar to those of EXPERIMENT CXXXI.

EXPERIMENT CXXXIV.

Repeated EXPERIMENT CXXXIII. but made pressure downwards and backwards.

Found that rotation took place into an antero-posterior position, under the same conditions and limitations as in EXPERIMENT CXXXIII. but that shoulders/

shoulders during descent moved away from anterior pelvic wall.

EXPERIMENT CXXXV.

Lowered aftercoming shoulders into model pelvis in left dorso-anterior position, and made pressure at about an angle of 15 degrees of arc behind the plane of the anterior wall.

Found that rotation took place into an antero-posterior position under the same conditions and limitations as in EXPERIMENT CXXXI.

EXPERIMENT CXXXVI.

Repeated EXPERIMENT CXXXV. but directed pressure downwards and backwards.

Found that rotation took place into an antero-posterior position, but that shoulders moved away from anterior wall during descent.

EXPERIMENT CXXXVII.

Lowered aftercoming shoulders in right dorso-posterior position into model pelvis, and made pressure at an angle of about 15 degrees of arc behind the plane of the anterior pelvic wall.

Found that rotation took place into an antero-posterior position under the same conditions and limitations as in EXPERIMENT CXXXI.

EXPERIMENT CXXXVIII.

Repeated EXPERIMENT CXXXVII, but made pressure downwards and backwards.

Found that rotation took place into an antero-posterior position under the same conditions and limitations as in EXPERIMENT CXXXI, but that during descent shoulders moved away from anterior pelvic wall.

EXPERIMENT CXXXIX-CXLII.

Repeated EXPERIMENTS CXXXI-CXXXIV, but with the breech, namely left sacro-anterior with pressure/

pressure directed downwards and forwards; the same with pressure directed downwards and backwards; and right sacro-posterior with pressure directed downwards and forwards; the same with pressure directed downwards and backwards.

Found that in every case rotation took place towards an antero-posterior position, the direction of rotation being determined by areas of contact of the two hips with the lateral pelvic walls, the hip in contact by its posterior surface with the pelvic wall moving forwards; that rotation in every case was a true spinning about an axis which did not make a transit inside the pelvis; that the breech as designed was rather small so that rotation was never complete, but ended as soon as the hips ceased to touch the lateral walls.

III/

III. MISCELLANEOUS EXPERIMENTS.

a. EXPERIMENTAL MANUAL ROTATION OF MODEL HEAD IN OCCIPITO-POSTERIOR POSITION IN MODEL CANAL.

EXPERIMENT CXLIII.

Experimental rotation of flexed head in right occipito-posterior position into right occipito anterior position, when at the outlet and non-rotated.

Raised up the head a little, applied pressure backwards and upwards and in the direction of rotation to the antero-lateral aspect of sinciput. Made pressure downwards and forwards through rod attached to occiput. Sinciput passed upwards and backwards along left lateral wall of pelvis until the suboccipito bregmatic diameter of the head engaged the brim in the right occipito-anterior position, the occiput having been simultaneously driven forwards under pressure to behind the anterior wall of the pelvis. Pressure being maintained, descent began in the right occipito anterior position which changed to the antero-posterior position under the sacral/

sacral promontory, if pressure was still maintained with the fingers on the sinciput; and at the outlet, if such pressure was earlier removed. The descent of the head to its old position was immediate, if axis pressure continued.

EXPERIMENT CXLIV.

Experimental rotation of extended head in right occipito-posterior position into right occipito-anterior position, when at the outlet and either non-rotated or mal-rotated.

Flexion of the head was found to be impossible, as the plane of the base of the head would not pass through any plane of the pelvis at right angles to the axis and above the outlet.

Raised up the head a little, applied pressure backwards, upwards and in the direction of rotation to the antero-lateral aspect of the sinciput. Made pressure downwards and forwards through rod attached to occiput. Found that the restraint of sinciput caused a transference of axis pressure from it to the occiput. Sinciput passed backwards along the left lateral wall of the pelvis low down, while/

while occiput under the direction of the axis pressure moved forwards high up to behind the anterior wall of the pelvis, until the position was nearly antero-posterior. Descent then began, occiput moving downwards more rapidly than sinciput, and flexion taking place at the outlet.

B. EXPERIMENTS WITH MODEL HEAD ON A SHEET OF GLASS.

EXPERIMENT CXLV.

A sheet of glass was taken. It was well greased. Lowered head on to the glass and made pressure downwards and forwards through left half of occiput, which alone made contact with the glass. The head advanced and rotated from left to right.

EXPERIMENT CXLVI.

Repeated last experiment, but made pressure downwards and forwards mesially to the head, the lateral halves of the occiput resting equally on the glass. The head advanced but no rotation occurred.

EXPERIMENT CXLVII./

EXPERIMENT CXLVII.

Repeated last experiment, but made pressure downwards and forwards through right half of occiput which alone rested on the glass.

The head advanced and rotation took place from right to left.

C. EXPERIMENTS WITH A BLADDER FILLED WITH WATER.

Experiments CXLVIII.-CLIV. were made for the purpose of showing the nature of hydrostatic pressure in relation to rotation.

EXPERIMENT CXLVIII.

A bullock's bladder was partly filled with water and then sealed. It was of such a size that it could only pass through the model pelvis by being elongated and narrowed. It was allowed to gravitate through the pelvis, the water being under no other pressure.

Found that bladder completely filled the model pelvis in all horizontal planes; that no rotation/

rotation occurred during descent; that instead of rotation deformation took place as required by the narrowing of the outlet.

EXPERIMENT CXLIX.

The bladder was filled completely, sealed, and then forced through the model pelvis by pressure downwards.

Found that the bladder completely filled the model pelvis in all horizontal planes; that no rotation took place during descent; that instead of rotation deformation was produced as required by the narrowing of the outlet.

EXPERIMENT CL.

A piece of wood was taken, of sufficient length to overlap the lateral walls of the outlet of the model pelvis, when admitted in the oblique position at the inlet. It was attached to a vertical rod in such a way as to be able to rotate freely in the middle of the distended bag. The vertical rod passed through the neck of the bladder which was sealed after being filled with water as completely as the arrangements allowed. Pressure was made downwards/

downwards and forwards through the rod, the bladder having been partly inserted into the pelvis with the horizontal rod in an oblique position.

Found that during descent the bladder did not rotate, but became impressed by the narrowing lateral walls of the pelvis until the ends of the horizontal rod came into contact with the walls; that the horizontal rod resisted deformation and was rotated towards an antero-posterior position; that during this rotation the bladder did not move horizontally in relation to the pelvis; that at the earlier part of rotation the portions of bladder caught by the ends of the horizontal rod were pulled in the direction of rotation, until the tension of the membrane overcame the adhesion at the ends of the horizontal rod, and caused a recoil of the stretched portions of the membrane of the bladder.

EXPERIMENT CLI.

The preceding experiment was repeated with a horizontal piece of wood short enough to escape contact with the lateral walls, when passed through the model pelvis in the oblique position. Made pressure downwards and forwards.

Found/

Found that horizontal piece did not rotate during descent; that it maintained its oblique position; that the associated deformation of the bladder by the lateral walls of the pelvis had no visible effect on the position of the horizontal piece.

EXPERIMENT CLII.

Arranged the rubber-sheet under tension and in a horizontal position. Filled the bladder with water and sealed it. Lowered the bladder on to the rubber, and made pressure downwards and forwards through the bladder.

Found that the lower surface of the bladder adapted itself to the rubber-sheet; that it was impossible to arrange the resistance to be applied more to one part of the lower surface of the bladder than another; that advance occurred without any form of rotation

EXPERIMENT CLIII.

Repeated preceding experiment, but arranged that bladder should be markedly distended, and that its horizontal section should be elliptical. Pressed bladder /

bladder downwards and forwards on to the rubber-sheet so that the posterior half of its surface made contact with the rubber.

Found that sufficient deformation occurred to equalise the resistance on the lower surface of the bladder; that during advance no rotation occurred.

EXPERIMENT CLIV.

Repeated preceding experiment with a horizontal bar arranged across the anterior edge of the rubber sheet. Made pressure downwards and forwards.

Found that bladder advanced over the rubber without rotation until it came into contact with the horizontal bar; that under continued pressure it distended the rubber, became deformed to a more circular shape, and escaped forwards non-rotated under the horizontal bar.

APPENDIX B/

APPENDIX B.

TABLES A TO E.

ANGULAR MEASUREMENTS FROM FROZEN SECTIONS.

APPENDIX B.

TABLES A TO E.

ANGULAR MEASUREMENTS FROM FROZEN SECTIONS.

Appendix B. contains tables of angular measurements derived from frozen sections, grouped according to period, viz. non-pregnant, late pregnant, first stage, second stage, third stage and post-partum, the first and last groups being added, though far from complete, for the sake of comparison.

The angles are those made with the true conjugate by the lumbar axis (as defined by BARBOUR), the anterior surface of the body of the first sacral vertebra, the "air-line" joining the promontory with the apex of the sacrum, a line joining the upper and lower borders of the symphysis pubis, the posterior surface of the pubis from the anterior end of the obstetric conjugate downwards, the upper surface of the first sacral body, the pelvic floor in the first and second stages, and in the second stage the anterior and posterior vaginal walls.

The level of the upper border of the symphysis pubis was obtained by dropping a perpendicular on to the posterior bony wall.

TABLE A. NON-PREGNANT

ANGLE WITH CONJUGATE	KELLY	BERRY HART
Lumbar	138	
Sacral	101	76
Air-line	81	67
Pubic	92	100
Post-pubic	91	96
First sacral body	180	149
Level of Pubis.	Sup. surface 1st Sacr.body.	Mid and lower thirds 1st sacr body.

TABLE B. BEFORE LABOUR.

ANGLE WITH CONJUGATE	BRAUNE*	WALDEYER	PINARD-VARNIER	PINARD-VARNIER	BARBOUR-WEBSTER	ZWEIFEL	LEOPOLD
Lumbar	152	146	148	159	149	149	144
Sacral	104	115	100	90	90	109	113
Air-line	76	70	75	74	68	73	74
Pubic	108	98	92	90	103	92	99
Post-pubic	110	115	86	89	103	97	113
First sacral body	163	166	168	152	148	159	180
Level of Pubis.	Upper surface 1st sacral body	do.	do.	do.	do.	do.	do.

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*Contracted conjugate.

TABLE C. FIRST STAGE

ANGLE WITH CONJUGATE	BARBOUR	SCHROEDER	BARBOUR-WEBSTER	TESTUT-le BLANC	PESTALOZZA	PINARD-VARNIER	TIBONE	WINTER	WINTER	+SAEXINGER	+LEOPOLD B	WILLIAMS
Lumbar		142			150			124		133		161
Sacral	108	78	100	91	91	84	99	107	114	117	89	81
Air-line	82	68	82	67	78	77	75	82	76	90		72
Pubic	87	107	93	111	93	78	99	97	93	95	87	118
Post-pubic	94	106	95	116	106	88	102	103	93	109	99	119
First sacral body.	166	174	176	158	172	148	165	174	178	165		148
Floor	13	10	6		17			20	12	9		10
Level of Pubis.	Lumbo-sacral articulation	Mid.sec. sacral body	Upper surface 1st sacr. body	do.	do.	Mid.1st sacral body	Upper surface 1st sacr. body	Mid.5th lumbar body	Lumbo sacral articulation	Upper surface 1st sacr. body		Mid.and lower thirds 1st sacral body

+Contracted pelvis

TABLE D.

SECOND STAGE

ANGLE WITH CONJUGATE	BRAUNE	CHIARI	BARBOUR-WEBSTER	ZWEIFEL head	ZWEIFEL breech	VON MARS	BUMM-BLURUREICH	CHIARA
Lumbar	149		127	125		134	132	130
Sacral	113	90	124	140	105	123	100	116
Air-line	79		85	86	82	87	77	81
Pubic	105	98	90	76	92	98	95	93
Post-pubic	111	98	103	78	91	98	98	91
First sacral body	151	140	180	218	167	172	180	189
Ant.vag.wall	112	100	109	98	102	103	90	94
Post.vag.wall	87	83	99	104	86	91	96	95
Floor	8	22	19	30	30	19	20	12
Level of Pubis.	Upper surface 1st sacr. body.	Upper surface 1st sacr. body.	Lower surface fifth lumbar body.	Lower surface fifth lumbar body.	Lumbo-sacral articulation	Lumbo-sacral articulation	Lumbo-sacral articulation	Lumbo-sacral articulation.

TABLE E	THIRD AND POST-PARTUM.					
ANGLE WITH CONJUGATE	BARBOUR.+	PESTALOZZA‡	BENCKISER*	WEBSTER	STRATZ.*	
Lumbar			147		146	
Sacral	86	111	112	113	112	
Air-line	74	88	97	79	96	
Pubic	73	82	93	99	90	
Post-pubic	82	94	93	100	88	
First sacral body	173		163	177	179	
Level of Pubis.	Lower surface 2nd sacral body	Upper surface 1st sacral body	do.	do.	do.	

* Contracted conjugate

\+ Kyphotic

‡ not mesial

SUMMARY.

SECTION I.

SUMMARY.

SECTION I.

1. The dilated pelvic canal consists of two portions, an upper or straight portion ending at the outlet, and a lower or curved portion whose centre line is a variable.

2. The outlet separating the superior from the inferior portion of the canal is formed on each side by the lower margins of the pubic segment~~s~~, the ischio-pubic ramus, the ischial tuberosity and the great sacro-sciatic ligament, and by the apex of the sacrum. Above the outlet flexion and internal rotation are usually completed; below the outlet the mechanism of extension takes place.

3. The upper portion of the canal is divided into two parts by an imaginary plane passing through the ischial spines. The upper part belongs properly to the end of pregnancy or the first stage; the lower is usually concerned in the principal event of the second stage.

4/

4. The upper portion is enclosed by a bony and ligamentous framework whose components are able to influence the mechanism of normal labour, and which is under maternal control to a limited, and as yet undefined degree.

5. The upper portion is commonly regarded as being nearly cylindrical. The view yields to analysis, and a canal is disclosed whose variations from cylindricity are appreciable, and have every appearance of bearing on the mechanism.

6. The most important matters are the normal inclination of the anterior segment of the pelvis from the plane of the brim at more than a right angle so that the superior portion of the canal is skewed relative to the brim, and the convergence of the antero-and postero-lateral walls with descent.

7. The axis of the superior portion is a straight line to the bottom of the cavity. It does not necessarily coincide with the axis of the pelvis, and neither the one nor/

nor the other is necessarily, or even probably, directed at right angles to the plane of the brim which is conventionally the plane of the conjugata vera.

8. The average measurements of the bony and ligamentous outlet are T = 111·3 mm., and O = 116·5 mm.

9. The muscles and other soft parts reduce the size of the pelvic diameters. But these parts are able to be effaced under pressure, to an irreducible minimum of probably 6 mm.

10. The attitude of the woman in labour is instinctive and has an important bearing on the relative dispositions of the bones of the pelvis and the spinal column, and on the diameters of the pelvis and the pelvic canal.

SECTION II.

11. The uterus acts as a constrictor and retractor, and not as a contractor and detrusor.

12. The abdominal powers are mainly constrictive.

13/

13. Both act normally together in the second stage of labour, and they act by developing a general-contents pressure, there being no such thing as fetal-axis pressure in the sense of pressure transmitted through the spinal column alone.

14. The head and the body of the child cannot be regarded as plastic fluids or as plastic solids.

15. When they are deformed, there is a limit to the capacity for deformation.

16. When the head, and in a lesser degree the body, are deformed they behave as elastic solids.

17. In consequence, though the pressure is of the hydrostatic type, in transmission through the fetus it becomes a shearing stress.

18. The uterus is fastened near its lower pole to the pelvis, and is able to move angularly on its attachments.

19. The axis of pressure is the central longitudinal line of the uterine cavity. It represents the sum of all the pressures, and it cuts the surface of the presenting part at a point which is known as the centre/

centre of pressure.

20. As the pressure of the uterus and of the abdominal system is developed at the lower pole of the uterus, the pressure has a direction which is primarily variable and finally determinate.

21. The generally accepted opinion that uterine and abdominal pressure is directed at right angles to the plane of the brim rests on the dubious premise that the canal is nearly cylindrical and that its axis runs at right angles to the plane of the brim.

22. Evidence is led to show that this arrangement of the parts is unusual, and that even when it happens the direction in which the canal tends to dilate does not necessarily run parallel, but is more probably inclined forwards.

23. No method has yet been evolved of accurately determining the direction of uterine pressure during a uterine and an abdominal contraction.

24. That being so, it is necessary to consider the mechanism of internal rotation under various inclinations of uterine pressure.

25. This is the more necessary because the centre of pressure lies excentric within the head after flexion or extension has been produced, and because the evidence points to an inequality of the mesial and transverse diameters of the head before internal rotation occurs, the form of the head derived from measurements made after birth being unsatisfactory as a criterion of the form prior to the occurrence of internal rotation.

26. Once engagement is complete, the direction of uterine pressure is remarkably constant during a uterine contraction.

27. The constancy of direction has an important influence on the mechanism of labour.

28. Experimentally the best mechanical results are obtained when pressure is inclined at an angle of 10-15° behind or before the axis of the brim.

29. The form and direction of the canal point to the conclusion that the axis of pressure is most frequently inclined downwards and forwards to the axis of the brim at an angle of 10°.

30/

30. The coincidence of the axis of pressure with the axis of descent still accurs so that there is no loss of power.

31. The ultimate determinants of the direction of the axis of pressure are probably the inclination of the several planes of rotation, the direction in which the vagina tends to dilate, and the relative position of the exit of the canal, the chief effector being the uterus pulling against its attachments during contractions.

32. The average diameters of the fetal head prior to internal rotation appear to be O.F. 12 cm S.O.B. 9·5 cm., Bi-P. 9·25 cm., Bi-T. 7·5 cm., and the diameters of the smallest average full-time head O.F. 10·5 cm., S.O.B. 8·5 cm., Bi-P. 8·7 cm., Bi-T. 7·5 cm.

SECTION III.

33. Flexion denotes a process whereby the presenting part is adapted to the pelvic canal.

34. Head, shoulders, and breech severally undergo changes denoted by flexion.

35. There are three movements of flexion. The breech shows one only, the shoulders possess two, while the head has all three.

36. The first movement is the approximation of the chin to the sternum.

37. It is normally complete and persistent through late pregnancy, the first and the second stage, except during the last moments of the expulsion of the head.

38. The first movement is a rotation of the head about a horizontal axis within the head.

39. The second movement is manifested by a dipping of the occiput towards the centre of the canal.

40. The second movement is chiefly a phenomenon of the second stage when it tends to become fixed in the lower part of the superior portion of the pelvic canal.

41. The second movement consists of a rotation or sliding of the whole head around the summit of the trunk and about a horizontal axis which is situated somewhere within/

within the body (trunk) of the child.

42. Third movement of flexion is the moulding of observers.

43. Moulding is divided into absolute and compensatory deformation.

44. The most important characters of moulding when the head is in the oblique position are the oblique distortion of the head and the apparent twisting of the elongated head around its axis.

45. Moulding may begin at the brim even under normal relations. It is fully developed in the second stage and in the lower part of the superior portion of the pelvic canal.

46. Flexion which includes moulding increases up to the moment at which internal rotation is about to begin. The movements of flexion change to those of extension as a rule at the beginning of internal rotation.

47. The intrinsic factors for the production of cephalic flexion are (1) the ability of the head to rotate about an internal horizontal axis, (2) the capacity of the head to revolve about an external horizontal/

horizontal axis, (3) the submissiveness of the head to compensatory deformation.

48. The intrinsic factors for the production of cephalic flexion during pregnancy are (1) the reflex activity of the living, healthy fetus, (2) the contact of the forehead with a resistance, which occurs usually during engagement in the pelvic canal.

49. The extrinsic factors for the production of cephalic flexion in labour are (1) the position of the centre of pressure relative to the presenting part, (2) the excentric position, within the canal, of the opening in the partially dilated cervix and vagina, (3) the total resistances of the soft parts of the canal, (4) the total resistances of the bones and ligaments of the pelvis, (5) the influence of adaptive moulding in modifying the distribution of pressure over the presenting part and in favouring the production of a delayed second movement of flexion.

50. As long as the axis of pressure truly centres the plane of the greatest circumference of the head and this plane is parallel to the plane of the girdle of resistance there can be no movement of flexion or extension. The difficulty may eventually be overcome by adaptive moulding.

51. In most cases the axis and the centre of pressure are excentric within the head, the first movement of flexion or extension being already complete or present.

52. This being so, pressure is still distributed over the whole sectional area of the greatest circumference of the head during the first stage and during the second as long as the head acts as a ball-valve. After the amniotic fluid is evacuated from the canal up to an unknown higher level, pressure is conveyed to the whole of the head by the column of the fetal body as long as the first movement of flexion is complete, and even when true extension is present little of the head can be free from pressure.

53. Though pressure is distributed equally over the area of the girdle of resistance and may be so over the superjacent parallel greatest circumference of the head, the pressure is not applied equally over th the area of the actual greatest circumference of the head.

54. The centre of pressure is nearly true within the area of the girdle of resistance, but it is excentric within the plane of the greatest circumference of the head, that is when the first movement of flexion or extension is present. The plane of the greatest circumference and the plane of the girdle are no longer parallel to one another. Hence it follows, if the axis of pressure centres the girdle at right angles, the axis cannot also be concentric with the plane of the greatest circumference of the head, but approaches whichever margin of the plane is lower within the canal.

55. The surface of the head which is applied to the resistances is always curved.

56. A curved surface is better adapted to overcome a resistance than a plane surface owing to the existence of LILIENTHAL'S tangential force which means that with an inclination of the surface of contact to the resistance the centre of pressure does not remain normal to the chord of the surface, but is inclined in the direction of dip.

57. The more the head dips the more the centre of pressure inclines towards the margin and within definite limits the more effective it becomes.

58. The curvature of the surface of contact is therefore in itself favourable to the production of flexion.

59. The axis of pressure in seeking the mesial plane of the canal and the area of least resistance tends to carry along with it whichever part of the head contains the centre of pressure.

60. The girdle of resistance lies anteriorly excentric within the canal. In consequence/

consequence that portion of the head containing the centre of pressure and lying over the area of the girdle descends through the girdle, while the remaining portions of the head are excentric to the centre of pressure, lie over the excentric resistances, and are restrained.

61. In the occipito-posterior positions, when the frons is not presenting, the delay in the occurrence of flexion is due to the primary want of coincidence of the centre of pressure with the area of the girdle. The occiput contains the centre of pressure and lies over the resistances; the sinciput lies over the area of the girdle but does not contain the centre of pressure.

62. Probably the anterior excentricity of the girdle of resistance is the primary condition and the anterior excentricity of the direction of pressure secondary.

63. The rapidity of dilation of the soft parts and the previous size of the girdle in the vagina are subsidiary factors.

64/

64. The concentric resistance of the soft parts acts as LAHS has described, but the effectiveness in the intervals of the pains is doubtful.

65. The bones and ligaments of the pelvis play an important part in the production of flexion by the convergence of the antero- and postero-lateral walls of the pelvis.

66. The pelvic influence is rendered possible because the sub-occipito-frontal diameter is usually engaged in the cavity and the occipito-frontal diameter is mechanically effective; the latter diameter being longer than either the transverse or the oblique diameter of the outlet.

67. When the sub-occipito-bregmatic diameter is truly engaged in the cavity of the pelvis the mechanically effective diameter is approximately the occipito-bregmatic. This diameter is probably seldom longer than the transverse or the oblique diameter of the outlet.

68. As a rule the bones and ligaments help to mould the head.

69/

69. Moulding effects a comparatively slight change in the diameters of the head and is more concerned with the production of internal rotation.

70. The measurement of the diameters of the head immediately after birth is no safe criterion of the form and dimensions of the head before rotation occurs and still more before the entry of the head into the pelvis.

71. Extension when it occurs in the cavity of the pelvis has the same factors as flexion and similar but reversed movements.

72. A misdirection of uterine pressure tends towards extension of the head.

73. With the aftercoming head traction at right angles to, or downwards and forwards from the brim maintains flexion. Traction downwards and backwards causes extension and impaction.

74. A uniform force acts best at an angle of 35° of incidence, and flexion should be produced to an extent sufficient to give this angle of inclination.

75/

75. In labour, however, greater or lesser angles of incidence are frequently inferred. It is then probable that circumstances render a less efficient action of the pressure necessary, or as it were sufferable, in order that some other difficulty may be overcome.

76. The shoulders exhibit two movements of flexion - the second and the third.

77. The lateral walls of the pelvis exercise a powerful influence on the shoulders.

78. The centre of pressure probably lies very near the mesial plane of the shoulders and nearer their anterior (pelvic) than their posterior aspect.

79. The shoulders, as a rule, descend simultaneously into the cavity of the pelvis.

80. Moulding causes an apparent earlier descent of the anterior shoulder.

81. Measurement of the reduction of the transverse diameter of the shoulders by flexion should be made between the humeral tuberosities.

82. The breech has only the third movement of flexion; otherwise it resembles the shoulders.

SECTION IV.

83. It is necessary to differentiate two forms of anterior or posterior obliquity.

84. In the one form the base of the fetal skull (the shoulder girdle or the pelvic girdle) is inclined laterally relative to the pelvic brim or to any parallel plane of the pelvic canal. A true lateral obliquity is present.

85. In the other form the base of the skull may or may not be synclitic, but the moulding of the head (the shoulders or the breech) is such as to give rise on palpation or on section to an appearance of lateral obliquity. An apparent lateral obliquity is present.

86. Thus NAEGELE'S or LITZMANN'S obliquity may be either true or apparent, or it may be both apparent and true.

87. The direction of true lateral obliquity depends ultimately on the direction of uterine pressure even when the relative proportions of the pelvis and the fetal skull are such that lateral tilting of the base of the skull is inevitable.

88. The form and position of the head within the pelvic canal, in the dead as well as in the living, and all methods so far employed to determine the position of the axis of the uterus afford no trustworthy indications either of the direction of uterine pressure or of the direction of true lateral inclination of the fetal head.

89. A normal inclination downwards and forwards of the direction of uterine pressure which my premises demand if not at the brim in many labours, at any rate in the majority after engagement is completed, implies a slight degree of true LITZMANN'S obliquity during descent.

90. After moulding has begun to appear the true LITZMANN'S obliquity is totally eclipsed by the production of apparent NAEGELE'S obliquity which reaches its greatest development at the moment when internal rotation is about to begin (unless the brim of the pelvis is contracted) and which depends essentially on the distribution of the intra-pelvic resistances

SECTION V.

91. The transverse mode of entry to the pelvis is probably normal, the oblique position being assumed as engagement is completed.

92. Though there is one region of the pelvic canal within which internal rotation usually happens, the movement may occur at a higher or a lower level.

93. The movement of internal rotation is essentially the consequence of the interaction of a force and a resistance which are not directly opposed to one another.

94. Internal rotation may arise within the cavity of the bony and ligamentous pelvis (pelvic rotation).

95. Rotation may be due entirely to the pelvic floor (perineal rotation).

96. Rotation may be partly pelvic and partly perineal.

97. Rotation may be produced by the interaction of the pelvic floor and the pubic arch (pubic arch rotation).

98. There may be no suitable resistance or adequate force when internal rotation necessarily fails to occur.

99. Movement downwards, upwards, forwards, or backwards of the fetal part to be rotated is necessary for the production of internal rotation.

100. The factors of greatest moment for internal rotation are:-

a. The presence and direction of pressure.

b. The position of the centre of pressure relative to the fetal part and the canal.

c. The coefficient of frictional resistance.

d. The rotative planes of the canal.

101. There are other less important factors.

102/

102. The optimal conditions for internal rotation are:-

a. A moderate amount of pressure so that progress is not too rapid.

b. An inclination of the axis of pressure downwards and forwards at an angle of 10°-15° to the plane of the conjugata vera.

c. A moderate coefficient of frictional resistance. If too high, it can be reduced by adaptive moulding.

d. An excentricity of the centre of pressure on the fetal part, proportional directly to the quantity of the coefficient of frictional resistance.

e. A want of coincidence of the centre of pressure with the areas of the fetal part exposed to resistances of rotative value, the separation proportional directly to the quantity of the coefficient of frictional resistance.

f. Appropriately directed and adequate thrusts from the rotative portions of the canal, the direction of the thrusts depending on the inclination of the rotative planes and on the direction of pressure.

103. A small head can undergo pelvic rotation owing to the excentric position of the head in the cavity of the pelvis, and because in most labours the sub-occipito-bregmatic/

bregmatic is not the diameter of engagement prior to internal rotation.

104. In most labours the sub-occipito-frontal is then the diameter of engagement. This diameter is longer than the sub-occipito-bregmatic.

105. The diameter of engagement is not necessarily also the diameter of the head concerned in the production of rotation.

106. The plane of rotation in the pelvic canal is obliquely inclined to the plane of engagement.

107. Hence, while the sub-occipito-frontal diameter is in the plane of engagement, the occipito-frontal lies in the plane of rotation.

108. The head must therefore, be fairly small before it is able to escape the rotative thrust of the bones and ligaments of the pelvis.

109. Only when the sub-occipito-bregmatic diameter is truly engaged in the pelvis is the head able to escape pelvic rotation.

110. The rotative plane is then nearly the occipito-bregmatic which usually is shorter than any of the diameters of the pelvic outlet.

111. In the well-flexed occipito-posterior positions the head undergoes pelvic rotation. Though the sub-occipito-bregmatic diameter is truly engaged the occipito-frontal diameter lies in the plane of rotation, owing to the excessive obliquity of the pelvic rotative plane in these positions.

112. In primiparae the sub-occipito-frontal diameter is engaged, the occipito-frontal is rotated, and the rotation is pelvic

113. In pluriparae the sub-occipito-bregmatic diameter is engaged, the occipito-bregmatic is rotated, and the rotation is mainly or entirely perineal or pubic.

114. In multiparae the sub-occipito-frontal diameter is engaged, the occipito-frontal is rotated, and the rotation is pelvic.

115. Small and soft heads react as do normal heads in pluriparae.

116. Large and disproportionate heads react as do normal heads in pluriparae, provided that the concentric resistances equalise the sagittal and coronal diameters of/

of the head. Otherwise the rotation is mainly pelvic. (Note:- These are general propositions valid only for the occipito-anterior positions).

117. The local cause of pelvic rotation is the form and size of the lower part of the superior portion of the pelvic canal, and more particularly the sacro-sciatic ligaments and the ischio-pubic ramus. The former operate especially to produce internal rotation.

118. Perineal rotation may arise on a rigid or a relaxed pelvic floor.

119. On a rigid floor the rotative moment is developed on one part of the head alone, and that part is commonly not far removed from the position of the centre of pressure. The rotative moment is in consequence low, and as the coefficient of frictional resistance is generally high, the production of rotation may be difficult.

120. On a relaxed floor rotative moments are developed on opposite poles of the head. The poles/

poles are normally unequally distant from the centre of pressure, and that pole which is the more removed from the centre of pressure receives the more effective rotative thrust which is able to overcome the thrust developed at the other pole, should the latter thrust take a contrary direction to the former.

121. In pubic arch rotation the factors are interaction of the floor and one ramus, the oval form of the head, and its excentric position relative to the canal.

122. Pelvic rotation is the commonest event. Perineal rotation occurs less often. Both are combined in a small section of the occipito-anterior positions. In the well-flexed occipito-posterior positions a pure pelvic rotation is hardly possible because the much elongated occiput strikes the floor early.

123. When the head is concerned the direction of rotation is nearly as important as the occurrence of rotation itself.

124. The direction of internal rotation is ultimately determined by the direction of uterine and abdominal pressure.

125. When the axis of pressure is inclined downwards and forwards to the brim, rotation of the presenting part is invariably forwards and inwards.

126. When the axis of pressure is inclined downwards and backwards, rotation of the presenting part is invariably backwards and inwards.

127. When the axis of pressure is directed at right angles to the brim, several things may happen under pelvic rotation. In the occipito-anterior positions rotation forwards and inwards, in the occipito-posterior positions rotation backwards and inwards. In both positions impaction may occur, or else an escape of the non-rotated parts by an increase of the second and third movements of flexion or extension.

128. When the axis of pressure is directed at right angles to the brim, the direction of perineal/

perineal and pubic arch rotations is invariably forwards and inwards in both positions of the head. But rotation is liable to fail or be imperfect, as the rotative moments are not so effective as they are when pressure is inclined to the brim.

129. When pressure is directed at right angles to the brim there is a liability to a persistance of, or a regression, temporary or permanent, to the transverse position of the head.

130. It is not strictly correct to speak of long rotation. One ought to refer to the transit of the occiput across the pelvic cavity. Rotation sets in only when the occiput reaches the anterior segment of the canal. But in practice the transit of the occiput and the rotation of the head are more or less confluent and long rotation remains the more convenient expression.

131. The shoulders undergo two rotations - cephalic and pelvic (pelvic, perineal, or pubic).

132. In cephalic rotation the shoulders are rotated from the oblique to the nearly transverse position by the movement of the head in internal rotation.

133. In pelvic rotation the shoulders move from the nearly transverse position towards an antero-posterior position, so that the second rotation is a reversed movement.

134. Internal rotation of the shoulders is most often pelvic in origin; its direction is controlled by the direction of pressure.

135. The shoulders always meet a relaxed floor.

136. In perineal rotation most of the rotative force is developed against the posterior shoulder.

137. In breech presentations pelvic rotation is unlikely to be more than partial.

138. Partial pelvic rotation is possible owing to the slightly excentric position of the breech within the pelvic canal prior to internal rotation.

139. Footlings and small breeches tend to rotate to the transverse position, large breeches tend/

tend to rotate towards an antero-posterior position.

140. As their form is symmetrical the shoulders and the breech may rotate either way without harm.

141. The shoulders and the breech are the analogues of the occipital segment of the flexed head.

142. In general, when the general resistances, as determined by the size of the canal and by the size and form of the fetal parts, are small internal rotation is approximately of the concentric type. To this group belong the shoulders and the breech.

143. When the general resistances are high and especially when the fetal parts are asymmetrical, internal rotation is markedly of the excentric type. To this group belongs the normal flexed or extended head.

144. The conditions favourable to internal rotation of the fetal head are best preserved by the excentric position of the head relative/

relative to the canal, and of the centre of pressure relative to the head, and by the maintenance of its long-oval form. When these provisions deteriorate internal rotation is most likely to fail.

SECTION VI.

145. The mechanism of extension is due to three maternal factors - pressure, perineal and pubic resistances.

146. The usual mechanism is a rotation of the fetal parts on the pubic arch.

147. As the mechanism of extension proceeds the fetal segments change their direction of motion, but the force which is applied to them cannot follow.

148. Hence the force tends to be applied to more and more posterior parts of the fetal segment concerned in extension.

149. The pelvic floor partly reflects and partly absorbs or dissipates this force.

150. The amount of the latter component depends mainly on the direction of pressure.

151. The length of the child's neck has an important bearing on the mechanism of extension.

152. Usually the chin leaves the breast as the perineum leaves the forehead.

153. Separation may occur earlier as when the mechanism of extension is exaggerated. The chin cannot remain in contact with the surface of the child above the manubrium sterni.

154. The stemming of the nape on the symphysis does not destroy the pivotal movement based on the pubis.

155. The main objection to the pivotal movement is the consequent bursting pressure which the perineum has to sustain.

156. There are three movements of extension viz: - (1) the separation of the chin from the sternum, (2) the rotation of the head around the trunk of the child, (3) moulding.

157. The moulding of extension differs in several ways from the moulding of flexion. The compression and depression of the forehead are less, the head is more greatly and more obliquely lengthened.

158. In the occipito-posterior position the head is usually born by an increase of the second and third movements of flexion.

159. More rarely the head is delivered in the persistent occipito-posterior position by a movement which is not flexional.

160. In face presentations there are usually no flexional movements in the cavity.

161. In the mento-posterior position the head is born by extension; in the mento-anterior either by flexion or extension.

162. In forehead presentations the tendency lies towards movements of extension.

163. The shoulders and the breech are mostly born by a pivotal movement.

164. Usually the anterior shoulder appears first and the posterior is born first.

165. In EDGAR'S mechanism both shoulders are born flexed; in RITGEN'S the posterior shoulder is sometimes flexed and sometimes extended.

166/

166. Extension of the posterior shoulder plus the pivotal movement is a danger to the perineum.

167. In EDGAR'S mechanism the shoulders behave like the occipital segment of the head, in RITGEN'S like the whole head.

168. With the head aftercoming experimental traction downwards and forwards to the brim tends to maintain flexion, downwards and backwards to produce extension.

169. For pelvic extraction a method is described which aims to maintain flexion of the head and arms from the beginning of descent.

170. Continuous pressure with the hand applied to the perineum is not an advantage.

171. Forced flexion seems to be the best method of preserving the perineum.

172. Pressure must be applied kinetically to the forehead to increase the third movement of flexion.

173. The pressure must be momentary so as to avoid fixing the perineum to the head.

174/

174. The head is born greatly elongated, and the extension of the occipital region is more vertical than oblique as it is in the ordinary mechanism.

175. Under continuous forced flexion the change of direction which the head makes is about 40°-50° from the axis of the brim.

176. The change of direction is momentary and occurs above the level of the distended pelvic floor.

177. There is no pivotal movement, no bursting pressure and no lengthening and fixation of the perineum.

178. It is impossible for the sub-occipito-bregmatic diameter to be engaged in the vulva and the occipito-frontal in the commissure of the pubo-rectalis muscle.

179. Extension in the ordinary sense is not allowed to occur until the forehead is born.

180. The shoulders and the breech are delivered with advantage by a similar mechanism.