REMARKS
ON THE
DANGER
OF
EXTRACTING LARGE CALCULI,
WITH THE
DESCRIPTION OF AN INSTRUMENT
INTENDED TO
FACILITATE THE BREAKING DOWN STONES OF
CONSIDERABLE MAGNITUDE.

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Read March 28, 1820.

IN witnessing the performance of the operation of lithotomy, I have often remarked the great disproportion which the size of the wound bore to that of the stone which has been extracted, and the extreme force that was required to bring it away. This circumstance I have observed both when the operation has been performed with the knife and the gorget, but more especially with the latter instrument. The laceration and contusion which

has been thus occasioned, has in several instances been the cause of inflammation and various symptoms that have terminated fatally, even where other circumstances were propitious to the recovery of the patient.

It must certainly be generally acknowledged an object of the first importance that the stone should be extracted without violence, and this can only be effected by the incision into the bladder being sufficiently extensive to allow of its easy removal. It is not however an uncommon occurrence to see a stone, the diameter of which, together with the forceps, shall measure above two inches, forcibly dragged through an opening made with a gorget with a cutting edge not exceeding three quarters of an inch. It is true that some patients have recovered after such operations ; but it cannot be denied that the operation has been thereby rendered much more painful and hazardous, and the subsequent recovery has been greatly retarded. On the other hand experience teaches us, that it is highly dangerous to make any very considerable wound in the bladder, and that the subsequent effusion of urine into the surrounding cellular substance, and other unfortunate circumstances, have, with some very rare exceptions, generally proved fatal. Whenever, therefore, a stone is of large dimensions, it becomes a desirable object to break it in the bladder, and to extract the fragments by repeated introductions of the forceps.

The occurrence of cases of such magnitude as to require the application of mechanical contrivances to break them, is not common, yet by no means so rare as might reasonably have been expected, when we consider the progress of surgical knowledge, and the great diffusion of county hospitals and institutions for the relief of the suffering poor. In little more than one twelve-month three instances have occurred within my knowledge, which I shall proceed to relate to the Society. I have been favored with the particulars of the first case by Mr. Travers.

“ Benjamin Bensley, a short and very corpulent man, by occupation a maltster, 43 years of age, was admitted into the Norwich Hospital on the 6th of June, 1818, under the care of Mr. Dalrymple. He had suffered under symptoms of stone in the urinary bladder during the preceding ten or eleven years, previously to which time he had been in the habit of voiding large quantities of red sand. His habits of life had been temperate and regular, and general health pretty good. His symptoms at the time of his admission into the hospital were very urgent. He had a constant stillicidium urinæ, and a large quantity of muco-purulent matter was mingled with his water. He was sounded before he was admitted into the house, and the calculus was discovered to be of unusual size. The lateral operation was performed on the 11th of June; the staff was easily passed as far as the neck of the bladder,

but, owing to the resistance occasioned by the size of the stone, could not be fairly introduced. The incisions, both superficial and deep-seated, were of ample extent, and a full sized pair of forceps was admitted with very little difficulty. After some little manœuvring, rendered necessary by the repeated slipping of the forceps, the stone was seized, as it was hoped firmly, but it escaped from the grasp of the instrument when brought to the prostatic opening. This occurred repeatedly to the operator concerned and his colleagues. Forceps of different sizes were used, and amongst others a pair of unusual size and power constructed for the express purpose of crushing large calculi; but in vain. These instruments did no other good than by detaching some small portions of the more external laminæ from that part of the stone which was presented to their grasp. After a lapse of about an hour from the commencement of the operation all hopes of extracting it were abandoned, the patient was carried to his bed with cold extremities and a fluttering pulse, and died at the expiration of about three hours. The body was opened on the following day. There was nothing presented by the dissection requiring to be detailed on this occasion. The parts are preserved in Mr. Dalrymple's collection, and exhibit a bladder much injured by the long continued and forcible application of instruments. The ureters and pelves of the kidneys were greatly enlarged. The calculus is very large, having numerous sparkling crystals co-

vering the greater portion of its upper and anterior surface. It weighs at present twelve ounces five drachms, and it is calculated that the fragments detached at its inferior extremity in the repeated attempts made to break it down, might weigh about five drachms more. No section has yet been made of it, nor have its chemical properties been examined." Vide plate I. fig. 2.

The second case occurred to Mr. Astley Cooper, who obliged me with the following particulars of the operation.

"The patient was 43 years of age, and had suffered from stone the greater part of his life; he had been sounded, but refused to submit to the operation when the stone was first discovered. The operation was conducted in the usual manner in making the incision, introducing the gorget and the forceps. When the forceps were applied to the stone, it was found to be of immense magnitude, and the instruments only embraced its extremity; from which they repeatedly slipped. I pressed upon the stone with a large pair of forceps in the hope of breaking it, but it was too hard to yield to the pressure of the instrument. I sent for a gimblet, and whilst I held the stone with the forceps, endeavoured to penetrate and break it, but could make but little impression on it. I therefore enlarged the wound to the sacro-sciatic ligament, extending the incision as much behind the rectum (but between it

and the tuberosity) as it is usual to do before it. I then passed the crotchet on the fore part of the stone behind the pubes, and directed my apprentice, Mr. Babington, to thrust the stone downwards towards the sacrum as much as he could, whilst I introduced the forceps, and with them extracted the stone. The patient survived the operation only four hours. Mr. Field, surgeon of Wilderness Row, who was a relation of the deceased, was present at the operation, and was so kind as to give me the calculus." Its weight was $\frac{3}{4}$ xvi. The diameter in the long axis was four inches and a half; in the short axis three inches and a quarter. Vide Plate II., fig. 1 and 2.

The third case occurred very recently at the Manchester Infirmary, and I regret that I have not been able to obtain any detailed account of the case. Dr. Henry has obligingly sent me the following report.

"The operation was performed with success so far as respected the extraction of the stone, which was too large to have passed through any opening that could have been made, and was therefore forcibly fractured. The part of it which I saw, consists of ammoniaco-magnesian phosphate, of much greater than usual hardness and density, and resembling fluor spar in these properties as well as its fracture. In consequence of this unusual hardness, the breaking it down was a work of great la-

bour and difficulty. The patient died in about twenty-four hours after the operation."

In addition to these more recent instances, very many cases of large calculi may be found in the records of surgery, which were forcibly extracted, and the patients either died under the operations or in a short time after. It may not be uninteresting to subjoin a few of the more remarkable instances, and in reading them it will be right to bear in mind that the weight can by no means be considered as a fair criterion of the bulk, as that must of course depend much on the composition of each individual calculus.

Hildanus* records a case operated on by Vitellius, in which the stone weighed 3xxij. and the patient died under the operation.

Dr. Charles Preston† mentions having seen at La Charité in Paris, a stone which weighed 3li. said to have been taken from one of the religious brothers in June, 1690, who died before the operation was concluded.

Borellus‡ relates a case of a stone of 3xviij.

* De lithotomiâ vesicæ liber, cap. 8. p. 720, et cent. 4. Obser. 51.

† Philosophical Transactions, Vol. XIX. page 310.

‡ Histor. et Observ. Med. Phys. Centur. 2. Observ. 22. 12mo. Leip. 1676.

weight, which was extracted by a skilful surgeon named Quesnotus, but the patient did not survive.

The late Mr. Birch extracted one of 3xvj. weight, at St. Thomas's Hospital, with a similar result.

Deguisse * removed one of 3xxxi. from a patient aged 65, by the high operation, having previously operated through the perineum. The patient died on the sixth day.

Marteau de Grandvilliers† extracted one of 3xiv. and another of 3xij., both with fatal results.

Vidal‡, Eller§, Palucci||, and La Motte¶, all mention cases of 3xij. weight, which were extracted by operations, but in no one instance did the patient recover.

Mr. W. Wadd obliged me with the loan of a

* Recueil périodique, &c. Tom. vii. p. 423, et Tom. xiv. p. 424.

† Journal de Médecine, Tom. xii. p. 54.

‡ Traité sur la production des pierres dans le corps humain, p. 262.

§ Histoire de l'Académie de Berlin, 1757, p. 30.

|| Nouvelles remarques sur la Lithotomie, p. 72.

¶ Chirurg. Observationes, p. 320.

very remarkable calculus, to exhibit to the Society, which was extracted by the celebrated Cheselden ; the patient died the following morning. The present weight of the stone is ℥xviijss. its circumference in the long axis is eleven inches and a quarter, in the short axis ten inches. Mr. Wadd is not certain whether it was removed by the high or lateral operation. In looking to the various publications of Cheselden, I can find no record of this calculus ; it was taken from a private patient, which is the probable cause of his having neglected to mention it, as he expressly states that he “ kept no account of his private cases, as they were not sufficiently witnessed.” Of the prodigious number of cases on which he operated, the three largest stones successfully extracted weighed twelve, ten, and eight ounces.

Without citing any more authors, it will be sufficient to state, that as far as my researches into this subject have hitherto led me, very few instances of success are recorded, where the stone exceeded seven or eight ounces*.

* The following are the largest successful cases which I have met with :—One ℥xv. weight, and $4\frac{3}{4}$ by $3\frac{1}{2}$ inches diameter, extracted by Mr. Harmer of Norwich, related in Gooch’s Surgical Observations, p. 54. The patient survived ; but the wound never healed. One of ℥xij. gr. xxx. weight, $3\frac{1}{2}$ inches diameter, and 8 inches circumference, operated on by Klein, with perfect success. Pract. Ansich. der bedeuten : Chir. Oper, p. 32. Pl. I. No. 9. Klein likewise refers to a case related in Mursinna’s Journal für die Chirurgie, IV. p. 94. in which a stone of ℥xij. 3ij.

On taking an impartial review of all the instances adduced in this paper, it will not, I trust, be assuming too much to say, that it would be a decided improvement in the operation, to endeavour to crush all large calculi by some mechanical contrivance, rather than trust to the uncertainty of their yielding to the pressure of common forceps, or to use any injurious force in the attempts to bring them away.

This practice has not, I conceive, been hitherto adopted, from the want of an instrument capable of embracing a large stone, and which could effect the fracture of it without incurring the risk of injuring the parts in which it is contained.

In the writings of many ancient authors, the propriety of breaking stones is inculcated. Celsus* informs us, that Ammonius of the Alexandrian school was the first who adopted the practice of cutting or dividing stones in the human bladder; for which art he acquired the surname of Lithotomist, which has ever since been erroneously adopt-

weight, was successfully removed. Ambrose Paré mentions the case of a confectioner operated on in 1570 by John Collo, where the stone weighed 3ix. and was $3\frac{1}{2}$ inches in diameter. Lib. 25. ch. 19. Tolet mentions a case of 3x. weight and $3\frac{1}{4}$ inches diameter, which was happily extracted, and the patient was recovering from the effects of the operation, when an abscess formed in the kidney from the presence of another calculus; the patient died on the ninth day from that of the operation.

* De Medicina, Lib. 7. cap. 26. art. 3.

ed by those who operate for the stone. His mode of operating consisted in fixing the stone with a hook, and after enclosing it in the grasp of a pair of forceps of moderate thickness, the edges of the blades being thin but not sharp, it was divided by the forcible percussion of the two blades. The successors of Ammonius followed his plan with little or no variation until the time of Ambrose Paré*, who increased the strength of the forceps, and added powerful teeth to the blades, and a thumb-screw through the handles, to assist in crushing the stones.

Le Cat † paid considerable attention to this subject, and has given a long description of two instruments he constructed for breaking calculi. The first of these may be considered as an improvement on Paré's; it consisted in a pair of very powerful forceps with strong wedge-shaped teeth, with a vice and lever passing through the handles, the action of which in closing the blades, would be more gradual and far more powerful than that of the operator's hands. He calculated the combined force of these three mechanical powers to be equal to 370,400 pounds, and of course more than equal to crush any calculus ever found in the human bladder.

* Lib. 17. cap. 42.

† Parallele de la Taille laterale, p. 262.

Frère Côme * recommended a somewhat similar contrivance, and these are the instruments which, with some slight variations in size and form, have been employed, or rather attempted to be employed, to the present day.

In addition to the violence which such instruments must inflict on the bladder and surrounding parts, they are highly objectionable on account of the great difficulty, nay almost impossibility, of introducing and expanding them sufficiently to grasp a stone of any magnitude. Whenever the calculus is of considerable size, and the bladder contracted round it, so as to make it present itself immediately at the prostatic opening, it is obvious that the blades must be opened in the tract of the wound, and even should the stone recede by pressure, so as to enable the blades to be passed into that viscus, they cannot be expanded, if constructed on the common principles of stone-forceps, without the handles being expanded in the wound to an equal if not greater size than the stone itself.

Franco† was aware of this objection, and endeavoured to obviate it by giving a peculiar turn to his forceps, which admitted of some expansion

* Perret, *Art de coutelier*, Part 2, pp. 429 & 432. pl. 142. fig. 12. pl. 145. fig. 1.

† *Traité des Hernies*, p. 135. 8vo. Lyons.

of the blades, without any increase in that part of the handles which occupied the track of the wound. This idea has been lately revived by Professor Assalini *, whose stone forceps in this respect bears a very close resemblance to that of Franco. The second instrument, invented by Le Cat †, was intended for cases where the bulk of the calculus was very great, and could not be included in any forceps. In such cases he recommended that the stone should be fixed by an assistant pressing above the pubes, and another by the rectum ; a hole was then to be drilled with a perforatör, made to act through a canula, to defend the bladder and soft parts. Larger perforators were subsequently to be used until the aperture was of sufficient size to admit an instrument resembling the perforator used in midwifery, only narrower. When passed into the centre of the calculus, the sharpened edges of the blades were to be forcibly separated by a vice and lever passed through the handles. This idea is ingenious, and it is probable that some modification of it might be applicable to cases where the whole cavity of the bladder was filled with calculous matter, and where no instrument could be passed round it. In such cases, however, as have been detailed in the early part of this paper, we have yet to regret the want of some efficient contrivance

* Transactions of the Society of Arts, &c. Vol. 33. pl. 7. fig. 8.

† Loc. cit. p. 278.

to facilitate their fracture without injuring the contiguous parts.

It is with a view to supply this desideratum in surgery that I now have the honor of addressing the Society, and submitting to their notice an instrument apparently calculated to fulfil the different indications. The necessity for such a contrivance first suggested itself to me after witnessing an operation performed by one of the most enlightened and experienced men in the profession, where the magnitude of the stone was so great, and the means of breaking it so wholly inefficient, that the operator was under the painful necessity of leaving his task unfinished. A further detail of this melancholy case is already before the Public in the *Philosophical Transactions* for 1810. The calculus which weighed 3xliv., and was sixteen inches in circumference, is preserved in the Hunterian Museum*. The instrument which I then construct-

* This, I believe, is the largest stone preserved in London; but many of nearly equal, and even greater dimensions, which were removed after death, may be found in different works. I subjoin some few instances. Kesseling states, that he saw at M. Morand's a stone that weighed six pounds, three ounces. Tolet gives three instances, weighing 50, 32, and 28 ounces. *Traité de la lithol.* c. 6, p. 36. Dr. Lister, in his journey to Paris, met with one of 51 ounces weight, and another of 34. Verduc gives an instance of 3 pounds 3 ounces weight. Mr. Goodrick states in the *Phil. Trans.* that he found one as large as the head of a new-born child, in the bladder of a boy at Bury St. Edmund's. The same gentleman removed 96 calculi from one patient. A stone 35 ounces weight was taken from the body of one Francis Dugood of Aberdeen. Tozzetti, in

ed was described by Mr. S. Cooper, in the first edition of his valuable compendium of surgery. I soon after improved upon it by substituting two blades, which were intended to be introduced separately, and united in the same way as midwifery forceps. Lately my attention has been again awakened to the subject, and the necessity for some improvement in this department of operative surgery has been forcibly impressed on my mind by the occurrence of the cases which I have had the honor of reading to the Society. On reconsidering the subject, I found my former instruments objectionable and imperfect, and determined to attempt to remedy their defects. Not without some trouble, I have obtained the one which I now present to your notice, after premising that I by no means consider it a perfect instrument, but rather an attempt on which better mechanics may hereafter improve*. The principle of its construction I believe to be correct, and calculated to effect the two-fold purpose of passing through a deep and narrow wound, and expanding round bodies of large and irregular dimensions. It would certainly have been much more satisfactory could I have subjoined any

his *Raccolta di Osserv. Med.* relates two instances of 28 and 39 ounces weight. Salmuth speaks of one "*totam vesicam explens.*" Mekel in his *Epist. ad Hallerum*, and Pallas in *Disput. Chirurg.* mention similar occurrences. Dr. Greenfield, in his work, *De Lithologiâ*, relates three instances of 18, 19, and 25 ounces weight.

* See description of instrument, page 92, plate III.

instance in which this instrument had been successfully employed on the living subject, but I am unwilling any longer to withhold it from the Public, that it may be the sooner submitted to the test of experiment, and either its utility confirmed, or its faults detected, and I would invite my professional brethren in the words of the poet,

“ Si quid novisti rectius istis
Candidus imperti, si non his utere mecum.”

Should this, or any other contrivance be found to be easy in its application, and effective in its operation, and should all the difficulties attending the use of such instruments be successfully surmounted, it may still perhaps be objected, that it is an evil to have the stone in fragments, because the introduction of the forceps or scoop would be thereby rendered necessary more than once, perhaps many times, and because it must always, in such cases, be uncertain whether the whole calculus had been removed. But surely it is a much greater evil to incur the risk of life, or of irreparable injury by extensive laceration of the bladder and urethra. In this operation, as in most others in surgery, the maxim, “ *sat cito si sat bene*,” cannot be too frequently inculcated. Let it be remembered that it is not the duration of the operation that endangers the safety of the patient, if his strength be not exhausted, nor the number of times instruments are introduced, provided they be cautiously and judiciously employed, but the quantum of injury done

to the bladder and surrounding parts. Admitting, however, that the repeated passage of instruments is an evil, how frequently, nay almost constantly, does it happen that in cases where the stone is extracted whole, the operator is repeatedly foiled by its escaping from his grasp, and should he at last succeed, extensive laceration is often superadded to the necessary duration and tediousness of the operation. With respect to the second objection, of not being able to remove all the fragments, I should much doubt its validity, as in all probability should any portions remain, or should the patient be too much exhausted to allow of their being removed at the time of the operation, they would readily make their way out at the wound in the course of a few days. Should any doubts, however, still exist of the propriety of breaking large calculi, the two interesting cases related to the Society by Mr. Mayo* and Mr. Dickinson will go far to remove them, as it cannot be questioned that the fortunate termination of these cases depended, in great measure, on the circumstance of the stone having yielded to the great force which was employed in the attempts at extraction, in the one case; and the rude, but judicious measures adopted for breaking the stone, at the moment of necessity, in the other.

It may, possibly, be urged that a surgeon cannot,

* See pages 54 and 61 of this volume.

at all times, be aware of the extent of the stone which he is about to extract, and therefore cannot be prepared with proper instruments for attempting to fracture it. This occurrence is certainly not very likely to happen, as the duration of the disease and the suffering of the patient, together with the sensation conveyed by the sound, and an examination from the rectum, must, in most instances, sufficiently apprize the surgeon of the nature of the case, when it would become his duty either to provide himself with efficient instruments, or not to attempt the operation. Occasionally, however, calculi do acquire considerable magnitude without causing any severe paroxysms of pain, and consequently without being suspected. Probably this arises from their being smoother on their surfaces, and being less liable to be moved in the bladder.

Henricus ab Heer* mentions a case where the stone acquired the size of a goose's egg, without producing any symptom.

Deschamps† speaks of a watch-maker, who had never experienced any symptom of stone, except that he could not retain his water for any length of time; when one day in lifting a heavy clock he felt a severe pain in the hypogastrium, from which he continued to suffer until he was brought into La

* *Observationes medicæ rariores*, 1685. Observ. 26.

† *Traité de la taille*, tom. 1. p. 166.

Charité, where a stone of 24 ounces weight was taken from him by Frere Côme by the high operation, and he died the following day. In such cases it is possible that a surgeon might find himself unexpectedly embarked in an operation for which he was not prepared, or however well he might have prepared himself, with various contrivances, the stone might be of such size and shape as to afford no reasonable prospect of success from the means with which he had provided himself. Under such circumstances it becomes a most important question how he should proceed, and I feel no hesitation in replying, that the safety of his patient should be paramount to every other consideration, and that he should immediately desist from all forcible attempts, which in all probability would be attended with fatal consequences. Thus at once to relinquish all attempts at removal of the calculus, which is the apparent end and object of the operation, would require considerable firmness of mind, as to some persons it might appear like a defeat by which their reputation might be endangered.

By thus desisting in time from any injurious and futile attempts, the surgeon would escape the odium of having accelerated his patient's fate, and at the same time he might acquire much valuable information relative to the size and shape of the stone, which might assist him in constructing instruments capable of fracturing it at some future period.

The simple incision in the perineum and neck of the bladder would be rather beneficial than otherwise, by allowing the free exit of the urine as it was secreted, by which the patient's sufferings would be much alleviated. The inflammation which would take place around the wound would probably be productive of good against any future attempt, by causing adhesions in the surrounding cellular texture which would render urinary infiltration much less to be dreaded. In any subsequent attempts the wound might either be dilated with sponge tents, which would render the operation bloodless, or the fistulous opening might be enlarged with the bistouri.

Many respectable advocates may be adduced in favour of thus performing the operation at two different periods.

Franco * and Fabricius † Hildanus particularly recommended this practice. Hunczowsky ‡ says, "if the stone does not present itself at the wound, it is better to defer the extraction." Frere Côme §, Hugo Maret, and Jean Zecchi entertained the same opinion.

* *Traité tres ample des hernies de la frene*, &c. p. 128, u. 134. Lyon, 1561.

† *De Lithotomiâ vesicæ liber*, cap. 16, p. 731.

‡ *Medizinisch chirurgische beobachtungen*, p. 295.

§ *Richter, Chirurg. Biblioth. t. 1. p. 116. t. 8. p. 46. t. 11. p. 507. t. 1. p. 15.*

Instances have also occurred in which from accidental circumstances the removal of the calculus has been delayed, and the cases have terminated favorably.

Dr. Charles Preston * informs us that a M. Parfaima operated at Ghent, in 1696, and found a stone adhering to the bladder, which, after eight days, he extracted with ease, and the patient recovered.

My father † relates the case of a child, aged five, who was operated on, but no stone could be found at the time ; after some days, however, it presented itself at the wound covered with spiculæ, which rendered its extraction difficult. Two similar cases are recorded in *L'Histoire de la Société Royale de Médecine* ‡, in both of which the extraction of the stones was delayed, but after a few days they found their way to the external aperture of the wound.

Tolet § relates a very interesting case of this description. In 1659, he operated on a gentleman, but, in consequence of the size of the stone, was unable, without endangering his patient's life, to remove it. The inflammation, consequent to the first operation, was abated by the 9th day, and the

* *Philosophical Transactions*, Vol. 19. p. 310.

† *Practical Observations on the Stone*, p. 68.

‡ *Tom. 2. p. 248. et sequent.*

§ *Traité de la Lithotomie*, p. 253. 5th edit. Paris, 1708.

stone was extracted on the 11th without difficulty; during all this time the wound was kept dilated with tents. The stone, he says, was, "*grosse comme une balle de longue paulme, revêtuë partout d'autres petites pierres figurées comme des poids mediocres.*"

Covillard * records a most important case, in which he entirely attributes the patient's recovery to this practice.

Collot † gives an account of a patient, aged 75, who was operated on, "*en deux tems,*" with an interval of eighteen days, with the happiest result, and adds, that he is confident, if he had persevered in the first operation, the patient would have sunk under it. He relates several other equally successful cases.

Saviard ‡ speaks equally favorably of this practice under particular circumstances; and gives an account of some important cases in which he followed it.

Although in common cases this temporising may be very justly condemned, and I am well aware that it might be abused, yet in such instances as I have supposed above, where it must, at once, be

* Observat. Medico-Chirurg. Obs. 4.

† Traité sur la Lithot. p. 178.

‡ Observ. Chirurg. Obs. 108, 206, et 443.

apparent to the surgeon that he possesses no efficient means to complete his operation, and in cases of great exhaustion from hæmorrhage, long suffering, old age, or the duration of the operation, I should consider such practice as far more justifiable than to endanger the life of the patient by long continued and improper application of force, or by making so extensive an incision into the bladder, either through the perineum or above the pubes, as would hardly afford a shadow of hope of ultimate success.

DESCRIPTION
OF
MR. EARLE'S
INSTRUMENT FOR BREAKING CALCULI
IN THE BLADDER.

THE instrument consists in three blades, united by two pivots at their upper extremities, and attached to three cylinders below, which move one within the other. The outer blade and cylinder are fixed below to a hollow steel handle ; the two inner cylinders and blades are made to revolve to the extent of one-third of a circle, one to the right, and the other to the left, by means of two rings with uprights, which move round the lower extremity of the outer cylinder, and are fastened with a pin when the blades are expanded. The cylinders are four inches in length. The outer blade is broader than the other two to admit of their closing under it. The length of it is likewise greater, and this projection nearly answers the purpose of a fourth blade. The blades are connected with the cylinders by means of a nut and two screws, which can easily be removed to allow of other sets of blades

of different sizes and forms, adapted to calculi of various dimensions, to be readily attached. The other parts of the instrument consist in a wedge-shaped perforator and screw made to pass up through the hollow handle and inner cylinder. The perforator does not turn round, being kept steady by two pins which work in its groove. The screw turns upon the lower extremity of the perforator, to which it is connected by a socket which works round a shoulder. The lower extremity of the steel handle is tapped for the male screw to work in. The steel handle is octangular, and a small moveable key, similar to that used for unscrewing pocket pistols, is adapted to it, to enable the operator to have a more steady hold of the instrument. When it is to be used, the screw, perforator, and key should be withdrawn; and the operator, having previously endeavoured to ascertain the size and form of the stone, should attach that set of blades which appears to him best adapted to the case. The inner blades should then be closed together under the broader outer one; the whole will thus occupy very little more space than one blade. The form of the whole instrument, in this position, bears some analogy to a catheter, and it should be passed in the same direction, upon the fore-finger of the left-hand, under the calculus. The inner blades should then be expanded by moving the rings and uprights. When the blades are equidistant, the two uprights will exactly oppose each other, and the steel pin should be passed through

the openings left in them, which will prevent the blades from moving. The operator should now carefully examine, with his fore-finger, to ascertain whether the calculus be properly secured within the blades; the small space occupied in the tract of the wound readily admitting of this examination. The next stage in the operation consists in fitting on the key, and introducing the perforator and screw, which is to be gradually turned round until it meets and crushes the calculus. The screw and perforator should then be withdrawn, the uprights unpinned, the blades closed, and the instrument removed from the bladder, with the same precaution and in the same direction that it was introduced. The fragments of the stone are then to be removed by common forceps, and should any portion of it be still too large for extraction, the instrument with smaller blades must be again introduced to effect a further division of it*.

* When I had the honor of laying the above written paper and instrument before the Society, Dr. Granville stated that a very similar contrivance had been invented by Levret, for the purpose of removing a detached fœtal head from the uterus. On referring to that author I find that in some respects the principle of the instrument alluded to by Dr. Granville, bears a very close resemblance to mine, although its object and application are different. Like mine it consists of three blades which close one within the other, and which are worked by three cylinders precisely in the same manner, except that the rings which move the blades are situated immediately at the junction of the blades with the cylinder. The form and length of the blades are likewise dif-

ferent from mine ; and there is no screw and perforator passing through the handle and inner cylinder. I feel much indebted to Dr. Granville for having pointed out this resemblance, and only regret that I was not earlier acquainted with Levret's contrivance, a knowledge of which would have saved me much trouble and expense. Vide Levret, Observations sur les causes et les accidens de plusieurs accouchemens laborieux. 8vo. Paris, 1750.

REFERENCE TO PLATE III.

Fig. 1. Represents the instrument with the blades closed and the perforator introduced.

- a.* The outer blade longer and broader than the others.
- b.b.* The two inner blades.
- c.* The perforator grooved on one side.
- d.* The nut for fixing on the blades, screwed to the top of the inner cylinder.
- e.* The outer cylinder, fixed above the outer blade, and below to the handle *h*.
- f.f.* Rings with uprights, for moving the inner cylinders and blades.
- g.* Pin to fix the uprights when the blades are expanded.
- h.* The octangular handle.
- i.* Key adapted to the handle.
- k.* The wooden handle to turn the screw *l*.

Fig. 2. Represents the same instrument in action.
The blades expanded, the pin fixed through
the uprights, and the perforator half in-
troduced.

Fig. 3. The perforator and screw detached.

- a.* The groove.
- b.* The joint uniting it to the screw.
- c.* The screw.
- d.* The wooden handle.

Fig. 4. The steel key.

Fig. 2.

Fig. 1.

Fig. 2.

Fig. 2.

Fig. 1.

Fig. 3.

Fig. 4.