JARVIS. LECTURES ON FRACTURES AND DISLOCATIONS.

LECTURES

ON

FRACTURES AND DISLOCATIONS,

EXPLAINING

NEW MODES OF TREATMENT, FOUNDED ON ANATOMY, PHYSIOLOGY, AND THE LAWS OF MECHANICS,

TOGETHER WITH

CONCISE INSTRUCTIONS

IN THE USE OF

THE ADJUSTER.

By GEORGE O. JARVIS, M. D.

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JARVIS'S ADJUSTER.

By means of this instrument the surgeon has at his command an extending and counter-extending force, equal to that of twelve men, all or any part of which he can apply to any limb at pleasure, and yet the limb remain perfectly moveable and free from manipulation.

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WOULD respectfully announce to the Medical Profession, to ship-owners, and ship-masters, that they have made arrangements with GEORGE O. JARVIS, M. D., the inventor and proprietor of the "SURGICAL ADJUSTER," for the sole and exclusive manufacture of that instrument in the United States; and that they are also authorized to sell the same for use, either by themselves, or by agents duly appointed for that purpose. All orders, therefore, for the instrument, addressed to them as above, will receive prompt attention.

They take pleasure in here giving their assurances to those who may wish to procure the instrument, that every part shall be made of the best materials, and shall also be finished in a style worthy of so important an apparatus in surgery, and as shall be best adapted to fulfil the indications required. In short, they would state in few words that they do not intend to allow an instrument to leave their establishment, which, at the time, shall be imperfect. Thus by faithfulness and fair dealing, on their part, they hope to receive that encouragement from the profession, and from ship-owners, which the addition of an instrument so important to surgery, and so valuable to the world, would lead them reasonably to expect.

It is, perhaps, unnecessary to mention, that this instrument has received the unqualified approbation of the most eminent surgeons both of Europe and America, and that it has been used with complete success in numerous cases where all the ordinary means, and the most persevering efforts to effect reduction, had failed. Should this their first effort to benefit the profession be crowned with success, they hope in due time to present other important surgical instruments of their manufacture, for examination.

ADDRESS.

In presenting this instrument to the surgeon, I beg leave to remark, that I had long felt the want of means better adapted to reduce dislocations, to adjust fractures, and to maintain coaptation ;—means more in accordance with sound principles of surgery, than any which had hitherto been presented to the profession.

In dislocations (for example), the application of force by pullies or by assistants, I found always and of necessity to operate from fixed points, over which the surgeon could have no control, and in consequence of which those movements of the limb, so necessary to render reduction easy, were so restrained by the means employed, as not only to prove a material hinderance, but occasionally, I had too much reason to believe, were actually the cause of defeat, and perhaps of additional injury ; nor indeed did the principles of science appear to me to be so applied as to do credit to a learned profession ; mere mechanical or physical force, applied in a given line, being all that could be relied upon to effect the object. In fact, with the most skilful, this was all that was available in the use of those means ; so that he who fearlessly pulled the hardest, and stuck to his case most perseveringly, regardless of the pain he inflicted on his patient, generally had the reputation of being " the best bone-setter." In short, this was almost the only way in which the skill of the surgeon could be exercised, and science employed in the use of the means above indicated ; and it is presumed, in consequence of those means operating mechanically just as they do in their not being conformed to the principles of surgery, that so many cases

have been dismissed by the surgeon before reduction, and the unfortunate patient doomed to perpetual lameness; becoming, in his hopeless state, an easy prey to the designing charlatan.

To illustrate these views, let us suppose a dislocation of the hip. The head of the bone being thrown upwards, and outwards, it would be driven as a consequence into the surrounding soft parts, and by the oblique position of the neck, to the shaft of the bone; the head and neck would now act like a hook thrown around the muscular fibres, which lie below them. When force is applied from fixed points and in a line with the shaft, that force will tend either to tear through the muscles around which they are thrown, or to break the bone, and not to disengage the head from the surrounding soft parts, while extension, and counter-extension, are thus operating on the limb: and any force applied posteriorly, would furnish but imperfect assistance to disengage the head, since that head is always larger than its neck, and of course, must press more deeply into the muscular substance beneath it. From this cause alone, it is believed, that the femur has occasionally been broken in attempts at reduction.

From the foregoing facts it must be apparent to every surgeon, that "all is not right" here; while the objection to the use of force operating from fixed points in reducing other dislocations, as in some cases of the shoulder, the elbow &c., are equally clear, as a moment's reflection will show, although the same mechanical difficulties may not, strictly, be involved in their reduction.

In fractures, too, the principles on which the various mechanical contrivances have hitherto been constructed for preserving coaptation, I cannot but regard as essentially defective. In their management I have long held *position*, and *extension* and *counter-extension*, to be two distinct and essential principles in surgery, of equal importance, or nearly so, of which, neither should give place to the other. In oblique fractures of the femur, for example, immediately below the trochanter minor, attended with strong muscular contractions of the limb, to disregard the action of the psoas

magnus and iliacus internus muscles, in throwing the upper portion of the fractured bone forwards, and that also of the short head of the biceps flexor cruris and gastrocnemii, in throwing the lower portion backwards (while there are none whose direct action tends to prevent this deformity) ; under such circumstances to adopt the straight position, for the sake of extension and counter-extension, would be to sacrifice entirely the *principle* of position ; while it yet requires a greater extending force to restore the normal length of the limb, in the straight position, than it would if those muscles were first relaxed by adopting the bent position.

On the contrary, to adopt the bent position, which would effectually relax those muscles, and would also incline the lower portion of bone into a normal line with the upper, and yet neglect to use extension and counter-extension ; in turn would be to sacrifice the *principle* of extension and counter-extension for that of position, the ill effects of which would probably be as strongly marked as in the former case, and both of which, it is conceived, the surgeon should, if possible, endeavor to avoid.

Nor, indeed, can these defects be fully remedied by attempting to combine the two principles in one apparatus. For example—the extending point being fixed to the foot, the counter-extending point being also fixed to the body at the perinæum, and these again operating from the two extremities of a double-inclined plane on which the limb is to rest, it must be apparent, to apply force to the two extremities of a limb thus situated, would tend, just in proportion as the limb is flexed, to throw the fractured portions of bone out of a normal line, by converting each portion into a lever ; and that, too, by the very mode of applying the force—the soft parts serving as their fulcra. These remarks and principles apply to other fractures of the femur below the trochanter minor, and also to fractures of the leg, as much as they do to the one just named, and yet not perhaps with all the ill consequences so frequently attending, as a careful examination of the action of the various muscles of the extremities will plainly show.

To these defects in surgical practice may be ascribed, mainly, the introduction of this instrument to the profession : and in perfecting its arrangements, the following principles were adopted in its construction.

First.—Always to admit of the same free motion of the limb during the application of force, which that limb possessed independently of the use of this instrument.

Second.—To allow the surgeon to apply any amount of force in the exact line of the shaft of the bone on which he is to operate.

Third.—To have that force both gentle and steady, capable of being applied either rapidly or slowly, and retained permanently on the limb, or relaxed instantly, as the surgeon shall choose, while it is also, at all times, under his entire control.

Fourth.—To enable the surgeon to confine the points of extension and counter-extension within the limits of any given round bone.

Fifth.—To enable the surgeon to apply extension and counter-extension in any position of the limb.

In presenting an instrument to the profession by which the foregoing principles may be conveniently and readily applied, I conceive that many of the difficulties in reducing dislocations, in adjusting fractures, and in maintaining coaptation, may be obviated ; and I respectfully invite a thorough investigation of its principles—a faithful trial of its merits. And that its objects may be clearly defined, I will distinctly state, that it is intended to reduce *all* dislocations,—to adjust *all* fractures,—and to maintain coaptation of *all* fractured bones, where extension and counter-extension are requisite to accomplish either of those ends.

It may not be out of place also to state, briefly, some further advantages which this apparatus possesses over every other means.

1. Its whole force being entirely subject to the command of the surgeon, and applied by his own hand; he is thus enabled to regulate that power at will, inasmuch as he is capable of feeling the amount of power which he uses. He is

also enabled to dispense with the services of assistants, the aid of more than one being never necessary, and generally not even that.

2. It is more readily applied than the pullies, and in places, moreover, where to apply these, it would be extremely difficult; it being just as conveniently and successfully used in the bed-chamber, or in the field, or in a ship, or, indeed, in any other place where the person injured can be approached, as in the best regulated hospital. It is also compact and portable, and made of materials so strong and durable, that it is not liable to get out of order.

3. In fractures at the neck of the thigh bone it allows the patient to lie on the side opposite the one injured. This is an advantage, which may not appear to many at first sight, but which is nevertheless a great one, and which on reflection will appear so obvious, that it will be accounted matter of no small consideration in the treatment of those injuries. On this and other points, however, I would refer the reader to my lectures delivered at the Royal Westminster Ophthalmic Hospital, Charing Cross, London, and published in the March, April and May Nos. of the London Lancet, which are here subjoined for the benefit of those who may use the instrument.

I have thus endeavored to point out, briefly, some of the more prominent objections—objections, I mean, to the *principles*, which must not only now, but always in the nature of things, lie against the use of the means in common use for treating both fractures and dislocations. I have also briefly, but plainly, and I trust correctly, stated some of the advantages to be obtained in using the Adjuster in those injuries. That I have not in the least magnified the defects of the one, or over-rated the benefits of the other, I leave it to the man of experience—the practical surgeon, to decide. I now cheerfully submit it to the profession in my own country, as I have already done to very many of the most learned in that profession in England, France and Germany, whose approval it has received (most promptly and cheerfully bestowed), for their candid investigation of its principles,

and their thorough trial of its merits, trusting it may prove in their hands, as it has in the hands of all who have used it, a blessing to mankind.

I take this opportunity to state that I have made arrangements with Mr. Henry Kellogg, of Birmingham, Conn., for the manufacture and supply of the Adjuster, and to him I refer not only members of the profession, but also ship-owners, and ship-masters, for the instrument, "against a time of need." I am happy in being able to state, that Mr. Kellogg is not only every way qualified for the task, but is worthy of their entire confidence, not only as a manufacturer, but also as a man, and that he has associated with him for the above purpose, Mr. George Kellogg, A. M., a scientific and practical mechanic of the first order. Under their management, the profession and all who are interested may be well assured that every part will be faithfully made, and that all business transactions will be honorably conducted.

GEORGE O. JARVIS, M. D.

Portland, Conn., July, 1846.

A COURSE OF FIVE LECTURES

ON

FRACTURES AND DISLOCATIONS,

EXPLAINING

NEW MODES OF TREATMENT, FOUNDED ON ANATOMY AND PHYSIOLOGY, AND THE LAWS OF MECHANICS.

BY GEO. O. JARVIS, M.D., &c. &c.
Portland, Connecticut, United States.

Delivered at the Royal Westminster Ophthalmic Hospital, Charing Cross, London, November, 1845.

Illustrated by Engravings.

LECTURE I.

Division of the Muscles of the Thigh into Classes.—Mechanical Action of those Muscles in Fractures of the Bone.—Usual Violation of the Laws of Mechanics in the Treatment of such Fractures.—Necessary Attention to fixed points in applying Force to reduce Luxations.

The brief course of Lectures, of which the present forms the first, will contain a summary of my experience during twenty-six years of professional labor, the last five of which, have been spent in a situation peculiarly favorable for the observation of fractures and dislocations, my attention having been particularly turned to the subject, while designing, testing, and perfecting, the apparatus which is now offered to the notice of the profession for treating those injuries. Numerous opportunities have occurred to me for

observation, at different hospitals in America, London, and Paris; but it is not without feelings of due respect to the opinions and practices of others, for whom I entertain the highest regard, that I attempt to advance principles, and to urge treatment, which is at variance with those in common use. Still it appears to me that the cause of science demands the step to be taken. Therefore I comply with the kindly expressed wish of those who have desired me to deliver these discourses under the present roof, trusting that the views which I advocate will be examined with care and candor, while I cheerfully say, that whatever I recommend, if it will not stand the test of experience on the part of others, I wish it to be rejected. I have come to this country for the purpose of obtaining and communicating information in matters of surgery. During my sojourn in Europe, I have visited the whole of the Hospitals in Paris, as well as those of London; and in the course of two months attendance at the former, I have performed operations in some of the wards, which were planned wholly in accordance with the principles which I am now about to develop, and happily with a success which had not attended the efforts previously made in the treatment of the injuries experienced. Having now completed the round of my observations in England, I am about to retire to my native country; the delivery of the present brief course being the only object which has induced me to defer until another voyage of the Boston steamer, my departure from this metropolis, after having derived very great pleasure and advantage from my visit.

In calling your attention to that branch of our profession which is to form the subject of our present

course, I do so, under the firm conviction that much of the practice of the present day is characterized by a very unsettled mode of treating fractures and luxations, and is not consistent with the laws of mechanics; or, in other words, that those laws are not so applied in practice, as always to be made conformable with sound and well-settled principles in surgery. To show this, therefore, will be the object of the present lecture, after which it is my intention to illustrate the manner in which mechanical proceedings require to be conducted, in order to make them accord with those principles; and in doing so, I must once more express my obligations to the surgeon of this Hospital, Mr. Guthrie, and to the Committee of the Institution, for generously tendering to me the use of this Hall, to meet you here assembled, before finally quitting this land of my Fathers, for that Western World where is my home.

I shall call your attention, first, to some of the effects which muscular contraction produces on a fractured bone, as the result of the laws of mechanics; and, to save time, I will confine my remarks to fractures of the thigh, trusting that if these be well understood, the comprehension of them will be quite sufficient to enable us to apply those principles to practice in other fractures.

It will not be thought necessary, I trust, that I should go into a particular anatomical description of the femur. You are already too well acquainted with the convexity of its shaft, its condyles, trochanters, oblique neck and round head, to need description of them. But respecting the *myography* of the thigh, although you may be well acquainted with that also, still I beg you to allow me to direct your attention par-

ticularly to them as agents of mechanical action; because, on their attachments, their locality, and the direction of their fibres, must depend the relative position which the two portions of a fractured bone occupy: and in order to make my views on this subject plain, let us divide the muscles of the thigh into three classes.

First, those which pass lengthwise over the femur, and yet are not attached to it at either extremity.

Second, those whose fibres are attached to it at one end, while the other is united to the pelvis above.

Third, those whose fibres are attached to the femur by one extremity, while the other descends, to be united to the tibia or fibula below.

I will call your attention to each particular class. Of the first class, or those which pass over the femur, are the rectus femoris, the sartorius, the gracilis, the semi-tendinosus, and the semi-membranosus, the long head of the biceps flexor cruris; and among these may also be classed (from its mechanical action on the limb when broken) the tensor vaginæ femoris. These seven, when the bone is broken, only tend to shorten the limb by approximating the two extremities of the bone; and in a fracture of the shaft of the bone, do not, in any measure, operate directly to throw the fractured portions out of a normal line. For such an effect as that, we must look to other agents than to the muscles just named, because, it is a well-settled principle in surgery, not less than in physiology, that a muscle acts only in a right line between the points of its attachments.

Of the second class, or those having their attachments to the femur at one end, and to the pelvis at the other, are, the pyriformis, the superior and

inferior gemellus, the internal and external obturators, the three glutei (maximus, medius, and minimus), the quadratus femoris, the three adductors (brevis, longus, and magnus), the psoas magnus, the iliacus internus, and pectineus. Of these, let it be remembered, all have their attachments to the femur, at, and above the point where the gluteus maximus is inserted, excepting the adductor longus, and about two thirds of the adductor magnus, the fibres of this last descending quite to the inner condyle.

Of the third class, or those diverging from the femur to the knee, there are the two vasti (externus and internus); and between them, on the anterior surface of the bone, lies the cruræus, while on its posterior surface are attached the two heads of the gastrocnemii, and the short head of the biceps flexor cruris. Of these let it also be remembered, that they have the whole of their attachments to the femur, below the insertion of the gluteus maximus, excepting a portion of the two vasti, and a portion, also, of the cruræus whose fibres are attached the entire length of the shaft of the bone. The fibres of these muscles diverge from the femur to the knee, as the fibres of the second class do from the femur to the pelvis.

We will now examine some of the effects which the mechanical action of this arrangement of muscles is likely to have in fractures of the femur: for, be it remembered, that the bone which before served as a connecting link, for the action of all the muscles (preserving, as it were, a just balance between them all), now no longer serves as the centre of that harmonious action; but a new centre, and a new combination of actions, form around each broken portion, as the result of this lesion of bone.

To illustrate our views, let us suppose a fracture of the femur, between the trochanter minor and the insertion of the gluteus maximus muscle, which, as you are well aware, would be in the upper third of the bone. Now what is it which generally attracts our attention in a fracture at this point? It is, the distorted figure of the limb, the peculiarly distinct angle at the point of injury, the unusual convexity at the upper and front part of the thigh. And why is this *the* form peculiar to this injury, excepting only those cases where the force applied to produce it, has evidently interfered with the natural action of some of the muscles? Is it not from the balance of power on the side of the psoas magnus, iliacus internus, and pectineus muscles, all of which have their attachments, as we have seen, to the upper portion of bone, and situated to act upon it anteriorly? I say, is it not from the balance of power which these possess, over those attached to the same portion posteriorly, which so casts the upper portion forward, while the fractured end of the lower portion is also carried forward with it, from its attachments to the two vasti and cruræus muscles; the gluteus maximus serving as a fulcrum to the lower portion in carrying the knee backwards, while the other extremity is thrown forwards by the attachments just named and by the force which acts on the upper portion? From this cause, then, arises the angle which we always see in fractures at this point; and from this cause, too, the inclination of the lower, always to separate from the upper portion or rising end of the bone, while it is only prevented to a much greater extent, as we may fairly presume, by its attachments anteriorly to the vasti and cruræus muscles. We also see, on

the lower portion, a balance of muscular power on the posterior side, always inclining it backwards, as that on the upper always inclines that portion forwards; this arising, obviously, from the more favorable position which the two heads of the gastrocnemii, and the short head of the biceps flexor cruris occupy, for acting on this portion of the bone, as compared with their antagonists, the two vasti and cruræus muscles, now that its shaft is severed. But more than this, that balance of muscular power must evidently be increased in both, as we depart from that angle of the limb which places the fractured portion nearest to a normal line. We here see, then, the mechanical effect which the muscles have on a fracture of the thigh at the point indicated. Let us next examine whether, in treating such fracture, the laws of mechanics have not been too often violated or neglected; and for the sake of brevity and clearness, I will first state, that there are but two positions, generally adopted by the surgeons of the present day, in the treatment of fractures of the inferior extremities—viz., the straight and the bent position of the limb, the patient lying on his back. Nor, at the present day, are there but three distinct and leading methods adopted for the application of mechanical principles to this department of surgery. Yet there are a thousand ingenious contrivances, through which these three are applied. I refer to the double-inclined plane, to the straight splint of Desault, and to a combination of these two. All others which I have seen, are mere modifications of the one or the other of those which I have named, and do not, in any measure, escape the general principles on which their originals were based. As these are found to be right or wrong, so must the others be also. And therefore

a particular description of them would not be needed —even if our time would allow it. You will doubtless examine many of them, if you have not already done so, and decide for yourselves, whether I have correctly stated the fact.

Let us then look at some of the effects which these different positions have on this fracture; and for the sake of rendering both more clear, we will at the same time consider some of the mechanical effects of the three kinds of apparatus just alluded to. With regard to position, it must be apparent, from what has already been shown, that to place the limb in a line with the body, inclines the fractured extremities to separate, to the utmost limit which the vasti and cruræus muscles will allow, from their attachments to the upper surface of the bone near the point of fracture; and much in proportion to the extent of lesion between the muscle and the bone, will this tendency be increased; and in proportion as the muscular contractions in the limb are strong or weak, will the two fractured ends be drawn asunder. Any force, therefore, which can overcome this separation, must be more than equal to all the muscular contractions which produce it; this force must be applied, too, exterior to the limb. Is it not plain, therefore, that we must apply force antero-posteriorly to overcome this separation of the fractured ends? an application of force which would be entirely uncalled for in a different position of the limb. Would it not require an amount, too, which is not always quietly to be borne? And more than this, should there be strong muscular contractions in the limb, what would be the effect of such an amount of force as to preserve co-aptation, on the circulation of the limb, especially if this arose

in an irritable system, with feeble constitution? Would it not also require a greater amount of extending and counter-extending force, to restore the normal length of the bone, than if it were first placed, so as to relax the flexor muscles of the limb? And would not the muscular tissue be more likely to be wounded and irritated by the fractured extremities, when the position is such as to render co-aptation difficult, than in one where it is rendered comparatively easy? This is the position in which the straight splint of Desault is always to be applied, and in all of its modified forms; and it is on account, mainly, of the extension and counter-extension to be obtained by it, that it is employed—a principle, sound in theory, and important in practice, when correctly applied, but in this instance, by the very mode in which it is obtained, another one, of equal or greater importance, is entirely sacrificed—I mean, *that position which inclines the fractured portions nearest to a normal line, and most effectually relaxes the muscles of the limb.*

It is conceived to be a sound rule in this department of surgery, so to apply force, as that the smallest amount capable of accomplishing the end, shall be employed. The reasons for this, it is believed, are too plain and obvious to need comment.

We will now, however, consider the application of the double inclined plane. And here I will observe, that this apparatus seems to have been arranged, more for the purpose of securing such a position as the surgeon shall choose, than for any other object; and, so far as position is concerned, it answers such intention quite well. Here we can not only relax the muscles which pass over the thigh, but we can also relax the

gastrocnemii and short head of the biceps. We can also so flex the limb on it, as to incline the lower portion of bone, nearest a normal line with the upper, and can also make the nearest approach to co-aptation, of which the two portions are capable, by the action of the muscles. Still, unless the weight of the body is sufficient to answer all the purposes of extension and counter-extension, we shall fail to preserve co-aptation, although we may have once effected it. And here allow me to show the importance of extension and counter-extension in this position of the limb, not more for the purpose of co-aptation, than to counteract the continual tendency of the fractured extremities to separate. Allow me to fix your attention for a moment on the fibres of the cruræus muscle, attached to the whole length of the upper surface of the bone, and also to the two vasti, attached in like manner, on each side of it, and these descending to the knee, to be united at the patella. What, I ask, would be the effect of traction, applied in the exact line of the limb, on the depressed end of the fracture, through the medium of these fibres of which we are speaking? Would it not be, to elevate the depressed portion, to a line with the upper, and thus to perfect co-aptation? Most certainly it would. Here, then, is where the double inclined plane, with all its modifications, is defective. But some may say, perhaps, there are many apparatus in use, where extension and counter-extension may be applied with the double inclined plane. I admit it; but not so (pardon the assertion) as that the points of traction shall operate in the exact line of the shaft of the bone. And here lies the fault, as I humbly conceive, in the multitude of ingenious contrivances for treating fractures. They all make the

perinæum one point of traction, and the foot or the leg the other. It must be plain, therefore, that to act on a limb, laid on the double inclined plane, with any force from these points, the force must be so applied, as that more of it is spent at right angles with the bone, than is exerted in the line of the limb, operating favorably to produce extension and counter-extension; and furthermore, all that is thus spent, there being sufficient to produce the necessary extension and counter-extension, tends to throw the fractured portions out of a normal line. We have an amount, too, which, if rightly applied, would be altogether beyond the amount required for the object in view. And it is, moreover, applied in a manner, which would not only be likely to give pain at the knee, but, as the ligaments become elongated by continued extension, they would very likely deceive the surgeon in the length of the limb. We will not, however, extend our remarks on this point.

I proceed, however, to consider, in the next place, some of the effects of these laws, on a fracture between the insertion of the gluteus maximus and the knee. And what do we observe in this, that we did not in the other case? The chief difference which we notice, is the greater mobility between the upper and lower portions of the thigh. That peculiar angle and convexity of the thigh, does not appear in this; and although there may be a greater deformity in the limb, still that deformity is characterized by other marks of derangement; as, for instance, the lower portion may appear as if thrown off from the upper—or if an angle appear, it may be either laterally or posteriorly; the inferior portion, however, being always found to lie at the back of the superior. And, why do we find

this difference in two fractures so near together, and in the same bone? Is not the chief cause of this difference the absence of an agent like that of the gluteus maximus, in the lower portion, to serve as a fulcrum for those muscles which throw the fractured end forwards, and the knee consequently backwards? To me this appears plainly to be the cause. In the first case, the fracture is more thickly covered with muscles than in this one; the muscles which attach to the fractured extremity of the lower portion, and are united to the pelvis, also depart from the bone nearer to a right angle, than in this. Still, these could not make the differences which we see, while the other might, and probably does. With reference to position, the same remarks which we applied to the first case, apply to this also; it cannot be necessary, therefore, to repeat them. Our remarks, too, in reference to the application of mechanical principles through the various apparatus, apply equally in this, as in the other case; nor will it be necessary to repeat them. We will, however, call your attention to but one more form of fracture, and that, a fracture at the neck of the thigh bone. And to avoid all physiological questions which might arise—since it is only mechanical principles which are to be applied to surgery, that I am attempting to discuss—I will confine my remarks to one of those supposable cases of a fracture out of the capsular ligament.*

* The author does not believe that a fracture of the neck of the bone, out of the capsular ligament, can take place, except the whole neck be separated from the trochanter and shaft of the bone. Any other one, it is believed, would be quite impossible, since the capsule envelopes the whole neck, as a careful examination of the parts will plainly show. Nor, indeed, does he believe in the great uncertainty (amounting very nearly to an impossibility) of an osseous union taking place *within* the capsular ligament. He has at his side, while writing this, a femur in which the head of the bone has been separated from its neck, and yet it is manifest that as perfect an osseous

In a fracture at the neck of the bone, what do we observe? the limbs being at rest, and the patient on his back. What is the first thing which attracts the attention of the surgeon? It is, that one limb is shorter by some two or three inches than the one on the opposite side. The foot is also turned outwards; and perhaps the trochanter major may also appear somewhat prominent. These are the chief marks of difference which we notice, on looking at the two limbs. And now, why so marked a difference between this and the other two cases? A greater difference in the fracture of any two limbs, could not well appear; and it is the result merely of a lesion at this part of the bone, rather than at another, which marks all the difference which we see. Is it not, that by this fracture another and a different mechanical effect is allowed the muscles acting on the two portions of bone? Must we not, therefore, expect that a different application of mechanical means would be required, in so marked a difference in the limb, to overcome this effect, and to restore it to its normal length and figure? Most certainly we must. In this instance the mus-

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union has taken place between them, as can be shown in the middle of the shaft of the bone—he has also seen other examples as plainly marked. More than this, he can no more doubt that osseous union within the capsule has taken place under his own practice, than he can that definitive bone has ultimately united a fracture in the shaft; instances of this kind are too frequent to admit the generally received opinion, that osseous union within the capsule is never to be expected. Surely without co-aptation and perfect rest we may hardly hope for it. The reasons are obvious: definitive bone appears to be designed to unite together only broken surfaces, under the most perfect rest, in all cases where the bone is deprived of a provisional formation, as it is in fractures within the capsular ligament of the hip-joint.

But with these—co-aptation and perfect rest, maintained during the time requisite for the formation of definitive bone—we may expect an osseous union, except where from the extreme age or impaired health of the patient such union would be unlikely to take place. The author hopes to be able hereafter to point out the causes which, in his judgment, have so generally operated with the profession to prevent an osseous union at the neck of the thigh bone. At present he can only say he is convinced that principles of a wrong pathology have generally prevailed with regard to them, and that it will afford him pleasure to contribute his share in endeavors to correct them.

cles of the first and second class only are concerned in producing the derangement in the line of the bone. The lower portion, which now includes the whole of the shaft and the trochanters, is thrown directly upwards, and the neck only is thrown from a normal line, and is also shortened, as one of the necessary effects of these mechanical laws, by the action of the muscles attached to the trochanter major and the pelvis. Now, it must be manifest, that we can no more co-apt a fracture, at the neck of the bone, without restoring it to its normal length, than we can one in the shaft, without giving that its due length; and any apparatus, which fails to do this, fails to fulfil all the indications which correct surgery requires in the case.

Allow me to call your attention, for a moment, to a particular arrangement between the pelvis and the head of the bone, for the purpose of calling your attention to it at another time; and that is, that the head of the bone serves as a pivot, on which, at the pelvis, turn all the movements of the body with the lower limbs, even the smallest motion which is made between them gives motion at this point. Now, from what has already been shown, I presume I shall be anticipated in my remarks, in reference to position; for it must be apparent that the straight position, or one nearly allied to it, must be the one which the mechanical effect of which we have spoken requires, that the means for restoring the normal length and figure may be correctly applied to the limb; and here the straight splint of Desault would seem to be well adapted. But how must it be with the neck?—what, in that apparatus, is to restore that to its normal length? Unfortunately, nothing; but, on the

contrary, much which is calculated to shorten it still more. We will endeavor to show this fact. One point of traction is to operate from the perinæum, by a band passed upward and outward on the anterior and posterior sides of the pelvis, to be made fast near the upper end of a broad splint, lying on the outside of the limb; the other point of traction is to be at the foot, and is secured to the other end of the splint. Now, is it not plain, that just in proportion as we apply force, to approximate the foot to the lower end of the splint, in order to lengthen the limb, a portion of that force must operate at the top of the splint, to incline it towards the perineum, that being the point of resistance from the body, which connects it with the upper end of the splint, by the means of the band, and which is out of the line of the two extreme points to which force is applied? And, therefore, must not the upper surface of the splint operate to depress the hip, just in proportion to the angle at which the belt is made to operate from the splint? Hence, if we regard, as of the least importance, the length of the neck or the wounding and irritating the muscles, by the fractured extremities, this application of the splint cannot be right in surgery. Indeed, no one, under any arrangement, which I have seen, tends to give length to the neck of the bone. On this account, they are all alike defective; yet all do not actually depress the hip, though they may, and most of them do, require a position, unsuited to the condition of the limb; and from two or more wrongs, it is often difficult to make a selection. We will not, however, detain you longer on the subject of fractures, but will proceed to examine into some of the modes in which mechanical principles are applied for reducing luxations.

In these, the first and great object which we generally have in view, is, to overcome any resistance which the muscles, opposing reduction, may offer to it. That resistance is generally from the power which the muscles possess of approximating their points of attachment, when the head of the bone is dislodged from its articulating cavity. To overcome this resistance, *extension* and *counter-extension* have very generally and very necessarily been employed. There have, however, been various expedients resorted to, for accomplishing this end, only two of which remain in general use at the present day. These are physical force, by means of assistants, and mechanical, by the use of pulleys; both alike are employed for the purpose of making traction on the luxated limb. I am aware that the screw has also been employed, at various periods of time and in many parts of the world; but the objections to it are so grave, and so numerous, that it has never been received into general favor. I may therefore leave that out of the account. As it regards the two methods remaining in use, their effects, mechanically, on the luxated limb, are precisely the same; for I cannot conceive a difference, where a given amount of force is employed, whether that force is applied through the pullies, or through assistants, provided both are equally steady in their application, and the points of traction secured alike in both. What I would be understood to say, is, that the mechanical operation of the two methods, on the luxated limb, is, for all the purposes of reduction, the same; one may command more power, and the other may be more gentle in its operation; still on these points I can see no difference between them, both being, as they may be, of equal power; or one may be

more steady in its operation, and the other more ready of application; yet this does not affect the main principle, that both act mechanically alike on the limb, so that in discussing the principles of the one, we also discuss those of the other. And that to which I would first call your attention, is, that they both operate from fixed points, over which the surgeon can have no control. Thus, if the line of extension happens to be the correct one, he does not desire it changed; but if it happens to be incorrect, the force must first be relaxed before he can change it. It is the effect of being thus confined to these fixed points, which I wish to consider.

We will suppose a luxated femur, the head of the bone in the iliac fossa. The appearances of the limb, we will not stop to notice. You are too familiar with them, to render it necessary. One condition, however, which frequently exists, I beg leave to notice. In consequence of the oblique position, which the head and neck occupy to the shaft of the bone, any force applied to the head, from the other end of the shaft, and in a line with it, necessarily forces that head, in some degree (while passing through muscle), to follow the obliquity of the neck, and not the line of the shaft, thus making an oblique track from the cotyloid cavity.

Suppose we apply the pulleys to reduce this luxated femur: the head and neck being forced obliquely into the muscular tissue, as not unfrequently happens: we have power, constantly and steadily operating from fixed points; and before the direction of that force can be changed, we must relax it. Would not the head and neck, from their oblique position to the shaft (and especially, since the head is larger than

the neck), be likely to operate like a hook, around a portion of muscle which lies directly below them; and before they could be disengaged (the force operating in one line), be likely to tear through the muscle, or break the bone? The case is not chimerical. It has happened. But suppose, instead of the extending point being fixed, as in the case of the pulleys, it is left free and subject to the command of the surgeon, while force is steadily and constantly applied, would not the surgeon be much more likely to disengage the head, by giving free motion to the limb, than he would by applying that force in one given line? Here, then, I conceive, is another error in the mode of applying mechanical principles to surgery.

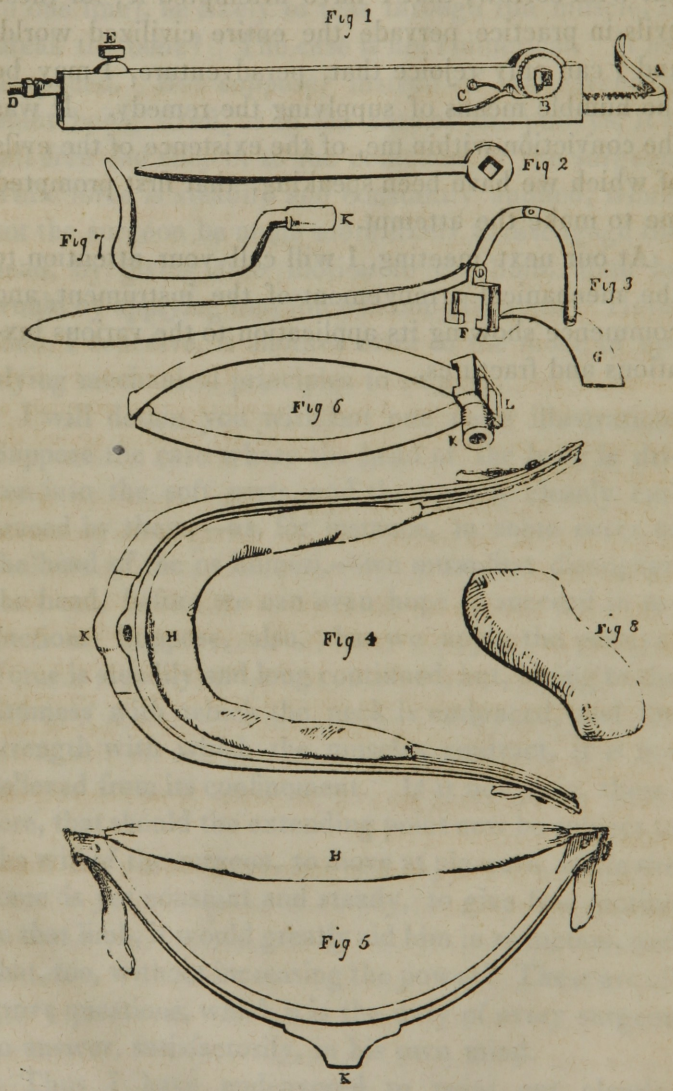
I will detain you with but one more illustration. Suppose the case where the head of the bone is driven into the soft parts, and the neck is closely embraced by them,—as, for instance, in some cases of the head of the os humeri,—we must first disengage the head, before we can even hope to succeed in reduction. Suppose, also, that we apply the pulleys. Force is steadily and long continued, but, owing to the firmness with which the neck is embraced, and the strength with which the muscles contract, it is not relieved from its confinement. Is it not plain, therefore, that should the extending point now be subject to the will of the surgeon, to move at pleasure, while the force is yet constant and steady, to give free motion to that limb, it would greatly aid him in reduction, and that, too, without increasing the power? These are all grave questions, which it is the duty of every surgeon to answer, satisfactorily, in his own mind.

Thus I have endeavored to point out clearly, wherein the laws of mechanics are violated, in this

every-day business of the surgeon; and in doing so, I beg you to consider, that it has not been with joy, but with sorrow, that I have attempted it; for these evils in practice pervade the entire civilized world, and I can only rejoice that, peradventure, I may be the humble means of supplying the remedy. It was the conviction within me, of the existence of the evils of which we have been speaking, that first prompted me to make the attempt.

At our next meeting, I will call your attention to the mechanical arrangement of the instrument, and commence showing its application to the various luxations and fractures.

PLATE I.



DESCRIPTION OF THE INSTRUMENT.

Fig 1. *The Adjuster:* A, the rack or extending bar. B, the shaft of the pinion and ratchet wheels. C, the catch. D, the counter-extending bar, for lengthening the Adjuster at pleasure. E, a screw for securing the counter-extending bar at any point,

Fig. 2. *The Lever:* the square socket in its end, is fitted to receive the square end, or heel, of the shaft B.

Fig. 3. *The Side Lever:* used in dislocations of the hip, to throw the head of the bone outwards. The fulcrum, F, is received on that end of the Adjuster, at which is the extremity of the counter-extending bar, D, the plate, G, pressing against the inside of the thigh.

Fig. 4. *The Thigh Fork*, with the roll or round pad, H, attached to it: K, the socket, to receive the end of the counter-extending bar D.

Fig. 5. *The Shoulder Fork*, with the roll, H, attached to it: K, the socket, to receive the end of the counter-extending bar D.

Fig. 6. *The Jointed Fork:* L, the two joints, in which the two arms move, and which are adjusted by two screws, removable at pleasure: K, the socket, into which the end of the counter-extending bar, D, is received.

Fig. 7. *The Elbow Fork:* K, its socket, for receiving the end of the counter-extending bar D.

Fig. 8. *The Pad:* used in fractures of the leg and thigh; there are two of them.

LECTURE II.

Violation of the Laws of Mechanics in the Treatment of Fractures.—Adjuster, and the Principles on which it is based.—Its Application to the four Dislocations of the Thigh.

At our last Lecture, I endeavored to show wherein mechanical principles, in attempting to apply them in the treatment of fractures and dislocations, were often violated or neglected. It will now be my endeavor to show in what manner they are to be applied so as to be conformed to the principles of surgery, in the treatment of these injuries. In showing this, I am to avail myself of the use of the instrument, which I now exhibit; and that you may readily comprehend the various modes in which it is applied, and the manner in which it operates, allow me to explain its mechanical arrangement. Let me first, however, lay down the indications which it is intended to fulfil which are—

1. To establish a line of extension between any two given points of the body:

2. To furnish an extending force, which is unlimited in principle, yet easily calculated, and which is perfectly subject to the will of the operator:

3. To be able to combine, with the simple extending force, a lever of the first or second order, according to the exigency of the case, so as to act transversely to the line of extension, yet without in any way interfering with it, and subject, in like manner, to the will of the operator:

4. To fulfil all these indications, without in any way interfering with the mobility of the limb:

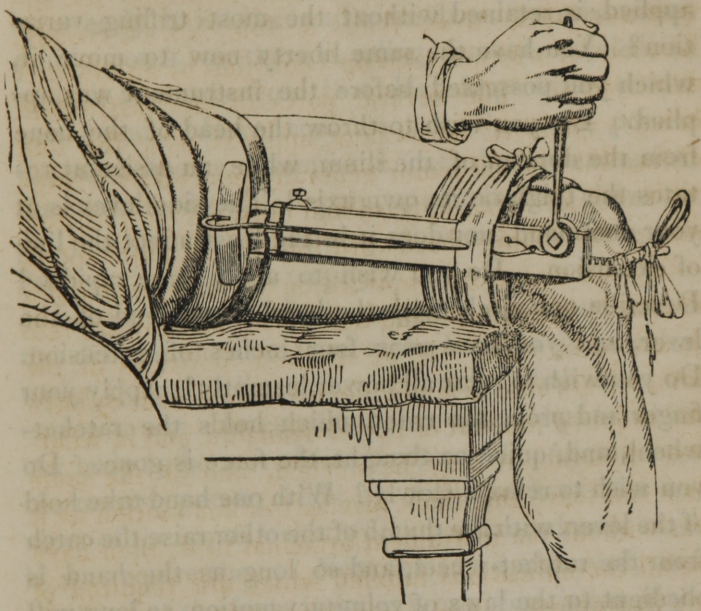
5. To enable the operator to apply the force, whether direct or transverse, either rapidly or slowly; and to retain it on the limb during his pleasure.

These indications, I conceive, may be fulfilled in the following manner:—A brass box or case (fig. 1) contains a rack-bar A, and a pinion-wheel within the case, the teeth of which match into those of the rack-bar, the pinion wheel within being at one end of the brass case. The brass case is about thirteen inches long, and is divided in the centre, lengthwise, so as to form two ways, one for the rack-bar, which is always the extending bar, and the other for the counter-extending bar, D, which may be drawn out, and fastened by a small screw, E, at any desirable point. On the surface of the brass case, and on the same shaft with the pinion-wheel, is a ratchet-wheel, B, with a catch, C, corresponding to the teeth of the ratchet-wheel; the shaft of these wheels terminating in a square heel, or hub, to which the lever (fig. 2) is applied. On the end of the counter-extending bar, is received, according to the case to be treated, one of these four forks—the thigh fork (fig. 4), the shoulder fork (fig. 5), the jointed fork (fig. 6), or the elbow fork (fig. 7). These are each received on the end of the counter-extending bar, by their sockets, K, K, K, K, and each, in its turn, according to the case to be treated, is used as the counter-extending point of the instrument; while the end of the rack-bar, which is turned at a right angle with the part which is received into the case, is always the extending point of the instrument. There is also a side lever (fig. 3), which is used to apply force transversely, to the line of extension; as in dislocations of the hip. The socket F is slipped on the end of the brass case

at D; and when the thigh fork (fig. 4) is received by its socket K, on the end of the counter-extending bar D, the plate G passes between the thigh fork, and the roll H, hanging loosely between the arms of the fork. To these belong several belts, straps, &c., which are for taking hold of the limb, securing the instrument, &c.; but as you will readily understand their use, in applying the instrument—and since the requisite instructions are always furnished by the manufacturers, Mess. Weiss & Son, No. 62 Strand, London—I will not take up your time by any further description. The several parts of the instrument being explained, let us now apply it, as to the four dislocations of the femur generally noticed by writers on luxations—viz., upward and outward on the dorsum of the ilium,—backward into the ischiatic notch, —forward and a little upward on the pubes and under Poupart's ligament,—and downward and inward into the foramen ovale. If, in all these positions of the limb, we are able to apply the instrument so as to have any required amount of power available, and in whatever direction it may be needed, and at the same time can leave the limb just as free for motion as it was without the instrument attached to it, then have we all the indications fulfilled which are required of any instrument. And not only so, we can also apply mechanical force to a dislocated femur, without the extending point being fixed, as at our last lecture we found it must be, in using the pulleys, or with assistants, and against both of which methods we found weighty objections to lie. Let us first apply it, as to a dislocation upward and outward; the head of the bone resting on the dorsum ilii. We must begin by placing the belt around the thigh, immediately above

the knee, with a loop lying on each side of the limb, and armed with strong cords. The instrument being arranged as already described, with the thigh-fork and side lever attached, and the roll suspended between the arms of the fork, we apply it to the inside of the thigh, the roll pressing firmly against the perinæum, observing, first, to lay some soft substance, such as wash-leather or cotton flannel, between the

PLATE II.



roll and the skin, to prevent friction on the skin by the roll when we move the limb. Tie the cords closely around the foot of the rack, having previously passed them through the loops, the arms of the fork having also been passed one on each side of the pelvis, upward and outward to the top of the ilium. Let a strap, crossing the top of the ilium, pass around each arm of the fork, having a buckle to it, and let it

make fast the arms in this position. To press the instrument close to the inside of the thigh, let a thick bolster of cloth be laid under the strap crossing the ilium; tie a strap or handkerchief around the instrument and limb close to the knee; apply the lever and make extension. Do you now wish to move the limb, to disengage the head of the bone from the gluteus minimus muscle, into which it has been driven, while all of the power which you have applied, is retained without the most trifling variation? You have the same liberty now to move it, which you possessed before the instrument was applied. Do you wish to throw the head of the bone from the dorsum of the ilium, while an assistant rotates the thigh on its own axis? The side lever is at your command, nor does it in the least affect the line of extension. Do you wish to apply force rapidly? Describe one circle with the hand at the end of the lever, and you have near four inches of extension. Do you wish to relax all power instantly? Apply your finger and press the catch which holds the ratchet-wheel, and, quick as thought, the force is gone. Do you wish to relax it slowly? With one hand take hold of the lever, with the thumb of the other raise the catch from the ratchet-wheel, and so long as the hand is obedient to the laws of voluntary motion, so long will the power be subject to the will of the surgeon. Thus, we have any amount of power which we desire; it can be applied in the most gentle and steady manner, or with the rapidity of voluntary motion. It can be relaxed instantly, or slowly, and retained during the pleasure of the surgeon; nor can the unruly movements of the patient in the least affect the line of extension, or change the relative position of the

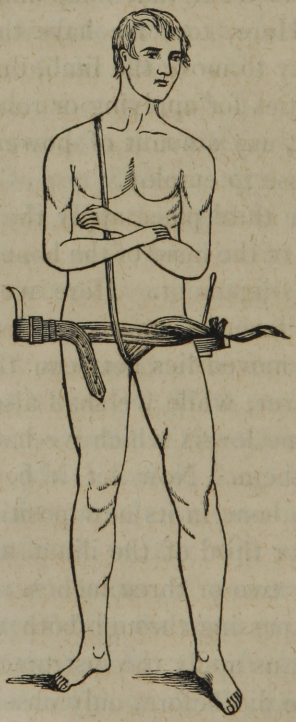
limb, while they are both entirely subject to the will of the surgeon.

Let us secondly apply the instrument as in the case of dislocation into the ischiatic notch. The instrument is applied in every respect as before, except that the arms of the fork stand more backward, and the limb nearer to a right angle with the body, that the head of the bone may be drawn towards the acetabulum. Here we have occasion to use the side lever early, to lift the head of the bone from the sacro-sciatic notch, as the extending force is applied, to bring it forwards from that deep impression, to the acetabulum. Here, too, we have the same power, the same liberty to move the limb, during extension, the same facilities for applying or relaxing, either rapidly or slowly, any amount of power which the surgeon shall choose to employ.

Let us in the third place apply the instrument, as to a dislocation of the head of the bone on the os pubis, under Poupart's ligament. Here we shall have occasion to use a lever of another order, that in which the body to be moved lies between the fulcrum and the moving power, while we shall also have the services of the same levers which we have already used, if we require them. Now let it be observed, that the head of the bone in its new position, is out of the line of the upper third of the ilium, and the inside of the knee, some two or three inches. It lies above a transverse line passing through both acetabula about one inch. Let us apply the instrument in the same manner that we did before, only observing to place a bolster of cloth under the strap crossing the ilium, sufficiently thick to firmly press the instrument against the inside of the thigh. It may here be observed,

that the greatest amount of force to reduce this dislocation, is generally required to operate transversely to the body, yet much will doubtless be required to restore the normal length of the limb. Now suppose, that while we are applying the extending force, we also gently, yet firmly, carry the instrument and limb outward. In such case the instrument itself becomes a lever; the strap passed around the arms of the fork, and crossing the dorsum of the ilium, becomes the fulcrum; the head of the bone, the body to be moved;

PLATE III.



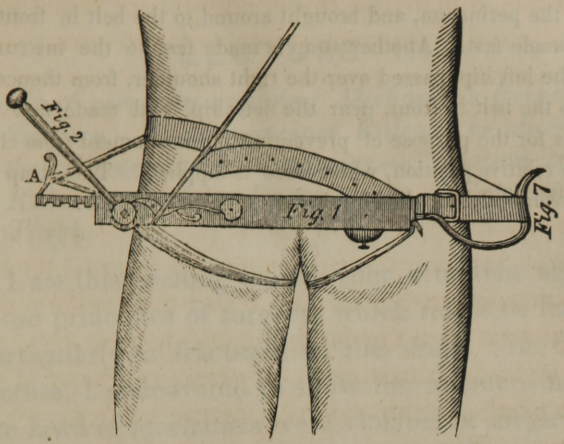
and the surgeon gently applies his own force to the end of the lever as the moving power; while he at the same time can apply the lever to the shaft of the

pinion-wheel to make extension. Should he require the aid, also, of the side lever, he could add to that already applied, five times the amount. It will here be observed, that the very mode of applying power transversely, to incline the head of the bone to the acetabulum, depends on the freedom from that restraint, which the pulleys uniformly impose. Thus have we sufficiently shown the application of the instrument to this dislocation.

The fourth case to which your attention will now be called, is to a luxation of the hip, when the head of the bone is lodged in the foramen ovale. Here we require an entire change in the application of power, and of course, in the direction of the instrument. For here the head of the bone lies below the acetabulum, and consequently, we require force, in the line of the limb, for no other purpose than to allow the head of the bone to pass over the cotyloid portion of the ischium. But here, allow me to observe, that in all the cases which I have seen, the rectus femoris and the adductor muscles were remarkably tense. Indeed, I can hardly conceive how it could be otherwise; there being no muscle whose direct tendency is, to throw the head of the bone outward to its normal position, it is plain, that the greatest amount of force is required, in a direction transverse to the shaft of the bone; and that this force must be applied on the inside of the thigh. It will readily be perceived, therefore, if we increase the tension of the adductor muscles — it being transversely through these that we are to act on the head of the bone, by the force applied — that force will with the greatest difficulty reach that head, so as to be likely to move it from its present abnormal position: espe-

cially since, I doubt not, it is often in those cases that the head is driven through muscular tissue in its passage to the foramen. It is the firmness with which the neck is embraced by the tissues around it, when the injury becomes one of long standing, which frequently so resists our efforts at reduction; and to increase the tension of the adductor muscles by extension, must increase the difficulty. To apply force, therefore, transversely, relaxing the rectus femoris and adductor muscles to the utmost limit which may be consistent with the condition of other muscles, and to move the limb freely, would allow the head of the bone to glide over that portion of the ischium, which separates it from the cotyloid cavity, more readily than to apply force in an opposite direction. We will therefore apply the instrument transversely; and in doing so, let me observe, that here the force is applied in the same manner as by the pulleys, when used for this luxation. This may readily be seen by consulting the excellent work on Practical Surgery, of Mr. Fergusson. Nor does the power here applied, possess any advantages over the same power applied by the pulleys, in the case under consideration, except that in this, the power is not so likely to be disturbed by the unruly movements of the patient. Nor, indeed, is the force so liable to vary during the operation. In all other respects, then, as far as I have yet been able to discover, for reducing this luxation, they may be regarded alike: yet, in these respects, in a grave luxation, those advantages are many times of no small importance. In this dislocation, instead of using the thigh fork, we remove it from the instrument, and apply the elbow fork (fig. 7), by its socket, K, to the end, D, of the counter-extending bar. Apply a broad

PLATE IV.



belt, or strap, with a buckle at one end, around the body so as to make the ilium of the injured side the resisting point, the instrument lying flat and crossing the sacrum; let the broad belt be buckled round the fork, over the uninjured side; pass another strap round the upper part of the thigh of the injured limb, and under the broad strap at the groin; tie the strap passing round the thigh to the foot of the rack-bar; let both straps be tied to the instrument at the respective sides of the body, to prevent them from slipping from the instrument; let padding be laid between the instrument and the body, and between the straps and the body; now, by the lever we throw out the rack-bar, and consequently the head of the bone, while we are able to move the limb in any direction.

Note.—The two Plates, III. and IV., which were not in the London Lancet, are here introduced, to illustrate more perfectly the application of the instrument to this dislocation. Plate III. presents a front view—Plate IV. a back view of the patient, with the instrument and belts or straps applied. It will be observed in Plate IV., that a small strap is tied round the instrument and belt,

over the right hip (the left being dislocated): this strap is passed under the perinæum, and brought around to the belt in front, and there made fast. Another strap is made fast to the instrument, near the left hip, passed over the right shoulder, from thence carried to the belt in front, near the left hip, and made fast to it. This is for the purpose of preventing the instrument from changing its relative position, when force is applied. The strap may be conveniently supplied by the use of handkerchiefs.

LECTURE III.

Mode of correctly applying Mechanical Principles to Surgery.—Four principal Rules to be observed in the Treatment of Fractures.—Violation of those Rules by all the ordinary means.—Fractures of the Thigh.

I AM this evening to call your attention again, to those principles of surgery, which relate to fractures, particularly to fractures of the thigh. In the first lecture, I endeavored to show the manner in which the laws of mechanics were violated or neglected in treatment. It will be my object, this evening, to show in what manner they may be applied, so as to fulfil the indications required, or, in other words, to be conformed to the principles of surgery.

But, before we proceed, allow me to lay down four principal rules, which I cannot but regard as essential in the treatment of all fractures. They are the following:—

1st.—So place the limb, as that the fractured portions shall be inclined to a normal line of that bone, the nearest that can be effected by the action of the muscles.

2nd.—So apply extension and counter-extension, as that the smallest amount, capable of preserving coaptation, shall be employed.

3rd.—So apply force, as that the line of extension shall operate the nearest possible to a perfectly normal line of the fractured bone.

4th.—Let the points of extension and counter-extension be confined within the limits of the fractured bone.

If, in our treatment, we succeed in applying efficiently these four rules in practice, it is conceived that we then have the laws of mechanics conformed effectually to the principles of surgery, in the treatment of fractures. If not, we fail in our object. We will first see, however, whether these rules have been correctly applied, by the apparatus in general use. You recollect, we showed that there were but three, although there may be, and undoubtedly are, a thousand modifications of these.

From what appeared at our first lecture, it is manifest, that in a fracture of the thigh, between the trochanter minor and the insertion of the gluteus-maximus muscle, and also, in one between the insertion of that muscle and the knee, if we place the limb in a line with the body, we violate our first rule, by inclining the fractured extremities further from each other, instead of the reverse, as should be the case. And this is the position which the splint of Desault always imposes. It also violates the second rule, by requiring more force to restore the normal length of the limb, than is required when the flexor muscles are relaxed. The third rule it does not appear to violate. The fourth one, however, is violated, the points of extension, &c. not being confined within the limits of the fractured bone. Thus, of the four rules, we find three of them entirely violated by the splint of Desault.

We will now look at the double-inclined plane. In this, it is obvious that the first rule may be correctly applied—viz., that of inclining the fractured portions nearest to a normal line, and relaxing the muscles of the limb. The second, third and fourth rules, however, are altogether neglected.

We will also look at the double-inclined plane, so arranged as to produce extension and counter-extension, from the extreme points of the limb. With this as with the last, the first rule would, of course, be correctly observed. But how is it with the other three? My remarks at the first lecture, pointed out that the second rule would be violated by there being more force exerted at right angles with the bone, than was employed in the line of the limb. Is the third rule any better applied? I endeavored to show, that the tendency of force, applied to the extremities of a limb, laid on a double-inclined plane, was, to throw the fractured extremities out of a normal line. Hence, if my remarks on that point were in any measure correct, this rule is also violated. But let us look at the fourth rule. Even this, too, is violated, for the points of extension and counter-extension are not within the limits of the fractured bone. Thus, important as are each of these rules (and it is believed their importance will not be denied by any surgeon), we find but one of them applied by any one apparatus. I therefore ask once more—is not that apparatus defective, which applies but one of these rules in the treatment of fractures?—which comes no nearer answering the intentions of the surgeon?—which violates, or neglects, so important a rule in surgery as that of coaptation?

It will not be claimed, I trust, that I have here been making rules, by which to try the various mechanical means. These rules are true in nature, and are founded on the immutability of her laws, and hence were always true; and the mere circumstance of my having given them a definite form, for the

purpose of aiding our own frail intellect, does not, in the least, touch the matter of their originality.

But some will say, perhaps, it is quite impossible to apply all these rules, and at once, in the treatment of any fracture.

During a recent visit to Paris, I was kindly invited by Marechal de Calvi, a military surgeon, and a gentleman of superior attainments in his profession, to visit the Val de Grace, a military hospital in Paris. At that visit he very kindly showed me through the various wards of that noble institution. He took especial pains to show me the fractures which were then in progress of treatment (for there were several, both of the leg and of the thigh) in their various stages. And what, think you, was my surprise, when I unexpectedly found, that precisely the same rules which I have here laid down, as necessary to be observed in the treatment of fractures, were there correctly applied in practice. Not, however, by adopting the same means which I employ, but those, nevertheless, which faithfully applied all those principles; not so conveniently, nor so happily perhaps, as might be desired, but yet they were applied; and I had a good opportunity to judge, too, of their effects, as compared, not only with others, but with those in my own practice. I understood that they did not always, and in every case, employ their apparatus, probably from the inconveniences which attended its use; but when the least difficulty presented itself, in preserving coaptation, they invariably resorted to it; and the cases which I saw, showed not only its efficiency, but the truth of the principles which I here advocate. Among all the hospitals which I have visited, I have not seen elsewhere such good results. They answered

perfectly to the experience which I had had in applying those rules. I will not stop to describe the apparatus. It was simple, and constructed on sound principles; but yet so inconvenient that it could not well be used, except in hospital practice; and then not always with the facility desired. I was told the name of the inventor, but unfortunately do not recollect it.* I was also informed that he ranked at the head of the military surgeons. I regret having lost his name, the more from having had the honor of a very pleasant and agreeable interview with him. Whether the inventor of that apparatus designed to fulfil the same intentions which I had in view, in the arrangement of the one which you saw, I know not; all that I know about it, is, that those rules were there applied; and I saw the results, which I have already stated.

We will, however, apply the apparatus which you have seen here; and you will then be able to judge, whether those rules may all be adopted in fractures. We will apply it, as in the case of a fracture of the thigh in the shaft of the bone.

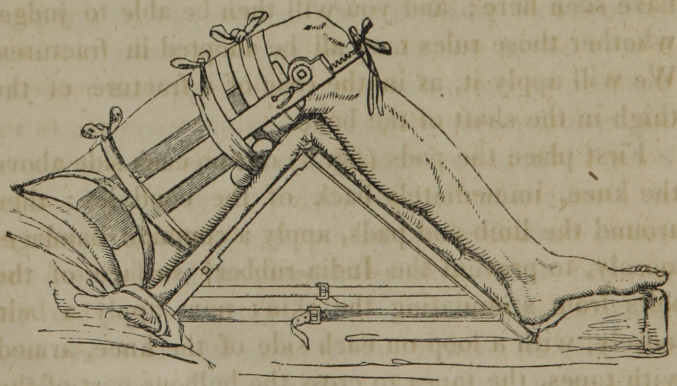
First place the pads (fig. 8) one on each side above the knee, immediately back of the condyles; then around the limb and pads, apply a common bandage, loosely, to prevent the India-rubber† surface of the belts from stimulating the skin; next apply a belt loosely, with a loop on each side of the knee, armed with tapes, the tapes to cross the bulbous part of the

*I am informed by my young friend Robert King Stone, M.D., of Washington, D. C, who was present with me at Val de Grace, that the name of the inventor, whose apparatus pleased me so much, is M. Baudens, surgeon in chief, a man of great surgical talents and attainments. He was chief of the surgical staff in Africa.

† Instead of India-rubber cloth, the inventor has of late preferred to use oiled silk, it being equally adhesive, yet less stimulating to the skin, and therefore in most cases it is esteemed much better.

pads. Apply the instrument to the limb, as in a dislocation of the femur, except that the side lever is not to be attached to it. Then lay the limb, and instrument attached, on the double-inclined plane, previously arranged with mats, or any thing which will make an easy surface on the plane, on which the limb is to rest. Over the whole, lay the eighteen-tailed bandage, or tapes, at suitable distances, ready for dressing, after the bone is adjusted. All being arranged in the manner just described, the surgeon will, with one hand, apply the lever (fig. 2) to the shaft of the pinion-wheel, while the other is laid over the seat of injury. Thus with one hand he makes gradual extension, while with the other he is able to feel the progress which the bones make towards co-aptation. When properly adjusted, apply splints on each side of the thigh, letting the ends pass a little

PLATE V.



distance under the pads. Let the space between the inside splint and the instrument be filled up with folds of cloth, so that the pressure may be equal on the inside of the thigh. Apply the tapes or bandages over the whole. A bolster should also be laid under

the bandage, between the instrument and plane, to support the former from bearing on the limb. I will here state the mode which I saw adopted at the Val de Grace Hospital, from which to fix the point of extension, which, in some cases, I think I should prefer. The dextrin bandage was applied, above, below, and over the knee, with tapes or a piece of roller inclosed in the coils of the bandage, so as to be tied to the extending point of the apparatus. Extension could not, of course, be made by it, until the dextrin had become dry and hard. Those on whom I saw it applied, appeared to wear it with perfect ease. The same material was used, for fixing the counter-extending point at the knee, and the extending point at the foot, in fractures of the leg. Thus, you see the mode in which this instrument is applied on the double-inclined plane, and you will therefore readily perceive, it is conformed to the first rule by the limb being placed on the inclined plane. It is also conformed to the second, by being so applied, that the smallest amount of extension, necessary to preserve coaptation, is employed. It is conformed to the third, because the line of extension is the nearest possible to a perfectly normal line of the fractured bone. It is, finally, conformed to the fourth, the points of extension and counter-extension being confined within the limits of the fractured bone. Thus we here see the four rules, applied to practice, by this apparatus, and at one time.

I will now call your attention to a fracture at the neck of the thigh bone. But, first, allow me to suggest another position, in which that fracture may be treated; and for that purpose, I beg your attention to that particular arrangement between

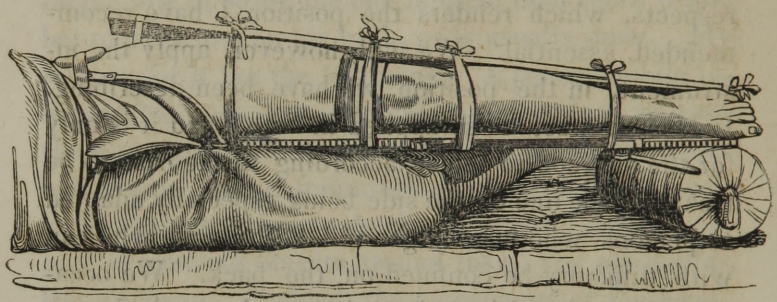
the head of the bone and the pelvis, to which I alluded on the first evening's lecture—viz., that the head of the bone serves as a pivot on which turn all the movements of the body. I next wish to show you, that, in a fracture at the neck of the femur, there will be less motion at the point of fracture, and between the fractured portions, by placing the patient on the side opposite the one injured, than there would be, to place him on his back, as is usually done. My reasons for it are the following. A person, while lying on his back, cannot raise his shoulders, or turn them to either side even but a trifle, without producing motion at the fractured point; and how much inclined patients are to do this, especially for the purpose of viewing objects around them, you are doubtless all aware. Indeed, the movements of the head, and the trifle of corresponding motion of the shoulders, seem almost involuntary. Still, involuntary as those motions may be, they all result in motion at the point of fracture; and it is not my wonder, that so *few* fractures at the neck of the bone result in an osseous union, but rather, that *so many* result in it; for motion, the great disturber of all osseous union, is constantly, yet involuntarily employed by the patient. On the other hand, by placing the patient on the uninjured side, the *position* subjects him to greater impediments to motion of the shoulders, than when he is on his back. He would be unlikely to raise his shoulders for any object, especially if he were told not to do so, and yet he could move his head freely, without communicating motion to the shoulders. His inclinations to turn to either side would doubtless be increased, although that could be greatly restricted. Still, if the limb were properly secured with the pel-

vis, it would move with the body, without producing motion at the site of fracture. These are my reasons for placing a patient, with a fractured neck of the thigh bone, on the side, yet if it is not found to answer (in the hands of others) equally well with the position of the patient placed on his back, there is nothing in our principles or treatment, in other respects, which renders the position I have recommended, essential. We will, however, apply the instrument, in the position we have been describing. Indeed, it must be so applied in both; and it is only for the surgeon to select, according to the case to be treated; the one on the side being especially adapted to persons who are large and fleshy, and who can with difficulty be confined on the back. We occasionally meet with such patients. I once had one; and I would have given any thing, to have been able to accommodate my patient, with that position she so much desired, but it was before I knew how to accomplish it. Extensive sloughing, after every thing we could do to prevent it, was the consequence of her confinement; and after suffering beyond my power of description, the case resulted in death. During the whole treatment, I was convinced, that could she have been allowed to be on her side — a position which she had used for years — without, at the same time, provoking greater pain by the fractured ends of the bone piercing the muscular substance around them, she would have been comparatively easy; but the last evil, at least for a time, seemed worse than the first. Her suffering was extreme, and she died at the end of about five weeks*

* This was written when I was obliged to trust to my memory. On referring to my notes of the case, I find that the patient lived seven weeks from the time of receiving the injury. J.

from the time of receiving the injury. But I will not detain you, by stating any more cases. For the one, however, which I have just related, should you ever have a case of the kind to treat, I doubt not, you will feel greatly obliged for the account I have here given. We will now apply the instrument.

PLATE VI.



The surgeon should first be provided with two long splints, one to reach from the perinæum to the sole of the patient's foot, the other from the top of the ilium to the sole of the foot. He should also be provided with a square piece of cloth in which to roll the splints, so as to make a trough, in which to lay the limb. First, apply a belt around the thigh above the knee, minding first to protect the skin by a common roller. Let a piece of tape, of about three feet in length, be tied to each loop, on each side of the knee. Now let the limb be laid between the splints, rolled in the cloth as described. The counter-extending bar, D, will now be drawn out to its full length, and made fast by the screw, E; the thigh-fork (fig. 4) will be applied to it, with the roll, H, suspended between its arms; and the rack will be drawn out, sufficiently to allow the foot of it to cross the sole of the patient's foot. Now apply the instrument, on the external

side of the inner splint, or, in other words, on the inside of the thigh and leg, and on the outer surface of the splint, the roll, H, pressing against the perinæum, as in fractures in the shaft of the bone. Draw the tapes tensely, and tie them on each side of the patient's foot, to the foot of the rack; apply the strap, across the top of the ilium, and around the arms of the fork, in the manner before described; place a thick pad between it and the skin, and draw the strap sufficiently tense over it, to give full length to the neck. Tie tapes around the whole, at convenient points, to securely fix the limb, splints, and instrument, as one piece. The instrument may be further secured to the pelvis by passing a band once around the pelvis, and, on its second turn, to pass it round the end of the arm of the fork on its respective side, and make it fast to it. Finally, give the necessary extension to the limb. I will not detain you, to point out how the four rules have been complied with in the treatment of this fracture, for I trust you will be able to discover it without assistance.

LECTURE IV

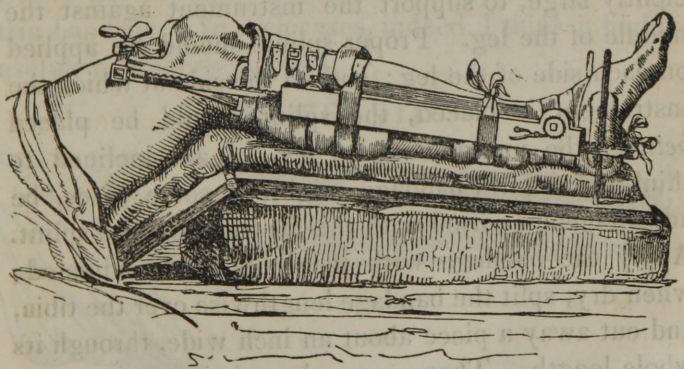
Fractures of the Leg.—The Dextrin Bandage used to fix the points of extension and counter-extension to the Limb.—Its abuse in Fractures.—Fractures of the Patella.—Dislocations of the Knee—of the Ankle.

I SHALL this evening endeavor to finish my remarks on fractures, and also, on the dislocations of the inferior extremities. I will first call your attention to a fracture of the leg. But, before I proceed, allow me to remark, that we find the same anatomical arrangement for mechanical action—if I may be allowed the expression—in the muscles of the leg, which we found in the thigh. Indeed, all the long bones have the same general arrangement of muscles. We cannot, however, now stop to classify them, nor, indeed, will it be necessary; since your knowledge of anatomy will readily furnish this very natural division. First;—of muscles passing over the bone, and yet are not attached to it at either end;—second, those attached to it at one end, the other end being attached at some point above;—and third, those attached, in like manner, at one end, while the other descends, and are attached below the bone. There are other muscles than those thus classified—for instance, where two bones lie parallel, as in the bones of the forearm. Yet they do not materially affect this division; nor do they in the least interfere with the principles, to illustrate which, this division is now made. It must be apparent, however, that much depends on this arrangement of muscles with the bone, in placing it in a favorable position for coaptation; and by

giving attention to this, it will readily be seen what position the bone should occupy, when fractured, to preserve coaptation most readily.

But, let us proceed to apply the instrument, as to a fracture of the leg. It is always to be applied in the same manner, let the surgeon adopt what position of the limb he may; for, be it remembered, with this instrument, the surgeon applies extension and counter-extension, *independently of position.* Position is one thing, and extension and counter-extension another; and they should ever be left free and independent for the surgeon to apply at his pleasure. Both are important principles in surgery. The one should, therefore, never be sacrificed for the other; and if right methods are adopted, such sacrifice never becomes necessary.

PLATE VII.

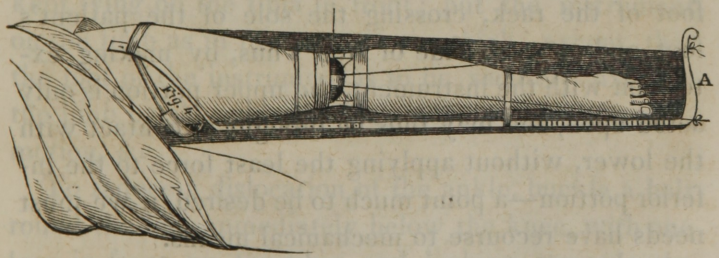


Apply the bulbous part of the pads (fig. 8), one on each side of the leg, below the head of the tibia; and around the pads and limb, a belt with a loop, on each side of the leg, the loops standing upward over the bulbous part of the pad. Arm the two loops with tapes. A belt may now also be applied to the ankle

with tapes in it. But I much prefer a fracture-shoe instead of a belt round the ankle, especially if there is any inflammation or swelling of the leg. The double-inclined plane, being arranged with a suitable mat, bandages, &c., and the instrument being properly arranged as to length; the arm of the jointed-fork (fig. 6), which will not be required for use, being removed from the fork; and the socket K, of the fork, being applied to the counter-extending bar D; let the tapes from the upper belt be tied to the arm which remains in the fork, immediately above the knee, and the foot of the rack be made fast at the sole of the patient's foot. Lay the limb and instrument, thus arranged, on the double-inclined plane; make the necessary extension; and apply the dressing; minding to place between the instrument and the plane, and under the bandage, rolls of cloth sufficiently large, to support the instrument against the middle of the leg. Proper splints should be applied on each side of the leg; and on the side at which the instrument is placed, the splint should be placed *between* the instrument and leg. I am inclined to think the dextrin bandage might, in some cases, be advantageously used with this instrument, as a splint. Apply the bandage with the limb nicely adjusted; when dry, split the bandage lengthwise over the tibia, and cut away a piece about an inch wide, through its whole length. Then, over the whole, apply tapes, at suitable distances. I have never used the dextrin in this form with the instrument, but its operation would be simple. I think I cannot be mistaken in the opinion I have formed of it. Indeed, I think it equally applicable in some fractures of the thigh. Of its use, however, in some of the cases in which I

have seen it applied, and especially the *manner* in which it was applied, I am obliged to remark that I cannot too strongly deprecate both. To leave a limb enveloped for days in this unyielding casement, during the inflammatory stage of a fracture, is hazarding the limb of the patient, and the reputation of the surgeon, beyond all bounds of prudence. Nor, indeed, as far as I have seen, has there been less deformity in the limb, resulting from its use, than with the more common means; yet there has, undoubtedly, been less trouble to the surgeon. And the practice of frequently cutting it off and re-applying it, is, necessarily, attended with evils of the worst consequences; for every time the dressing is re-applied, coaptation, and the fractured ends, must be greatly disturbed. When provisional callus has formed around the fractured ends of the bone, and yet the limb requires support, I have not the same objections to this use of the dextrin bandage. In such cases, indeed, I think it highly useful, if properly applied.

PLATE VIII.*



I will now call your attention to a fracture of the patella. It is not usual, however, that any mechanical means are required in this injury, other, than to

* Plate VIII., which was not in the English edition, is here added, the better to illustrate the application of the instrument to fractures of the patella.

place the limb perfectly straight, and to elevate the foot, so as to relax the rectus femoris and vasti muscles. Indeed, any attempt to approximate the two fractured portions by an apparatus about the knee, generally results in a greater separation of the fractured portions, than to leave the limb as above described. Yet this is not always the case. There are instances in which it is desirable to overcome, in some measure, the extreme contractility of the three muscles above named. This may be done in the following manner:—Place the bulbous part of one pad above and against the upper fragment of bone, and around it and the limb, apply a belt with a loop lying over the bulb; pass the other belt around the limb below the lower fragment, with a loop lying over the broken portion; pass a tape through the loops and tie moderately tight; but through the upper loop, pass a long tape, an end of which is to pass down on each side of the leg. Apply the instrument, as in fractures at the neck of the thigh-bone, but without any splints or bandages. Let an end of the tape be tied to the foot of the rack, crossing the sole of the patient's foot, and on each side of it. Thus, by making extension with the instrument, the upper portion is only acted upon, and may thus be brought in contact with the lower, without applying the least force to the inferior portion—a point much to be desired, if we must needs have recourse to mechanical means.

I here close my remarks on fractures; and will again call your attention to dislocations. This evening particularly, to dislocations of the knee and ankle, beginning with the knee.

The knee is subject to luxations every way, though fortunately, they are not frequent. When they do

occur, the injury is apt to be so extensive, that amputation is required; yet, in general, it is in those cases where reduction is most difficult, that the surgeon should by all means in his power endeavor to save the limb. It is not my business, however, to lecture either upon diagnosis or pathology,—mine merely relates to treatment. I will at once, therefore, explain the method of reducing a luxation of the knee by this apparatus. There are two ways, and the surgeon is to select that one which applies best to the kind of luxation which he has to reduce.

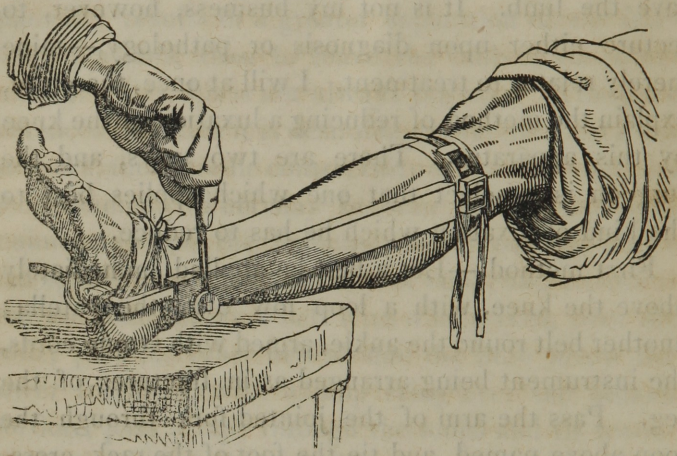
First method.—Let a belt be applied immediately above the knee, with a loop low over the patella; another belt round the ankle, armed with strong cords, the instrument being arranged as in fractures of the leg. Pass the arm of the jointed fork through the loop above named, and tie the foot of the rack, crossing the sole of the patient's foot, to the lower belt. Make extension and free motion if necessary.

Second method.—Apply a large silk handkerchief, by a clove-hitch, immediately below the knee, the knot lying on the tibia in front; put the instrument on the limb as in fractures of the thigh, except that the foot of the instrument is to be securely fixed to the limb by the silk handkerchief; apply extension, motion, &c.

To reduce a dislocation of the ankle, buckle a belt round the leg, immediately below the knee, with one loop in front, on the tibia, and looking towards the foot; another directly back of it, on the posterior side of the leg. Pass the two arms of the jointed fork through the two loops above named; insert the end of the counter-extending bar, D, into the socket of the fork (fig. 6), and to make fast the extending point of

the instrument to the foot, the following method should be adopted:—Let the back of the limb, immediately above the heel, rest on the middle of a large

PLATE IX.



silk handkerchief in form of a roll, the foot of the rack lying across the hollow of the patient's foot. Bring the ends of the handkerchief down on each side of the heel, and cross them over the sole of the patient's foot and the foot of the rack; carry them forwards and cross them again on the top of the foot; pass each end, as respectively inclined, under the handkerchief lying on the side of the heel; bring the ends forward again, to the top of the foot, and tie them closely and firmly down.

In a dislocation where the foot is thrown either outward or inward to a great extent, to prevent the sole of the foot from being drawn too suddenly under, another handkerchief may be thrown around the top of the foot and tied to the foot of the rack. This will prevent the patient's foot from turning, until the surgeon thinks he may have sufficiently extended the foot, to admit the two points of the luxated bones to

pass each other. He may then suddenly loose the last-named handkerchief, and all the force will now fall upon the handkerchief first applied, when the surgeon can manipulate the limb.

I conceive it quite possible, that in some cases, an additional instrument might be required, to make extension lengthwise of the foot, at the same time. In this case, or when the force is required between the tarsal and metatarsal bones, the jointed fork being attached to the instrument, and the instrument placed to the sole of the foot, let a strap pass from arm to arm of the fork, in front of the leg, at the instep; and with a band applied round the metatarsal bones, in the form of a clove-hitch, the knot lying on the under side of the first metatarsal bone, attach the patient's foot to the foot of the rack. This is the mode in which I reduced a dislocation of the metatarsal from the tarsal bones, at Hopital Cochin, as reported in the *Gazette des Hopitaux*, Oct. 2d, 1845.

LECTURE V.

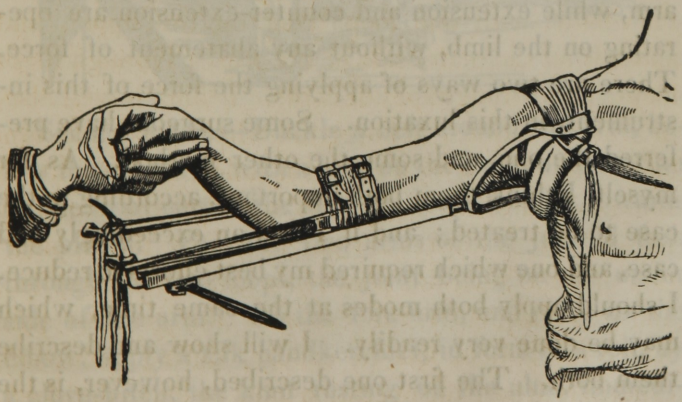
Dislocations of the Shoulder—of the Elbow—of the Thumb.

I WILL, this evening, call your attention to dislocations of the superior extremities. We will begin with those of the shoulder; and, from the manner in which this instrument operates, you will at once perceive, that there is no necessity of its having but one mode of application for luxations of this joint; the line of extension being entirely under the control of the surgeon, to vary it at his will. Whether the head of the bone is under the tendon of the triceps, in the axilla, or under the pectoralis muscles, it is equally subject to his direction; and therefore its one mode of application is quite sufficient for every variety. Let us now apply the instrument, and describe that mode.

Buckle a belt round the arm, immediately above the elbow, with one loop lying on the upper, and another on the under side of the arm. Through these loops, pass strong tapes or cords. I think it well also, in grave luxations, to cover the whole hand and arm below the belt, with a common roller, to prevent, in some measure, the congested state of the capillary vessels. It is always certain to attend the application of force from this point, in whatever way applied, and it is frequently the cause of the greatest pain which the patient has to endure, during reduction, especially where the operation must be long continued. Prepare the instrument by buttoning tensely across the top of the shoulder fork (fig. 5), the roll, H. Apply the fork to the counter-extending bar, D; place

the roll in the axilla, and tie the tapes closely round the foot of the rack. I would here recommend, in difficult cases, to lay in the axilla, between the roll and the skin, folds of cloth sufficiently thick to prevent the roll from pressing strongly on the tendons of the latissimus dorsi and pectoralis major muscles, the folded cloth being placed between those tendons. By doing this, the surgeon can, if he chooses, make the instrument operate precisely like the heel in the axilla; but much more steadily, and with much greater force than he can ordinarily command. Moreover, the whole operation is immediately under his control. The instrument being thus applied, buckle the strap across the shoulder; or, as I prefer, pass the strap which is used on the dorsum of the ilium, in fractures at the neck of the thigh-bone, around the roll on each side of the shoulder, crossing the top of the scapula. Draw the strap sufficiently tight to press the roll firmly against the under side of the shoulder, so that

PLATE X.



the line of extension shall be from the centre of the elbow, to near the centre of the glenoid cavity.

This arrangement completed, apply the hollow

part of the strap (which accompanies each box of the instrument for that purpose) to the point of the acromion process; carry the ends on each side, between the fork and the roll, and around the body; and let it be drawn tight and buckled. Thus, as you see, the instrument is now on the patient, and ready for the operation. By the lever you hold great power in your hand, more than a prudent man would ever think to use on the shoulder. You will, however, soon get so accustomed to its use, that you will know very nearly the amount which you at any time may use; indeed, by this instrument, with very little trouble, you may tell to an ounce, at any time, the amount of power which you have applied.

I will not detain you longer with this luxation, but will call your attention to one of the elbow. We will suppose the case, where the coronoid process of the ulna is lodged in the posterior fossæ of the humerus. It is an important point in this dislocation, when it presents difficulties, to be able to flex the arm, while extension and counter-extension are operating on the limb, without any abatement of force. There are two ways of applying the force of this instrument, in this luxation. Some surgeons have preferred the one, and some the other method. As for myself, I think them both important, according to the case to be treated; and if I had an exceedingly bad case, and one which required my best efforts to reduce, I should apply both modes at the same time, which may be done very readily. I will show and describe them both. The first one described, however, is the one which I commonly use.

Buckle the belt having a close loop on it around the arm, with the loop low over the olecranon pro-

cess. Buckle the short belt around the wrist, with a loop on each side of the hand armed with strong tapes. Insert the elbow fork (fig. 7) into the close loop, and the counter-extending bar, D, into its socket K. Tie the tapes in the belt at the wrist, to the foot of the rack, minding to draw them closely round the foot of the instrument. With the lever make extension, &c. [*See Plate XI.*]

PLATE XI.

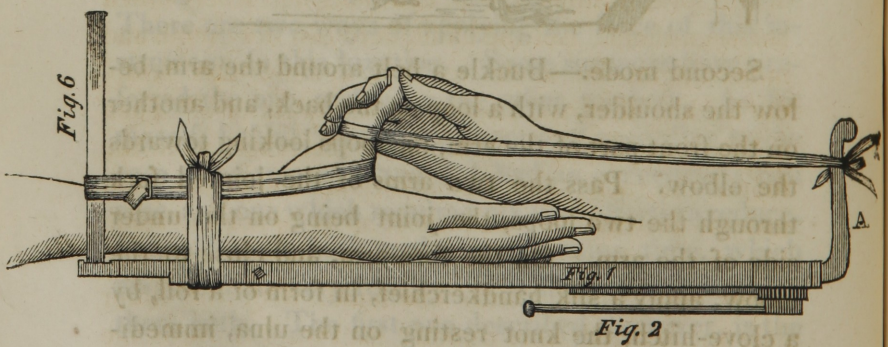
Second mode.—Buckle a belt around the arm, below the shoulder, with a loop on the back, and another on the front part of the arm, the loops looking towards the elbow. Pass the two arms of the jointed fork through the two loops, the joint being on the under side of the arm. On the fore-arm, and close to the elbow, apply a silk handkerchief, in form of a roll, by a clove-hitch, the knot resting on the ulna, immediately below the olecranon process. Insert the end of the counter-extending bar, into the socket of the fork; and tie the handkerchief closely around the foot of the rack. To securely fix the instrument to

the limb, let another handkerchief be passed closely round both, near the top of the instrument, and tied. With the lever make extension, &c.

Thus you have the two methods explained; and you will readily see, that they are both easy of application, and may be applied at the same time, by employing two instruments. The last mode would bring the radius and ulna down, while the arm is in a flex position; thus drawing the coronoid process out from the fossa. The first would press the humerus backward, while the fore-arm was being flexed on the arm; thus bringing the coronoid process forward of the trochleated surface of the humerus.

There is but one more luxation to which I would call your attention, trusting, that if you understand those already shown, you will be able to apply this instrument in every case which you may be called upon to reduce. The one of which I speak is of the thumb; and although this is but a small member, it

PLATE XII.*



often makes a grave case for the surgeon. Yet with this instrument I am quite sure you need never be

* Plate XII. was not in the English edition, but is here introduced to show the application of the instrument to reduce a luxated thumb.

defeated; and the same may be said of all the phalanges.

The application of the instrument to reduce this luxation is not so easily exemplified as in the other cases which you have seen. This proceeds, mainly, from the want of that peculiar prominence, which the luxated bone presents, projecting over the side of the distal extremity of the bone from which it was dislocated; since it is around this prominence of the luxated bone, that the force is to be applied. The thumb may be dislocated, either backward or forward; and whichever way the bone is displaced, the force should be applied, against the upper extremity of the distal bone. Suppose the thumb displaced backward — wet a broad tape, and apply it, smoothly doubled, lengthwise, by a clove-hitch, over the projected shoulder on the back of the thumb, letting the knot rest on the inside. Apply the jointed fork to the instrument; and let the strap which is used to cross the dorsum of the ilium, be suspended from the arms of the fork, forming a loop, and hanging loosely down between them. Let the hand, between the thumb and index-finger, be made to rest against this strap, the back of the hand resting on the brass case. Then tie the tape which is attached to the luxation, to the foot of the rack; pass a handkerchief round the wrist and the instrument; and tie it so as to confine them together. With the lever make extension; and, while that is made with one hand, with the other cast the luxated bone directly backward towards the wrist. When the extremity of the bone to which the tape is applied, has reached the edge of the articulating surface from which it was displaced, bring the luxated bone forward again, and the two articulating

surfaces will readily be restored to their normal position. When the thumb is luxated inward, apply the tape to the prominent end on the inside — as it was before applied to that on the back of the thumb. Let the thumb also be cast inward, as it was before backward. In all other respects the two operations are alike.

Thus I close my remarks on luxations; and it only remains for me to return you my sincere thanks for the attention I have received, while I have been attempting to contribute a small amount to the general stock of surgical knowledge. My desire has been to do good, by endeavoring to improve the practice of that profession, in which there should be felt but one common interest; and in conclusion, I have only to ask that what I have said may be judged by the standard of truth.

APPENDIX.

NOTICES OF THE ADJUSTER.

EXTRACT FROM THE GAZETTE DES HOPITAUX.

Notice of a new Apparatus of Dr. Jarvis, for the Reduction of Luxations and Fractures. By Dr. Stout.

"Among the various means which surgeons employ for the reduction of grave luxations, there is one not yet known in Europe, and which seems nevertheless to merit their acquaintance; we allude to an apparatus invented by Dr. Jarvis, to which he has given the name of surgical adjuster, and which he makes use of to reduce not only all luxations of limbs requiring mechanism, but also fractures with displacement, and to coapt the latter in an efficacious manner when they present any difficulty.

These three distinct applications of the same apparatus result from its simple construction, which presents nothing but what is conformable to the laws of mechanics applied to surgery, as the result of the effects produced by its application, and which are :—

1st. To establish a line of extension between any two parts whatever of the body, according to the exigency of the required case; or as regards luxations only, to establish a straight line of extension, which shall operate in the normal line of the luxated bone.

2nd. To furnish an extending force, illimitable but calculable, and perfectly subjected to the will of the operator.

3rd. To combine with the simple extending power, the power of a lever of the first or second order, according to the operative procedure adopted by the surgeon.

4th. To be able to add a line of extension at right angles to the preceding, without interrupting its action.

5th. To fulfil all these different indications without interfer-

ing with the mobility of the dislocated limb, and to permit the operator to act according to his pleasure.

6th. To give the patient more liberty during a long treatment than he would have had by any other known means.

The mechanism which produces these results is simple, and merely a happy application of the pinion wheel and rack-bar to surgery. A brass case, thirteen inches long, one inch and a half wide, and half an inch thick, incloses a pinion wheel which moves a steel rack-bar, with teeth corresponding with the pinion wheel, and of the same length as the case; which rack-bar constitutes the extending power. A ratchet wheel, on the exterior of the case, operating on the same shaft with the pinion wheel within, is held by a catch so as to maintain, at any desired point, the extending force. Upon the axis of these two wheels is applied a lever, of length sufficient to give the instrument the power of twelve men. The extending power occupies one side of the brass case, the counter-extending power the other side, provided with a mechanism which allows of its elongation or contraction at pleasure, and according to the case to be treated. The rack-bar is bent at right angles at one extremity, in order to make the line of extension in the axis of the limb, while the instrument is applied parallel to its side.

At the counter-extending point, are alternately applied, several appendages for properly securing the instrument to the parts which form the point of resistance for the counter-extending force. Thus for the thigh there is a long steel fork, between the branches of which is suspended a cushioned roll. When this fork is applied to the perinæum, so that the cushioned roll rests upon the great tuberosity of the ischium, one of its branches passes in front of the pelvis, while the other lies back of it. The fastenings which unite the extremities of the fork to the cushioned roll form the points of counter-extension. Thus the points of traction are bounded on one side by the extremities of the fork, and on the other by the foot of the rack-bar.

Certain modifications of these appendages for the securing of the limb, render the application of the instrument easy to all parts of the body. But a description of them and of the bands destined to fix the apparatus, would surpass the limits of this notice; and might besides tend to cause an opinion of there being some complexity in the instrument, which, in fact, does not exist. We will hereafter publish a detailed description of the whole apparatus,

with the necessary cuts, and the mode of its application in all cases.

Surgeons have for so long a time been in search of a means of powerful extension and counter-extension, at the same time regular, subject to the will of the operator, and easy of application, that it is astonishing that the apparatus of Dr. Jarvis, which seems to have almost reached perfection, should have been till now undiscovered. Indeed, by the aid of this apparatus, the pulley becomes in future useless; hereafter we are freed from the greater part of the inconveniences which usually accompany the reduction of a luxation. The operation will be performed in a manner more conformable with the dignity of the surgeon. There will no longer be a necessity for six or ten assistants; two are sufficient, or, if necessity require it, the surgeon alone may suffice. With regard to the place where the operation is to be performed; the bed of the patient, a table, or even the field of battle, offer as great conveniences as the best furnished amphitheatre. There will no longer be occasion to look around the patient for fixed points for extension and counter-extension, which, in the ordinary proceedings, call for so much of the surgeon's attention. The point of counter-extension, departing directly from the centre of the motion of the instrument, is furnished by the apparatus itself; but it is not only in the removal of the inconveniences which surround an attempt at reduction of a difficult case, that the greatest utility of this apparatus consists. The operator will now have at his disposal an enormous power, which the most vigorous muscles can no longer resist, but which he will apply according to circumstances. He may increase it, diminish it, apply it rapidly, or as slowly and mildly as he may wish, according to the resistance of the muscles, without danger of injuring them in any manner. In fatiguing them, there will no longer be any fear of losing the degree of extension already obtained. The extension that has been gained, is maintained as long as the operation requires; if it be diminished, it is readily increased to the same degree. From the foregoing, it is seen that with the new apparatus is obtained a notable diminution in the time required for the reduction of difficult and painful cases.

Another advantage, not less important, is the facility this instrument gives to the surgeon, of acting upon the mobility of the dislocated limb, during the whole period of reduction, which remains free, in spite of the progress of the extension, and the unvarying

application of the apparatus; and from the position of the fixed points we have indicated, it is no longer possible for the line of extension to be deranged by the unruly movements of the patient. Moreover, these movements themselves become less violent, in consequence of the mildness combined with the power, and the invariable certainty of the action of the apparatus.

The patient can also, in his movements, carry with him the instrument, without interfering with its action, or without causing the axis of extension to deviate. Dr. Jarvis has not contented himself with these ameliorations only, important as they are; he has found, by the ingenious employment of a lever, the means of applying at pleasure, a power which operates at right angles to the axis of extension; this lever is arranged in such a manner as to be applied or removed without affecting the action of the extending power in any case; as for example, to throw out the head of the femur from the pelvis, after the proper extension has been made, and without interrupting in any wise the other parts of the operation. There are cases where, in the ordinary modes, reduction becomes impossible without the aid of two pulleys, which act at right angles to each other; and then how many difficulties unexpectedly arise! how many unlooked-for obstacles! how many assistants are required! and, finally, how often a sudden movement of the patient may in an instant destroy the effect of a long and tedious attempt. The side lever replaces the second pully and remedies all these inconveniences.

It will, perhaps, be objected that the greater portion of dislocations are reducible by other means; in fact, we may use others, since we have not at hand a methodical apparatus. But, in future, the surgeon will not be obliged to put himself in such positions with respect to his patient, which are often so unpleasant and ridiculous—as are fully described in treatises on surgery. By the aid of the surgical adjuster, we shall no longer see the operator forced to put his foot in the axilla of the patient, in order to reduce a dislocation, or for his aid to pass a towel around his neck in order to make extension upon the pelvis, steadying and pulling upon it at the same time with his hands. If there be some cases which are very simple, in which we can do without this instrument, it is not less true that as soon as a dislocation presents any difficulties, we regret not having at our disposal a mechanical means which shall be powerful and easy to manage, to re-place the enormous efforts to which we find ourselves obliged

to have recourse, and which too often give rise to local lesions, inflammation, and febrile re-action, which complicate through ill-treatment, cases which were very simple in their origin.

We have as yet spoken of the application of the surgical adjuster to luxations alone: let us glance at its use in the treatment of fractures. Do we wish to treat a fracture with the double-inclined plane which accompanies the apparatus, with a modification which allows of its being shortened or lengthened at will; the employment of this instrument gives the facility of adjusting the limb in the first place upon the inclined plane, then the necessary reduction is made, and the dressing applied with or without the apparatus, but without communicating to the patient any of those various motions which tend to destroy or separate the parts brought together, and increase the pain and the re-action. The patient thus treated with the apparatus as a fixture, is not bound to preserve always the same position; he can put himself more at his own ease, and even change his position. The parts remain always maintained in their proper place, the instrument being disarranged with difficulty. Do we wish to dress the member in a straight line, and continue the extension in order to guard against shortening; the instrument having become a fixed apparatus is elongated to equal the length of the leg, securing it against any consecutive retraction, at the same time that it permits the patient to change his position, and the surgeon to examine all the necessary dressings which may now be less complicated and less bulky than before.

The surgical adjuster offers nothing in its application contrary to the soundest principles of surgery, and admits of every variety of dressing. If it act with considerable, and, we may say, irresistible power, it is to the manner in which it is constructed that it owes it, and to the facility with which its principal action may be directed; thus it may be confided, with the assistance of a short instructive pamphlet, drawn up by Dr. Jarvis himself, to hands little accustomed to its use. Hence in America it is found on board of vessels fitted out for the whale fishery, and those bound upon long voyages. We are however aware that in spite of the ease with which this instrument may be applied, it does not dispense with the surgical knowledge necessary for diagnosis and the other parts of the treatment of luxations, or fractures with displacement, on the part of those who make use of it."

EXTRACT FROM ARCHIVES GENERALES DE MEDECINE, AUG., 1846.

"*Description of the new Apparatus of Dr. Jarvis, for the Reduction of Dislocations, the Adjustment of Fractures, and keeping them in their place. With Plates.*"

The author of the above article in the (Paris) Archives Générales de Médecine, gives a very fair history of Surgical Instruments invented to reduce luxations and fractures, from the days of Hippocrates to the present, and which he very justly divides into three periods, as follows, viz.: 1st. From Hippocrates to the time of Ambrose Paré in 1582. 2nd. From the time of the great Paré, to that of J. L. Petit in 1750. 3rd. From the time of J. L. Petit to the present: each of which he regards as characterized by improvements and circumstances peculiar to itself, and which he clearly defines: he then proceeds to say, "We come finally to speak of the lever acting by means of the rack and pinion. The apparatus of Dr. Jarvis is constructed on this principle. The assemblage of essential qualities which this principle presents, renders it more applicable to surgery than all of those of which we have spoken. Force multiplied mechanically, combined with gentleness and precision, constitutes the whole of the requisite qualities, and which are all found in the use of the rack and pinion."

APPRECIATION.

After having given an idea of the apparatus which preceded Dr. Jarvis's, it remains only to give due prominence to the merits which give to his Adjuster the preference over all other machines. These advantages are the following.

1. The universality of its application, whether to luxations or to fractures, the adjustment and coaptation of which offer difficulties even in supporting a limb while the injured person is raised and carried home, or finally as an orthopedic apparatus.

2. The facility of communicating motion of every sort to the member subject to its action, without deranging or interrupting that action.

3. The harmony of its action, with such a position of a limb as places its muscles in repose.

4. Its application in every place, without the necessity of searching for fixed points around the patient in order to establish extension and counter-extension.

5. The possibility of modifying at will the force employed, in regard either to its quantity or its velocity.

6. The facility of transportation—the whole apparatus being inclosed in a box, 15 inches long, 12 inches broad, and about 5 inches high.

7. In difficult and painful reductions, the considerable diminution of time, and the patient's enjoyment of much greater liberty during his treatment.

By the aid, then, of this instrument, the Surgeon possesses a regular and powerful force, subject to his will, and easy of application. He has at his disposal a power which the most vigorous muscles can no longer resist, and which he will manage according to circumstances. He can augment or diminish, accelerate or retard this power, according to the resistance of the muscles, without injuring them in any manner. He will no longer fear to lose, by fatiguing them, the degree of extension already obtained. The extension he has gained is sustained as long as the operation requires; whenever it shall be judged proper to diminish it, it can without difficulty be brought back to the same degree. Henceforth the pulleys become useless. The operator, no longer obliged to seek around the patient those fixed points for extension and counter-extension, which so much pre-occupy his attention in the ordinary methods, finds himself relieved from most of the embarrassments which accompany the reduction of a luxation. The point of counter-extension proceeding directly from the centre of motion in the instrument, is furnished by the apparatus itself.

As to the place where the operation must be performed—the patient's bed, any kind of table, even the field of battle itself, affords as convenient a position as the best furnished amphitheatre.

Among the advantages of this apparatus we cannot insist too much upon that which it possesses, of leaving the surgeon free during the whole continuance of any operation, to act with facility on the *mobility* of the luxated limb. Notwithstanding his apparatus is immovable, and the limb is extended to the uttermost, nothing hinders the operator from turning the limb round, or changing its direction in every way. It is no longer possible that the line of extension should be deranged, either by the movements caused by the surgeon, or by the uncontrollable movements of the patient. Besides, the precision in the action of so methodical an apparatus renders all these inconveniences shorter and less fatiguing for the operator, as well as for the patient; at most, the patient in his agitation can only carry his instrument away with him, but will not interrupt its action, nor cause the axis of extension to deviate.

EXTRACT FROM THE LONDON MEDICAL GAZETTE, MAY 23d, 1845.

Lectures delivered before the Royal College of Surgeons, May, 1845; by Bransby B. Cooper, F.R.S., Professor of Surgery, &c.

The Professor next introduced to the notice of his audience an instrument, invented by Dr. Jarvis, an American surgeon, for reducing fractures and dislocations, and commented on its use. This instrument has been modestly denominated "the Adjuster" by its ingenious inventor; a name which correctly enough points out the ultimate effects produced by its application, but conveys no adequate idea of the enormous power and wonderful simplicity of action which characterize this important invention; and Mr. Cooper gave it as his opinion, in unqualified terms, that the apparatus must necessarily rise into the most general use.

Extract from the Proceedings of the Convention of the President and Fellows of the Connecticut Medical Society, held at Hartford, May 14th and 15th, 1845.

Voted, That Doctors E. K. Hunt, Witter, W. Hooker, Fowler, and Beckwith, be a Committee to examine Dr. Jarvis's Surgical Adjuster, and report to this Convention.

Report of the Committee on Dr. Jarvis's Surgical Adjuster, was accepted, and the following Resolution recommended by them was adopted:—

Resolved, That in the opinion of this Convention, the "Surgical Adjuster" of Dr. Geo. O. Jarvis, for simplicity of design, ease and efficiency in its operation and management, in the reduction of dislocations, and maintaining in coaptation oblique fractures of the longer bones of the body, has never been equalled—successfully supplying a desideratum which has long been admitted to be wanting in the practice of surgery. We cordially recommend it to the notice of all those engaged in this difficult and responsible department of our art.

OPERATIONS PERFORMED BY THE ADJUSTER.

FROM THE BOSTON MEDICAL AND SURGICAL JOURNAL.

Dislocation of the Humerus of five weeks' standing, reduced by means of Dr. Jarvis's Surgical Adjuster. Reported by Robert King Stone, M.D.

Clinique of Prof. J. F. May, Columbian College, Washington, D.C., Nov. 21st, 1846.—Wm. Boothman, ætat. 36, an Englishman, of exceedingly robust and muscular frame, presented himself to-day, on account of a dislocation of the humerus, the origin of which, he thus describes. About six weeks since, he suddenly ceased his unfortunate habits of intemperance, and in consequence had a slight attack of delirium tremens; while in this condition, and crossing a street, he fell, striking the back of his right shoulder against the curbstone. He was not aware that any dislocation had taken place, but supposed that the pain, great tumefaction and discoloration which extended to the wrist, were merely the results of a violent bruise. It was but a few days before presenting himself, and after the tumefaction had subsided, that he observed the permanent immobility of the arm, and the deep depression under the acromion. Examination detected a dislocation downwards and forwards, with the head of the bone resting under the edge of the pectoralis minor, the elbow thrown backwards and very slight mobility in its new position. Much numbness of the arm had existed since the accident, on account of pressure on the axillary plexus, and was still a subject of complaint. It would be proper to remark that the right clavicle had been fractured in his youth, and its bad coaptation produced deviation backwards and slightly upwards of the acromion. Careful examination satisfied Prof. May, that although the head of the bone was but slightly moveable, no danger was to be apprehended from any complication of the axillary artery.

Although previously preferring and exceedingly successful with the pulleys, Prof. May acceded to my wish to apply the apparatus of Dr. Jarvis, in a case so capable of testing its powers. Its application was preceded by vs. ʒxviij., and an ineffectual attempt to nauseate with tart. antim. and ipecac. Traction for a few minutes, in connection with the rotation so fully permitted by the

adjuster, seemed greatly to increase the mobility of the head of the bone, and the ratchet bar was left in this position for some time, in order to weary the muscles and act gently upon the adhesions. This alternate extension and rest was continued at proper intervals, when just before the moment at which reduction would have been perfectly practicable, the extending bands, which had not been previously well examined, all gave way, leaving only the gain of greater mobility at the head of the bone. As it was impossible to remedy the accident at that moment, Prof. May applied the sheets, &c., in the ordinary method, assisted by Profs. Miller, Johnston and others, but without success. Recourse was next had to the pulleys, which being gently and steadily applied for a long time, until the man's endurance was exhausted, were also laid aside.

In questioning the patient as to the relative suffering during the three processes, he declared that the action of the adjuster was by far the least painful, and at the moment of snapping the extending bands, he "felt the bone at its socket, and that it slipped away."

Nov. 23d.—Vs. ℥xx. Tart. antim. and ipecac. with much better effect; the man for the first time acknowledged nausea. Having procured stout cords, we proceeded to the reduction with Jarvis's adjuster. The axilla was filled with a mass of cotton as usual, and the pad of the fork placed thereon. It may be worthy of remark, that on this occasion, the perineal was substituted for the axillary fork, on account of the man's great depth of thorax, as it was observed that on bringing the elbow forward, on Saturday, its end impinged upon the sternum, causing excessive pain. The arm being flexed at the elbow, the extending cords were made fast and extension commenced. At this stage of the operation, the vast superiority of Dr. Jarvis's instrument was manifested, for whilst extension was made precisely in the axis of dislocation, Dr. May, with one hand in the axilla and the other grasping the forearm, had the most perfect command of the limb, and could produce rotation at his pleasure. When satisfied that the head of the bone had been brought low enough in the axilla, and sufficient mobility existed, a broad band was passed under the neck of the humerus and tied over the shoulders of the operator. The forearm was then resigned, and with both hands he grasped the bone in the axilla, at the same time throwing back his body, so that the head of the humerus was forcibly lifted upwards

and outwards. Whilst this manœuvre was performed, the elbow was rapidly thrown forwards at "the word" and "hard up" against the ribs, and the extending bands instantly relaxed. As a matter of course, the bone entered the glenoid cavity precisely in the same manner as it left it.

Although this case had resisted the best efforts with the sheets and pulleys, the reduction was effected in less than thirty minutes with the adjuster. Of course a very slight depression remained after the reduction, on account of the wasting of the deltoid, &c.; but when a pad was placed in the axilla and Desault's apparatus applied, the roundness of the shoulder was restored, making but a slight deduction for the deformity from the old fracture of the clavicle. This result is a source of gratification to the operator and those surgeons who witnessed it, as it proved conclusively the great power of the instrument, and that the manœuvre could not have been thus performed with the aid of any other. I should remark, that the method of commanding the head of the bone by Prof. May, in connection with the instrument, was novel to myself, although I had the pleasure, a year ago, of seeing Dr. Jarvis apply the adjuster in a similar case at the Military Hospital of Val de Grace at Paris.

In the application of this instrument, the proper rule for traction seems to be, to draw down until the patient feels it severely, and then to rest a few moments and rotate, waiting until the muscles are so wearied as to enable us, when extension is resumed, to make great progress at a moment when they are unable to resist. Extension and rest are thus to be alternated, until the operator is satisfied that the head of the bone is brought down parallel with the plane of the glenoid. In this case there was no deviation in extension from the axis of dislocation, and the head was made to retrace its path precisely; then by lifting it forcibly, whilst at the time of relaxing the extension, the elbow was brought forwards and close to the thorax, the bone was set free in a line outside of the glenoid cavity. When thus set free, the muscles were made available, and even the triceps and pectoralis assisted in the reduction.

The patient is now perfectly well—only carrying his arm in a sling as a precautionary measure.

Washington, D. C., Dec. 20th, 1846.

EXTRACT FROM THE GAZETTE DES HOPITAUX.

Luxation of the first Phalanx of the Thumb.

Dr. Michon, surgeon of the Hospital Cochin, has had the kindness to put at Dr. Jarvis's disposal, the two following cases:—

First Observation.—No 9, Salle Cochin, M—, cook, fell in the street, and throwing out his hands to save himself, received a compound luxation of the thumb. The accident occurred five days ago. During two days, various unsuccessful attempts were made to reduce the luxation. Extension was made by means of straps and several men. At the time of the operation the first phalanx of the thumb was much swollen by erysipelatous inflammation; a large wound was found on the inner side of the thumb, near the dislocated articulation. The phalanx was dislocated outwards, and carried obliquely upon the second phalanx. To diminish the inflammation, leeches, poultices, and local baths of warm water, had been employed.

Operation.—The hand being placed upon the brass case, the fore-arm rested in a jointed fork joined to the counter-extending point. A strap fixed to the two branches of the fork, passing directly between the thumb and the indicator. A sailor's knot (made with a tape) attached the first phalanx to the extending point; this tape mounted very high upon the phalanx and compressed the wound. In consequence of the state of tumefaction, it made every thing attached to it slip off easily, and, in fact, prolonged the operation, the tape having slipped once during the extension.

The reduction was completed in about fifteen minutes.

Second Observation.—No 11, Salle Cochin, Legendre, carter, has been confined to bed for twenty-two days* with a luxation of the bones of the metatarsus upon the tarsus. His horse fell upon him. Nothing has been done.

On the day of the operation, the foot was found to be swollen with a sub-acute inflammation, and was painful when handled; the internal edge of the foot presented a very concave line; the head of the first phalanx projected out, and a depression was felt behind it. The apophysis of the last phalanx very projecting over the external edge of the foot; the foot shortened and slightly twisted.

Operation.—The instrument being applied upon the sole of the foot, was fixed by bands which were carried around the ankle and

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* I understood the Interne, five weeks.—G. O. J.

the heel to the counter-extending point; with other bands the foot was fastened above the inferior extremities of the bones of the metatarsus, and they were fixed to the extending point.

A stronger extension was here required than in the preceding case, but at the end of fifteen minutes, and by the aid of a pretty vigorous manipulation of the foot, the bones returned to their normal situation.

During the operation, the patient, although he was a very timid man, did not utter a cry.*

FROM DR. SKILTON, OF TROY, N. Y.

Dr. G. O. Jarvis.

Dear Sir,—I have used the Adjuster to reduce luxations on several occasions—once in a case of dislocation of the hip, on the fifth day of the accident—five times in dislocations of the shoulder, in one of which ineffectual attempts had been made at reduction, on the day of the accident, by others. On the second day, however, I reduced it with the adjuster. In all these cases the success was perfect—highly satisfactory. I have also used it in a case of dislocation of the elbow, complicated with fracture of more than five weeks standing. In this case I was happily able considerably to increase the mobility of the joint, and thus to give to the little patient the assurance of eventually recovering a fair use of the limb.

I feel under deep obligations for this improvement in surgery, and I am bound to state that I find the instrument, on trial, to operate on sound and correct surgical principles, and to afford facilities to the surgeon, which, as I believe, he can find in no other apparatus for treating the injuries for which this one is especially designed. Yours truly,

(Signed) Avery J. Skilton.

Troy, N. Y., Nov. 28th, 1846.

FROM DR. WRIGHT, OF WESTERN NEW YORK.

Akron, Erie Co., N. Y., Nov. 29th, 1846.

Dr. Jarvis.

My Dear Sir,—I have had some practical experience with the Surgical Adjuster, and I can cheerfully say that I think it one of the greatest improvements in modern surgery. I will refer to one or two cases succinctly.

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* Nor did the man in the first operation.—G. O. J.

The first one to which I will refer was a case of oblique fracture of the femur, with shortening of the limb. I applied the instrument: the bones were very readily brought into coaptation, and with very little inconvenience to either patient or myself they were there retained. In five weeks, I had reunion of the bone, and a limb of full length. This, I think, could hardly have been possible with any of the old methods.

In a dislocation of the elbow backwards, where some attempts at reduction had been previously made, by a neighboring physician, I applied the adjuster, and with extraordinary ease, and even comfort, to the patient, the parts were restored.

I have used the instrument in some other cases, and always with the happiest effects. Indeed, it has inspired me with so much confidence, that my faith in it is almost unbounded for accomplishing the objects for which it is arranged, especially when compared with all the other methods with which I am acquainted.

I am, with much esteem,

Yours, &c.

(Signed) Samuel S. Wright, M.D.

FROM THE ATTICA DEMOCRAT.

"Surgical Adjuster," is the name of an instrument invented by Dr. Jarvis, for the purpose of setting dislocated or fractured limbs. How long it has been in use we are not informed, but we can speak from actual experience of its utility. It was our misfortune to have our right shoulder dislocated by a fall from a horse, on Saturday evening last. Dr. A. P. Curtis happening to be at hand, applied the instrument for the purpose of re-placing the bone in its proper place. Having seen and assisted in the setting of many fractured and dislocated limbs, we were prepared to undergo the usual amount of excruciating pain attendant upon the old mode of procedure in such cases. But before we were scarcely aware of it—and *without the least additional pain*—the bone of the arm was re-placed in its socket—something of a soreness about the shoulder caused by the fall, only reminding us of the accident.

Dr. Curtis, the possessor of the instrument, has been at considerable expense to procure it, and if those who are afflicted like us, knew its value, they would prefer to be *mended up* in this mild method, rather than by the usual hauling and pulling of half a dozen men.

TESTIMONIALS.

From the Adelphi Society, London, of which His Royal Highness, PRINCE ALBERT, is President, and who, in person, presented the Gold Medal, referred to below.

Society for the Encouragement of Arts, &c.
Adelphi, May 23, 1845.

SIR,—I have the pleasure to inform you that the Society have voted you their gold Medal for your Surgical Adjuster, and that your card of admission is sent herewith.

I am, Sir, yours, &c.

FRANCIS WHISHAW, *Secretary.*

From Professor MOTT, of New York.

New York, December 4, 1843.

I am acquainted with Dr. Jarvis's "Surgical Adjuster." It is a valuable present from a highly deserving and intellectual Physician to the Surgical Profession. Its value to the Surgeon cannot be too highly prized in the treatment of fractures and dislocations. It ought to be in the hands of every practitioner, and should make a part of the instruments in the possession of every Surgeon in the Army and Navy.

(Signed) VALENTINE MOTT.

From Mr. STANLEY, Surgeon to St. Bartholomew's Hospital, London.

Brook Street, Grosvenor Square, June 16, 1845.

MY DEAR SIR,—I beg to assure you that I have, with very great pleasure, witnessed the application of your apparatus for the reduction of dislocations. Many of the contrivances it presents appear to me entirely new, and they are certainly most ingenious. I can readily believe that your apparatus may be successful in the reduction of dislocations, when all other contrivances have failed, and I am sure that the public in all countries owe you a debt of gratitude for the pains you have bestowed on so important an object.

Wishing you, most sincerely, the fullest success for your labors, I remain, my dear Sir, yours very truly,

EDWARD STANLEY.

From the late Dr. FORREY, Editor of the N. York Medical Journal.

New York, November 4, 1845.

I have examined with much interest and satisfaction the apparatus calculated for all the purposes of extension and counter-extension, invented by Dr. George O. Jarvis, of Connecticut. I am free to say, that as regards reduction of dislocations, the adjustment of fractures, and the maintenance of the coaptation of the latter, Dr. Jarvis has supplied a desideratum in this mechanical contrivance, and which in point of ingenuity and simplicity is perhaps unparalleled in the whole history of surgical instruments. (Signed) SAMUEL FORREY.

From Dr. HODGKIN, Author of Lectures on Morbid Anatomy of the Serous and Mucous Membrane, London.

Brook Street, Grosvenor Square,
17, 11, 1845.

MY DEAR FRIEND,—I greatly admire thy Surgical Adjuster, which gives great command of power without increase of risk to the patient, but as I conceive with rather a diminution of danger, since the whole of the force employed is under the same direction. I was particularly struck with the general applicability of the Instrument, which must be seen in operation to be duly appreciated. Thine, sincerely,

To Dr. Jarvis. THOMAS HODGKIN.

From Professor PARKER, of New York.

College of Physicians and Surgeons,
New York, December 4, 1843.

I have examined with care the apparatus invented by Dr. George O. Jarvis, for the treatment of fractures and dislocations, and concurring very fully in the favorable opinion of it which so many distinguished surgeons have expressed, I most heartily recommend it to every practising surgeon.

(Signed) WILLARD PARKER, M.D.
Prof. Surgery.

From Mr. FERGUSSON, Surgeon to King's College Hospital, London, and author of "Practical Surgery," &c. &c.

Dover Street, June 14, 1845.

MY DEAR SIR,—I feel greatly obliged to you for the demonstrations which you have made of your instrument for reducing dislo-

cations and adjusting fractures, and regret that I have not had an opportunity of trying its effects, so that I might give my testimony in its favor from actual experience. I have no hesitation, however, in stating my admiration of the apparatus, and that it appears to me, as the most ingenious and powerful ever devised for such cases. I am, most faithfully, &c.,

W. FERGUSSON.

From Mr. KEATE, Surgeon to St. George's Hospital, London, Sergeant Surgeon to the Queen.

15 *Albemarle Street, August* 14, 1845.

DEAR SIR,—I have examined carefully the apparatus which you have invented for reducing dislocations and adjusting fractures, and I have watched with great interest its application by you to these different objects. It appears to me calculated to save much trouble to the surgeon and much pain to the patient, and as a proof of my favorable opinion of it, I purpose to recommend one to be purchased for use in St. George's Hospital.

I am, dear Sir, your very faithful servant,

ROBERT KEATE,

Sergt, Surgeon to the Queen, and Surgeon St. George's Hospital.

From SAMUEL COOPER, Esq., Author of "First Lines on Surgery," "Dictionary of Practical Surgery," &c. &c.

Woburn Place, London, June 14, 1845.

MY DEAR SIR,— Your apparatus for the reduction of dislocations and the treatment of fractures, exhibits a great deal of mechanical ingenuity directed to the fulfilment of the indications in particular cases with superior efficacy. I consider the invention likely to prove exceedingly useful in old dislocations or displacements of the head of bones, where the ordinary means fail, or cannot be employed with safety.

I am, my dear Sir, yours always truly,

S. COOPER.

From Mr. QUAIN, Professor of Anatomy, &c. at University College Hospital, London; Author of a valuable work on Anatomy, &c.

Keppel Street, June 20, 1845.

I have had an opportunity of examining the apparatus invented by Dr. G. O. Jarvis, for assisting in the adjustment of fractures and the reduction of dislocations of the limbs, and I have seen

the method of its application by its inventor. My belief is, that the apparatus is calculated to give increased power to the surgeon, as well as precision in applying the power, at the same time that it will enable him to dispense with several of the assistants, which are now required in some forms of the injuries referred to. For these reasons I regard the contrivance as an excellent one, and, as well as can be judged without seeing it used in actual practice, I am satisfied that it will afford important assistance to the practitioner. It will readily be inferred that, in my opinion, Dr. Jarvis is entitled to much credit for the persevering application of his ability and mechanical skill in the construction of so useful an instrument. R. QUAIN.

From Professor MUTTER, of Philadelphia.

Philadelphia, November 29, 1843.

I beg leave to offer my testimony in favor of an instrument of Dr. Jarvis's invention, for the reduction and treatment of dislocations and fractures. It is unquestionably a most ingenious and excellent apparatus, and must prove highly useful in many cases of accidents, for the relief of which it has been invented.

(Signed) THOMAS D. MUTTER, Prof. Surgery, &c.

From Sir BENJ. BRODIE, Bart., V. P. R. S., Author of "Clinical Lectures on Surgery," "On the Urinary Organs," "On the Joints," &c. &c.

14 *Saville Row, June* 13, 1845.

I have examined the machine invented by Dr. Jarvis for the reduction of dislocations and adjustment of fractures. The construction of it appears to me to be highly ingenious, and as far as I can form an opinion on the subject, without having seen it actually employed on the living person, it is likely that it will prove very useful in severe cases in surgical practice.

(Signed) B. C. BRODIE.

CONCISE INSTRUCTIONS IN THE USE OF THE ADJUSTER.

TO REDUCE A DISLOCATION OF THE HIP.

[*See Plate II.*]

Buckle the long belt around the thigh immediately above the knee, a loop lying on each side of the limb. Let each loop be armed with a strong cord. Attach the roll, H, to the thigh fork (fig. 4), by the buttons on its arms; letting it pass over the end of each arm so as to hang loosely down between them. Slip the fulcrum, F, of the side lever (fig. 3) on to the brass case at D, making it fast at the point which will allow the stem of the plate, G, to move freely between the fork and the roll. Insert the end, D, of the counter-extending bar into the socket, K, of the fork; the stem of the side lever (fig. 3) passing between the roll and the fork. Apply the instrument thus arranged to the inside of the thigh, the roll, H, pressing firmly againt the body, the arms of the fork (fig. 4) passing upward and outward, the one in front of the hip, the other back of it, so that by the strap, No. 1, passing around each arm of the fork and crossing the body above the hip, the instrument may be made to press firmly against the inside of the thigh. Let the strap be drawn tense and buckled; and let a bolster be placed under the strap, of sufficient thickness to enable the surgeon, by means of the strap, to press the instrument firmly against the inside of the thigh. Make the limb fast to the other end of the instrument by the cords drawn tight. Tie a handkerchief around the instrument and limb, immediately above the knee, so as to confine them together. Apply the lever—make steady and gradual extension; moving the limb freely, if need be, until the head of the bone is brought down to a transverse line with the socket. Now, by means of the side lever let the surgeon throw the head of the bone outward; that an assistant may rotate the thigh on its own axis, preparatory to the head being again received into its socket.

NOTE.—In all cases when the thigh fork is used, a piece of wash leather, cotton-flannel, or other soft material, should be placed between the roll and the skin, in its entire length, to prevent friction. This rule should be observed, equally in fractures as in dislocations, for it is an important one in both.

TO REDUCE A DISLOCATION OF THE KNEE.

Buckle the long belt around the limb, immediately above the knee; with one loop lying low over the knee-pan. Buckle the short belt around the ankle. Take off that arm of the jointed fork (fig. 6) which will not be required to be used; and pass the other arm through the loop, over the knee-pan. Attach the Adjuster to the fork, and make fast the lower belt to the foot of the instrument, by tapes passed through the loops. Apply the lever, make extension, free motion, &c.

TO REDUCE A DISLOCATION OF THE ANKLE.

[*See Plate IX.*]

Buckle the long belt around the leg, immediately below the knee. Let one loop lie in front, and another directly back of it, on the posterior side of the leg; the loops being on the lower edge of the belt and looking towards the foot. Pass the two arms of the jointed fork (fig. 6) through the two loops above named. Insert the end of the counter-extending bar, D, into the socket, K, of the fork; and to make fast the extending point of the instrument to the limb, let the following method be adopted. Let the back of the limb, immediately above the heel, rest on the middle of a silk handkerchief in the form of a roll. Let the foot, A, of the rack, cross the hollow of the foot. Bring the ends of the handkerchief down, on each side of the heel; and cross them over the sole of the patient's foot; and foot, A, of the instrument. Carry them forward and cross them again on the top of the foot. Pass each end as respectively inclined, under the handkerchief lying on the side of the heel. Bring the ends forward again to the top of the foot; and tie them closely and firmly down. Apply the lever; make extension; and manipulate as necessary, to effect reduction.

TO REDUCE A DISLOCATION OF THE SHOULDER.

[*See Plate X.*]

Buckle the short belt round the arm immediately above the elbow. Pass the tapes through the loops; one being placed on the under and another on the upper side of the arm. Button the roll tensely across the top of the arms of the shoulder-fork (fig. 5). Insert the end of the counter-extending bar, D, into the socket, K, of the fork. Place the roll in the arm-pit, and tie the tapes, drawn tensely, to the foot of the rack, A. Buckle the hip strap across the shoulder, passing it around the roll, H, on each side of the shoulder; minding to draw it sufficiently tight to press the roll firmly against the under side of the arm. To prevent the shoulder-blade from yielding to extension, apply the hollow part of the acromion strap, to the point of the shoulder. (Acromion process.) Let each end pass between the fork and the roll, at their respective sides: the long end passing round the body and under the opposite arm to the short end. Buckle it closely round the body. Apply the lever; make extension; use free motion with the arm, as necessary to favor reduction.

TO REDUCE A DISLOCATION OF THE ELBOW.

[*See Plate XI.*]

Buckle the long belt with the loops standing upwards, round the arm above the elbow; and very low down: taking care that the *close loop* lies immediately on the point of the elbow. Buckle the short belt round the wrist. Insert the elbow fork into the close loop. Attach the adjuster to it by inserting the counter-extending bar, D, into its socket, K. Arm the loops on the front and back of the hand with strong tapes; and tie them to the foot, A, of the rack. Apply the lever and make extension; while free motion is made with the limb.

TO REDUCE A DISLOCATION OF THE THUMB.

[*See Plate XII.*]

Apply the jointed fork (fig. 6) to the instrument. Pass the hip strap over the arms of the fork, the ends being buckled together so as to form a loop hanging loosely between the arms of the fork.

Let the hand, between the thumb and index finger, rest against the middle of the strap; the back of the hand resting on the instrument. Make the thumb fast to the foot, A, of the adjuster, by a clove hitch with a broad tape, doubled. Tie a handkerchief round the wrist and instrument. Make extension with the lever, and throw the distal extremity of the thumb directly backwards, and when the two articulating surfaces are sufficiently approximated, let it be again brought forwards.

FOR FRACTURE OF THE THIGH.

[*See Plate V.*]

Place the pads (fig. 8), one on each side of the thigh, immediately above the knee. Around the limb and pads, apply the long belt, having two of the loops armed with strong tapes, cross the bulbous part of the pads. Apply the instrument to the limb as in dislocations of the hip; except that the side lever (fig. 3) is not to be attached to it. Prepare the double-inclined plane for receiving the limb and instrument upon it, by adapting the length of the two parts of the plane to the length of the two portions of the limb. Give the plane that angle which the limb is judged to require, and cover it with mats, or anything that will make an easy surface, on which the limb is to rest. Over the whole, and on the appropriate part of the plane, lay tapes or an eighteen-tailed bandage, ready for dressing the limb when adjusted. On the plane, thus prepared, lay the limb and instrument already attached. By the lever, make sufficient extension to set the bone; now place splints on each side of the thigh, the inner splint being placed between the instrument and limb. Let the lower end of each splint pass a little distance under its pad. Be careful to allow none of the weight of the instrument to press on the limb—this is done by placing a bolster between the instrument and the plane. Let the space between the inner splint and the instrument be filled with folds of cloth, so that the splint shall press equally and gently on the whole length of the thigh. Over the whole apply the tapes or eighteen-tailed bandage.

Note.—In all cases of fractures, when the belts are lined with India rubber cloth, the limb should be covered with a cotton or flannel bandage beneath the belts, to protect the skin from the too stimulating properties of the lining. Where oiled silk is the lin-

ing, such precaution is less essential. Where the pads are used, the belt should be but loosely applied. To apply it tightly would be doing a wrong to the patient and the instrument.

FOR A FRACTURE OF THE KNEE-PAN.

[*See Plate VIII.*]

Apply one of the pads above and against the upper fragment of the fractured bone. Around the pad and limb, buckle a belt with a loop crossing the bulb of the pad. Buckle the other belt around the limb, immediately below and against the lower fragment, with a loop from the upper edge of the belt, crossing the fragment. Pass a tape, about six feet long, into the upper loop. Let the tape cross the centre of the bulb in its passage to the foot. Apply the instrument as in a fracture at the neck of the thigh bone ; except that no splints or cloth are to be used. Tie an end of the tape, on each side of the patient's foot, to the foot of the rack. Make the necessary extension with the instrument, to coapt the fractured bone, when the two loops are gently brought together by a short piece of tape ; and then let them be tied. Lay the limb on a perfect plane, and let the foot of it be a little elevated to gently elevate the limb.

TO DRESS A FRACTURE AT THE NECK OF THE THIGH BONE.

The limb being in a straight position, and the patient resting on the side opposite the one injured.

[*See Plate VI.*]

Apply a belt, as in fractures of the thigh, but without the pads. Let two straight splints 2½ inches broad, three eighths of an inch thick, one of them the length of the limb on the inside, the other, the length of it on the outside, to the top of the hip, be rolled in a square piece of cotton cloth, so as to form a trough ; in which place the limb. Run out the counter-extending bar of the instrument to its full length, and fasten it in that position by the screw, E. Run out the rack, so that the foot, A, of the instrument shall cross the sole of the patient's foot. Apply the thigh fork (fig. 4) as in a dislocation of the hip. Apply the instrument on the inside

of the limb, and over the inside splint. Make the limb fast to the foot of the instrument by the tapes. With the lever, make the necessary extension of the limb, and of the neck of the bone, by the strap crossing the body above the hip, and passed around both arms of the fork. Let a thick bolster be placed between the body and the strap, sufficiently thick to give effect to the strap, in lengthening the neck of the bone. Let tapes be tied around the whole, at several convenient points, to secure the perfect rest of the limb. Let the foot rest on a pillow of sufficient height, to place the limb horizontally, and to admit the sound limb to move freely under it.

The surgeon can adopt this position, or the one with the patient lying on his back, at pleasure.

FOR A FRACTURE OF THE LEG.

[*See Plate VII.*]

Apply the pads, one on each side of the leg, immediately below the knee, and the long belt around the limb and the pads; with a loop on each side, standing upwards, and crossing the thick part of each pad. Let the two loops be armed with tapes. Apply the short belt around the ankle, with the loops towards the foot, armed on each side with tapes; or, in lieu of the belt, apply to the foot, the wood-soled fracture shoe, and fasten it to the foot of the instrument. Remove that blade from the jointed fork, which will not be required for use, and place the other blade across the thigh, immediately above the knee. To it, attach the upper belt, by its tapes from either side. Apply the instrument to the fork as before. Make fast the foot of the instrument to the lower belt, or to the shoe, whichever may be used. Place the limb, in a bent position, on the double-inclined plane, prepared with tapes or bandages for dressing. Apply extension, to set the bones. Apply splints on each side of the leg, and secure the whole by the bandages or tapes previously arranged on the plane.

Should there be much swelling and inflammation of the limb, the fracture shoe is greatly to be preferred. There should, however, always be placed between the top of the foot and the shoe, some folded flannel and a thin piece of sole leather, to prevent any unequal pressure from the straps of the shoe. The care with which the belts, fracture-shoe, dextrine bandage, or any other

means which may be adopted, and from which the points of extension and counter-extension are to act, should be applied to a limb, in a case of fracture, so that the pressure may operate equally over a large surface, and their bearings be made to press gently and kindly on the limb, so as quietly to be borne by the patient, is a point in the treatment, which cannot be too strongly urged upon the attention of the surgeon. Without this duty being well performed, the danger is, that the necessary extension and counter-extension will not be long endured by the patient, nor will its benefits be secured to the surgeon. This, then, should be a rule in the treatment of all fractures. *To so apply the materials, whatever they may be, by which the points of extension and counter-extension are attached to the limb, that the necessary pressure, in making extension, may be quietly borne by the patient.*

Great care having been taken in the construction of the parts, used for the above purpose, it is believed that they may be quietly maintained by the patient, in every case, where continued extension and counter-extension are requisite, if correctly applied. But, should they be negligently, or carelessly used, the ease and comfort of the patient would most surely be much disturbed ; and the success of the surgeon would thus be rendered extremely doubtful.

Let the foot of the plane be so elevated, as that the leg shall lie in a horizontal position ; the thigh resting on the elevation of the plane.

By giving attention to the foregoing directions, so as to understand them fully, it is believed that every surgeon will be able to apply the adjuster readily and correctly, in all cases where any extending force is required, and with much greater ease and safety to the patient, than by employing any of the ordinary means ; although the especial mode of its application may not, in all cases, be here particularly described.