A brief description of surgical apparatus : intended to accompany a series of delineations of the most important mechanical auxiliaries of surgery / by Henry T. Chapman.

A

BRIEF DESCRIPTION

OF

SURGICAL APPARATUS;

INTENDED TO ACCOMPANY

A SERIES OF DELINEATIONS

OF

THE MOST IMPORTANT MECHANICAL AUXILIARIES
OF SURGERY.

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AND

HENRY EARLE, Esq. F.R.S.

SURGEONS TO ST. BARTHOLOMEW'S HOSPITAL,

This Work

IS RESPECTFULLY INSCRIBED,

BY THEIR OBLIGED PUPIL

THE AUTHOR.

ERRATA.

Page 43. last line, for " A" read " a"
46. line 6, for " head and fore-arm," read " hand and fore-arm."

PREFACE

In undertaking the following work, the author has been chiefly influenced by a recollection of the difficulties experienced by himself, and shared by many a fellow student, when first entering upon the management of surgical cases in which mechanical assistance was required, in consequence of a very imperfect practical acquaintance with the scattered resources of this branch of surgery.

The importance of this knowledge is sufficiently manifest, and its cultivation is strongly urged by every writer on the subject. Independent of the intrinsic value it bears, a consideration of another kind must be allowed some weight; the reputation of a young surgeon is more frequently founded upon address displayed even in the most common manœuvres of this department, than on the possession of more solid but less conspicuous qualifications; for as every looker-on can appreciate the manner of their execution, they are made the standard by which his general ability is estimated.

In order to attain the requisite degree of skill in these operations, careful and repeated practice is necessary; but the only efficient source of practice open to the British student is that of hospitals; an advantage which can be enjoyed by a comparatively small number, and by many of them for a period too short to afford more than a partial intimacy with the subject.

In the Continental schools, besides hospital practice, students have other opportunities of exercising themselves; they may resort to the public courses of lectures, one of which is devoted to surgical apparatus, to look over the several articles, see them applied, and afterwards practise their application, upon a man paid to attend for that purpose; or a party enter into an arrangement for mutually applying them upon each other, taking as a guide one of the several works on the subject to be met with in the French and German languages.

In our own language, although bandages occupy their station in general treatises on surgery, and in many instances explanatory sketches are added, without which the clearest description will scarcely prove intelligible,—the majority of these works are of some standing, and necessarily defective in modern improvements, omitting a number of extremely useful recent inventions. In short, we cannot be said to possess a collective detail of the surgical mechanism in use at the pre-

sent day, and this production is an attempt, in some measure, to supply the deficiency.

In the prosecution of his object, the following are the sources from which the author has derived the greatest assistance.

The surgical works of Gooch, Benjamin Bell, John Bell, Pott, and Hey. The lectures of Sir A. Cooper, Mr. Abernethy and Mr. Lawrence. The Practical Observations of Mr. Earle, and the First Lines of Mr. S. Cooper. These, together with a multitude of suggestions dispersed through the various medical periodicals, may fairly be said to include all that is substantially useful relating to this province in British authors.

The foreign publications which have been consulted are, Heister, Brambilla, the more recent plates of Richter and Ott, the illustrations of the Dictionaire de Chirurgie, Gerdy Traité et Atlas des Bandages, and Bourgery Traité de Petite Chirurgie.

From these authorities whatever appeared most valuable, and at the same time most simple, has been selected and embodied; and, as different writers make use of a variety of names in describing the same article, those synonymes which most frequently occur are appended.

It is necessary, however, to state that the drawings have not been copied from the delineations of others, but, with very few exceptions, taken from the bandages &c. actually applied to the

subject. The greater number are those which have been long employed in one of the largest hospitals of this metropolis; but as the surgeon in private practice cannot be expected to provide himself with the *armamentarium chirurgicum* of a hospital, a variety of simple and domestic contrivances, which can be readily procured, have been introduced as substitutes for some of the more expensive forms of apparatus.

The instruments ordinarily required in operative surgery have also been admitted, as constituting a part of surgical apparatus. Although of diminished size, their characters are given distinctly; and, with the notice in the text, will answer the purpose of a table of reference, in which the young student may find an explanation of the uses of many of them, which their names are little calculated to express.

In the descriptive matter as much connexion as the plan of the delineations would allow has been maintained: and, in order to give the whole a more systematic form, it is preceded by a short classification assembling the corresponding parts of the subject under distinctive heads.

24, *Argyle Street*,
January, 1832.

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INTRODUCTION.

SURGICAL apparatus comprehends, *Bandages* of all kinds; *Apparatus* for *Fractures*, *Apparatus* for reducing *Dislocations*, and *Instruments*, whether for Operative Surgery or other intentions.

I. *Bandages.*

Bandages are employed to confine dressings, blisters, &c. in their proper situations, to restrain hœmorrhage from wounded blood-vessels by compression, to support parts in a state of debility, assist union where a solution of continuity has occurred, and oppose certain displacements of the viscera.

They consist of rollers of various forms and combinations; handkerchiefs for slings, &c.; bandages secured by buckles, composed of leather or webbing, in most instances substituted for particular combinations of the roller; and lacing bandages. To these may be added trusses and the contrivances for Prolapsus Ani and Uteri.

They are referred to two general divisions, the simple and compound bandages. The former comprises the various dispositions of the common roller, namely, the circular, nodose, reflex, crossing or figure of 8, and spiral forms, with the slings.

The second division embraces all bandages constructed of several pieces arranged in a certain order, such as the T, the triangular inguinal, suspensory scrotal, the many-tailed, and uniting bandages; lacing bandages, and those with buckles. Trusses and similar contrivances may be included in this compartment.

Distributed under distinct heads expressive of the indications they fulfil, the general uses to which each bandage is applicable will be seen at a glance; thus,

The confining indications are effected by

The circular, crossing, and spiral; the sling with six heads, the T, many-tailed, and triangular inguinal bandages.

The compressing, (under which head are included those called expellent bandages) by

The circular, nodose, reflex, spiral, crossing, and many-tailed bandages.

The supporting, by

The spiral, (including Baynton's bandage for ulcers of the legs, and that used by Mr. Scott in his treatment of diseased joints,) the many-tailed, lacing bandages, and those with buckles.

The uniting, by

The spiral, many-tailed, and several uniting bandages, with sutures.

The suspensory, by

The common slings, and that with four heads; clavicle bandages, and the scrotal suspensory bandage.

And lastly the retentive, by

The crossing and T bandages, trusses and other contrivances for remedying displacements of the viscera.

II. *Apparatus for Fractures of the Limbs*, viz.

Pads, splints, fracture boxes and beds for fractures.

III. *Apparatus for reducing Dislocations*, viz.

The pullies, with their counter-extending straps and belts; and other mechanical means for the same purpose.

IV. *Instruments, divided into*

Instruments occasionally introduced into the natural canals of the body, as catheters, bougies and sounds; with the probang, stomach pump, &c. *and* instruments employed in operative surgery.

DRESSINGS.

BEFORE commencing any description of the Plates, it is necessary to devote a short space to the consideration of the various dressings, in aid of which many of the bandages have been devised.

The object in applying dressings, is to maintain injured parts in a state in which the restorative processes of nature are enabled to act favourably; to defend them from the contact of the air, miasmata floating in it, changes of temperature, and the action of other external bodies; to absorb fluids exuding from wounds, and thus prevent the formation of incrustations over their surfaces; and to answer the purpose of vehicles for the application of such medicinal substances as are deemed essential to the cure. The instruments usually required in the management of dressings are, the dressing forceps, straight and bent scissors, pointed and eye-probes, a director, and spatula; besides which, the dressing-case should contain straight, curved, and probe-pointed bistouries, a dissecting forceps, tenaculum, caustic case, needles, silk, and adhesive plaster. Other indispensable requisites are, warm water, sponges, towels, and a vessel to receive the former dressings; a weak solution of chlorate of soda or lime will also be

found a useful addition at some seasons, to get rid of disagreeable effluvia.

The materials of which dressings are composed are, lint, applied simply or spread with ointments; old linen, for upper dressings and compresses; and adhesive plaster. Lint is objected to by French surgeons, as neither sufficiently absorbent nor permeable; instead of it they make use of *charpie*, of which there are two species; *charpie brute*, consisting of a mass of threads, unravelled from square portions of linen, all knots and inequalities being carefully removed; and *charpie râpée*, a kind of down, produced by rasping with a knife the surface of a piece of linen stretched tightly. *Charpie* is rolled up, and disposed in a variety of fashions, each distinguished by a particular name.

Lint is very easily convertible into *charpie*, and this change may frequently be made with advantage.

In its simple state, lint is used for many purposes: it is insinuated between the lips of wounds, to oppose union by the first intention under some circumstances, and encourage suppuration (*la meche*); it is spread over the surface of wounds, to absorb fluids exuding from them; in this case, a light spongy mass of charpie (*plumasseau*) is much more suitable than lint in its compact state; pledgets or dossils of lint, of different sizes, (*boulette, bourdonnet, pelotte,*) are employed to cleanse

the surface of ulcers, before the dressings are re-applied, as compresses to arrest hæmorrhage from small arterial branches, or as plugs to check violent bleeding from the nasal fossæ; for the last intention, the mass must be rolled up tightly, and tied round with strong threads, by which the plug may be withdrawn when its end is accomplished. A small portion of lint wound lightly round the end of a probe, forms a pencil, or fine brush, by which stimulating solutions, &c. may be taken up and diffused over a small surface, as an ulcer of the cornea.

When used as a base for medicated ointments, the lint is generally cut to the size of the ulcer, and an upper dressing of simple cerate, spread upon linen, is applied to confine it.

Linen rag is used for upper dressings, spread with simple cerate; and for compresses of various forms and thickness.

The upper dressings are adapted in shape and size to the parts upon which they are applied, and fitted closely by snipping their borders more or less deeply; one or two of the numerous figures depicted in the older surgical writers may be mentioned. The Maltese cross consists of a square portion, divided from the corners towards the centre; it embraces very conveniently the ends of the fingers and toes, the penis, and the stumps of amputated limbs. Another variety is the perforated dressing, (*pansement fenetrée*); the rag or

lint is pierced with a number of holes before it is spread with cerate; the advantage proposed by this is, that the secretions may ooze through the openings in the plaster, and be absorbed by *charpie* placed externally; the perforated dressing is well calculated for burns.

Compresses are portions of linen folded in square, triangular, and oblong forms, of various sizes and thickness, according to circumstances. The graduated compress is a variety of the oblong, made in the following manner: one border of a square piece of linen is folded over to produce a plait, about half an inch in breadth; this plait is folded back upon the linen, to form a second, somewhat broader than the first; the two are then carried forward, and a third plait produced of greater width than the second, and so on with each successive plait, until the square is reduced to an oblong compress of considerable thickness along its central line, and gradually becoming thinner to its edges. (Plate VI. Fig. 4. D.) A graduated compress of a pyramidal shape may be made by folding a triangular piece of linen in the same manner. Compresses are employed to give greater solidity to the dressings, fill up inequalities of the parts beneath a bandage, approximate the edges of deep wounds, prevent accumulation of pus in the course of sinuses, compress the trunks of wounded arteries, &c.

Adhesive plaster is applied with three objects;

as a preservative, to defend parts exposed to excoriation from acrid discharges, or friction, and diminish the tendency to sloughing from long-continued pressure in emaciated bed-ridden subjects; as an uniting medium to all wounds in which union by the first intention is expedient; and as a support, it enters into the formation of Baynton's bandage for the treatment of old ulcers. Previously to its application with any intention, the hair should be entirely shaved from the part, and the skin washed and carefully dried.

For the first purpose, diachylon plaster, Empl. Plumbi, is best suited; it should be spread upon leather in preference to linen, and applied in large portions fitted smoothly to the part, by snipping the edges, or taking out triangular portions if necessary.

For the second, the Empl. Resinæ is employed, spread upon linen or calico, and cut into straps proportioned in length and breadth to the volume of the parts, and size of the wound requiring them; the straps are placed side by side, with slight intervals to permit the escape of fluids, the confinement of which might interfere with union. As the amount of adhesive force depends chiefly upon the breadth of each extremity of the straps, they may be cut in such a manner as to contract gradually from the two ends to the centre, where they cross the line of wound, and thus leave a free space between each, at the same time acting quite as effectually,

as if they covered the wound entirely. The removal of adhesive straps from a wound deserves some attention; the whole dressing having been previously soaked with warm water, the ends of each strap are lifted and gently peeled back towards the wound; the strap is then turned upon its side and removed, all danger of tearing asunder the recently united edges being thus avoided.

The third intention for which adhesive plaster is resorted to, is to approximate the edges of old ulcers, and support the surrounding parts, as practised by Mr. Baynton, in order to ensure a firmer cicatrization; described Pl. VI. fig. 5.

Upon the proper application of dressings very much depends the propitious healing of wounds and ulcers, and frequently the successful issue of important surgical operations. In order, therefore, that the full advantage may be derived from them, attention to a few particulars is indispensable. They should be applied with as much adroitness and celerity as is consistent with gentleness, and a correct performance of the duty; the surgeon preparing the several pieces, arranging them in due order, and disposing every thing likely to be required near at hand, so that no hindrances may occur in the subsequent proceedings. A good light should be thrown upon the part; and the postures adopted both by patient and surgeon, be sufficiently commodious to prevent either becoming fatigued before the

dressing is concluded. The wound is not to be exposed to the air longer than to ensure its perfect cleanliness, which must be strictly observed with every part of the dressings and the bed. When the operation is completed, the part should be placed in the position most favourable to healing, and least irksome to the patient. To facilitate the adhesive process, the neighbouring parts must be maintained in a state of relaxation; the semi-flex position of the limbs is that most easy and natural, and may be selected with advantage in almost every case. To promote the effects of expellent bandages in preventing purulent collections in the cavities of abscesses or the course of fistulous canals, the opening by which the pus makes its exit should be depressed by position to a point lower than its source. Pressure upon the wound in certain situations is avoided by making use of soft cushions, or a circular pad with a central aperture; the inflated pads suggested by Mr. Benson (Pl. XI. fig. 5.) are well suited to this purpose. The weight of the bed-clothes frequently proves a serious inconvenience; an arched cradle or foot-stool placed upon the mattrass and crossing the limb, readily obviates this.

Among the numerous expedients which have been suggested with a view of rendering the constraint inseparable from the treatment of many surgical maladies as little burthensome as possible, the invalid bed of Mr. Earle (Pl. XIV. fig. 1.)

is unquestionably the best, and when absolute quiet for a long period, is desirable it should always be had recourse to.

The length of interval allowed to elapse between each dressing, depends upon a number of circumstances. Renewal of the dressings too frequently interferes with the natural processes towards the cure, and irritates and fatigues the patient needlessly. The consequences of too great an interval, on the other hand, are accumulation of the secretions, and an alteration in their quality, often productive of mischievous results. With the majority of wounds dressing once in 24 hours is sufficient; but where the secretion of pus is copious, any part of the surface is in a sloughy state, irritating fluids, as the urine, &c. make their way into the dressings, or the heat of the weather is excessive, it is better to repeat them once in 12 hours.

Two, three, or more days may elapse, before the removal of dressings from a wound threatening hæmorrhage; and the dressings to compound fractures should, if possible, be still more rarely disturbed. Mr. Abernethy attempted, whenever practicable, to bring compound fractures to the state of simple, by closing the wound with adhesive plaster, and "hermetically sealing it," to use his own expression, by a layer of varnish externally. And Baron Larrey carries the same principle still farther, frequently leaving the dressings

untouched till the complete consolidation of the fracture.

Although the morning is ordinarily the period for re-applying the dressings, the comfort and ease following their renewal, will in many cases point out the superior advantage of transferring the operation to the evening, for the purpose of procuring the patient a better night's rest.

I. BANDAGES.

Plate I.

Fig. 1. The single-headed roller; ordinary length 7 yards, breadth 3 inches.

Fig. 2. The double-headed roller; ordinary length 10 or 12 yards, breadth from 3 to 6 inches. Both forms are varied in length and breadth according to circumstances. The manner of rolling them up, is a point well deserving the surgeon's attention; with an even, firm, and compact head, the application of the roller is effected with much greater precision. The materials of which rollers are made should possess sufficient strength to fulfil the end proposed, and at the same time be supple enough to accommodate themselves readily to the parts upon which they are applied. Moderately fine calico makes the best rollers for ordinary purposes; it is important that the roller be torn from a piece of the entire length required, so that it be free from joining, hem, or selvage.

Flannel is occasionally employed, and forms a

good supporting bandage for ulcers of the legs in old persons, and where increase of warmth is an object; it is, however, too clumsy for general use. An excellent cotton stuff of the texture of an ordinary stocking, is also woven expressly for rollers, and being more elastic than calico, is well adapted to cases of anasarca of the lower extremity, varicose veins and hydrops articuli. It is sold at Churton's, Oxford Street, under the name of Churton's Stocking Bandage.

Fig. 3. The double T bandage; it is made by stitching a broad band divided longitudinally upon the middle of a short roller at right angles, and acts as a confining bandage for dressings to the anus and perineum; it is also applied with a compress to prevent a second descent of the gut, after reduction of a prolapsus ani; the roller is intended to surround the waist, the band descending from the loins, and the divided ends being brought up on each side the scrotum to be pinned to the rollers in front.

In the single T bandage the vertical band is undivided. A particular form of this bandage is used for confining dressings between the fingers and toes, in burns or scalds of the hands and feet. (Vid. Pl. VI. fig. 7.)

Fig. 4. The triangular inguinal bandage, composed of a triangular piece of calico or holland, stitched to the two portions of a single T. bandage,

at their juncture, to confine dressings and poultices to the groin. (Vid. Pl. IX. fig. 2.)

Fig. 5. The scrotal suspensory bandage or bag truss, for supporting the scrotum and its contents in hernia humoralis, hydrocele, and hernia of large size. (Vid. Pl. IV. fig. 8.)

Fig. 6. The sling with four heads, a double-headed roller divided nearly to the middle, used as a supporting bandage for the jaw, (Vid. Pl. VII.) and as a confining bandage to the breast and flexures of joints.

Fig. 7. The sling with six heads, a piece of linen or handkerchief, divided longitudinally at each end into three portions; employed as a covering for the head, and, the centre being perforated with holes for the eyes nose and mouth, as a mask to confine dressings to the face in severe burns, &c.

Fig. 8. The many-tailed bandage, as prepared for the leg; the cross-bands are stitched to the longitudinal band a little obliquely, this disposition causing them to fold over each other more neatly; commencing at the foot they embrace the whole limb, each one overlapping and securing that below it. (Vid. Pl. XI. fig. 7.) It is chiefly employed as a supporting bandage in fractures of the leg and thigh, as it can be unfolded and reapplied without disturbing the limb. Also with compresses, as an expellent bandage to prevent pus collecting in

a sinus; and sometimes as an uniting bandage. The form of this bandage is varied to meet particular circumstances. Scultetus's variety is described Pl. XI. fig. 7. The cross-bands are sometimes divided into two portions, which are stitched to the longitudinal band at an angle. Mr. Hodgson of Birmingham uses a form of tailed bandage instead of a roller, to confine the dressings upon stumps after amputation; the extremity of the longitudinal band crosses the face of the stump, while the cross-bands encircle it.

Fig. 9. A broad roller with tails *a a a*, and corresponding slits *b b*, forming the uniting bandage for longitudinal wounds. (Vid. Pl. VI. fig. 2.)

Plate II.

In the application of a single-headed roller, the external surface of its initial extremity is placed on the part opposite to the injury, and being fixed by the fingers of one hand, the head, held lightly by the fore finger and thumb of the other, is carried onwards, unrolling itself in its progress; as it becomes necessary to change sides, the head is passed from one hand to the other, and after a few turns to secure the commencement of the bandage, it is continued circularly or spirally according to circumstances, and, when completed, its terminal extremity fastened by a pin.

When greater compression is desirable, a double-headed roller is necessary; the middle of the roller is placed on the surface opposite to the seat of injury, and the heads carried round in contrary directions; an inconvenient roping will, however, occur at the points where the two heads meet, unless provided against by the following manœuvre; as they cross let the undermost roller, say *A*, take a slightly oblique direction downwards, continuing the superficial roller, *B*, onwards; then, by a turn over the latter, the first is made to resume its course evenly.

Fig. 1. The nodose or radiated bandage for the head, employed to suppress hœmorrhage from the temporal artery.

Having completely divided the vessel, place a pledget of lint upon the orifice, and pass a double headed roller several times rather tightly round the head; then cross the two heads over the wound so as to form a knot upon the compress, bring one under the chin, the other over the head, and on meeting again at the wounded temple, let them cross a second time; this is repeated three or four times if necessary, and the remainder of the roller carried round the head so as to act pretty firmly upon the knots and compress.

Synon. { Stella. / Bandage Nouée. / Nœud d'Emballeur.

Fig. 2. The napkin and scapulary, or body

bandage, for confining dressings, blisters, &c. to the chest.

Fig. 3. The fillet as applied to the arm preparatory to venesection.

Fig. 4. The fillet applied after bleeding in the form of a figure of 8.

The object of the fillet previously to venesection, is to distend the vein by obstructing the flow of blood upwards; two or three turns round the arm, about two fingers breadth above the point where it is intended to make the puncture, are sufficient, taking care that the arterial circulation be not interrupted by tying it too tightly. In applying it afterwards, the obstruction ought to be below the puncture, and with this view it is better, after completing the figure of 8, to bring the ends of the fillet round the fore-arm, and tie them in front; this will effectually guard against the recurrence of hœmorrhage.

Fig. 5. The single spica bandage for the groin, made by conveying a single-headed roller round the pelvis and groin in the form of a figure of 8. It may be crossed either upon the groin, or just above the hip, as in Fig. 3. Pl. III; in the former case a firmer compression can be exercised, but the bandage is more liable to become loosened on bending the thigh.

Lightly applied, it acts as a confining bandage for dressings to the groin, after an operation for hernia, &c. more firmly, with a compress, as a

temporary substitute for a truss, to retain a hernial protrusion; as a compressing bandage, also, it is frequently serviceable in forwarding the absorption of a bubo in its indolent stage.

A few stitches are always necessary to keep the turns in place.

Synon. Huit. de chiffre de l'Aine.

Plate III.

Fig. 1. The reflex bandage for the head. It is formed by a double-headed roller, one head of which is made to describe horizontal, the other oblique and vertical semicircles; the two last being crossed by the horizontal half-circles alternately upon the occiput and forehead.

With a double-headed roller, commence the circular bandage explained Plate II.; but after surrounding the head several times, give *A*, the descending roller, a still greater obliquity; consequently, on making the turn upwards, *A* will take an oblique course over the parietal bone to the forehead, overlapping the upper margin of the circular bandage. Here *A* will be intersected by *B*, and taking a second oblique turn, from the forehead over the opposite parietal bone, again reach the occiput and be crossed by *B*, when the same manœuvre must be repeated, until the head

is entirely covered. The roller may then terminate by horizontal turns round the head.

This bandage is capable of being very tightly drawn; and, with the aid of compresses, will restrain hæmorrhage from arterial branches out of the range of the circular and nodose bandages.

Synon. { Capelina. / Bandage Récurrent.

Fig. 2. The rib bandage, composed of strong webbing, furnished at one end with five or six buckles, and at the other with as many straps. The surface next the skin should be lined, and two shoulder straps attached to its upper margin. Buckled tightly round the chest, in fractures of the ribs, it serves to suspend, as much as possible, their movements in respiration. The napkin and scapulary, or a strong towel with tapes sewed to it, is a very good substitute. A broad double-headed roller also answers well as a rib bandage. (Vid. Plate VI. Fig. 1. *C.*)

Fig. 3. The double spica bandage for the groins, consisting of the turns of a double-headed roller round the pelvis and both groins, in the same manner as the single spica, but describing a double figure of 8. The uses of both forms of spica are the same

PLATE IV.

Trusses, &c.

The name of Truss is given to a species of bandage applied for the purpose of retaining a hernial protrusion, after it has been returned to its proper cavity. Trusses are either non-elastic, constructed of leather, webbing, or similar materials; or elastic, consisting of a steel spring to embrace the pelvis, and a pad to close the aperture by which the contents of the hernia have escaped from the abdomen. The latter are unquestionably very much superior to any form of non-elastic truss.

The qualities constituting a good truss are, that the pad press equally and unremittingly upon the mouth and neck of the sac, so as to resist a second protrusion; and that the spring fit the pelvis accurately, to prevent the truss slipping. The surgeon ought to superintend its first application, and see that these intentions are fulfilled; placing the patient in the horizontal position, to ensure a complete return of the contents of the sac; this rule should always be observed in re-applying the truss, as without such a precaution a fold of intestine may remain in the sac, and the pressure of the truss itself endanger strangulation. Cleanliness of that part of the skin upon which the pad rests should be particularly enjoined, and with this view

it is better to have two trusses and change them daily.

Fig. 1. Pindin's non-elastic Truss for inguinal hernia. The thigh-strap necessary to maintain a non-elastic truss in place, is a very galling appendage. This inconvenience, and the obvious circumstance that a non-elastic truss cannot accommodate itself to the varying size of the abdomen, are insuperable objections to their use.

Fig. 2. Eagland's spring Truss. The spring possesses considerable elasticity, and its lower edge describes a curve of greater circumference than the upper; by which it is made to fit the pelvis accurately, and is less likely to become displaced.

Fig. 3. Salmon and Ody's spring Truss. The pad is connected to the spring by a ball and socket joint, the mobility of which enables it to follow closely the changes of the abdominal parietes. The posterior extremity, which is also padded, rests upon the spine; and the spring, curving round that side of the pelvis *opposite* to the hernia, crosses the lower part of the abdomen to reach it.

Fig. 4. Egg's spring Truss. The peculiarity of this truss consists in the greater strength of the spring, and its very slight degree of elasticity.

Fig. 5. Eagland's spring Truss for inguinal hernia on both sides; the principle of this truss is the same as that of the single truss, Fig. 2.

Fig. 6. Eagland's Exomphalos Truss. This is the truss for retaining umbilical hernia, invented by Eagland Sen^{r}., late of Leeds, and recommended by Mr. Hey in the later editions of his surgical observations.

Fig. 7. A second form of truss for umbilical hernia, invented for Mr. Hey by Marrison of Leeds, and of which a drawing is given in the earlier editions of Mr. Hey's work. An ingenious variety of this form of truss, adapted to females, is constructed by Weiss, namely, the projection of a curved spring and pad from the inside of the busk passing down the centre of a pair of stays.

Fig. 8. The suspensory scrotal bandage (Pl. I. fig. 5). Besides its use in supporting the scrotum, the bag truss is a very convenient bandage for retaining a catheter in the bladder; to answer this purpose, it is necessary to stitch three or four tapes round the opening through which the penis passes, and tie them to the end of the catheter when introduced.

A, The thigh-strap, brought round the back part of the thigh on each side, to be fastened to the waistband over the hips.

Fig. 15. The Truss for femoral hernia.

Pessaries are instruments introduced into the vagina to support the uterus, bladder, vagina itself, and oppose hernial descents in its neighbourhood.

Of the ring and ball pessaries there are six sizes, and out of this number a selection should

be made of that which is best suited to the peculiarities of the case.

Fig. 9 and 10. Circular and oval ring Pessaries of elastic gum. Pessaries of the same forms are made of ivory or box-wood.

Fig. 11. The ball Pessary, composed of ivory or box-wood; it is hollowed to make it lighter, and the opposite sides perforated by several holes; a tape is attached to its inferior surface to facilitate its removal from the vagina.

Fig. 12. The stem Pessary, supported on a shield; an improvement upon the cup and ball pessary of the French, by Mr. Duffin, (Vid. Med. Gazette, March 26th, 1831.)

The head is of box-wood hollowed; the stem is composed of ivory also hollowed, and consists of an upper and lower portion, the latter screwing within the former at one end, and terminating in a ball at the other, which rests loosely in an ivory cup let into the box-wood shield. By this ball and socket joint the instrument accommodates itself to every motion of the body, while the shield, confined to the perineum by a T bandage, affords a steady support. The screw in the stem of the pessary allows an alteration to be made, by which it may be adapted to vaginæ of various lengths.

B, The under surface of the shield, on which is seen the opening of the canal of the pessary externally.

Fig. 13. A form of stem pessary constructed by Eagland for Mr. Earle.

The head, *C*, is of ivory, supported on a curved metallic stem, which is connected by a hinge to a small plate resting just above the pubis; the plate is maintained in its situation by two metallic bands meeting behind the pelvis, and secured by a cross strap in the same manner as the Exomphalos Truss (Fig. 6.) The narrow band of iron, *D*, slides over the jointed extremity of the stem, when the head is introduced into the vagina, to fix it steadily; and by moving it on one side, the pessary is abstracted without difficulty. The plate and metallic bands are both softly padded to guard against painful pressure by any part of the instrument.

Mr. Earle employs a modification of this contrivance, as a palliative in those distressing cases of vesico-vaginal fistula, where the size of the opening between the bladder and vagina, or other circumstances, renders an attempt to cure the infirmity by operation unadvisable. In place of the ivory head forming the pessary, a small bladder coated with elastic gum, is attached to the end of the stem; the neck of the bladder is mounted with a ring, closed by a valve, to receive the nozzle of a small condensing syringe, by which it is inflated after its introduction into the vagina, filling up the aperture in the anterior surface of the vagina as it expands.

Fig. 14. Eagland's instrument for resisting a prolapsus ani.

The belt is intended to surround the waist, and is buckled in front; a narrow plate, united by a

hinge to the back of the belt, descends towards the anus, and is furnished at its lower end with two straps which pass between the thighs to be attached to the anterior part of the belt; from the front surface of this plate a spring projects, bearing on its extremity a pad, *E*, to press upon the anus and withstand a second descent of the gut; the inner surfaces of the spring and plate are well padded.

An elastic brace is sold by Weiss for this purpose, the two bands of which cross beneath the anus, and support it upon a compress of soft sponge.

Plate V.

Sutures.

Sutures are now much less frequently resorted to than formerly; adhesive plaster, uniting bandages, and, above all, position, being found to produce the same effects in many cases, with less irritation. They should only be employed, therefore, when these means are insufficient.

Common silk is a better material for sutures than dentist's silk, which is apt to cut through the skin.

Five forms of suture are described by surgical writers; the common interrupted, the dry, the glover's, the quilled, and the twisted suture.

Fig. 1. The interrupted suture, for approximating the edges of wounds in loose flabby parts as the scrotum, &c. or in cases where a flap is produced.

It is made by carrying a curved needle and thread through both sides of a wound, and, having drawn together the edges, tying the ends of the thread with moderate tightness.

This suture is now employed by M. Dupuytren and Mr. Earle, in preference to the twisted suture, for uniting the pared edges of vesico-vaginal fistulæ (Vid. Med. Gazette, Nov. 14th, 1829); the porte-aiguille (Fig. 18. Pl. XIX.) enables the operator to manage the needle within the vagina, with tolerable facility.

M. Dupuytren has frequently succeeded in closing small openings of this kind by applying the actual cautery to the margin of the aperture. (Vid. Journ. Hebdom, No. 58.)

The dry suture, called also the false or bloodless suture, is thus described in the older surgical works; two strips of adhesive plaster spread upon calico having a selvage down one side of it, are applied so that the two lines of selvage lie parallel to each other on either side of the wound; they are then brought together by stitches, closing the wound in the same manner as the interrupted suture, but without piercing the skin. It is recommended in wounds of the face and neck as it leaves less scar.

Fig. 2. The glover's suture, used only in the

operation of sewing up bodies after post-mortem examinations.

A stout straight needle is best adapted to the formation of this suture; the skin is pierced from within outwards, and each stitch passing between the edges of the wound prevents them becoming everted.

Fig. 3. The twisted suture, with Dent's uniting bandage.

A, The twisted suture, applied chiefly to promote union after the operation for hare-lip, or other incised wounds of the lip.

B, Dent's uniting bandage; this bandage is composed of three pieces of tape about an inch in breadth, connected together by two sets of threads, intersecting each other in such a manner as to form the middle portion into a loop; the loop is slipped over the head, the threads drawn close upon the suture, allowing the ends of the pins to pass between them, and the ends of the bandage carried back to the nape of the neck, and tied. Four narrow tapes are frequently sewed to the bandage at the points where it crosses the cheeks, two of which are brought up and tied upon the crown, the others under the chin, to preserve it from slipping.

C. The silver pin employed in this suture, with a moveable steel point; this is detached as soon as the pin has passed through the lip.

The first pin must be introduced close to the

red margin of the lip, about a quarter of an inch from the edge of the wound on one side, and passing through two-thirds of the thickness of the lip, emerge at the same distance beyond the other margin. The second pin is passed higher up, taking the greatest care to bring the edges accurately together. A piece of waxed silk is then wound round them in the form of a double figure of 8, endeavouring to cover as much of the wound as possible. A dossil of lint should be inserted beneath each end of the pins as a support. Dent's uniting bandage, *B*, is next passed over the head, and, with the assistance of two compresses, the cheeks brought forward and fixed, to prevent any tension on the edges of the wound. The pins may be removed about the third or fourth day, continuing the bandage some days longer.

Sir A. Cooper prefers the interrupted suture and uniting bandage to the pins. M. Louis also advocates this mode of healing the wound after the operation for hare-lip. It is, however, manifestly less to be relied on than the twisted suture.

For short or superficial wounds, one pin is sufficient.

Troublesome fistulous openings may frequently be closed by means of this suture, first paring away the callous edges or lining.

Fig. 4. The quilled suture, used only in deeply incised wounds of the abdomen.

By the side of the figure, the suture is given in

an incomplete state, to explain the method of applying it. A curved needle, being threaded with the two loose ends of a doubled piece of silk, is introduced about half an inch from the edge of the wound on one side, carried nearly to the bottom of the wound, and brought out half an inch beyond the other edge. Into the loop thus left, a quill or portion of a bougie is inserted, and between the threads on the opposite side, a second; on tying the ends upon the latter, the sides of the wound will be drawn into apposition in their entire depth. The traction is effected by fewer stitches, is more uniform, and removed to a greater distance from the wound than in the interrupted suture.

Fig. 5. An apparatus for retaining the catheter in the bladder.

It consists of a wooden ring covered with list, to embrace the penis, secured to the pubis by four tapes passing up to a waistband, two before and two behind; two or three narrower tapes pass forwards to be attached to the end of the catheter. The French have invented a somewhat similar apparatus made of elastic gum, in order that the varying diameters of the penis may be accommodated. Weiss's bracelet for retaining the catheter is ingeniously contrived to answer the same purpose. But the simplest retentive bandage is the bag truss, with two or three tapes sewed to the opening for the penis, and tied to the end of the catheter.

For retaining the catheter in the female urethra, the T bandage will generally answer perfectly.

Fig. 6. The spica bandage for the axilla, used only as a confining bandage.

Plate VI.

Uniting bandages are applied to preserve in contact the edges of wounds in certain parts, by restraining motions tending to separate them; or to second the action of sutures and adhesive plaster in producing the same effect, by giving a general support to the neighbouring parts. Besides the several forms exclusively devoted to that purpose, the many-tailed and spiral bandages are frequently used as uniting bandages.

Fig. 1. The uniting bandage for transverse wounds of the neck and throat.

Two long bands, *A*, *B*, are thrown over the head so as to cross each other upon the crown, and hang down in front of the chest and behind the neck; to fix them securely, a circular bandage is passed round the head, and the posterior ends of each band turned over the folds of the bandage; the chin is then depressed till the head is brought to the position most favourable for keeping together the divided parts, when the anterior extremities of the bands are drawn tight, and encompassed by the turns of a double-headed roller round the chest.

By this bandage the separated portions of the

trachea, in deep wounds of the throat, may be maintained in apposition, when it is very difficult to succeed by other means.

The bandage reversed will keep the head back, to assist the union of transverse wounds of the muscular parts at the back of the neck, or to prevent the contraction following cicatrization of burns in front of the neck.

The circular bandage round the chest, *C*, in this figure, is the rib bandage mentioned in the description of Fig. 2. Pl. III. The method of crossing the two heads of the roller, by making a reverse with one of them, causes the bandage to lie smoothly on the skin; this manœuvre is called by the French *entrecroisement par renversé;* its application to the head is described Pl. II.

Fig. 2. The uniting bandage for longitudinal wounds (Pl. I. fig. 9) applied.

Compresses are first laid on either side of the wound to bring together its deeper walls, and the uniting bandage (fig. 9. Pl. I.) is applied in the following manner. The portion of roller between the tails and fissures is placed on that surface of the limb opposite the wound; the tails, *a a a*, are slipped through the fissures, *b b*, and drawn in a direction contrary to the course of the roller, pressing the compresses nearly together; the tails are then carefully laid down, the roller brought over them and the compresses, and carried round the limb to complete the bandage.

The bandage is made with one, two, or more

tails and fissures, according to the length of the wound. In many cases adhesive plaster and the spiral bandage will be equally effectual.

Fig. 4. A bandage of similar construction to Dent's uniting bandage for the lips (Pl. V. fig. 3), but on a larger scale for wounds of the limbs.

The loop is slipped over the limb, compresses applied, the two ends of the roller drawn in opposite directions, and the bandage completed in the same manner as the former.

Fig. 5. A form of uniting bandage described by French writers, for deep transverse wounds of the muscular parts of the limbs.

In its formation, two compresses, a long band divided at one end into two or three tails, a second in which corresponding fissures are cut, *E*, and two single-headed rollers, are necessary.

Supposing the case to be a deep wound across the front of the thigh, the bandage is commenced as follows; the limb being placed in the extended position to relax the wounded muscles, the undivided end of the band with tails is laid upon the front of the leg, and surrounded by a spiral bandage carried half way up the leg, turning its extremity over the folds of the bandage to fix it more surely. The band with fissures, *E*, is applied in the same manner upon the front surface of the thigh above the wound, using the half only of each roller; a compress is then placed on either side of the wound, the tails of the lower band passed through

the fissures in the upper, and the ends of the two bands drawn in opposite directions, and laid down respectively on the front of the leg and thigh, where they are finally secured by carrying on the two rollers till they meet, and the bandage completed.

The design of this bandage is to overcome the retraction of divided muscles, and accomplish their re-union with as little intermediate structure as possible; it is however complicated, and tedious in its application; and does not add a great deal to the effect of position, which must always be strictly attended to in these cases. Modifications of it are employed for ruptured extensor tendons, and fractures of the patella and olecranon, of which Sir A. Cooper's bandage is an example. (Pl. X. fig. 1.)

The lower part of this bandage, (fig. 5.) is the spiral bandage as applied to the leg.

It is begun by several turns of a single-headed roller round the foot; a figure of 8 is next described round the ancle and instep, and the roller continued spirally up the leg, each turn overlapping the upper third of that below it; as it mounts upon the calf, the spiral direction is increased, and a particular manœuvre practised to make it lie evenly; at every circumvolution on the bulk of the calf, the roller is gently turned back upon itself, its internal surface becoming external, and its superior border inferior; this is called a reverse (*renversé*) and is repeated until the bandage reaches

the thickest part of the calf; as it diminishes towards the knee, the reverses are made in the opposite direction. The same plan is always adopted under the like circumstances.

The chief difficulty in this bandage, is the application of the roller smoothly to the ancle and calf, to produce equable pressure on the whole of the limb; a narrow roller is adjusted more closely to the ancle than a broad one, and, whether broad or narrow this object is much facilitated by dipping the roller in water previously.

The spiral bandage fulfils a greater number of indications than any other; it is used as a confining, compressing, supporting, and frequently as a uniting bandage.

As a supporting bandage in forwarding the healing of chronic ulcers of the leg, it has acquired a high degree of importance within the last few years. The essays of Mr. Whately and Mr. Baynton, first brought it into general notice, and the plan followed by the latter gentleman is now universally adopted.

In addition to the support of the bandage, Mr. B. endeavoured to approximate the edges of the ulcer, by surrounding the leg with adhesive plaster; the middle of a strap about two inches broad is placed upon the surface of the limb opposite the ulcer, and the ends brought round so as to overlap each other; the ulcer and two or three inches of the skin above and below it should be covered

with the strapping; it is the practice of Mr. Scott to envelop the foot and the whole of the lower part of the leg with it; compresses of rag or calico are next carried half way round the limb, and over these the spiral roller applied. The whole should be well soaked with cold water, continuing its application if much inflammation be present. Patients under this plan of treatment may follow their usual occupations without interfering materially with the cure. The bandage ought to be put on soon after rising in the morning, before swelling has come on; unless the secretion of pus be copious, it may remain undisturbed for several days.

Mr. Scott's treatment of chronic diseases of the joints consists chiefly in the employment of brisk friction with camphorated spirit, the application of mercurial ointment with camphor next the skin, adhesive strapping, compresses, and the spiral bandage to produce a moderate degree of compression.

A very convenient apparatus, employed by Mr. Macartney of Dublin, for steaming diseased joints, is sold by Stodart; it is adapted to all the joints and is very easily managed.

Fig. 6. Shoolbred's elastic lacing stocking, an excellent supporting bandage for varicose veins of the lower extremities.

Knee caps, and lacing belts for other joints requiring support, are constructed of the same material.

Fig. 7. The multiplied T bandage, for confining dressings between the fingers and toes.

Plate VII.

Fig. 1. The sling with four heads as a supporting bandage in fractures of the lower jaw.

In the first place a pasteboard splint, *A*, is to be prepared, by dividing a strip of pasteboard at both ends nearly to the middle, and after soaking it in warm water, moulding it to the shape of the jaw. When dry enough to retain its form, it must be removed, and a piece of lint spread with cerat: saponis, and cut in the same manner as the splint, applied; the skin being liable to excoriation by contact with the pasteboard.

The splint is then re-adjusted, the middle of the sling placed upon the chin, and the two heads from the front of the jaw carried backwards to the occiput, where they cross, and afterwards encircle the head; the two heads from beneath the jaw ascend on either side to the crown, and may be secured there at once, or again pass under the jaw to give additional support; at the points of crossing over the temples, and on each side the jaw, a few stitches are required to retain the bandage in place.

If the teeth meet in such a manner as to close the jaws entirely, the insertion of flat pieces of cork between the molar teeth is advised, to allow a sufficient opening for the introduction of liquid food; without this precaution, it can only reach the stomach by a tube passed through the nostril.

In fractures of the condyles, the support should act directly upon the angles of the jaw.

Synon. { Capistrum
Fronde à quatre chefs.

The sling with four heads is also used as a confining bandage for poultices and dressings to the axilla, groin, hip, and ham.

Fig. 2. Brasdor's bandage for fractures of the clavicle, an improvement upon the figure of 8 bandage for the shoulders.

It is seen applied upon the figure.

Two well-padded straps pass from the sides of the back-plate under each axilla, and return over the shoulders to be buckled to the upper part of the plate. To the lower margin of this plate a belt is attached to surround the waist, and fix it in its proper situation. The back-plate is usually divided down the middle, and the two portions connected by a lace to enable it to fit persons of various sizes.

The action of Brasdor's bandage is merely to draw the shoulders backwards; with the addition of a sling it may support the fractured bone very well, but it is of little service alone.

Mr. Abernethy recommended a simpler form of this bandage, consisting of two padded rings for the shoulders, with a strap and buckle connecting them together across the back.

Fig. 3. Moore's compressor, invented for the purpose of applying pressure to the ischiatic nerve in sciatica. This instrument consists of a curved

band of iron,—one end of which is broad and flattened, the other formed into a ring for the reception of a screw, —and a long screw with a pad at its extremity. Its use as a tourniquet has been suggested to command the axillary artery just below the clavicle, in operations about the axilla. The pad at the end of the screw is placed over the artery, and the curved band passed across the shoulder, where its broad padded extremity acquires a firm hold ; the screw is then turned, until pulsation in the vessels of the arm is suspended. It acts in the same manner as Dahl's tourniquet, which differs from it only in the greater length of the curved band.

Fig. 4. The common tourniquet, usually called Petit's. It is composed of a strong band of webbing with a firm pad and buckle attached to one end of it, and a brass frame work forming a kind of bridge, elevated by a screw passing through it ; the band runs under the base of this frame and over two little rollers, one on each side the bridge. The pad is placed upon the artery, the band brought round the limb and buckled upon it, and by turning the screw on the opposite side of thelimb, the bridge is elevated, tightening the band to the degree requisite. The dotted line gives the ordinary situation for applying the tourniquet to the thigh.

Fig. 5. The dressings applied to a stump after amputation.

1st, The edges of the wound being brought together, two broad straps of adhesive plaster cross

the middle of the stump, leaving an interval of about half an inch.

2nd, A narrow strap to keep the edges in contact at each corner; over the lower strap the ligatures may be collected and laid down.

3rd, A portion of simple dressing is applied along the face of the stump, including the corners, and cut to fit it as closely as possible.

4th, A single broad band of roller crosses the line of the stump from the outside to the inside of the thigh.

5th, Two-thirds of a long roller having been passed round the pelvis as a spica bandage, before the commencement of the operation, the remainder is now to be continued half way down the stump, encircling the limb with moderate firmness, but not tightly, and secured by a pin. Over its termination another shorter roller is to be applied and brought down to the wound. The object of these rollers, besides confining the dressings, is to check spasmodic retraction of the muscles. Should swelling supervene, it may be necessary to snip the lowest turns of the roller and leave them divided.

By using a second short roller, the renewal of the dressings may be conducted without interfering with the support given by the upper roller to the stump.

Plate VIII.

Handkerchiefs, or large pieces of linen undi-

vided (called by the French *bandages pleins*), are employed as slings for the arms, and are also made use of by French surgeons as confining bandages to the head.

The quadrangular bandage for the head, (*grand couvre-chef*) is made by throwing a handkerchief over the head, furling up the front border to the forehead, and carrying the corners which hang down in front backwards, to tie behind the occiput, while the posterior corners are brought forward and tied under the chin, forming a kind of night-cap.

Fig. 1. The triangular bandage for the head, (*couvre-chef en triangle*) is the cap frequently worn by the French women. It is simply a handkerchief doubled cornerwise, folded round the head in its long direction, and tied, the corners falling lightly over the crown. Both forms are rather apt to heat the head, and are inferior to the sling with six heads. (Pl. I. fig. 7.)

Fractures of the clavicle.

These cases were formerly managed by applying a double spica bandage to draw back the shoulders, upon which practice Brasdor's bandage is an improvement. This alone is not sufficient; the indications which every form of bandage should fulfil are three; to elevate the shoulder of the injured side, carry it out from the body, and throw it back, to produce extension of the clavicle and bring its overlapping ends in contact.

These were the views advanced by Dessault, and upon these principles his bandage is con-

structed. Two single-headed rollers nine yards in length, and a wedge-shaped pad for the axilla, are required in its formation. The pad is placed in the arm-pit, and secured by two ribbands attached to it, which are tied over the opposite shoulder; the elbow is brought forward, lifted upward and pressed inward against the chest, thus making the humerus act as a lever upon the pad in the axilla, to extend the fractured clavicle; being supported in this position, with the elbow bent, one of the rollers is carried round the chest and upper arm, drawing it more tightly as it approaches the elbow; a compress dipped in camphorated spirit is next laid upon the fractured bone, and the second roller taken up; commencing in the opposite axilla, it is carried across the breast, over the compress and shoulder, and passing down behind the arm and under the elbow again mounts upon the breast; its course is then continued under the sound shoulder, round which it takes a turn, across the back, a second time over the compress and fractured clavicle, and down in front of the arm to the elbow, whence it ascends obliquely across the back to the axilla, where it commenced, and the same course is repeated till the roller terminates. The turns are secured by pins or stitches, and the hand supported by a sling. It is, however, very difficult to keep the folds in place, and many attempts have been made to provide a bandage upon the same principle, more compact in its structure, and less complex in its application. Boyer in

France, and Mr. Earle in this country, have contrived exceedingly ingenious forms of apparatus with this view. Mr. Earle's bandage fulfils all the above-mentioned indications most effectively; one objection, however, attaches to it; the cap upon which the sling depends, and by which the injured member is supported, in one form of the bandage, rests upon the opposite shoulder joint, and, throwing all the weight of the other limb upon it, presses on the joint painfully and impedes its motion. To remedy this, the cap, in another form of the bandage, has been altered in shape and shifted to the top of the shoulder; a short sleeve is attached to it and drawn over the arm to prevent the pad slipping higher, and compressing the muscles of the neck, which, however, it does not successfully accomplish; and whilst endeavouring to overcome this difficulty, the idea of the following bandage occurred to me; in its present form it has been tried in two cases only, in both of which it succeeded.

Fig. 2. A bandage for fracture of the clavicle, consisting of the pad for the axilla, *A*, suspended by a cap to cross the shoulder; a long band of webbing, *C D E F*, to support the arm and confine it to the body, the two ends of which are buckled in front and behind to a circlet, *B*, slipped over the opposite arm, and resting chiefly on the scapula. The circlet, *B*, and the shoulder cap are connected behind by a strap, *A*, which crosses be-

tween them, and is buckled to the posterior part of the cap, to draw back the shoulders if necessary. This bandage is adapted to fractures of either clavicle, by simply reversing the band of webbing, and transferring the cross-strap, *a*, to the opposite sides of the shoulder cap and circlet, for which change a second buckle and button are added, as seen in front of them. The band is divided down the middle and reunited by a lace at the back, to accommodate persons of different sizes.

Fig. 3. The bandage applied.

The pad is first placed in the axilla of the injured side, and fastened to the cap by tapes, the circlet is slipped over the opposite arm to the shoulder; next, passing the hand through the aperture, *D*, the extremity, *C*, of the band of webbing is buckled to the back part of the circlet, the elbow adjusted to the inner fissure, and the band drawn tightly round the waist; the elbow is then lodged in the second fissure and the elevation of the shoulder effected by buckling the termination of the band, *F*, to the front of the circlet. Lastly, the transverse strap, *a*, is tightened to the degree necessary to throw the shoulder back moderately.

The weight of the injured member rests, in a great measure, upon the opposite scapula, and as the circlet is well padded, produces scarcely any inconvenience; from the action of the bandage in the cases to which it has been already used it appears competent to apply an extension fully

sufficient to restore the line of a fractured clavicle, and maintain it reduced with as little constraint upon the patient as possible.

Fig. 4. Mr. John Bell's improved sling for the arm: the fore-arm rests in a hollow pasteboard splint, covered with leather; and is supported by two leather straps, connected to a softly padded leather circlet slipped over the opposite arm to the shoulder; the strap by which the hand is suspended passes through a ring attached to the lower part of the circlet; that arising from the posterior extremity of the splint crosses behind the back to the opposite shoulder, passes through the ring at the top of the circlet, and returns to be secured to the buckle.

Plate IX.

Handkerchiefs are much more serviceable in forming slings for supporting the upper extremity, than coverings for the head.

The sling may be applied in two ways; first, the ordinary method, in which the doubled edge of a handkerchief folded corner-wise is passed under the hand, the two long ends brought up in front of the chest, and tied behind the neck, and the corners drawn over the elbow and pinned; In the second form the handkerchief is reversed: the corners support the hand, and the doubled

edge envelops the elbow, whence the posterior long extremity is carried up behind the back to meet the anterior ascending in front, and be tied over the opposite shoulder. This is by no means a needless distinction; the action of the first is to support the head and fore-arm; that of the second to elevate the elbow and shoulder, which is seen most effectually accomplished in the following bandage.

Fig. 1. The handkerchief clavicle bandage, in the construction of which, a pad for the axilla and two handkerchiefs are required; the cushion being placed in the axilla, the arm is suspended in the second form of sling described above, a soft pad being interposed where it crosses the opposite shoulder; the fore-arm and elbow are further included in another doubled handkerchief, the ends of which are carried round the waist to confine the elbow closely to the side. If the outer handkerchief be well attached to the sling by pins or stitches, the bandage may remain undisturbed until the fracture is consolidated, merely tightening the sling and waist-band occasionally A great disadvantage of this bandage is the pressure of the sling upon the side of the neck, frequently to such an extent as to produce excoriation.

The bandage delineated Plate VIII. fig. 2. and this substitute for it, may be used in fractures of the neck of the scapula, and of the acromion, omitting the pad for the axilla in the latter case;

also for dislocations of the clavicle. In that very troublesome accident, displacement of the acromial end of the clavicle, an additional broad band is necessary, passing under the elbow and over the shoulder of the injured side, and tied or buckled tight enough to preclude the possibility of motion between the end of the clavicle and the acromion; where it crosses the shoulder, in using it with the handkerchief bandage, a soft cushion must be placed beneath it.

Fig. 2. The triangular inguinal bandage (Plate I. fig. 4.) applied. The roller is carried round the waist, and the descending band passes between the thighs to be tied or pinned to it behind, drawing the triangular portion of the bandage closely over the groin to confine poultices and dressings to that region.

Plate X.

Fracture of the olecranon,

In this accident, the fractured process, if quite detached from the ulna, is drawn upwards by the strong action of the triceps muscle, leaving occasionally a considerable interval at the elbow. The first point therefore, in the treatment, is to relax the extensor muscle as much as possible by position, in order to bring down the fractured portion to its natural situation, the posterior semilunar or sigmoid cavity of the humerus, in which

it may be fixed very steadily. To maintain the fractured surfaces in apposition, one of the following plans must be adopted.

1st. Keeping the arm fully extended, a narrow compress is placed on either side of the olecranon and confined by two strips of adhesive plaster, crossing each other just above the process; two pieces of soaked pasteboard about 12 inches in length and three in breadth are next moulded to the arm in front and behind the elbow, at that time flexed slightly, (namely, to an angle of 160°). These are bound to the arm by a spiral bandage and left till dry; the arm in the mean time resting quietly in this position on a pillow. They are then removed, lined with leather, and re-applied, with a spiral bandage from the hand nearly to the shoulder. In about three weeks or a month gentle passive motion of the joint may be commenced.

The second method is that employed by Sir A. Cooper, seen at Fig. 1., a modification of the uniting bandage for transverse wounds, by which the arm is preserved throughout in the straight position.

The arm being completely extended, a band or tape ten or twelve inches in length is placed on either side of the olecranon, and secured to the arm by several turns of a roller above and below the elbow; the ends are then brought together and tied, thus maintaining the fractured surfaces in apposition; over them a roller is applied, from the hand to the axilla, and a

splint bound upon the front surface of the arm to keep up a continued extension. The third bandage is that of Mr. Amesbury, which acts in the same manner as the last, and is put on more readily.

Fig. 2. Mr. Amesbury's bandage for fracture of the olecranon.

A bandage differing very little from this is seen applied for fracture of the patella, (Fig. 3.) and will assist in illustrating those parts of Fig. 2. which are out of view.

It is composed of two square pieces of leather well padded on the inner surface; to the outside of which are attached three straps and buckles, long enough to surround the arm; the pads are connected by two short straps passing from one to the other. A splint and pad are first placed upon the front of the arm, and the pads, *A B*, applied, one above, the other below the elbow, and secured by bringing the straps round the arm and splint, and buckling them firmly; the short straps, one of which is seen at *C*, are now passed through their respective buckles, and drawn tightly, approximating the opposite edges of the pads, and at the same time keeping the fractured process in its natural situation.

Fractures of the patella resemble those of the olecranon and are managed in a similar manner. The limb is placed in the extended position to relax those muscles which act upon the upper portion of the patella, and one of the bandages

described below adopted to oppose retraction more actively. Sir A. Cooper's bandage is simply a broad strap buckled round the thigh just above the knee, and a long strap descending from this belt on the inner side of the leg, passing under the sole of the foot, and brought up to be buckled on the outside of the thigh belt; the foot and leg as high as the knee should first be surrounded by a spiral bandage, and the limb afterwards fixed in the extended position upon a long splint reaching from the middle of the posterior surface of the thigh to a point a little below the calf.

Fig. 3. Mr. Amesbury's bandage for fracture of thepatella, consisting, like that for the olecranon, of two pads, *D*, *E*, buckled tightly to the front of the limb above and below the knee, and two short straps connecting them together; with the addition of a long strap passing from the upper pad down the outside of the leg, under the sole of the foot, and up again to meet a buckle sewed to the inside of the lower border of the same pad.

The limb is maintained in the extended position, by fixing it upon a straight splint, *F*, the upper part of which is secured by the long strap of the two pads, *D*, *E*, the lower by a band or handkerchief carried round the ancle.

Fig. 4. The bandage for rupture of the tendo achillis. In the management of ruptured tendons, the chief point to be attended to, is the

maintenance of the tendon in that position which is most favourable to union; in the present case the separated portions are readily brought into apposition by complete extension of the foot with slight flexion of the knee; the difficulty is to preserve them in contact.

A broad band of leather or webbing, *G*, is buckled or laced round the upper part of the calf, a soft compress is placed on either side the tendon, and confined by the turns of a spiral roller ascending from the foot to the knee; a sock or slipper, *H*, having a strap attached to the heel, is next put on the foot; this strap is brought up to the back part of the belt round the calf and buckled, extending the foot as it is drawn tight, at the same time compressing the muscles of the calf, and checking any retraction of the upper portion of the tendon. A high-heeled shoe can be worn over the sock, and the foot may rest upon a low stool with the knee a little bent.

I, the slipper with a long strap affixed to the heel part of it.

A very fair substitute for this bandage may be made with a band about three feet in length, and two single headed rollers; one end of the band is applied along the sole and fixed by several turns of one of the rollers round the foot; the foot is then completely extended and the other end of the band laid down upon the upper part of the calf and secured there by the second roller; the

compreses are placed on each side of the tendon, as in the former bandage, and the first roller carried over them and continued spirally up the leg. A few stitches between the band and rollers are necessary to connect them more intimately.

In all accidents of this kind the patient should commence motion of the ancle very cautiously, and even after 5 or 6 weeks walk with a high-heeled shoe.

Fig. 5. The French crutch, a much lighter form than the common crutch, yet furnishing a steadier support.

The spring crutch is another improvement on the ordinary form; a spiral spring is enclosed in a kind of barrell near the top of the crutch, and the padded handle, resting upon it, yields a little under the weight of the body.

II. APPARATUS FOR FRACTURES OF THE LIMBS.

Plate XI.

Pillows and pads for lining splints and fracture boxes.

Before the description of the several kinds of pads is entered upon, a few words on the arrangement of the bed are necessary. Patients with fractures of the lower extremity should be placed upon a mattress, a feather bed being much too soft; some surgeons introduce a board beneath the mattress to render it still more unyielding; for unless the surface upon which the patient rests be quite firm, the pelvis is sure to sink, and the fractured bone become displaced. The bedstead should also be as narrow as possible to allow free access to the limb on either side.

The best stuffing for pads is curled horse-hair, the cotton wool used by dressmakers, tow pulled out and disposed evenly in layers, or oat chaff; layers of flannel, wool, or dry bran are occasionally used.

The pad should be sufficiently thick to ensure protection from inconvenient pressure by the edges of the splint, but soft enough to mould itself readily to the shape of the limb. At the points which will correspond to the prominences of joints, as the internal condyle of the humerus, or malleoli, it is better to knead the pad a little preparatory to applying it. Those intended for the inside of the arm or thigh should be long enough to turn over the end of the splint, and thus defend the axilla, bend of the arm, or perineum.

Fig. 1. The form of pad for the humerus, forearm, and thigh, varying in size according to circumstances.

Fig. 2. The pad for the hand-splint, (Plate XII. fig. 2.)

Fig. 3. The form of pad for the leg-splint; the foot-piece of the outer pad should be longer than that of the inner.

A stocking half filled with chaff or bran might be used as a substitute in a case of emergency.

Fig. 4. The pillow for Assalini's fracture box, (Plate XIII. Fig. 2.) It is made broad enough to enclose two-thirds of the circumference of the leg. Three narrower pillows are employed for the floor and sides of the old fracture box, (Plate XIII fig. 1.) and a fourth covers the foot-board.

Fig. 5. A pad inflated with air, constructed o the same material as Macintosh's elastic pil

lows &c. It is inflated to the degree required after its application, by means of the tube at one end, which is closed by a screw. It has been adapted to surgical purposes by Mr. Benson, and will no doubt prove serviceable in many cases besides fractures, where a soft, equably distended cushion is desired.

Fig. 6. The wedge-shaped pad for the axilla, forming part of the bandage of Dessault for fracture of the clavicle (Vid. description of PlateVIII.)

Fig. 7. The many-tailed bandage applied to the leg. When the limb rests upon its side in the semiflex position, the cross-bands for the foot may be dispensed with, and the termination of the longitudinal band brought from beneath the outer ancle across the sole of the foot, and surrounded by the turns of the lowest cross-bands.

In compound fractures, Scultetus's is a more convenient form of this bandage; it differs from it merely in the circumstance that the cross-bands are not sewed to the longitudinal band; any one of them can therefore be withdrawn if soiled, and replaced without disturbing the limb, by stitching a fresh band to the end of the former and drawing it under as that is removed. The cross-bands may be spread with soap cerate if more support is thought advisable.

Fig. 8. The method of treating fracture of the lower part of the fibula pursued by M. Dupuytren.

A thick pad doubled is placed along the inside of the tibia from the knee to within two inches of the ancle ; a straight splint long enough to project several inches beyond the sole of the foot is laid upon it and bound firmly to the upper part of the leg by a circular bandage; the inner edge of the foot is then braced to the splint by a figure of eight bandage, and eversion of the foot effectually prevented.

Plate XII.

Splints of various kinds.

Splints are employed to maintain a broken bone in its proper direction, and prevent motion between the fractured ends. To effect this they should always be somewhat longer than the fractured bone, so as to command its entire length without compressing the neighbourhood of the fracture.

They are composed of wood or iron, hollowed out to receive part of the surface of the limb; or of pasteboard softened by moisture, moulded to the shape of the limb, and afterwards covered with leather; The latter are particularly suited to fractures occurring in children. Instead of a solid piece of wood hollowed, they sometimes consist of a thin slip of deal, upon one side of

which leather is glued: and the substance of the wood afterwards divided longitudinally into three or four portions, connected to each other by the leather alone; they yield a little to the shape of the limb, and afford a very good support, but are on the whole inferior to the solid splint; one of them is seen in application, at fig. 2. Plate X. The splints made use of by French surgeons, (vide Plate XI. fig. 8.) are simply narrow slips of board, neither hollowed nor shaped in any way to correspond to the inequalities of the limbs; but as they are applied on the outside of a thick coating of bandages they give sufficient support. A very simple splint is used at the Middlesex hospital, consisting merely of a layer of straw enclosed in a wrapper of linen; the limb is placed upon the middle of a square piece of linen or a towel, and a layer of unbroken straw folded up in its opposite borders till each bundle is brought up tightly on either side the limb; the pads are then introduced, and the whole secured by broad tapes tied round the outside. This might frequently prove a valuable resource in the absence of other apparatus.

Fig. 1. The form of splint for the humerus, fore-arm, and thigh, differing in length and breadth according to the size of the part requiring them. To fractures of the humerus three splints are necessary, for the front, back, and outside of the arm; a thick pad, reaching from the axilla to the

inner condyle, being placed along the inside; a fourth splint is sometimes added. The arm is first encircled by a spiral bandage, over which the pads and splints are applied, and the turns of the roller are then brought down from the shoulder to the elbow on the outside of them. The fore-arm is suspended in a sling.

Fig. 2. The hand-splint for fractures of the metacarpal bones and fingers. The fingers are brought together, the palm of the hand placed upon the pad for this splint, and the whole surrounded by a spiral bandage. This splint applied to the palmar surface of the fore-arm, with the common form on the outside, answers much better than two of the latter, in fractures of the bones of the fore-arm; the palm cannot take any other direction than that facing the chest.

To fractures of the shaft of either radius or ulnar, no circular bandage ought to be used, as it may press the fractured bone out of its natural line and produce deformity. To guard against this occurrence, the French have recourse to the graduated pad, (Plate VI. fig. 4. *D*,) which is placed in the interosseous space to keep the bones apart.

In fractures of the lower end of the radius too, this splint is often extremely serviceable; the hand being fixed to it with the fingers pointing a little downwards, to extend the separated portion and preserve the fractured surfaces in contact.

M. Dupuytren manages these troublesome

cases in a manner very similar to that employed by him in fractures of the fibula (Plate XI. fig. 8.) A narrow metallic splint hollowed to receive the ulna, and bent within three inches of its extremity to a considerable angle, is lined with a pad and placed along the ulnar edge of the arm and hand, which are secured to it by a spiral roller; the hand is thus fixed in a position with the fingers directed downwards, and extension of the broken extremity of the radius steadily kept up. The hand-splint may be associated with this contrivance, and the fore-arm supported in a sling.

For securing splints to the upper extremity, straps of adhesive plaster are more to be relied on than any number of tapes; they are seen encircling the hand-splint, before the roller is applied.

Fig. 3. A double splint connected by a hinge, *a*, for fractures implicating the elbow joint; *b*, the external view of the hinge, which can be fixed at any angle required, by means of the thumb-screw.

It is applied, with a couple of pads, along the outside of the humerus and fore-arm, the elbow being bent; and two separate splints run along the inside of the arm. By loosening the screw on the outside, passive motion may be resorted to at any time without deranging the rest of the apparatus,

The hinge splint is capable of effecting the

extension of contracted joints, acting gradually and with considerable power; and of opposing contraction produced during the cicatrization of burns, for which purpose it was suggested by Mr. Earle.

After the operation for resection of a joint also, its employment would no doubt be attended with great advantage.

Fig. 4. The external splint for the leg, with leather straps attached to it, which pass round the leg to be fixed upon the studs of the inner splint (Vid. fig. 5.) The opening for the malleolus ought to be lower and backwarder in the outer than the inner splint.

Fig. 5. The splints applied to the leg; the straps are seen coming round from the outer splint, and fastened to the studs of the inner.

The usual cross-strap beneath the sole is scarcely sufficient; a second is required across the instep to prevent the foot slipping in that direction.

The toes should be slightly raised by a small cushion inserted beneath them.

Fig. 6. An interrupted splint, occasionally made use of in compound fractures of the leg, or cases of simple fracture attended by much contusion of the soft parts, when it is desirable to place the patient on the side. The knee and ancle are steadily fixed by it, and the proper line of the bone preserved, while the tumefied soft parts are

uncompressed, and open to the application of lotions, &c. The pad consists of two portions to match the splint.

It can be lengthened or contracted at will by altering the situation of the thumb-screw; for which purpose both bars are perforated with corresponding holes.

The same construction is adapted to splints for the arm and thigh.

Plate XIII.

In the treatment of severe compound fractures of the legs, or simple fractures accompanied by laceration and contusion, where much swelling is apprehended, splints cannot well be employed. In these cases a fracture box is the best form of apparatus, as it affords a support equal to that of splints, whilst the pressure is more easily regulated.

Fig. 1. The old hospital fracture box.

The sides and foot-board move upon hinges connecting them to its floor; three soft pillows cover its inner surface, and a pad is adapted to the foot-board; a sheet of oilskin is thrown over them to prevent moisture penetrating. The leg is gently deposited upon the middle pillow, and the sides raised and made fast by a cross strap and buckle. A short roller is then passed round the ancle and instep, the end brought through the fissures in the foot-board, and tied; by this means

a moderate extension may be kept up. The upper surface of the limb is sufficiently exposed to admit of the application and renewal of cold as long as necessary. Farther extension can afterwards be made by drawing the whole box downwards a little, and tightening the cross strap; its weight alone will keep it in place. If the surgeon wish to give the limb a semiflex position, nothing more is required than the insertion of a pillow beneath the upper end of the box on which the ham rests. This box is certainly cumbersome and in some respects inconvenient, but no contrivance supports a fractured leg more securely; and it is so simple, that any carpenter could knock one together when required.

Fig. 2. A modification of Assalini's fracture box.

The sides, from two inches below the knee to an inch above the ancle, open upon hinges, and are closed by long straps crossing obliquely, held by studs on either side; the foot-board is moveable, by means of an iron pin and the holes seen in the sides of the box, to be accommodated to limbs of various lengths; and the heel rests upon a band filling up an opening made for that purpose in the floor of the box; the floor is also hollowed out to receive the calf. Besides being lighter and more manageable than the former, this fracture box allows a full exposure of the limb at the situation of the injury, wit out endangering any displacement of the fractured ends. The knee and

foot may also be steadily fixed from the commencement, while the part at which swelling is likely to arise is exempt from pressure.

A cross board, *A*, should be nailed to its inferior extremity to give this apparatus greater stability.

Mr. Neville's flexible metallic splints, (Vid. Medical Gazette, Feb. 26th, 1831), forming, when put together, a fracture box, have been lately tried with success at St. Bartholowmew's Hospital. The apparatus wants steadiness, and is apt to roll whenever the patient moves; this would be remedied by a cross board similar to that represented at Fig. 2. *A*.

In compound fractures of *both* legs no contrivance equals the raised plane of Mr. Earle's bed (Fig. 1. Plate XIV.)

The management of fractures of the thigh, for which a great variety of apparatus has been devised, stills remains for consideration.

Three different plans of treatment have been followed in these cases: continued extension in the straight position, the method of Dessault; the semiflex position of the limb, the patient being placed upon his side, recommended by Mr. Pott; and the combination of extension with the semiflex position, the patient lying on his back with the limb resting upon a double inclined plane, advocated by Mr. Charles Bell, Mr. White, Sir A. Cooper, and Mr. Earle, now very generally adopted by English surgeons.

Fig. 3. Dessault's splint, with the addition of Boyer's screw and foot support.

The whole limb being enveloped by a tailed bandage, and a pad placed on its outer side, a belt is buckled round the upper part of the thigh; into a small pouch on the outside of this belt the end of the splint is introduced. The foot is attached by a kind of gaiter to the foot-support, which slides in a groove at the lower end of the splint and is fixed by thumbscrew; by turning the handle of the long screw the foot is drawn down, as the other end of the splint is pushed up, and the limb extended.

Splints are now placed on the front and inner surfaces of the thigh, and the limb preserved in this state of extension by broad tapes tied round the whole.

A straight splint of simpler form is met with at surgeons' instrument makers; it is long enough to reach from the hip to the foot, the upper end is forked, and the lower provided with a foot-piece; the fork is fixed against a thigh-belt, and the foot, extended till it reaches the foot-piece in which it is received.

The principle of treatment by these contrivances is simply permanent extension by mechanical force; and the following objections are urged against them.

Besides the irksomeness of so constrained posture, by bracing the limb to a straight splint

there is some danger of forcing the shaft of the femur out of its proper line; and in fractures of the upper part of the thigh-bone the constant tendency of the flexor muscles to draw forward the pelvic portion will be assisted by the action of the thigh belt, and deformity almost certainly result; the inconvenience also arising from the pressure of this belt upon the vessels of the groin is not inconsiderable; and lastly, the removal of the fæces &c. is a continual source of disturbance. The straight splint is nevertheless still employed by many surgeons.

In fractures of the lower part of the femur extending into the knee-joint the straight position is better than the semiflex, as the head of the tibia offers a broad surface upon which the condyles may rest in their natural situation.

The apparatus of Hagedorn for fractures of the neck of the femur, (of which a sketch is given in Mr. S. Cooper's First Lines of Surgery,) consists of the straight splint, with the addition of a square moveable foot board large enough to allow the attachment of both feet; and thus the line and dimensions of the injured limb may be compared and regulated by that of the sound one placed under the same circumstances.

Two other varieties of apparatus for extension must not be passed over; those of Mr. Gibson and Nicolai. In both of them two splints are made use of, long enough to reach from the ax-

illa to a point several inches below the soles of the feet, connected by a foot-board similar to that of Hagedorn, to which both feet are fastened. In Mr. Gibson's, each splint is a single straight piece of wood passing through the foot-board, which slides upon it and is fixed at the length required by pegs. The machine of Nicolai is more complex, the splints being formed of two portions jointed at the hip to allow some little change of position.

The principle of Mr. Pott's method consisted in placing the limb in such a position that the more powerful muscles would be relaxed. This he attempted to effect by turning the patient on his side, and bending the thigh upon the pelvis and the knee upon the thigh: supporting the fractured bone by splints, as in the upper extremity. It was soon found, however, that although a partial relaxation of the muscles of the thigh was easily accomplished, the effects of their action could not be entirely overcome without some counteracting extension. The patients too, not being actually confined, were apt to turn over upon the back while the leg remained on its outside. To remedy these disadvantages, Mr. Charles Bell contrived a machine called the double inclined plane, which has since undergone various improvements.

Fig. 4. The double-inclined plane for fractures of the thigh.

The frame is composed of two boards about

ten inches in breadth, — one reaching from the tuberosity of the ischium to the ham, the other from the ham to the heel, — united by hinges at an angle beneath the knee joint, so as to form a double inclined plane supported at its extremities upon a frame extending horizontally between them; the first board or ascending plane is connected by hinges to the upper end of the frame; the under surface of the second or descending plane is furnished with a prop, connected to it by a hinge, and resting in the racks which cross the lower end of the horizontal frame; by altering the position of this prop a greater or less elevation is given to the knee. The foot-board slides along a groove in the descending plane, and is fixed by a thumb-screw. A short thigh-splint, *B*, has been added, which slides in a similar manner upon the ascending plane to lengthen it if necessary, and is also fixed by a thumb-screw. And lastly the box is provided with side splints and cross straps, both for the thigh and leg. A single pad covers its floor from one extremity to the other, and distinct pads line the splints.

The patient lies upon his back with the limb reclining in an easy bent position, and slight extension is kept up by securing the foot to the foot-board.

The double inclined splint of Mr. Amesbury for fracture of the thigh, is very similar to this

box; it consists of two portions of wood, or splints, united by a joint; the under surfaces of which are connected and supported by a horizontal bar of iron, running in a groove along the under surface of that upon which the thigh rests, and fixed, when the splints are bent to the angle required, by a thumb-screw; the limb is enclosed in a case of leather, and thigh and leg splints applied.

These two forms of apparatus, constructed merely with reference to the injured limb, are imperfect in several respects; they are too narrow and light, and do not support the limb with sufficient steadiness; the advantage, also, of comparing the line of the fractured thigh with that of the sound one, is lost; as the latter rests upon the bed perfectly unconfined, a liberty by which the balance of the apparatus is frequently endangered. Several other machines have been contrived upon this principle, but none of them carry the idea into effect so fully as Mr. Earle's bed.

Plate XIV.

Fig. 1. Mr. Earle's bed for fractures &c.

This invalid bed consists of a strong frame rabbeted to receive a moveable frame of the same length, but about three inches narrower; the

moveable frame is divided into three parts, connected by joints; the superior portion is intended to support the head, and trunk; the middle is adapted to the thighs, and is constructed with a telescopic slide on each side, worked by a long screw and cog-wheels, by which it is capable of being lengthened and shortened to the extent of several inches after the patient is placed upon it; the inferior division is intended to receive the legs. The upper and middle divisions are connected by two sets of hinges, with a short plane surface intervening, upon which the pelvis rests with steadiness. Different degrees of elevation may be given to the several divisions, by raising or lowering the props.

A well stuffed hair or wool mattress is fitted to the inner frame, and nailed to its upper division, but left free below to enable the apparatus to be regulated to limbs of different lengths. The central division has a narrow trap-door, which can be let down for the admission of the proper utensil, *A*, to receive the fæces and urine. The opening is made narrow to prevent the pelvis sinking into it; the mattress at this part has a corresponding vacancy, which is filled up, except when the patient is using the tin, by a pad, *B*, fitted to the opening. A similar trap-door is made in the superior division for the convenience of dressing issues in cases of disease of the vertebra. The foot-boards are supported by an iron rod passing

through them, which rests on two upright pieces of wood fixed to the sides of the inferior division by thumb-screws, and moving up or down along the range of holes in the side of the frame. These foot-boards answer the purpose of steadying the feet, and maintaining the proper length of the limb, at the same time that they sustain the weight of the bed-clothes, and take off pressure from the heels; the feet may be attached to them by a kind of lacing boot, or a roller carried round the ancle and instep.

A swing desk and side tables are occasionally added; the latter can be raised to different elevations, and will be found a valuable addition in cases complicated by injury to the upper extremity.

The bed is prepared by straining a blanket and sheet separately over the mattrass, and carefully sewing them all round its edges, to prevent any subsequent wrinkling; in fitting them to the apertures it is better to make a cross cut thus, ×, and sew down the loose corners. In compound fractures of the thigh or leg where there is a probability of profuse discharge, a piece of oilskin or a draw sheet should be introduced beneath the part affected.

For fractures of the neck and shaft of the femur, the bed is raised to the double-inclined plane, the feet secured, and three or four splints applied as represented in fig. 2. Extension is thus

combined with the semiflex position in a most complete manner; the limbs lie parallel to each other, allowing the advantage of comparing and adjusting the line of the fractured thigh by that of the sound one; and, by the contrivance for carrying off the motions, the patient is preserved in a perfect state of quietude.

In fractures of the femur just below the trochanters, the two planes must be elevated to a more acute angle, by altering the situation of the central prop from the oblique to the perpendicular direction; and the upper portion of the bed so raised as to place the patient in a half-sitting posture. Fractures of the pelvis, and simple or compound fractures of both legs require the lowest division of the bed to be raised to the horizontal plane as seen in the plate. The pelvis may be supported by a rib-bandage, (Plate. III. fig. 2.) buckled round it; and in the latter case, the legs are secured in splints or fracture boxes as upon an ordinary bed.

In active disease of the spine and hip joint, and, in short, all cases in which absolute rest is necessary, it has long been found eminently serviceable.

Besides the improvement in the mode of producing extension, Mr. Earle has lately rendered his bed capable of a wider range of utility, by adapting it to the circumstances of the Army and Navy. The legs being omitted, it may be slung in a car for the field, and employed in the same

manner as Baron Larrey's *ambulances volantes ;* in the naval service it may be admitted among the sick-cots.

In the bed for fractures employed by Mr. Amesbury, instead of being merely attached to a foot-board, the foot of the fractured limb rests in a box, which is moveable upon the lower division of the frame.

This bed does not possess the same commodious means of extension as that of Mr. Earle, and in the amount of its general utility is certainly inferior.

An exceedingly ingenious invalid bed has been invented by Mr. Jerrad of Honiton, a drawing and detailed account of which will be met with in the Lancet for July 19th, 1828.

It is suited to a great variety of purposes; but a main obstacle to its becoming extensively useful is, that although considerably more expensive, in no point is it practically superior to Mr. Earle's bed.

Fig. 2. and 3. present different views of a box occasionally used by Mr. Earle as a substitute for his bed; its construction is better seen, fig 3. The upper surface somewhat resembles the lower and middle divisions of the bed; it consists of two portions united by hinges, which arrangement allows the lower half to be raised and supported at the necessary elevation, by two props connected to its under surface by hinges, and

resting upon a double rack formed in the floor of the box; in the ascending plane is an aperture through which the motions are passed, a bed-pan being easily admitted by the opening in the side of the box; the foot-boards are fixed by a couple of iron legs, inserted into one or other of the pairs of holes seen in the lower division, and held fast beneath by thumb-screws.

This machine is covered by a soft pillow stuffed with tow or wool, in which an opening is left in conformity to that of the box; it is placed upon an ordinary bed, made with a firm mattrass instead of a feather bed, and a draw-sheet slipped beneath it.

In fig. 2. the box forms a double inclined plane, upon which a fracture of the thigh is put up, as follows; gentle extension having been made, the thigh is enclosed in three (or four) splints well padded; the external splint differs from the others; it is longer, and near its upper extremity has an oval aperture to correspond with the prominence of the trochanter; a small loop also is attached to this part of the splint. They are secured by two straps of webbing buckled firmly romnd them; and a third long belt of the same material, terminated at one end by a buckle, at the other by a leather strap; the webbing encircles the body, and the leather strap is carried through the loop on the outer splint, and brought round the upper ends of all the

splints, after the manner of the spica bandage, to meet the buckle over the trochanter.

Should a farther extension appear necessary, it is easily effected, by introducing one or more pads beneath the upper part of the calf; the foot-board may now be adjusted, lined with a pad, and the foot confined to it by a figure of 8 bandage.

Mr. Earle employs this box chiefly in fractures of the thigh, and acute disease of the hip-joint, occurring in children. As it possesses the advantages of great facility of construction and portability, at much less expence than the bed, although unsuited to large heavy subjects, its use might be extended to many cases occurring in adults.

III. APPARATUS FOR REDUCING DISLOCATIONS.

Plate XV.

In the reduction of dislocations, the chief difficulty arises from the contraction of the strained and excited muscles surrounding an injured joint; and this opposition is the greater, in proportion to the length of time which has elapsed since the accident. An attempt to overcome this opposition by a high degree of extending force applied at once, will tend to rouse the contractile power of the muscles to greater resistance, and rather increase the difficulty. We must therefore endeavour to tire them by a moderate extension unremittingly continued, and gradually increased if necessary. As an auxiliary in diminishing muscular power in young and active subjects, bleeding, and the warm bath, to produce faintness, with nauseating doses of tartarized antimony, are resorted to. The modes of effecting the necessary extension are various. In luxations of the shoulder, the two methods practised by Sir A. Cooper are the most prompt and simple; in the

first, the patient is placed in the recumbent posture upon a bed or sofa, near its edge; a wet roller is bound round the arm immediately above the elbow, and a handkerchief tied upon it by a clove-hitch knot, (fig. 1.); the surgeon then sits down on the edge of the bed with one foot resting on the floor, places the heel of the other in the axilla, and extends the arm steadily with the handkerchief; the reduction is frequently accomplished in a few minutes.

In the second method the patient sits upon a low chair, on the seat of which the surgeon rests his foot, placing his knee in the axilla; then taking hold of the arm above the elbow, he draws it down over his knee, till the head of the bone returns to its socket.

Cases requiring a greater degree of extension are managed by the plan represented in fig. 2.

Fig. 1. A handkerchief or towel rolled up and folded into the loop necessary to form the clove-hitch knot.

The handkerchief being held in the left hand, a loop is made round the fingers of that hand, and the thumb placed upon its termination; a second loop is made and held in the same manner by the thumb and fingers of the right hand; then, by a twist of that portion, *A*, passing between them, one loop is turned over the other; the patient's hand and fore-arm are slipped through them both, and the ends drawn tight upon the wet roller

above the elbow. By fixing two handkerchiefs in this manner, so that the ends hang down over each condyle, extension may be made by two or more persons.

Fig. 2. An apparatus for reducing a dislocated shoulder consisting entirely of domestic materials.

In the reduction of this dislocation, as of every other, the first point requiring attention, is to fix that part of the trunk steadily to which the dislocated bone is articulated.

The patient being seated upon a high chair, a jack-towel or half sheet is rolled up and passed under the axilla, slipping a cushion beneath it to defend the parts from pressure; the towel is crossed over the shoulder, and either secured to some fixed body or held by two assistants. A wet roller is next bound round the arm above the elbow, and two handkerchiefs tied upon it by clove-hitch knots, (fig. 1.); one or two assistants then taking hold of the ends of these handkerchiefs commence a steady equable extension — if the head of the bone is in the axilla, with the arm raised nearly to a right angle with the body, — if under the pectoral muscle, downwards and backwards, — if upon the dorsum of the scapula downwards and forwards, the surgeon examining the progress of the bone and directing its course. In case it should not slip into place as soon as it reaches the edge of the glenoid cavity, this may

be hastened by rotating the bone, slightly: or, with his knee in the patient's axilla, the surgeon raises the head of the bone, pressing the acromion downwards and inwards. After the reduction the limb must be supported in a sling, and kept perfectly quiet for some days by a bandage confining it to the side.

The pullies are only required in old dislocations of the shoulder, or in cases where much difficulty is anticipated from powerful muscular action.

The management of dislocations of the clavicle are considered under the head of fracture of that bone.

Dislocations of the elbow are not very common, and when they do occur, may be reduced without much difficulty.

The dislocation of the radius and ulna backwards is reduced by bending the arm round the knee, placed against the front part of the lower end of the humerus, at the same time pressing the fore-arm away from the humerus. The arm should be supported in a sling for a week or ten days after the accident.

Luxation of both bones forward can only occur with fracture of the olecranon, and must be treated as such.

Dislocations from the condyles of the humerus laterally, are reduced by extending the fore-arm forcibly.

Dislocation of the head of the radius back-

wards, — by extension and forcible supination; of the lower end of the radius forwards, — by supination.

The reduction of dislocations of the fingers is effected by applying extension to the lower end of the finger, and pressing the head of the phalanx into its natural situation; a narrow slip of roller, must be applied to the finger for a few days, and the hand suspended in a sling. That of the first phalanx of the thumb backwards is a much more difficult operation; the cause of this difficulty, as explained by Mr. Hey, is found in the wedge shape of the head of the metacarpal bone, and the very narrow space between the tubercles on its palmar surface, from which the ligaments take their origin; so that when the broad posterior surface of the head of the bone has slipped between these ligaments, they embrace its neck closely, and obstruct our efforts to return it. Powerful extension will rather augment this obstacle, by causing the ligaments to clasp the neck of the bone more tightly. Instead therefore, of attempting reduction in this manner, or by any division of the ligaments, a practice which Sir A. Cooper strongly condemns, Mr. C. Bell advises pressure to be made upon the head of the dislocated phalanx, at the same time bending the thumb towards the palm, with the view of relaxing the ligaments, to admit its passage between them.

Fig. 3. The compound pullies; by means of

which a steady ixtension, gradually increased from a moderate to a very powerful degree, can be applied with the greatest ease, to accomplish the reduction of a dislocated limb. Each frame contains three pullies arranged edge to edge, and is mounted with a strong steel hook; they are prepared for action by passing one end of a slender cord through a hole in one of the frames, and, having tied a knot upon it to secure it, coiling it round each pair of pullies in succession; the hook of one of the frames is then fixed to a staple screwed into a door-post; that of the other passed through the rings attached to the brace, (fig. 4.), and extension made by pulling steadily at the free extremity of the cord.

Fig. 4. The brace by which the pullies are connected to a dislocated limb. It consists of a well padded belt of leather, provided with straps and buckles to brace it firmly round the limb; and two stout straps, furnished with rings to receive the hook belonging to one set of pullies: as seen in fig. 7, and 8, *B*.

In dislocations of the hip the pullies are always resorted to; their direction and management differ according to the variety of the dislocation.

Fig. 5. The pullies applied to reduce a dislocation of the head of the femur upwards, upon the dorsum ilii.

The patient lies upon his back on a table co-

vered by a blanket, or upon a bed, and the counter-extending belt, *A*, is passed between the pubis and thigh, and hooked to a staple, for the purpose of fixing the pelvis.

A sheet folded longitudinally may be substituted for the belt, and fastened to one of the legs or posts of the bedstead; or, a blanket being wrapped round the bed-post, the patient may be placed astride of it, with the affected limb on the outside of the bed.

B. The pullies — attached by one hook to the belt above the knee, which is slightly bent, by the other to a second staple — extending the thigh obliquely across the sound limb.

On reaching the margin of the acetabulum, a gentle rotation of the knee and foot causes the head of the bone to glide over it, and completes the reduction.

Fig. 6. Reduction of a dislocation into the foramen ovale.

The patient lying upon his back, the counter-extending belt, *A*, is passed round the pelvis to fix it steadily.

B, The pullies, acting in an opposite direction to the belt, to draw the head of the femur outwards and upwards.

As soon as the head of the bone approaches the acetabulum, the surgeon grasps the ancle and draws the injured limb across the other, making a lever of it to lift the head into its

socket. Some extension of the limb is occasionally required to disengage the head of the thigh bone from the obturator foramen.

Fig. 7. Reduction of a dislocation into the ischiatic notch.

The patient is turned upon his side, and the counter-extending belt, *A*, passed between the thighs, and secured to a staple behind him, to fix the pelvis.

B, The pullies, extending the bone in a direction across the middle of the sound thigh.

C, A towel or band passed round the thigh, by which the head of the femur is lifted into the acetabulum as soon as it has been brought to its margin by extension. A round-towel slipped under the thigh, and over the shoulders of the surgeon, is sometimes employed for the same purpose. It may also be effected by pushing forward the trochanter with the hand, at this stage of the extension.

Fig. 8. The reduction of a dislocation upon the os pubis.

The patient in this case is placed upon his side, and the counter-extending belt, *A*, passed between the thighs, and attached to a staple a little above the end of the table.

B, The pullies drawing the thigh bone downwards and backwards, in a line behind the axis of the body.

C, A napkin or band round the upper part of the thigh, by which the head of the femur is

lifted over the edge of the acetabulum after extension has been continued for some time.

Dislocations of the knee are rare; when they do occur, reduction is effected without difficulty by extension of the leg, and pressure upon the head of the tibia. The chief object to which the treatment should be directed, is the adoption of measures to check the inflammation consequent upon so extensive an injury; and, after this is subdued, to restore the flexibility of the joint.

Partial displacement of the semilunar cartilages of the knee, from the situation which they occupy in relation to the condyles of the femur, is rectified by first extending the limb completely, and then suddenly bending the joint to a very acute angle; a knee-cap tightly laced upon the joint, or a firm bandage, must be worn for some time, to prevent a recurrence of the derangement.

Dislocation of the patella is reduced by pressure, the extensor muscles of the leg having been first relaxed by position. In this case also, a laced knee-cap, with a strap and buckle above and below the patella, is necessary, to support the bone for a short time.

In luxations of the tibia from the astragalus inwards and outwards, reduction is easily accomplished upon Mr. Pott's principle, by bending the knee to relax the powerful muscles of the calf: and maintained, by supporting the foot in splints, (Vid. Plate XII. fig. 5.); the long foot-piece of the outer

splint, (fig. 4.) is particularly important in this case, to counteract eversion of the foot. After reduction, M. Dupuytren manages the dislocation inwards, which is always preceded by fracture of the fibula, simply as a fracture of that bone; his apparatus is represented Plate XI. fig. 8.

Dislocation of the tibia forwards is very uncommon, and, like that inwards, is attended by fracture of the fibula; it requires considerable force in aid of position before the reduction can be completed. Sir A. Cooper then places the leg upon a pillow, resting on the heel, and keeps the foot at a right angle to the leg by enclosing it in splints. M. Dupuytren applies a thick pad and straight splint along the back of the leg and heel, and binds the tibia and fibula firmly to them by a roller, thus counteracting the tendency of the foot to glide backwards from the articular surface of the tibia. A soft cushion must be interposed between the bandage and the front of the tibia.

Dislocation of the tibia backwards is so rare, that no case has ever fallen under the observation of Sir A. Cooper.

Luxations of the toes, like those of the fingers, are reduced by extension and pressure upon the head of the dislocated phalanx.

Complete dislocation of the lower jaw is reduced in the following manner; the patient is seated on a low stool, and the surgeon, standing behind him, introduces his two thumbs, well

guarded by a wrapper of lint or linen, into the mouth, sliding them as far back as possible upon the molar teeth of each side: at the same time carrying the fingers of both hands under the base of the jaw; the thumbs are then made to depress the angles of the jaw, while the chin is elevated by the action of the fingers, and the condyles return to their natural situation with a sudden snap.

Pieces of cork are sometimes inserted between the molar teeth instead of the thumbs.

In dislocation of one condyle, the same means will succeed, applied to that side only. The jaw must be supported for a few days by the sling with four heads (Plate VII. fig. 1.)

IV. INSTRUMENTS.

Plate XVI.

Instruments employed in various operations connected with the urinary organs.

Fig. 1. The silver catheter.

A, The stilet withdrawn.

Fig. 2. The catheter preferred by Mr. Stanley.

Fig. 3. M. Amussat's straight catheter.

A variety of curvatures are given to male catheters, all of which cannot be founded on correct principles. Fig. 1. and 2. are introduced into the bladder with greater facility than curves of a larger diameter; that of Mr. Stanley has been modelled upon the natural form of the urethra; excepting that the curved portion of Mr. Stanley's instrument is shorter, they do not materially differ. Amussat's straight catheter also passes very readily, if the penis be depressed as soon the end of it reaches the prostate.

Fig. 4. The elastic gum catheter.

Varnished catheters are much better than those of silver, where it is necessary to leave the instrument in the urethra for any length of time, as they are less irritating and less liable to calculous incrustations; in consequence of their flexibility also, small elastic gum catheters will sometimes make their way into the bladder when others fail. In enlargements of the prostate gland, when the curve of the prostatic portion of the urethra is much increased, the method practised by Mr. Hey of withdrawing the stilet a little, to enlarge the curve in proportion to that of the urethra, will generally overcome any difficulty; the dotted line, *B*, represents the stilet withdrawn, the outline, *C*, the increased curve of the catheter.

Fig. 5. The female catheter; the upper part is made to slide within the lower, to render it more portable.

D, a cap which fits closely upon the end of the catheter; when the spout is adjusted to the opening in the side of the catheter, it serves to direct the stream of urine into the vessel for its reception; when turned in the contrary direction, the cap acts as a stop-cock closing the orifice completely.

Fig. 6. The gauge or scale, by which the size of catheters and bougies is measured.

By the side of this figure, a reduced scale of

inches, and one inch of the full size, are given, to explain the proportionate reduction of the instruments, lineated in this Plate.

Fig. 7. The metallic bougie; the material of which these bougies are composed, is sufficiently flexible to take any curve, and at the same time possesses solidity enough to retain it during its introduction. Metallic instruments are believed by many surgeons to diminish morbid irritability of the urethra more efficaciously than those of wax or elastic gum; a wax bougie is best while the stricture is narrow; but after it has produced some dilatation, the metallic is preferable. A soft wax bougie is also of great service for taking a cast of the stricture to ascertain its characters. The French employ the elastic gum bougie almost exclusively; for taking an impression of the stricture, M. Leroi uses one of them graduated, at the end of which a soft yielding composition is attached; the graduation gives the exact distance of the stricture from the orifice, preparatory to the application of caustic.

Another point in which the metallic bougie is superior to the two other varieties is, that while the latter are impaired by heat, the former may be used with undiminished effect in any climate.

In Vols. 25 and 27 of the Edinburgh Medical and Surgical Journal a method of treating stricture by forcible injections is detailed, as practised suc-

cessfully by M. Amussat, and Professor Cittadini of Arezzo.

Fig. 8. Mr. Charles Bell's urethra probe for sounding the urethra and examining the nature and extent of a stricture. A series of probes are used, the knobs of which vary in size, from that of a very narrow stricture to the full diameter of the urethra.

Fig. 9. Ducamp's tube for applying caustic to a stricture. The greater part of the tube is elastic, but the upper and lower extremities are made of silver; it is graduated externally, and hollow to contain the stilet, *E*, which is also partly composed of elastic gum. It is prepared for use, by melting a granule of nitrate of silver into the small groove of the stilet, which is replaced within the tube, where it lies concealed until the instrument rests upon the stricture; the stilet is then pushed forward, and gently rotated within the stricture, in order that the caustic may act upon its entire circumference.

Sir E. Home's armed bougie, made by inserting a small portion of argenti nitras within the end of a bougie in its soft state, is also a very convenient mode of applying caustic, where it is necessary.

Fig. 10. The conical catheter, or bougie, for forcing a passage through a stricture which cannot be overcome by other means. It is a dange-

rous instrument, and must be resorted to with much caution.

Mr. Stafford has published a number of cases in which he has divided firm strictures successfully, by a small lancet shaped blade, fixed at the end of a stilet, and protruded from a silver tube introduced into the urethra as far as the stricture.

M. Amussat occasionally employs an instrument constructed upon the same principle ; but in which the division of the stricture is effected by six small knives projecting from the end of the stilet.

Mr. Earle has used a cutting instrument with advantage in many cases of stricture at the orifice of the urethra, followed by the same train of evils which are the consequence of stricture in any other part of the canal ; it consists of a narrow blade, shaped like a lancet, but cutting at one edge only, fixed in the centre of a conical metallic bougie about three inches in length ; the edges project a little beyond the diameter of the bougie, and, when used, the tip of the bougie is introduced into the urethra, with the cutting edge of the blade turned downwards, and the instrument pushed suddenly on through the obstruction.

The sound is a steel instrument, very similar in shape to the metallic bougie, (fig. 7,) employed to determine the question of the presence of a stone in the bladder. Sounds of various curves, accord-

ing to the capacity of that organ, are necessary to settle the point satisfactorily.

Fig. 11, Is the sound made use of by Mr. Earle for examining the bladder in children.

The knob at its extremity offers a surface for striking the stone equal to that at the end of a full sized sound, while its slenderness allows it to have free play in the narrow urethra of a child.

Fig. 12. The common staff for directing the incision in the performance of lithotomy in the male. The groove generally runs along the convex surface of the staff; but some surgeons prefer it a little on the left side.

Fig. 13. Mr. Aston Key's straight staff.

In employing this staff, it should be borne in mind that during the early part of the operation the extremity is not in the bladder; in order to carry on the knife, after having cut into the urethra, it is necessary to depress the penis and handle of the staff considerably, before its point can reach the bladder.

Fig. 14. The staff for lithotomy in the female.

Fig. 15. Weiss's dilator for the male urethra, acting also as a forceps for extracting small stones by or from the urethra. An instrument for the same purpose is used by Mr. Brodie, which is hollow like a catheter, in order to catch the stone between the blades, as the urine is drawn off.

Mr. Hunter's instrument for removing small calculi from the urethra consists of a straight canula

and stilet; the extremity of the latter when protruded forming a kind of spring forceps, by the branches of which the stone may be grasped and withdrawn.

Fig. 16. Weiss's dilator for the female urethra. The branches are gradually expanded by turning the circular handle, which pushes down a wedge in the centre; the dilatation should be conducted very gradually and steadily.

Plate XVII.

The Stomach Pump.

Fig. 1. The syringe of Read's apparatus, constructed with ball valves, the simplest and least liable to derangement of any form of valve. Weiss's patent syringe is another very ingenious contrivance for the same end.

Fig. 2. The intermediate portion of tube, which connects the syringe with the œsophageal tube when the pump is injecting water into the stomach, (fig. 5), but through which the water is expelled during the reversed action of the syringe (fig. 6.)

Fig. 3. The œsophageal tube, the part introduced into the stomach; it is calculated to fit al-

ternately upon the extremity of the intermediate tube, as seen in fig. 5, and within the lower end of the syringe, (fig. 6.) It is occasionally necessary to pass a smaller tube into the stomach through the nostril, for the purpose of giving food and medicine in cases of wounds of the trachea, fracture of the lower jaw, or under the circumstance of obstinate refusal to take them voluntarily by insane persons.

Fig. 4. A wooden gag, placed between the teeth to prevent the jaws closing upon the œsophageal tube. The back part should rounded off, or the lips will be in danger of laceration by its edges.

Fig. 5. The pump in action, throwing tepid water from a basin into the stomach.

Fig. 6. The action of the syringe reversed; when a sufficient quantity of water has been thrown in, the intermediate portion is detached from the œsophageal tube, and the extremity of the latter being inserted within the lower end of the syringe, the piston is worked cautiously and the contents of the stomach returned into the basin. Unless this part of the operation be performed with gentleness, the mucous coat of the stomach may be drawn into the aperture at the end of the tube, and be seriously injured.

Fig. 7. Enema pipes adapted to the intermediate tube. The rectangular pipe fitted upon

the extremity of the tube enables a patient to throw up an injection without assistance

The stomach pump is employed to evacuate the stomach in all cases of poisoning, excepting those by the mineral acids, or other powerfully corrosive substances which occasion an immediate destruction of tissue.

During the introduction of the œsophageal tube, a temporary obstruction to its passage is frequently produced by spasm of the pharyngeal muscles; this is soon overcome by keeping the end of the tube in contact with the posterior wall of the pharynx, and increasing the curve of that portion within the mouth. If, in the subsequent operations, the tube should press upon the larynx, or the admission of air be in any way impeded, (of which instant warning will be given by a recurrence of the struggles, and the livid tint of the lips,) it must be instantly withdrawn, or some risk of suffocation will be incurred.

It is rarely necessary to reverse the action of the syringe in order to evacuate the stomach, unless the system be under the influence of a powerful narcotic. When distended to a certain point, the expulsive efforts of the stomach and diaphragm will be excited, and the contents poured forth, notwithstanding the presence of the tube, by vomiting. This may be accelerated by gently drawing the tube backwards and forwards

over the epiglottis; nevertheless, if retching be not provoked when about 2½ pints have been thrown in, that quantity should be abstracted, as a farther distension will not be altogether free from danger. Injection of the stomach and removal of the fluid must be persevered in as long as the water retains any colour from the contents of that viscus.

Plate XVIII.

Instruments required in Operative Surgery.

Fig. 1. The common scalpel. Various forms of the scalpel are made use of according to the kind of operation; when long sweeping cuts are required, the edge should take a large curve towards the point; for minute dissection the blade may be narrower, and the edge less curved.

Fig. 2. The double-edged scalpel.

Fig. 3. The straight or French bistoury, the best knife in many operations in which a narrow pointed blade is requisite. It is particularly suited to the performance of amputation of the fingers and toes, as the point is readily insinuated between the heads of the bones forming the joint.

Fig. 4. The curved bistoury, employed for laying open fistulous canals.

Fig. 5. The curved bistoury with a probe point, adapted to the same operations as the former, but preferable in cases where the point might endanger blood-vessels or other parts of importance. In fistulæ ani it can only be resorted to when a communication between the sinus and the gut exists.

A modification of Millikin's sheathed bistoury (fig. 17.) is the most convenient instrument for operating in this disease; the extremity of the sheath, *E*, is ground to a point, in order that it may perforate the coats of the rectum, and make a passage for the probe-pointed blade; being then withdrawn, the probe point is pushed forward, caught by the finger of the operator, and the operation completed without the same hazard to the finger as with the pointed bistoury.

Fig. 6. The common tenaculum, for transfixing the mouth of a divided artery, to draw it forth and place a ligature upon it.

Fig. 7. Assalini's tenaculum; the branches are closed by a spring, and retain a firm hold of the wounded vessel. With this instrument a surgeon may secure a bleeding artery without assistants, as its weight is sufficient to prevent retraction of the vessel.

Fig. 8. Wilkinson's tenaculum, a form of the above combined with the forceps.

M. Amussat, and several other French surgeons, in lieu of securing a divided artery by ligature, seize its mouth with a pair of forceps and twist it with some degree of force, by which a separation of its coats is said to take place, producing an obstruction sufficient to arrest the hæmorrhage entirely.

This method may perhaps prove serviceable in wounds of small arterial branches, but few surgeons would venture to trust to it in arteries of large size.

Fig. 9. The common aneurism needle, for passing a ligature beneath the trunk of an artery; the blade should be of silver, as it may then be bent to any curve.

Fig. 10. An aneurism needle with a lateral curve, a form adapted to carry a ligature round the subclavian and other deeply seated vessels.

Fig. 11. The watch-spring aneurism needle of Dessault; the stem forms a sheath in which a watch-spring, *C*, is enclosed. When used, the end of the sheath is passed down by the side of the artery, and the spring is made to glide round it by pushing down a button in front of the sheath; the eye is then threaded with the ligature, and the spring withdrawn, bringing the ligature under the vessel with it.

Bremner's needle is very similar to this, but being composed of three watch-springs united within the sheath, it is much stronger.

Fig. 11. Weiss's aneurism needle, a contrivance for carrying a ligature round a deeply seated artery without the slightest assistance from the eye. The branch connected with the handle resembles the common aneurism needle in shape, but the eye is placed as far back as the curve; from this eye to its extremity the branch is hollow, forming a sheath for the reception of the short needle, *A*, which is merely a portion of watch-spring perforated at both ends. At the end of the second branch is a double claw, the points of which almost meet, barely admitting the substance of the needle, *A*, between them on pressure, when they snap into the aperture in its projecting extremity and take firm hold of it. The instrument is prepared for use by threading the eye of the needle, *A*, through the corresponding eye in its sheath; the sheath and needle are then insinuated beneath the artery on one side, and the second branch passed down on the other, gliding the ridge, *B*, along a directing groove in the opposite branch, till its notch catches upon the rivet; the points of the two branches may now be pressed together, the double claw seizes the extremity of the needle, *A*, and the needle and ligature are detached from their sheath, and brought round the vessel.

Many other instruments for carrying this object into effect have been suggested; a description of a number of small needles of various curves, with a moveable handle, employed by Messrs.

Hartshorne and Parish, and afterwards by Professor Mott, will be found in Vol. 9. of the Medico-Chirurgical Transactions.

Mr. Abernethy recommended a strong eye probe, as it can be bent into any curve to meet the circum stances of each particular case.

To ensure the effectual formation of the knot upon vessels lying deeply, Mr. Liston uses a pair of forceps with a notch at the termination of each branch; the ends of the ligature are drawn through the notches, brought up by the side of the handles, and the branches extended, tightening the knot securely.

Drawings of two ingenious instruments for the same purpose, but less simple, contrived by Prevosti and Professor Jacobson, are given in the 79th Number of the Edinburgh Medical and Surgical Journal.

Fig. 13. The double hook for laying hold of piles and other tumours, to assist in their extirpation.

Fig. 14. The blunt hook for similar operations; it is used in the removal of cysts containing fluid, as it does not penetrate so deeply as the former.

Fig. 15. Sir A. Cooper's knife for dividing the stricture, in the operation for the relief of strangulated hernia. About half an inch only of the blade possesses an edge, so that there is very little danger of the intestine, or any other part except that to be divided, coming in contact with it.

Fig. 16. A hernia knife made by Weiss with the view of lessening still further the danger of wounding the intestine; the edge of the blade is guarded by a small grooved sheath, *D*, which is pushed forward along it by a button attached to its lower extremity; no more of the edge, therefore, is exposed than may be sufficient to divide the stricture.

Fig. 17. Millikin's sheathed bistoury, for laying open fistulæ of the anus, &c. It may also be used as a hernia knife, as the blunt blade, *E*, forms a kind of sheath guarding the edge of the cutting blade.

Fig. 18. The amputating knife for dividing the soft parts in circular amputations. A single-edged knife of the same kind, but much longer and narrower, bears the name of Lisfranc, and is the knife with which he amputates at the hip joint.

Fig. 19. The catlin, a knife with a double edge, used in amputations of the forearm and leg, to divide the soft parts between the bones.

A long narrow catlin is employed by M. Lisfranc in amputation at the shoulder joint, and of the thigh by the double flap. Mr. Liston's knife for the latter operation possesses a double edge only within an inch of the point; the back of the blade between this and the handle is blunt.

Fig. 20. The metacarpal saw for cutting through small bones in situations where the common am-

putating saw cannot be used, as the metacarpal and metatarsal bones.

Fig. 21. The small straight saw for the same purpose.

Fig. 22. The chain saw, invented by Professor Jeffray of Glasgow, to facilitate the excision of carious joints.

F. A few links of the saw of larger size, to explain the manner of its formation.

The needle is passed round the bone between it and the soft parts, and the serrated chain is drawn after it; the needle is then removed, and a second handle attached to the hook; by these two handles the saw is worked, but it is difficult to keep the blade in its proper direction perpendicular to the bone. Mr. Green at St. Thomas's Hospital, and Mr. Cusack of Dublin, have also employed it in amputating portions of the lower jaw. The small saw, (Fig. 21.,) may be substituted for the chain saw on many occasions.

Fig. 23. The trephine, a circular saw for removing a part of the cranium, to admit of the elevation of a depressed portion of bone in consequence of fracture, or to allow the escape of fluid effused between the skull and dura mater.

A handle similar to that of the chain saw (Fig. 22.) is attached to it when in use.

G, the centre pin, which hinders the trephine from slipping until the saw has made a groove sufficiently deep to enable it to work steadily; it

is then retracted by sliding the milled headed screw, higher on the stem of the instrument.

Fig. 24. The elevator, the point of which is introduced beneath a depressed portion of the skull, and acts as a lever to raise it to the proper level.

Fig. 25. Mr. Hey's saw; very serviceable in many small operations upon the bones.

Fig. 26. Mr. Earle's saw for cutting into the substance of the tibia to remove a dead portion of bone; it is worked by resting the hand which grasps it upon the wrist of the other, and giving the serrated edge a short quick motion upon the bone.

Fig. 27. A circular saw invented by Savigny for the same purpose as the last. It consists of a thick handle or frame of mahogany about ten inches in length, at the lower end of which two iron feet covered with leather, *a*, *a*, project, forming a rest, which slides upon the back of the frame, and is fixed by a thumb-screw; the front surface of the frame is channelled to admit a slip of wood, *d*, to which a circular saw two inches in diameter, *b*, provided with teeth in one half only of its circumference, is attached in the following manner: — A groove is cut through the substance, and near the circumference of the other half of the saw, and upon it a semicircular plate, *c*, is confined by two rivets passing through the groove to another plate let into the slip of mahogany, *d*; this slip is fixed at any point best suited to the

action of the saw, by the small screw, *e*, passing through it. When employed, the frame is held in the upright position, and the saw,—worked by the handle, *f*, connected to it by a loose joint,—turns round the pins, acting precisely as if mounted on an axis, while it preserves the effect of its entire diameter, and possesses depth enough to cut through any tibia.

An account of two tibia saws, invented by Messrs. Machell and Griffith, will be found in the 11th vol. of the Edinburgh Medical and Surgical Journal; and in vol. 19, a description of the rotation saw of Professor Thal of Copenhagen.

Fig. 28. Mr. Liston's bone-nippers, a stout kind of cutting forceps or shears, for removing portions of bone upon which a saw cannot act with effect.

Plate XIX.

Fig. 1. Mr. Cline's Gorget as used by Sir A. Cooper; the groove is considerably deeper than that of Mr. Cline's instrument.

Fig. 2. Mr. Stanley's Gorget; the handle and blade are straight, and the two edges, contrary to those of the gorgets of Hawkins, Scarpa, and Abernethy, turn down, so that the incision into the bladder corresponds with the external wound. The other forms of gorget are now scarcely ever

employed. The blunt gorget is, however, sometimes used by Mr. Brodie for dividing the prostate, after having cut through, or *nicked*, the prostatic portion of the urethra.

Fig. 3. The bistoire or lithotome cachée of Frère Côme. It consists of a curved blade, attached to the body of the instrument by a pin forming a kind of axis, and lodged in a groove running along its convexity, in which it is concealed by the action of a spring beneath its broad extremity, *A*, until raised by pressure upon this part.

B, A screw passing through the handle, and directed towards the broad end of the blade, *A*; by its elevation or depression the expansion of the blade is regulated.

The instrument is introduced closed along the groove of the staff, and the blade opened when fairly in the bladder; the incision through the prostate is then made as it is withdrawn, the length of the wound depending upon the extent to which the blade is expanded.

Fig. 4. The double bistoire cachée of Dupuytren. It is constructed with two blades, which are opened in a different manner to that of Fig. 3; the pyriform portion of the handle is moveable, and is turned higher or lower upon the body by means of a screw within it; when its widest diameter arrives between the handles of the blades, their dilatation is very limited,—when almost withdrawn from between them, very considerable.

It is introduced closed into the bladder, and being then turned with the convexity upwards, the blades are expanded and both sides of the prostate divided, extending the external incision to the right of the raphe if necessary.

This instrument is considered by Dupuytren as superior to any other, when a longer incision than usual is required for the removal of a large stone.

Fig. 5. Mr. Blisard's beaked knife as used by Mr. Earle. The button at the end of the blade serves to guide it along the groove of the staff into the bladder, and the incision is completed as the knife is withdrawn.

Fig. 6. Mr. Brodie's beaked knife, employed in the same manner as Fig. 5.

Fig. 7. Another form of the above, with a double edge for dividing both sides of the prostate, if more space should be required.

Mr. Aston Key operates with a large scalpel, without a button or guard of any kind; he makes the external incision, reaches the bladder, and completes the section of the prostate with this knife alone.

Fig. 8. The common straight forceps for extracting a stone from the bladder.

Fig. 9. The curved stone forceps, by which it may generally be reached when out of the range of the former.

Fig 10. Assalini's stone forceps; the advantage offered by this instrument is, that as the

blades are expanded to seize a large stone, the handles are separated to a much less extent than in the common form, and, consequently, the external parts are subjected to less strain. A pair of strong nippers, provided with teeth, is occasionally had recourse to, as a stone-breaker, when the calculus is too large to allow of its extraction entire.

Fig. 11. The scoop for removing fragments of stone from the bladder, when a calculus has given way under the grasp of the forceps, or where the stone breaker has been resorted to.

For washing out the bladder under similar circumstances, Baron Heurteloup makes use of a syringe with an aperture about an inch from the end of the nozzle, directed obliquely backwards; the water is thus driven back from the closed extremity through this aperture, and the collapsed folds of the bladder washed out.

Fig. 12. The trocar and canula for tapping the abdomen.

C, The canula, divided at its lower end to admit the passage of the three-sided head of the trocar, round the neck of which it closes strictly, and offers no obstruction to the plunge of the trocar.

A much smaller instrument is used for hydrocele: and an elastic gum bottle, mounted with a stop-cock pipe small enough to fit within the canula, is necessary, to inject the sac after the evacuation of its contents.

Fig. 13. Pouteau's curved trocar, for puncturing the bladder from the rectum in retention of urine irremediable by other means.

D, The canula, which is retained in place by tapes, passing through two holes in its expanded extremity, and tied to a waistband.

A long straight trocar is employed in the operation above the pubis.

Fig. 14. The canula introduced into the trachea, to keep up respiration after the performance of tracheotomy. It is secured by tapes running through the holes, and tied round the neck. Shorter canulæ, either of silver or elastic gum, are sometimes preferred.

Fig. 15. The nasal canula and spring, for plugging the nose, to arrest hæmorrhage; the canula is passed through the nostril to the back of the pharynx, when the spring is pushed forth, and projects forwards under the velum palati into the mouth; a piece of sponge, or plug of lint, at the end of a long string, is attached to the ring,—the spring retracted,—and the instrument withdrawn from the nostril, bringing the string with it; the sponge is then wedged into the posterior cavity of the nose, and the nostril firmly plugged in front. Another string should pass from the inferior surface of the plug through the mouth, to aid in disengaging it when its intention is fulfilled.

A small elastic gum catheter, without the stilet, is a very good substitute for this instrument.

Profuse hæmorrhage from the gum, after, the extraction of a tooth, may be suppressed, by moulding a portion of wax between the fingers, pressing it firmly into the socket, and retaining it there by a pledget of lint, upon which the patient must be directed to close his jaws.

Fig. 16. The probang, a rod of whalebone with a ball of sponge at one extremity.

It is passed down the œsophagus, to carry on into the stomach any solid matter lodged in the pharynx.

Fig. 17. A hook fixed to the other end of the probang, by which coins, or other flat bodies, may be caught and withdrawn from the pharynx.

An elastic gum bougie of large size is introduced into the œsophagus, for the relief of stricture of that canal.

Fig. 18. The porte-aiguille, a pair of forceps closed by a slide, *E*, and mounted on a handle, to assist in the formation of the interrupted suture in deep cavities, as the fauces, or vagina.

F, The branches of the port-aiguille grasping a short needle.

Fig. 19. Curved needles required in the construction of sutures.

G, The ordinary curved needle.

H, The form employed by Mr Earle, in the operation for the cure of vesico-vaginal fistulæ.

Fig. 20. The needle used in the performance of acupuncture.

I, The sheath.

Fig. 21. Seton needles.

K, The seton needle adapted to the elastic gum tape; instead of being furnished with an eye, the blade is divided for a short distance into two plates, between which the tape is inserted, and held fast during the plunge of the needle beneath the skin.

L, The old form of seton needle made with an eye, through which the skein of silk is drawn.

22. The porte-moxa, a metallic ring fixed to a handle and supported upon three ebony feet, to retain the moxa in place during its combustion.

Fig. 23. The blow-pipe, by which the intensity of the combustion of a moxa is regulated; the blow-pipe should be worked by an assistant, and the surgeon, holding it near the point, directs the stream of air properly.

Plate XX.

Fig. 1. Mr. Saunders's needle for depressing cataract. The blade is one inch and $\frac{1}{8}$ in length; from the shoulder to the middle it is round, and from thence to the point it is gradually flattened; the edges near the point are sharp. The handle is octagonal, and the sides corresponding with the

edges of the blade are dotted with black, if the handle is of ivory, and *vice versâ*, in order that the direction of the edges may be known when it is introduced.

Fig. 2. Mr. Hey's couching needle; its flattened surface is seen in the first view, its edge in the second. The length of this needle is somewhat less than an inch; it is round except near the edge, where it is ground flat; the extremity is semicircular, and ought to be as sharp as a lancet; the round part of the needle gradually increases in diameter towards the handle. Ivory dots are inlaid upon the two sides of the ebony handle which correspond with the edges.

Fig. 3. Scarpa's couching needle; the blade is slender, pointed, and slightly curved; the convexity of the point is flat; an eminence runs along its concavity to the point, and forms two oblique surfaces descending to its edges, which are sharp; marks or dots are placed on the side of the handle corresponding with the convexity of the point.

Schmidt's curved lancet-shaped needle very much resembles Scarpa's.

Fig. 4. Beer's straight spear-pointed couching needle.

Fig. 5. Wenzel's knife for dividing the cornea in the operation for extraction of the lens.

Fig. 6. Ware's cornea knife; the blade is broader, and less spear-shaped than the former, in order

that its edge may sooner pass below the inferior margin of the pupil.

The cornea knife of Jaeger of Vienna, adopted by Mr. Guthrie, has two blades—one of steel, the other of silver,—exactly similar in form to Mr. Ware's knife; the silver blade is moveable, and, when pushed forward to the point of the steel blade, forms a guard to the latter as it passes in front of the iris.

Fig. 7. Beer's cornea knife; the back of the knife is perfectly straight, and rounded off nearly to the point; the greater breadth of its blade than that of either of the preceding knives, and its triangular shape, enable it to complete the lower part of the section as its point transfixes the opposite side of the cornea.

Fig. 8. A small curved knife for enlarging an imperfect corneal section; the edge is sometimes on the convexity, sometimes on the concavity, of the blade.

Fig. 9. The capsule needle; a curved needle with sharp edges, for dividing the capsule to allow the escape of the cataract.

Fig. 10. Daviel's curette, a small silver scoop, which is introduced to assist in detaching the lens: or to prevent fragments of it falling back into the posterior chamber.

Fig. 11. The iris knife used by Sir W. Adams in the operation for artificial pupil.

Fig. 12. The cataract tenaculum, or hook, by

which the capsule may be seized and the lens extricated, in cases where it is retained more firmly than usual. It is also employed in the operation for artificial pupil.

Fig. 13. Reissinger's double hooked forceps, for tearing back a portion of the iris to form an artificial pupil.

Fig. 14. The capsule forceps, for the removal of portions of the capsule after the lens is extracted.

Fig. 15. The scissors made use of by Maunoir to divide the iris, in his operation for artificial pupil.

Fig. 16. Daviel's double curved scissors, for enlarging the section of the cornea when insufficient for extraction of the lens.

Fig. 17. Pellier's speculum oculi; by this instrument the upper eyelid is kept out of the way of the operator. It is also frequently employed to hold aside the edges of the wound, or important parts exposed, during great operations.

Fig. 18. Sir W. Adams's elevator of the eyelid.

Fig. 19. M. Dupuytren's elevator; a third instrument for the same purpose.

Fig. 20. Another form of capsule forceps; they are also used for plucking out the eyelashes in trichiasis; the ends of the branches are frequently made square for the latter purpose.

Fig. 21. The forceps employed by Bartische in

the operation for the relief of entropium. The branches are closed by a spring, and the plates at their extremities hollowed out, which enables them to grasp the fold of skin securely.

Extirpation of parts superficially torn by the bite of a rabid animal is conveniently performed by the aid of this instrument.

Fig. 22. Mr. Ware's style, a silver pin introduced into the nasal duct, after the operation for removing obstruction of that canal. M. Dupuytren restores the passage by inserting a small tube, which is allowed to remain in the duct permanently The same plan was followed by Mr. Wathen. Beer preferred dilatation by pieces of catgut gradually increased in size.

Anell's lachrymal probe is a silver instrument small enough to pass through the puncta lachrymalia into the sac. His syringe is small, and terminates in a very minute gold tube, capable of entering the puncta, for the purpose of injecting fluid into the sac and nasal duct.

Fig. 23. A pair of curved forceps closing by a slide, used by Mr. Wardrop in the extraction of nasal polypi.

Fig. 24. The speculum auris; the branches are expanded gradually by the thumb-screw passing through the handle; their inner surfaces are highly polished, and concentrate the light upon the membrana tympani.

Fig. 25. Weiss's speculum ani; the branches are steadily expanded by turning the handle, and, like those of the last instrument, are polished internally. The speculum vaginæ differs only in possessing three branches. An undivided tube of bright pewter, of considerable size, is employed by French surgeons as a speculum and dilator of the vagina.

Fig. 26. Levret's double canula, for carrying a ligature round the stem of a polypus of the uterus, improved by Dr. Gooch.

It consists of two separate canulæ, eight inches in length, and open at both ends, down which a piece of strong whip-cord is passed, leaving a noose projecting from their upper extremities; one canula is placed by the side of the stalk of the polypus, and the ligature directed round it by the other; when the stalk is completely encircled, the canulæ are connected together, by slipping over them two rings at the end of a silver rod, springing from the middle of a short double canula; and are further united, by being inserted within the double canula, so as to form one instrument; the ends of the ligature are now tied upon the shoulders of the double canula, and the loop tightened round the stalk of the polypus.

Fig. 27. A string of beads and reel, for effecting the same object as the last instrument; the loop must be fixed upon the root of the polypus by means of a long pair of forceps, and the liga-

ture is tightened by turning the screw of the reel.

Drawings and descriptions of the instruments employed in midwifery, and those required in dental surgery, have been omitted, as they are given very fully in treatises on those subjects exclusively.

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