than normal deviations occasion no maiming or halting, and are of no consequence.

A distinguished English surgeon has recently said that he has given up measuring broken thighs,—because of the uncertainty of measurements, I infer. This is a return to the practice of surgeons for many centuries preceding the present century. Until within the last thirty years no systematic attempt was ever made to determine the exact length of limbs after fractures. Tables were given from various hospitals at home and abroad, declaring how many were cured, with some slight notices of deformity, but with no reference to the amount of shortening. It was this which led Mr. Johnson, the famous editor of the *London Medico-Chirurgical Review*, to say of Mr. Radley's results, that he would "like to know something about the length of the cured limb, and a few other matters of that sort."

In the April number of the *Buffalo Medical Journal* for 1849, I published the results of a careful measurement of 136 cases of fracture of the long bones, treated in various ways by different surgeons. So far as I know, this was the first publication of the kind ever made. In 1853, Dr. John Boardman published from my notes additional cases, making 461 in all. In my report on deformities made to the American Medical Association in 1855–6–7, additional cases were reported at length, making a total of 605.

The results of these observations were startling, both to the author and the public generally, and led, I have reason to believe, to that widespread interest which has since manifested itself in this country, as to the causes of the apparent defects in this department of surgery, and to serious inquiry as to the remedy. Surgeons everywhere were stimulated to a new exercise of their ingenuity and skill. Then followed speedily the abandonment of all the double inclined planes for fractures of the femur, and also of the long splints of Desault, Boyer, Liston, Hagedorn, Gibson, Physick, and others, which, while they gave better results so far as the form of the limb was concerned, made little or no improvement in the matter of length. I do not hesitate to say that within these last thirty years, through the more intelligent efforts and correctly applied genius of surgeons, the proper treatment of fractures has made more progress than it had in all the centuries preceding; and especially is this true of fractures of the femur, where the defects were most apparent, and the remedies were most needed.

Shall we cease these efforts now, when the attainment of practical perfection is almost within sight? So far as the lower extremities are concerned, with the present appliances, lateral obliquity, or deformity from this cause, in the case of simple fractures, is, according to my personal experience, no longer necessary; while the average length of the limbs is greatly increased. We shall have abandoned the further advancement of this branch of science when we cease to measure limbs.

As to the mode of measuring limbs, I shall speak in connection with particular fractures.

I think it proper to mention venous and fatty embolisms in connection with prognosis in fractures, since modern pathological investigations have established their occasional connection as sequences, if not as consequences.

Virchow, in 1846, was the first to call attention to an example of pulmonary embolism due to the presence of a venous clot and consequent upon a fracture. Since then, similar examples have been reported by other surgeons; the accidents having taken place usually at periods varying from two to six or seven weeks after the fracture occurred, and being due, as is believed, to the displacement of a clot from a vein in the vicinity of the fracture, whose channel had been temporarily closed by inflammation and pressure.

The presence of a pulmonary venous embolism in the lungs may be recognized by the sudden occurrence of pain, cough, and dyspnœa, accompanied, perhaps, with bloody expectoration, and the usual physical signs of localized congestion or consolidation. In some cases, the symptoms are more urgent, and the patient dies in a few minutes.

In 1864, Flournoy reported a death from fatty embolism, consequent upon a fracture of the leg, death having occurred thirty-six hours after. Since then, Busch, Wagner, Czerny, and others have reported similar examples. The accident is supposed to be due to the absorption into the venous and capillary circulation of the crushed fat globules contained in the marrow at or near the point of fracture. The symptoms are said to resemble those of shock and of traumatic and alcoholic delirium; but an interval always exists between the occurrence of the accident and the accession of the symptomatic phenomena, which latter are by no means uniform, the most reliable signs being referable to pulmonary and cardiac obstructions. The breathing becomes suddenly difficult or labored; the pulse becomes feeble and rapid, the countenance pale or cyanosed, and delirium, followed by coma, terminates speedily in death. It is affirmed also, that in other cases, where the fatty embolisms are less extensively distributed, the symptoms, although presenting the same general type, are less urgent, and may terminate in recovery.

It is gratifying to know that both of these forms of embolism, as sequences of a fracture, are probably exceedingly rare, and that some excellent pathologists have even denied that any relation whavever has been shown to exist between the presence of the oil-cells in the blood-vessels and capillaries and the symptoms which have been attributed to them.

CHAPTER VI.

GENERAL TREATMENT OF FRACTURES.

ALL that has been said in relation to the propriety of handling a broken limb gently, when the surgeon is examining the position and character of the fracture, is equally applicable to the lifting and transporting of the patient to his bed, to the removal of the clothing, and to the general management of the limb before it is dressed. Rude or

awkward manipulations, by which needless pain is inflicted, are not simply acts of wanton cruelty, but they are sources, and I think I may say frequent sources, of inflammation, suppuration, and gangrene. Here, as in all the subsequent handlings, everything should be done slowly, thoughtfully, and systematically. Yet it is difficult to state the precise manner in which the surgeon ought to proceed. Much will depend upon the circumstances of the case, something upon one's natural tact, and upon the amount of experience, but more, I think, upon natural kindness of heart, and social education. The man of refinement and sensibility will know instinctively how to proceed, and needs no instruction. They who lack these qualities can never learn, and it would be quite useless to undertake to teach them. I sincerely wish such men as these latter would find some more suitable employment than the practice of a humane art.

Nearly all fractures present three principal indications of treatment, namely: to restore the fragments to place as completely as possible; to maintain them in place; and to prevent or to control inflammation, spasms, and other accidents.

It ought to be regarded as a rule, liable only to rare exceptions, that broken bones should be restored to place, or to the position in which we hope to maintain them, as soon as possible after the occurrence of the accident. If the patient is seen within the first few hours, or before much swelling has taken place, we scarcely know the circumstances which would warrant an omission to adjust the fragments either end to end or side by side, as the one or the other might be found to be practicable. We have before sufficiently explained the general impossibility of again restoring to place, end to end, and fibre to fibre, fragments which have been made to override. We are therefore in no danger of being understood to say that bones should in all cases be immediately "set," in the popular sense of this term. They ought to be "set," no doubt, if this can be accomplished through the application of a prudent amount of force; but if they cannot be thus placed end to end, they may at least be laid in such a manner side by side as to restore, in some measure, the natural axis of the limb, and prevent the points of the bone from pressing unnecessarily into the flesh.

Experience has, indeed furnished us with four or five very good reasons why broken bones should be reduced as soon as possible. When the injury is recent, the muscles offer less resistance; their resistance being increased after a time not only by the reaction which ensues upon the shock, but also by actual adhesion between their fibres; effusions distend both the muscles and the skin, and compel the limb to shorten; the constant goading of the flesh by the sharp points of the broken bones increases the muscular contractions; the patient will submit readily to manipulation and extension at first, but after the lapse of a few days it is very seldom that he will permit the limb to be in any manner disturbed, even if he is assured that his refusal entails upon him a great deformity. If it is true that no callus or bony structure is deposited earlier than the seventh or tenth day, it is also true that the renewed attempt to adjust the bones at this period, by chafing and tearing again the tissues, reduces the fracture, in some degree, to the same condition

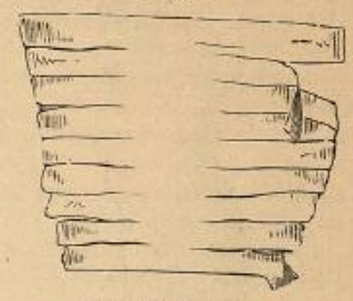
in which it was at first, and, consequently, the time which has elapsed, or, at least, a portion of it, may be regarded as lost.

We cannot, therefore, understand the argument by which Bromfield, South, and a few other surgeons have persuaded themselves, that reduction should never be attempted before the third or fourth day; nor, indeed, do we fully appreciate the refinement which Malgaigne has given to this question, in itself so simple. To affirm that we ought not to reduce the bones to their original positions during the period of intense

Fig. 6.

Application of the "roller" by circular and reversed turns.

Fig. 7.



Many-tailed bandage.

inflammation, or of great swelling, or while the muscles are acting spasmodically, is only to affirm that we may not do what is impossible; and the attempt to do which, therefore, can only be mischievous; but to authorize their restoration to a better position, by such manipulation, extension, and lateral support as they may comfortably bear, is warrantable under any circumstances. The practice is not only defensible, but imperative, and we do not think any really sound and practical surgeon ever intended to teach the contrary. We say still, if bones can be easily reduced, or the position of the fragments improved at any momnnt, or under any circumstances, it ought to be done; and if we fail in accomplishing all that we wish to do in the first instance, we must remain incessantly watchful to seize the earliest opportunity which presents, to complete the adjustment. No doubt our efforts will prove fruitless very much in proportion to the amount of swelling, inflammation, or muscular spasm which exists, and also in proportion to the time which has elapsed; but this will not excuse us for omitting to do all which the circumstances permit.

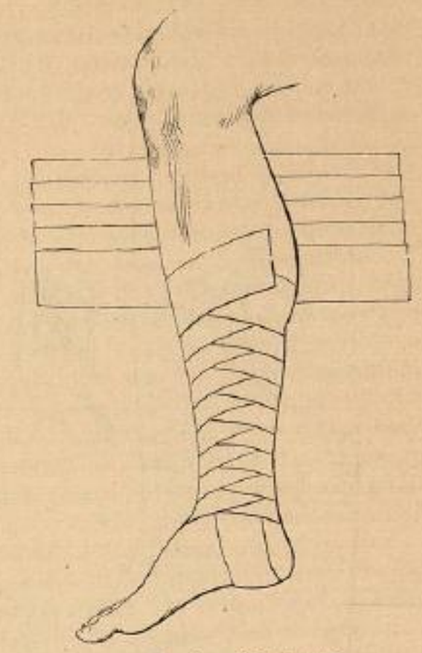
It has been the practice of most surgeons, for a long period to cover the broken limb with some form of a bandage or roller before applying the lateral splints. (This observation was more true when I published my first edition than it is now.)

Of these primary dressings there are two principal varieties: first, the "roller" or simple bandage, applied to the limb in circular and reversed turns; and second, the "many-tailed bandage," consisting of a piece of muslin, or other cloth torn down from each side into a suitable number of strips, leaving the centre, which is to be applied to the back of the limb, entire.

Fig. 8.

Application of the many-tailed bandage.

Fig. 9.



Bandage of Scultetus.

A modification of this latter bandage consists of a number of separate strips, so laid upon one another, commencing from above, that each strip shall overlap the other by one-third or one-half of its breadth. This is called the bandage of Scultetus, and it possesses one advantage over the many-tailed bandage just described, especially in the case of compound fractures, in the facility with which each separate piece may be removed and another substituted. Some surgeons prefer to form the bandage of separate strips, and having overlaid them in the manner directed, to unite them again into one by running a thread through the whole mass along the centre.

Whichever of these several varieties of strips are employed, the mode of applying them is the same. They are folded alternately around the limb, being made to overlap and cross upon each other in front, and only the last strip or two is fastened with a pin.

The object proposed in the use of the roller or of the many-tailed bandage is twofold; first, to compress and support the muscles, by which

their tendency to contraction is in some measure controlled; and second, to protect the limb against the direct pressure of the side-splints.

A moment's consideration will convince us that the first of these objects is in most cases fully attained by the lateral splints themselves, and by the bandages by which they are retained in place; and that the second can be as well accomplished by a single fold of cloth, or by the compresses, which ought generally, even when the roller is used, to underlie the splints. Nevertheless, we should hardly feel authorized to reject these primary dressings solely because the splints and compresses furnish a convenient substitute, especially since we are compelled to admit that they are occasionally useful, unless objections of a more serious nature could be brought against them. Unfortunately, this latter supposition is actually true. By ligating the limb completely, leaving no point of the tegumentary surface to which the pressure is not applied, they too often occasion congestion, inflammation, and gangrene. It is not until lately that the attention of surgeons has been sufficiently called to this subject; but the records of surgery are to-day filled with these terrible accidents, formerly attributed to the original injury or to the splints themselves, but now understood to be plainly traceable to the too common employment of the primary bandage. The roller is by far the most dangerous dressing of the two, since it does not yield to the swelling so readily as the bandage of strips, and it is more objectionable also on account of the inconvenience of applying and removing it; but even the bandage of strips may be so confined as to produce the same consequences, as I myself have seen in more than one instance. It is also all the more dangerous in the hands of the inexperienced surgeon, because he feels a confidence that it will not cause ligation.

Except in rare cases and for especial reasons, which I shall attempt to indicate in their appropriate places, I cannot recommend the employment of any kind of bandages next to the skin.

In order to fulfil the second indication, namely, to maintain the fragments in place, we employ usually what are called short, side, or coaptation splints, and long or extending splints, or the weight and pulley.

Side-splints may be constructed from various materials, according to the size and circumstances of the limb, or according to the convenience of the surgeon; and as the surgeon cannot be expected to have always on hand, at the bedside of the patient, such splints as he might prefer to use, it is well for him to understand how to avail himself of such materials as may be within his reach, in order that he may make the most of his sometimes imperfect resources.

Lead, sheet-iron, zinc, and other metals have been occasionally employed, but especially tin and copper, which possess all of the requisite firmness and malleability to allow them to be hammered, and thus moulded to the limb. In general, however, they are unnecessarily heavy, and demand too much labor to be wrought into shape. I have sometimes employed tin splints perforated with large fenestræ to diminish their weight and increase their flexibility, and found them to answer, in certain emergencies, an excellent purpose. The light perforated zinc splints, introduced into the U. S. Army during the civil war of 1861–65, by the Sanitary Commission, were found exceedingly useful for field service.

Iron-wire splints, made from wire-cloth or coarse gauze, were first publicly mentioned, so far as I can learn, in a communication to the *Memphis Medical Recorder*, made by Dr. J. C. Nott, of Mobile; but they have been brought more particularly into notice, and their construction perfected, by Louis Bauer.[1] These splints, as modified by Bauer, are moulded upon "gypsum or wooden casts," of different sizes, and surrounded with a stout iron-wire frame, in order to give them the requisite degree of firmness, and to preserve their forms; after which they are tinned by galvanism, and varnished, to prevent them from becoming rusted. When applied, Dr. Bauer recommends that they shall be filled with loose cotton, and that they shall be held in place by rollers. It is claimed for these splints that they are light, flexible, permeable to air and to the perspiration, and that they permit the application of cooling lotions without impairing their firmness; the last of which is a quality of questionable value, since lotions applied to permanent dressings of any kind are only warm fomentations, and do not, therefore, in this respect serve the purpose for which they are intended. They render the skin tender, and disposed to vesicate, and they, also, give rise to a sensation of scalding, which is sometimes almost intolerable. The water soaks into the bed, and in many other ways renders the patients uncomfortable. Lotions are only applicable where the dressings are open, loose, and temporary.

According to Poinsot (note to French edition of this work), the wire-gauze splint has been used in the Hospital of St. Andrew, Bordeaux, since 1868; a strip of leather being substituted for the stout wire frame of Bauer.

The same objections hold, also, to this as to all other forms of moulded metallic, or carved wooden splints, namely, that they seldom exactly fit the limb, even when the supply of assorted sizes is complete, and that they are not sufficiently flexible to adapt themselves to anything but the slightest irregularity of surface. They are not, however, without merit, and they deserve at least a qualified commendation in many cases.

Horn and whalebone may be employed in thin plates, or in the form of narrow strips quilted into cloth; but they are expensive, and possess no special value except in an emergency. Reeds, the coarse rank grass which grows in swamps, flags, willow branches, and unbroken wheat straw, may be quilted between two thicknesses of cloth in the same manner, and form very excellent temporary splints. I have especially found it convenient to use wheat straw in the form of junks. Gathering up a bundle of unbroken straws of the size of my arm, I roll them snugly in a broad piece of cotton cloth, cut off the projecting ends, and then stitch up the cloth neatly. We have thus a splint of considerable firmness, and one which is cool and especially adapted to the summer, allowing the perspiration to evaporate freely. Straw splints were employed sometimes by Ambroise Paré, by J. L. Petit, Larrey, and I have seen them in the wards of certain European hospitals, although I am unable now to say under whose direction. Mr. Tuffnell, of Dublin, has especially recommended them in the form of junks.[2]

[1] Nott and Bauer, Buf. Med. Journ., vol. xii., April, 1857.
[2] Tuffnell, New York Journ. Med., March, 1847, p. 264.

Wooden splints, made of pine, willow, white or linden wood, or of some other light and easily wrought timber, are probably of more general application, and possess greater intrinsic value than splints constructed from any other solid material; but I wish at once, and for all, to disclaim any intention of giving even a qualified approval of any of those carved, polished, and generally patented wooden splints, which are manufactured and sold by clever mechanics, and which one may see suspended in almost every doctor's office, whether in the city or in the country. Constructed with grooves and ridges, and variously inclined planes, for the avowed purpose of meeting a multitude of indications, such as to protect a condyle, to press between parallel bones, to follow the subsidence of a muscular swelling, etc., they never meet exactly a single one of these indications, whilst they seldom fail to defeat some other indication of equal importance. They deceive especially the inexperienced surgeon into the belief that he has in the splint itself a provision for all these wants, and consequently lead him to neglect those useful precautions which he would otherwise have adopted.

If carved wooden splints are employed, they ought to be made especially for the case under treatment. But this requires time and some more mechanical skill than can always be commanded; and when accurately fitted, it is quite probable that the subsidence or increase of the swelling will, within the next forty-eight hours, render some change in the form of the splint necessary, or compel the surgeon to throw it aside.

I much prefer to use plain, straight strips of wood, of the requisite width and length, which may be cut at any moment from a pine shingle or a thin piece of board; but in order that these splints may adapt themselves to the inequalities of the limb, and properly support the fragments, they ought to be covered with a muslin sack, open at both ends; into which, and on the side of the splint which is to be placed against the limb, bran, wool, oakum, curled hair, or cotton batting may be pressed, until it is made to fit accurately. I generally prefer cotton batting. Bran is liable to get displaced, and curled hair does not pack firmly enough. When the sack is sufficiently filled, the two ends must be stitched up. This mode of constructing the splint is simple and easy of accomplishment; the splint can be fitted very accurately; the padding never becomes displaced; and when the bandages are applied, they may be pinned or sewed to the cover in such a way that they shall not slide or loosen.

If pads are employed separate from the splint—and for this purpose, also, I generally prefer the cotton batting—they ought to be made and fitted with the same care, and neatly stitched together at their ends, rather than pinned. Cotton batting laid loosely next to the skin, or underneath the splints at any point, will not keep its place so well as when it is inclosed in covers—it is more liable to get into knots, and it has altogether a slovenly appearance. The pads may be stitched to the roller, and in this way secured effectually in place, but loose cotton is subject to no control.

When I speak of pads, it must not be understood that I intend to recommend them for compresses, or for the purpose of pressing fragments into place. Nothing could be a greater source of mischief in the dressing

of a broken limb. I have only directed their employment as a means of adaptation, and to protect the skin against the direct pressure of the splint.

Dr. Jacobs, of Dublin, says that he has seen an excellent splint made from the "fresh bark of a tree, taken off while the sap is rising." "It fits admirably," says Dr. Jacobs, "just like pasteboard soaked in water."[1] Dr. C. C. Jewett, of the 20th Mass. Vols., recommends for the same purpose the bark of the liriodendron, or tulip tree.

Hemlock-tanned, undressed sole leather, cut into shape and soaked a few minutes in water, adapts itself easily to the limb, and is sufficiently firm. It is especially applicable to fractures of the larger limbs. At Bellevue Hospital it has for several years taken the place of almost all other materials, for the construction of movable splints. Oak-tanned leather is less flexible than the hemlock-tanned, and does not make so good a splint. The specimens selected should be of medium thickness. Before applying the splint the edges should be bevelled on the inner side, and the corners rounded, and a piece of woollen cloth should be interposed between the splint and the skin. The leather will become hard within twenty-four hours, and at the next dressing it may be removed, covered with a sack made of woollen or cotton cloth, and replaced. Dr. Ap-M. Vance, assistant at the Hospital for Ruptured and Cripples, New York, prefers what is known as "bridle leather," which is more plastic than sole leather, hardens as quickly, and becomes as firm. It can be made very hard by substituting hot water for cool in soaking the leather.

A splint is also occasionally made of thin calfskin, veneered with some light timber, such as linden or white wood, the latter being subsequently split into strips of from half an inch to one inch in width, so as to combine a certain degree of flexibility with the requisite firmness.

Fig. 10.

Wood and leather splint.

The Turks use, according to Sedillot, in a similar manner, the "nervures" of palm, laid upon sheepskin, and fastened with wooden thongs;[2] and Packard mentions that he has seen narrow slips of some light wood glued in the same way upon soft pieces of buckskin, and then fastened together with two strips of buckskin, which were also glued to the splints.[3]

Common, unpolished pasteboard, cardboard, and the stout millboard used by bookbinders, constitute invaluable domestic resorts, since they can generally be found in the house of the patient; and if in no other way, pasteboard may generally be had at the expense of some paper box or of the loose cover of some old book. For small bones, the thinner sheets afford a sufficient support; but for large bones the thick binder's board is necessary. In preparing the latter for use, it ought to be moistened with water; but if soaked too much it will separate and fall into pieces, or lose its firmness when dry, in consequence of having parted with some of

[1] Jacobs, New York Journ. Med., March, 1847, p. 265, from Dublin Med. Press.
[2] Amer. Journ. Med. Sci., vol. xxiii., Feb. 1839, p. 481.
[3] Packard's edition of Malgaigne, vol. i. p. 173.

its paste. This splint may be applied to the limb without the interposition of anything but a few folds of muslin cloth, or a piece of flannel; or we may use instead a single sheet of cotton wadding. It must be bound to the limb by the roller whilst it is moist; and, as it dries speedily, it forms a smooth, firm, and reliable splint.

Felt, made of wool saturated with gum shellac, and pressed into sheets, makes an excellent moulding tablet for splints. This may be obtained at any hat manufactory. Until recently, they were manufactured, and moulded into a great variety of forms, by Dr. David Ahls, at York, Pennsylvania. A similar material is now made and sold by J. Peirce, of Bristol, Pa. A much cheaper material, however, and which has nearly all the qualities of the real felt, may be made from old pieces of broadcloth, or from any similar closely woven texture, by saturating it thoroughly with gum shellac, the gum being dissolved in alcohol in the proportion of one pound of the former to two quarts of the latter. Thus prepared, it is to be spread upon both surfaces of the cloth with a common paint-brush. When this first coat is well dried by suspending the cloth where the air will have free access to both surfaces, a second must be spread upon one of the surfaces; and then a third; the cloth being allowed to dry after each successive coat. Finally, the sheet is to be folded upon itself, so as to bring the most thickly covered surfaces together, and pressed with a hot flatiron. If it is necessary to have greater strength, more gum may be laid upon the cloth, and it may be again folded and pressed. When used, it is to be dipped into boiling water or held near the fire until it becomes flexible. Shellac cloth hardens very rapidly in cooling, and demands, therefore, some quickness in its application; but once applied and fitted, it forms a hard but smooth splint, well adapted for all the purposes for which it is designed. It is well to mention, if one wishes to keep any portion of the solution which is not used, that, in order to prevent evaporation, the vessel in which it is contained must be closely covered. Boiling water deprives it of a portion of its shellac, and it is better to soften it by holding it to the fire.

Recently, I have found an article, made by I. M. Holly, a manufacturer of hatters' goods, at 77 Greene Street, New York, which is better for general use than woollen cloth treated with gum shellac. The fabric is lighter, cheaper, and more flexible. It is made of from four to six layers of cotton cloth, saturated with gum shellac and smoothly pressed, and is sold by the manufacturer at the rate of about two dollars per yard. At the present time it is used more often by myself, than any other material for the ordinary purposes of a movable plastic splint, and I think is preferred by most of our surgeons. It is light, and, if dipped in hot or boiling water for a few moments, it becomes sufficiently flexible to adapt itself readily to almost any inequality of surface. Before being cut, a paper model should be made from the limb to serve as a pattern. It hardens quickly, but not too quickly for accurate adjustment.

There has been lately introduced from Boston, Mass., a kind of blanket cloth, coated on one side only with shellac, but it seems unnecessarily thick and heavy, and has not much firmness, and is, I think, in all respects much inferior to the cotton cloth shellac material last described.

The principal objection to all of those forms of splints which contain

gum shellac is, they harden so rapidly after being made flexible by exposure to heat, that it is often found difficult to give them an accurate mould to the limb.

It has been objected to the felt splint occasionally, that it is impervious to air and moisture, and that it confines the insensible perspiration; but, as I never use splints of any kind without underlaying them with compresses, or woollen cloth, which act sufficiently as absorbents, I have never been aware of any inconvenience from this source.

Dr. R. O. Cowling, of Louisville, Ky., has called attention to the value of Manilla paper in the construction of splints.[1] A limited use of this material satisfies me that it possesses most of the qualities of a good splint. It is cut into strips, stiffened with starch, and applied longitudinally or spirally, as may be necessary to cover the limb completely and smoothly. For the lower extremities six to eight layers are required. The material may be obtained at most large paper stores.

The employment of gutta percha as a coaptation splint was first suggested and practised by Oxley, of Singapore. For fractures of the thigh, and for the large bones generally, I prefer a thickness of about one-sixth or one-fifth of an inch; but for the fingers or toes it need not be more than one-sixteenth of an inch in thickness. In its natural state, and at the ordinary temperature of the body, it is nearly as hard and as inflexible as bone; but when immersed in hot water it almost immediately softens, and would become too soft to be conveniently handled unless soon removed. It can therefore be adapted to any surface, however irregular, and its form may be changed as often as may be necessary. It does not harden as rapidly as felt, and it possesses, therefore, in this respect, an advantage, since it allows the surgeon more time for adjustment; whilst, on the other hand, it hardens much more rapidly than either starch, paste, or dextrine. Ten or twenty minutes is all the time usually required for gutta percha to acquire that degree of firmness which will prevent it from yielding under the pressure of a bandage.

To use gutta percha skilfully requires some experience, and I have known surgeons to reject it after a single trial; but by those who have acquired the necessary skill it is generally regarded as an invaluable resource.

When constructing from this material a thigh-splint, we should order a very large tin pan, or some open, flat tray, in which we may lay the splint at full length. If the splint is required to be twelve inches long and six inches wide, we must cut it about fourteen inches long by seven wide, so as to allow for the contraction which always takes place more or less when the hot water is applied. It is then to be laid upon a sheet of cotton cloth of more than twice the width of the splint, in order that the cloth may envelop it completely when it is folded upon it; and the cloth should be enough longer than the splint, to enable us to handle and lift it by the two ends without immersing our fingers in the hot water. If the gum is not thus covered and supported, it will adhere to the vessel, to the fingers, to the surface of the limb, and indeed to whatever else it comes in contact with; it may even fall to pieces, or become

[1] American Practitioner, Jan. 1871.

very much stretched and distorted by its own weight. The cloth cover will generally adhere to the splint, and may be permitted to remain upon it permanently.

Place the splint, thus covered, in the basin, and pour on the water slowly. As soon as it is sufficiently softened, lay it over the limb, moulding it carefully with the hands, or by pressing it against the limb with a pillow. If it does not harden rapidly enough, this process may be hastened by sponging the outer surface with cold water; and as soon as it has acquired sufficient firmness to support itself, it may be removed and immersed in a pail of cold water or placed under a hydrant; after this, it is to be neatly trimmed and wiped dry, when it is ready for use.

When gutta percha remains a long time exposed to the air, it gradually oxidizes, its color becomes darker, it loses its tenacity and flexibility. This may be prevented by keeping it constantly immersed in cold water. It may be sufficient to place it in a damp cellar.

The same objection has been made to gutta percha which is occasionally made to felt, namely, that it confines the perspiration, but to this I have already sufficiently replied.

There is scarcely any fracture demanding the use of a splint in which I have not demonstrated its utility, but it is especially valuable, as I shall have occasion to mention again, as an interdental splint in fractures of the jaw, and as a moulding tablet in all fractures occurring in the vicinity of joints.

Sheets of gutta percha of any required thickness may be obtained in this city of Mr. Bishop, the manufacturer, on Twenty-fifth Street, near the East River. One pound will make about four thigh-splints.

Benjamin Welch, of Lakeville, Conn., has contrived a very ingenious application of gutta percha to the purposes of a splint, by veneering a thin plate of the gum with equally thin plates of elastic wood. The veneering is laid upon both sides, and then it is pressed into form in moulds. The elasticity of the wood, together with the plasticity of the gum, enables the surgeon to change its form somewhat at pleasure, by dipping it into hot water. Its form cannot, however, be changed to any great extent, and by frequent immersion in hot water the veneering is apt to loosen from the gutta percha.

The moulding tablet of Alfred Smee, composed of gum-arabic and whiting, spread upon cloth,[1] has nothing special to recommend it; any more than the cloth splints, hardened with the whites of eggs and flour, used by Larrey.[2] Starch and alum, glue, pitch, and various other materials of a similar character deserve only to be mentioned as having been occasionally employed, but which have never succeeded in securing for themselves the confidence of surgeons.

Immovable or Permanent Dressings.—In 1834, Seutin, of Brussels, introduced the use of starch as a means of hardening the bandages; his method of using which is essentially as follows: A dry roller is first applied to the skin, and then smeared with starch; all of the bony promi-

[1] Amer. Journ. Med. Sci., vol. xxvi. p. 220, May, 1840; from London Lancet, Jan. 25. 1840.

[2] Amer. Journ. Med. Sci., vol. ii. p. 216, May, 1828; from Journal des Progrès, vol. iv.