SURGICAL WARD WORK

AND

NURSING.

A Handbook for Nurses and Others.

BY

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Dedication of First Edition.

TO

A. G. MILLER, Esq.,

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THIS LITTLE WORK IS RESPECTFULLY DEDICATED

BY HIS FORMER PUPIL AND HOUSE SURGEON,

THE AUTHOR.

PREFACE TO SECOND EDITION

WHILE the general scope of this work remains the same as in the first edition, the subject matter has been thoroughly revised, in places rearranged, and all through considerably extended. The chief additions are in those sections dealing with aseptic procedures in surgical operations, and with the after-treatment of operation cases. The chapter on the antiseptic spray has been omitted. Many of the old illustrations have been replaced, and a large number of new ones added.

I desire here to express my thanks to Dr. Lewis Crook, House Surgeon to Leith Hospital, for several photographs; and to acknowledge the kindness of the various instrument-makers who have granted the use of the illustrations of their surgical instruments.

1, GEORGE SQUARE, EDINBURGH,
October, 1899.

PREFACE TO FIRST EDITION

At the foot of the ladder of surgical literature there appears to the author still to be a step wanting. The junior student and the nurse-probationer entering on the duties of the surgical ward require a guide more minute and detailed than is furnished by any of the excellent works on minor or practical surgery now at their command.

In the hope of filling this gap, rather than with a desire to traverse ground already so satisfactorily occupied, this little work is sent out. To the experienced nurse or the senior student, there may be in it much that appears elementary, perhaps even trivial; but they may be reminded that there was a time when they were ignorant of it, and that the present comfort of their patients depends more on careful attention to the minutiæ of surgical technique than on the appreciation by them of the broad principles of the science. 'There is no real elevation of mind in a contempt for little things.'

I gladly embrace this opportunity of expressing my thanks to Miss Marion Stenhouse, Staff-Nurse, Royal Infirmary, Edinburgh; and to Miss S. M. Ferrier, of the Rio Tinto Hospital, Huelva, Spain, for many useful hints on practical points connected with the nurse's duties; and to my friend, Dr. A. B. Giles, for valuable aid in correcting and revising proofs.

To several makers of surgical instruments I am also much indebted for kind permission to make use of their illustrations.

EDINBURGH,
October, 1893.

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SURGICAL WARD WORK AND NURSING

SECTION I.

ANTISEPTIC SURGERY

CHAPTER I.

GENERAL PRINCIPLES OF ANTISEPTIC SURGERY.

In the present day, when the Listerian method of wound treatment predominates over all others, and guides every surgical procedure, it is essential that its first principles should be thoroughly grasped by all who, even in the humblest capacity, take part in any surgical operation or dressing.

The great aim of modern surgery is to obtain primary union of wounds by what is called *first intention*—that is, without the occurrence of inflammation—and this can only be done by the prevention of sepsis.

What is Sepsis?—Let us imagine two patients admitted to a surgical ward on the same day under similar conditions, and each requiring amputation of a limb. When the stump of the first patient is dressed on the fourth day, it is found that the deeper part of the original dressing applied at the time of the operation is stained with blood, but perfectly dry. The drainage-tube, on being withdrawn, is found to be filled with a pale-coloured blood-clot, having a faintly mawkish odour. The lips of the wound are in contact all along the line, and there is no swelling or redness of the parts around. The stitches show no redness or inflammation around them, although they may be somewhat tighter than when first introduced. There is no pain, and but slight tenderness on pressure over the stump. The patient looks and feels well, and has a normal temperature, healthy pulse and appetite.

It is very different with the other patient. The whole of the dressing, even out to the bandage, is moist with discharge of a yellow colour and has a disagreeable odour. The stump is red, swollen and painful, and on pressure a quantity of thick yellow discharge escapes from the drainage-tube, and from between the edges of the wound, which are gaping widely from one another. The stitches are tight, buried in the tissues, or cutting their way out, and discharge is seen oozing from their openings. The patient appears very ill. He has been shivering, his temperature is 102° or 103° F., and his pulse 120, small and weak; he has no appetite, and sleeps badly.

The first is healing by first intention; the second has become septic.

On what does the difference depend? On the introduction of certain minute organisms, germs, microbes, or, as we prefer to call them, *bacteria*, into the wound.

It is an every-day experience that animal matter placed under certain conditions undergoes decomposition by putrefaction. These conditions are: 1st, that the material be dead, or, at least, very much devitalised; 2nd, that it contain a certain amount of fluid; 3rd, that it be kept at a particular temperature; and, last and most important, that certain minute fungi or micro-organisms gain access to it.

Of this combination of circumstances essential to the septic process, it will be evident that, at least, the first three exist in every surgical wound. The tissues, in virtue of having been injured, are to some extent devitalised —'below par'—in some instances, indeed, actually dead. The discharges—blood and serum—and the normal fluids of the body tissues furnish the necessary moisture; while the ordinary temperature of the body, 98·4° F., is highly favourable. But a wound will not become septic unless the fourth factor be added to the others. The bacteria must reach the wound, where they find a suitable 'nidus' for their growth and development, ere the septic process is established.

Nature and Action of Bacteria.—So far as we are at present concerned with bacteria of surgical interest, it will suffice to say that they are divided into two different classes, according to their shape.

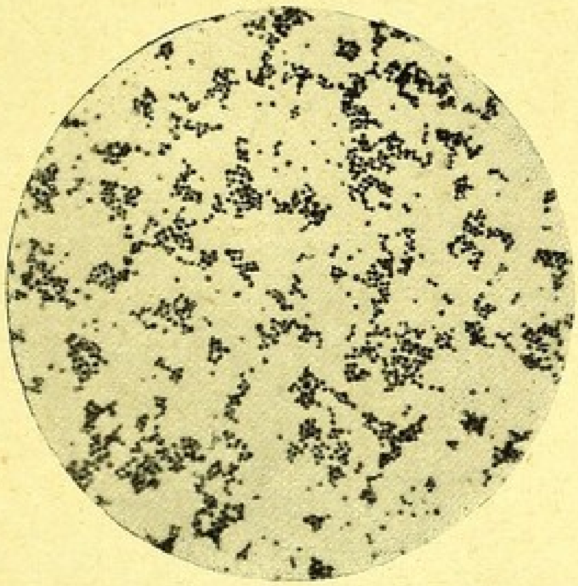


FIG. 1.

1. We have the small *round* organisms known as *cocci*, some of which occur grouped in masses like bunches of grapes, and are spoken of as *staphylococci* (Fig. 1); while others form long chains, and are known as *streptococci* (Fig. 2).

Staphylococci give rise to localised inflammatory and suppurative conditions, such as boils, abscesses, and certain diseases of bone; while streptococci produce spreading diseases, such as erysipelas, and diffuse cellulitis.

2. The other great class of bacteria—the *bacilli* (Fig. 3) —occur in the form of short *rods*. A great many diseases are due to bacilli of different kinds; for example, tuberculosis, tetanus, diphtheria, pneumonia, typhoid fever, etc.

Each micro-organism, to whatever class it belongs, is practically a small cell, consisting of a minute mass of protoplasm bounded by an envelope, and in some cases

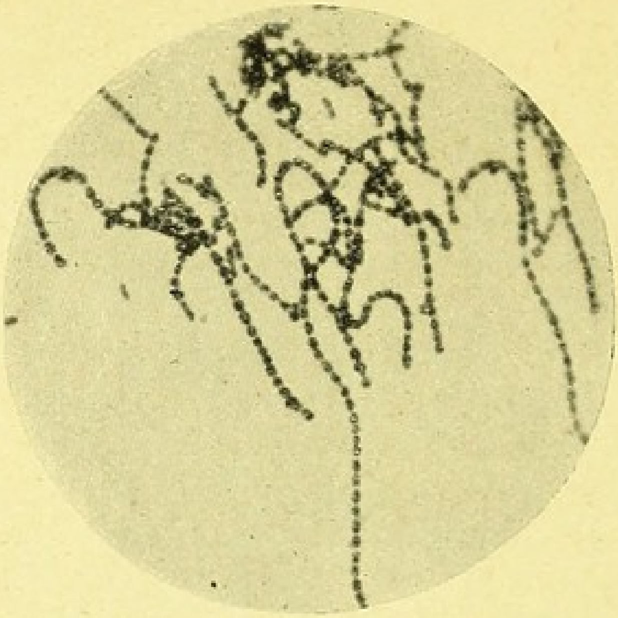


FIG. 2.

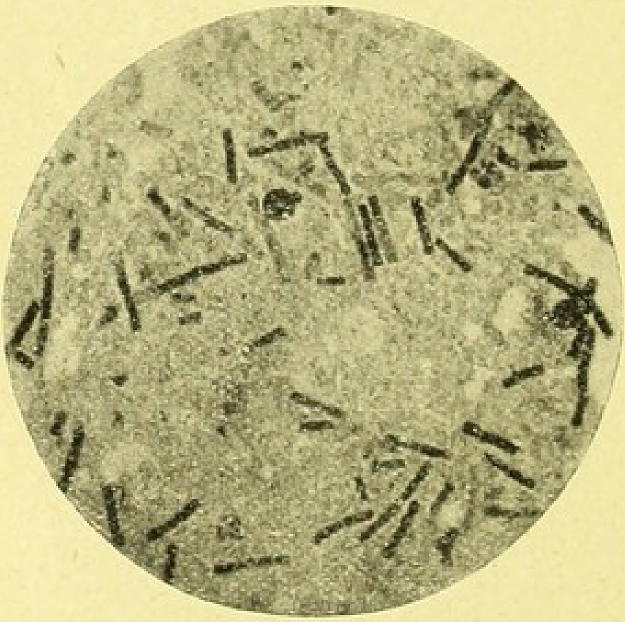


FIG. 3.

containing a quantity of coloured pigment, the commonest shades found being yellow, orange, red, and blue. These colours are best seen when the organisms are artificially cultivated in tubes containing such nutrient media as gelatine, blood-serum, or slices of raw potato, on which they grow very readily, and many varieties are identified by the colour of the 'colonies' which spring up under these conditions. They are all so minute as to require very high powers of the microscope to render them visible, and for the study of their structure and life changes.

For their nutrition these organisms require a supply of hydrogen, nitrogen, oxygen, and carbon, and in many cases some phosphate. This they obtain by breaking up the elements of the tissues in which they find a suitable habitat, this breaking-up process being what we know as sepsis.

Not only do they disorganise the tissue in which they actually live, but, in addition, each variety of organism produces some poisonous chemical substance, known as its *toxine*, and it is the absorption of this poison by the patient that produces the blood-poisoning associated with septic wounds; and as different organisms produce different toxines, we have many clinical varieties of septic poisoning —for example, sapræmia, septicæmia, etc. In some cases the organisms themselves pass into the blood and lymph streams, and so get disseminated throughout the body, starting fresh foci of infection, and consequently increased production and absorption of toxines, a condition known as pyæmia.

Distribution of Bacteria.—Bacteria of many varieties are exceedingly abundant under almost every condition of ordinary life—in the atmosphere we breathe, in the water we drink, on our clothes, our furniture, and even on our skin, so that, unless every precaution be taken to prevent it, they are almost certain to gain access to our wounds. The omnipresence of septic agents is a fact constantly to be borne in mind by all who have in their hands the treatment of surgical patients.

By *surgical cleanliness* alone can we hope to avoid infection of our wounds, and so obtain healing by first intention. And surgical cleanliness must be understood to mean something more than ordinary personal and domestic cleanliness. It means not only the absence of gross and visible dirt, but also of the invisible, microscopic particles of dust which harbour the ubiquitous germs.

Means by which a Wound may become Septic.—To illustrate the numerous ways in which bacteria may be introduced to wounds, take, for example, the case of a man receiving a scalp wound by a blow on the head with a stick. The organisms may pass directly into the wound from (1) the *stick;* or (2) from the patient's *cap;* (3) from the *hairs* in the vicinity of the wound; (4) or from the *skin* in the region. Failing these sources of infection, it may take place (5) from any *handkerchief* or *cloth* applied to the wound; (6) from *water* used to bathe it; or from (7) the *hands* of those rendering first aid. Should a doctor see the case, (8) his fingers or *probe* used in investigating its extent may carry in organisms; (9) his *needle or thread* used in stitching it up; or (10) even the *dressings* he may apply, unless they are of a reliable antiseptic nature. (11) It is not impossible that organisms may pass into such a wound in the *dust* of the air.

In the case of surgical operations, the chief sources of septic infection are: (1) The skin of the patient himself; (2) the hands of surgeon, assistants, or nurses; (3) the instruments, ligatures, or stitches; (4) impure sponges, swabs, or drainage-tubes; (5) inefficient lotions; (6) dust from the air; or from (7) various other accidental sources.

The three words *septic*, *aseptic*, and *antiseptic*, so constantly used in relation to wounds and their treatment, will, in the light of what has just been said, be now quite intelligible. A septic wound is one in which infection by bacteria has taken place, and the organisms having established themselves are producing their results; while a wound which is aseptic is free from bacteria. The term antiseptic is applied to anything which will counteract the process by destroying the vitality of the organisms causing it. It must be remembered that a wound may remain aseptic either because organisms have never gained an entrance to it, or because the tissues of the patient have been strong enough to combat the germs, and so to ward off their attack. It is a well-established axiom that 'healthy tissue is our best antiseptic.'

Importance of Asepsis in Wounds.—The importance of preventing sepsis in surgical wounds cannot be exaggerated. It makes the difference between successful and unsuccessful surgery, in many cases between the life and death of the patient. To mention that among septic diseases such affections as septicæmia, pyæmia, erysipelas, hospital gangrene, malignant pustule, and a host of others, are to be numbered, will indicate the desirability of guarding our patients from the attacks of organisms, or of destroying these should they be present.

As we go on we shall find that it is only by attending to the minutiæ of antiseptic surgery, and by giving the most scrupulous attention to apparently trivial details, that we can hope to command success.

Means adopted to prevent Wounds becoming Septic.—The chief means adopted to prevent septic infection are:

1. Ordinary personal cleanliness on the part of patient, surgeons, and nurses.
2. Surgical purification of the part to be operated upon.
3. Surgical purification of instruments, sponges, ligatures, and dressings coming in contact with the wound.
4. Surgical purification of the hands of surgeons, nurses, or others taking part in the operation.
5. Irrigating the wound with antiseptic lotions.
6. A surgically pure atmosphere.
7. Avoidance of all sources of contamination during the operation and at subsequent dressings.

Asepsis is the ideal of modern surgery, and in the light of recent discoveries and extended experience in the Listerian methods, it should be attainable in all cases where the skin is unbroken when the patient comes under the care of the surgeon. Unfortunately, many patients have already been infected with septic organisms before seeking or obtaining surgical aid, and with them our endeavours must be directed to counteracting the effect of these, by improving the health of the tissues, and by a judicious use of antiseptic agents—external and internal.

CHAPTER II.

ANTISEPTIC LOTIONS.

SUCH, briefly stated, are the general principles on which the system of antiseptic surgery is based, and we may proceed to consider its practice.

There are many antiseptic lotions now in use, and it will not be necessary to enumerate, much less to describe, all of them. There are some, however, which are so universally employed, and so efficient, that we shall say a few words about each.

(1) *Carbolic Acid Lotion.*—This agent is of much historical interest, being that employed by Lord Lister when he first introduced the antiseptic system in the year 1865. In a field of a hundred competitors it still remains the first of antiseptics. It is a substance derived from coal-tar by a complicated process of distillation, and in its pure, strong form is in long white crystals. As a lotion, however, it is used largely diluted with water. One part of the acid is dissolved in 19 parts of hot water, and forms a lotion, spoken of as '1 in 20 carbolic.' This is the strongest carbolic lotion in common use, and for many purposes it is too strong. As a rule, a lotion half that strength, spoken of as '1 in 40,' is what is used in ordinary surgical operations and dressings. The lotion, if pure, is quite clear, and should it be the least turbid, impurities which will irritate the skin may be suspected.

Caution!—It must be borne in mind that carbolic acid is very poisonous, and the bottle should always bear a prominent poison label. Not only is it deleterious when taken by the mouth, but when large quantities are used at an operation, or when a carbolic dressing is applied over a large area, such as an ulcer or burn, it may be absorbed, and give rise to unpleasant symptoms, such as giddiness, nausea, and vomiting. As some people are peculiarly susceptible to the action of carbolic acid, it is always necessary to keep a sharp look-out on the patient, and if he show any of these unpleasant symptoms this lotion should be discontinued, and some other substituted. Evidence that the lotion is being absorbed is often to be found in the urine, which is passed of an olive-green colour, and on standing becomes almost black. This in itself is not a dangerous condition, but should be accepted as a hint that the patient is intolerant of the drug, and as an indication for making a change.

The chief *advantages* of carbolic lotion are: (1) Its cheapness; (2) its volatility; (3) that it does not injure instruments or sponges.

Its *disadvantages* are: (1) Its being poisonous by absorption; (2) its being irritant to the skin of some patients; (3) it renders the operator's hands anæsthetic if used throughout a prolonged operation.

Uses.—Pure, liquefied with a few drops of glycerine: to sterilise septic sores, sinuses, or fistulæ; and in emergencies to purify instruments. 1 in 20: to purify skin of patient; to purify hands of surgeon and assistants; to purify sponges and instruments; to prepare and store gauze, sponges, and drainage tubes; and to prepare dipped towels. 1 in 40: for operation or dressing lotion.

(2) *Corrosive Sublimate Lotion.*—This antiseptic was at one time much used. It is a preparation of mercury, and goes by various names—'corrosive lotion,' 'perchloride,' 'bichloride,' 'sublimate,' and sometimes simply 'mercurial lotion.'

The perchloride of mercury is a white crystalline substance, and is extremely poisonous. The lotion is made by dissolving the powder in distilled water. It is antiseptic in very much diluted forms, up to 1 in 5,000 being often used. The commonest strength in use, however, is 1 in 2,000. It is customary to keep the ward stock of

1 in 1,000, and to dilute it with equal parts of tepid water when 1 in 2,000 is required. It is often tinted with aniline orange to distinguish it from other lotions.

It is unfortunate that this lotion corrodes metallic instruments, which greatly restricts its use, and this property should always be borne in mind, as otherwise expensive and delicate instruments may be destroyed by purifying them with it. On this account, also, tin basins must not be used for corrosive lotion, the tin being instantly corroded, losing its polish, and turning the lotion black. Glass, porcelain, or, better still, enamelled dishes must be employed.

So also with syringes. A brass syringe should never be used with corrosive lotion, always a glass or vulcanite one.

As far as possible, sponges should not be put into corrosive lotion, because, although it does not actually destroy, it permanently blackens them.

Corrosive lotion is easily rendered non-antiseptic by the addition of a quantity of blood or pus to it. The albumin of the blood or pus acts on the solution, forming an albuminate of mercury, which is not antiseptic. Therefore the lotion should be changed very frequently during an operation. One can tell when this action has taken place by the thick brown deposit, resembling very much the sediment of strong beef-tea, which falls to the bottom of the basin. The addition of a quantity of chloride of ammonia or of common salt to the lotion prevents this deposit.

Caution!—Corrosive sublimate is a most deadly poison if taken by the mouth. It should therefore always bear a prominent poison label, and be placed in some position where children or delirious patients cannot reach it. Like carbolic, it may also produce symptoms of poisoning by being absorbed through the skin, or from a wound. These symptoms are diarrhœa, vomiting, and collapse, which may be followed by rapid death. A large moist dressing of corrosive sublimate should never be applied, nor should macintosh ever be used outside of such a dressing to prevent evaporation, because the contact of the lotion with the skin produces irritation, and absorption rapidly follows.

The *advantages* of corrosive lotion are: (1) Its cheapness; (2) being non-volatile, it remains antiseptic; (3) its efficiency; (4) its general applicability.

Its *disadvantages* are: (1) Its poisonous properties; (2) it corrodes instruments, tins, etc.; (3) it blackens sponges.

Uses.—1 in 500: For washing out septic cavities (care being taken not to leave any in the cavity); for purifying the skin; for purifying the surgeon's hands. This strength is rather irritating for the surgeon's hands, but its efficiency is undoubted. 1 in 1,000: Same uses as 1 in 500. This is the strength which should be kept in the stock-bottle. 1 in 2,000: For irrigating at operations; for irrigating at dressings, etc. This strength may be used for almost any purpose, being efficient, safe, clean, and readily procurable. 1 in 5,000: In ophthalmic surgery; as a vaginal douche in gynæcology, etc. It is prepared by adding four times as much water as 1 in 1,000.

(3) *Lister's Strong Solution.*—For purifying the hands of the surgeon and the skin of the patient before operation a lotion containing a mixture of carbolic and corrosive is used by many. It is prepared by making a 1 in 20 solution of carbolic acid in distilled water, and in every 500 parts of this one part of perchloride of mercury is dissolved.

(4) *Biniodide of Mercury.*—Within the last few years this antiseptic has been gradually superseding corrosive sublimate. It is a less irritating and more powerful antiseptic than corrosive, and has the great advantages that it neither forms an inert albuminate with blood or other wound discharges, nor does it tarnish instruments.

It is used in the same strengths and for the same purposes as corrosive lotion. It is prepared as follows: Dissolve 24 grains of perchloride of mercury in a pint of tepid water; also dissolve 2 drams of iodide of potass in a pint of tepid water; mix the two solutions and add other two pints of tepid water. This gives a 1 in 500 solution, which may be diluted as required.

(5) *Boracic Acid Lotion.*—This, which also goes by the name of boric lotion, has the great advantage over the mercurial and carbolic lotions of being practically non-poisonous. It is only a very weak antiseptic, which 'may prevent but cannot eradicate sepsis.' It is a saturated solution of boracic acid crystals in water. A 'saturated' solution means that the water is allowed to dissolve as much as it will of the drug. Hence it is impossible to use a lotion of boracic acid which is too strong, because the water refuses to take up more than 1 in 30, this forming the usual efficient lotion. To make it, add an ounce of the crystals to a pint of *boiling* water (because boiling water dissolves more than cold), and allow it to cool, when the excess of acid falls to the bottom again in the form of crystals. The stock lotion bottle should always have a few crystals at the bottom, as an indication that it is sufficiently strong. In some hospitals the boracic lotion is coloured pink by adding some rose-aniline to it. This is merely that it may be readily distinguished from other lotions by its colour, and is by no means necessary for its efficiency. In some exceptional cases it acts as an irritant on the skin, producing an acute eczematous condition.

The *advantages* of boracic lotion are: (1) Its cheapness; (2) its safety; (3) it is non-irritating as a rule.

Its *disadvantages* are: (1) That it is not a sufficiently powerful germicide to warrant its use in septic cases; (2) that it sometimes produces eczema; (3) it is said to produce symptoms of poisoning in some rare cases.

Uses.—To clean and dress wounds of all sorts; as an eye-wash; as an ear-wash; as a mouth-wash or gargle; as a nasal douche; is particularly useful for washing out the bladder; as a vaginal or uterine douche. For all these purposes it should be used tepid, and it is better to heat the full strength lotion than to add hot water, as the latter method diminishes its strength.

(6) *Lysol*, one of the newer protected antiseptics, is of considerable value. It is one of the coal-tar derivatives, and contains substances analogous to carbolic acid. It is powerfully antiseptic and deodorant, and is said to be

non-poisonous. It forms a clear solution with water, and possesses the cleansing properties of a mild non-alkaline soap.

It is sold in a concentrated form, and is used in strengths of from $\frac{1}{4}$ to 1 per cent. For ward purposes it is best to keep a stock of 1 in 100, and dilute it with tepid water when required. It should not be diluted with boracic lotion, which abolishes its soapy character. The pure lysol should be added to the water, and not *vice versâ*.

The *advantages* of lysol are: (1) Its cheapness; (2) its safety; (3) its soapy character, which enables it to remove grease and blood very rapidly; (4) its antiseptic efficiency; and (5) it does not irritate the skin.

Its *disadvantages*: (1) That when mixed with blood or pus it forms a slimy, sticky mixture; and (2) its odour, which, however, is by no means disagreeable.

Uses.—1 in 100. For purifying the skin of the patient, both before and after operation; the hands of the surgeon and assistants; for cleansing the blood off instruments and sponges after operation. $\frac{1}{4}$ per cent. solution may be used for douches.

(7) *Izal* is of a similar nature to lysol, but forms a white emulsion with water. It is used in the strength of 1 in 200, or even weaker, as an antiseptic and deodorant in foul-smelling ulcers and wounds; and 1 in 400 as a mouth-wash, both before and after operations, on the jaws, tongue, or throat.

(8) *Creolin* is very like izal, and has the same applications. It is used as 1 in 100 to 1 in 500 solutions in water.

CHAPTER III.

ANTISEPTIC POWDERS.

Of antiseptic powders in common use, the chief are iodoform, powdered boracic acid, and mixtures of these with other substances.

1. *Iodoform.*—This substance is practically a preparation of iodine, and is met with in three forms: (*a*) Crystals, large, irregular, rough, and coarse; (*b*) powder, which is simply these large crystals crushed and broken down into small, regular, golden-yellow particles; and, best of all, (*c*) precipitated powder, which is a fine flour-like impalpable powder.

In whichever form it occurs, it has a peculiarly persistent and somewhat disagreeable odour, which may be masked, or at least altered, by various means, such as tincture of musk, tonquin bean, or balsam of Peru. It is said to have an anodyne action when applied locally, and is sometimes used in painful affections of the rectum as a suppository, containing 3 grains, on this account. It is not a powerful antiseptic, but has a specially beneficial action in tubercular affections, and in certain venereal diseases. It seems to act by chemically altering the toxines in such a way as to render them less harmful. It is used largely to dust over septic wounds, but in aseptic cases it is not only useless, but hurtful. Under no circumstances should iodoform be applied to an aseptic wound, unless it itself has been sterilised by heat, or with 1 in 20 carbolic acid.

In all conditions in which the discharge has a disagreeable odour, such as septic abscesses, open cancers, and so on, iodoform is a very valuable application, its own characteristic odour serving to mask that of the discharge.

Gauze is often charged with iodoform, 10 to 20 per cent., and used as a deep dressing or to stuff cavities. For the latter purpose, one long strip of gauze is preferable to a number of shorter strips, as it is more easily removed, and there is no risk of leaving any in the wound. Iodoform should be kept in a cool, dry place.

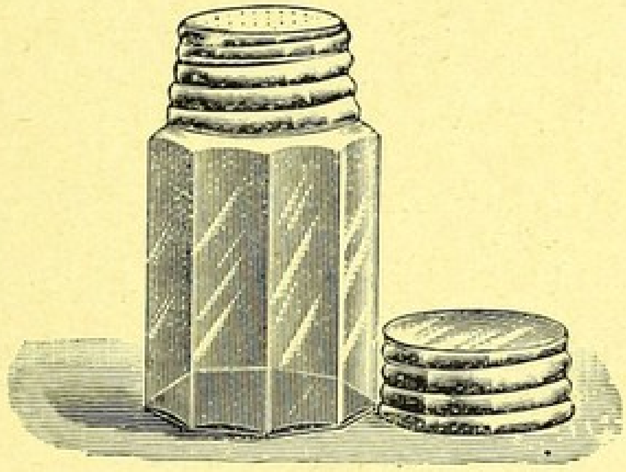


FIG. 4.—POWDER DREDGER.

Caution!—In children and in old weakly people, symptoms of iodoform poisoning sometimes occur when large quantities have been used, and especially if the powder has been blown into cavities and left there. These symptoms vary much, and differ in the young and old. They are, loss of appetite, mental depression or excitement, and sometimes more grave brain symptoms. Should these occur, the drug must be discontinued, and the patient stimulated.

Its chief *advantages* are: (1) Its special action in tubercular and venereal diseases; (2) its deodorising properties; and (3) its anodyne properties. And its *disadvantages:* (1) Its expense; (2) its persistent odour; (3) its alleged poisonous properties; (4) it may contain germs in the dry state; (5) it sets up an acute eczematous or pustular eruption in certain people who are peculiarly susceptible to it.

Uses.—(1) To dust on all septic wounds, especially tubercular and venereal; (2) to dust on the conjunctiva in purulent conjunctivitis; (3) to charge gauze for stuffing cavities, etc.; (4) as a deodoriser, *e.g.*, in cancerous ulcerations.

Iodoform in Ether.—A solution of iodoform in ether is sometimes brushed over wounds, or injected into cavities. When the ether evaporates, a fine coating of iodoform is left.

Iodoform Emulsion.—One part of *sterilised* iodoform in 10 parts of glycerine has been recommended by Lord Lister for injection into tubercular joints and cold abscesses.

Iodoform Insufflation, for various cavities, such as nose, ears, rectum, etc., is made by mixing 1 grain of iodoform with ½ grain of powdered starch. The mixture shows less tendency to cake than iodoform alone.

2. *Aristol* is a proprietary dusting-powder which depends upon iodine for what efficiency it has. Its only advantage over iodoform is that it has no characteristic smell. Its uses are the same.

3. *Loretin* is a non-poisonous unirritating substitute for iodoform, with marked deodorising properties, and with less tendency to cake than most other dusting-powders.

4. *Boracic Acid Powder* is largely used as a dusting-powder for wounds and irritated or moist skin-surfaces, as well as for insufflation into the nasal or aural cavities. It often causes pain when applied to raw surfaces, such as ulcers or burns, and is apt to cake when mixed with blood or serum on the surface of a wound. It is non-poisonous, but is only a feeble antiseptic.

Boracic Acid Powder and Starch in equal parts is a more generally useful dusting-powder than the pure boracic acid. It is useful to apply to parts subjected to pressure, and liable to become the seat of bed-sores.

Iodoform and Boracic Acid Powder is a most useful dusting-powder, combining the advantages of the two constituents, and diminishing their disadvantages.

Take of:

Boracic acid powder	... ...	3 ounces
Iodoform in fine powder	... ...	1 ounce

Mix.

Boracic Acid, Zinc, and Bismuth Powder.—This forms an excellent powder for dusting over raw surfaces such as result from burns; also for keeping the skin of bed-ridden patients dry, and so preventing bed-sores.

Take of:

Boracic acid powder	Equal parts.
Oxide of zinc	
Carbonate of bismuth	

Mix.

CHAPTER IV.

ANTISEPTIC UNGUENTS.

In spite of the advances which have been made in the preparation of antiseptic agents, we still seem to be in want of a satisfactory antiseptic unguent or oil. Those in ordinary use for the lubricating of catheters, bougies, exploring-needles, etc., have each some disadvantage—some are irritating, others are unreliable as germicides.

1. *Carbolic Oil* consists of 1 part of carbolic acid dissolved in 5, 10, or 15 parts of olive-oil, according to the strength required. Although this preparation is often recommended for antisepticising catheters, hypodermic needles, etc., it is by no means a certain agent. 'The value of these oily compounds is very doubtful, as they have been found to have no influence on germs' (Mitchell Bruce). When freshly prepared it may be efficient, but it has been shown that after standing for a short time, it loses all its germicidal power, and is simply a plain oil. The author has tested a large number of samples of so-called carbolic oil found in various hospital-wards, and has almost without exception found them to consist of simple olive-oil.

Carbolic oil, therefore, should never be used to disinfect instruments unless it is perfectly freshly *prepared;* to be fresh from the shop is not sufficient—it may have stood there long enough.

2. *Catheter Oils.*—More reliable antiseptic oils for lubricating urethral and other instruments are prepared as follows:

(*a*) Take of

Absolute phenol	1 part
Castor oil	7 parts
Almond oil	8 parts

Mix.

(*b*) Take of

Eucalyptus oil	1 part
Olive oil	$2\frac{1}{2}$ parts
Castor oil	$2\frac{1}{2}$ parts

Mix.

(*c*) The following unguent has been found very useful for lubricating urethral instruments. It is a good antiseptic, and the cocaine seems to soothe the urethral mucous membrane, preventing subsequent spasm and urethral fever:

Take of

Vaseline	$2\frac{1}{2}$ ounces
Oil of vaseline	$2\frac{1}{2}$ ounces
Eucalyptus oil	1 ounce
Cocaine (alkaloid)	30 grains

Dissolve and mix.

3. *Eucalyptus Oil* is the oil distilled from the fresh leaves of the plant of the same name, a species of gum-tree. It is used in surgery mixed with olive-oil in the proportion of 1 in 6. It is of a pale straw-colour, and has an agreeable aromatic odour. It is a fairly reliable antiseptic, and on this account, as well as because it is less irritating, it is preferable to carbolic oil.

CHAPTER V.

MATERIALS FOR DRESSINGS.

Varieties of Wool.—Wool is very largely used in surgery for padding splints and other appliances, and as a part of almost every dressing. There are different varieties of wool, some plain, others charged with antiseptic agents.

1. *Plain Wool.*—This is ordinary cotton wadding made up in sheets about half an inch thick, and having one side covered with a paste which keeps the wool together. This material is not charged with any antiseptic, nor is it absorbent, and must never on any account be used in dressing an open wound, for padding splints in the setting of a compound fracture, or for any part connected with a discharging sore. For these purposes antiseptic wool of one kind or another must be employed.

Plain wool may only be used as padding for splints in cases of simple fracture, or where one is dealing with unbroken skin.

The paste backing should be peeled off before the wool is used, as it interferes with the escape of the skin secretions, which are apt to cause irritation when retained.

2. *Corrosive Sublimate Wool.*—This is fine white cotton-wool, which is highly absorbent, and has been rendered antiseptic by impregnation with corrosive sublimate. It is used in the dressing of all open wounds, and for padding splints and other appliances which are to come near sources of discharge. The advantage of this wool lies, of course, in its being antiseptic, but it must be borne in mind that the pus and blood render the corrosive no longer

antiseptic by forming with it an albuminate of mercury. Hence, so soon as ever a dressing gets soaked with discharge, it is no longer *anti*septic, but only *a*septic, and should organisms gain access to it, it will soon become *septic*. The practical application of this is, that when using corrosive wool a sharp look-out must be kept on the discharge, which must never be allowed to get through the bandage. If it should do so in spite of watchfulness, *at once* re-dress the wound, otherwise the chances are it will become septic, as pus in a warm, moist pad of wool forms an excellent nidus for germs, and germs never lose an opportunity of establishing themselves. Although corrosive wool is fairly absorbent, the discharge tends to pass in a straight line through it without much lateral diffusion.

3. *Wood-Wool.*—This is made by subjecting chips of pine-wood to certain chemical processes, by which the oils and resins are removed, and the remaining substance is rendered very absorbent. It is most conveniently employed in the form of wood-wool wadding or wood-wool tissue, to which a sufficient quantity of cotton-wool has been added to give the dressing cohesion. It is charged with corrosive sublimate to make it antiseptic, and has the advantage of being much more absorbent than ordinary corrosive wool. When saturated with discharge, it, too, loses its antiseptic properties. In wood-wool the discharge diffuses itself widely in every direction.

4. *Salicylic Wool* is fine cotton-wool charged with salicylic acid. Two strengths of the antiseptic are used, the stronger containing 10 per cent. by weight, the weaker 3 per cent. The excess of powdered acid which comes off the wool is apt to irritate the eyes and nasal mucous membrane of those around, setting up in some people a violent coryza. For this reason it has been given up by many surgeons.

5. There are various other antiseptic wools available, such as *carbolised wool*, 6 per cent.; *iodoform wool*, 10 per cent. for wounds, or 50 per cent. for use in aural cases; *sal-alembroth wool*, 2 per cent. This wool is usually tinted with aniline blue to distinguish it.

It will thus be seen that each of the varieties of wool mentioned has certain disadvantages: some are irritating, others are rendered non-antiseptic by discharges, some are deficient in absorptive power, and all are expensive.

Practical Points.—There are one or two points of importance in preparing the wool for a dressing or operation. Wool must never be allowed to lie exposed to the air and its inevitable dust and germs. It is best kept clean by being placed in well-closed tin boxes; or, failing these, it should be kept rolled up in the thick paper in which it is sold. As it comes from the chemist, it is in long thick rolls, each weighing about a pound. It will be found convenient to cut these rolls into pads about a foot square, and place them one above another in the boxes. As wool will only tear in its *long axis,* it is easier, and wastes less wool, if the sheets be cut *across* with scissors.

Cellulose Dressings.—With a view to cheapening dressings, attempts have been made to employ thin layers of cellulose either alone, or mixed with corrosive wool; but their powers of absorption are not great, and they have only met with a very partial success.

Sawdust as a Surgical Dressing.—The following are the directions given by Dr. E. F. Neve, of Kashmir, for the preparation of the sawdust-bags he so strongly recommends on the grounds of economy and efficiency:

Materials Required.—(1) Clean sawdust passed through a sieve of $\frac{1}{8}$ inch to $\frac{1}{4}$ inch mesh; (2) bags of muslin or butter-cloth of various shapes and sizes.

Method of Preparation.—Slightly moisten the sawdust with 1 in 1,000 solution of mercury perchloride, and then fill the bags and lightly stitch up the open end; dip one surface into a 1 in 20 carbolic lotion. After all the bags have been so treated, they are placed in a sterilizing oven, and heated to 100° C. for one hour. They are now ready for use, and are simply bandaged on over a deep dressing of Lister's double cyanide gauze. The sawdust absorbs better if the surface next the wound is moistened with an antiseptic lotion.

LINT.—1. *Plain* or *Surgical Lint* is a soft material, made by scraping old linen cloth, and is used as a dressing in certain cases. It is not antiseptic, therefore its use is much restricted. It may be covered with antiseptic ointments, oils, etc., and applied to open sores. The two sides of lint are different—one is plain, the other is woolly—and the question is often asked, Which side should go next the wound? It is very much a matter of taste. It will be found that one can spread ointment more evenly and with greater ease on the plain side. The plain side is less apt to stick into a sore, and the dressing is thus removed more easily, and with less pain to the patient. On the other hand, when applying lint to an unbroken surface, the woolly side is the softer, and absorbs skin secretions better.

2. *Boracic Lint* is ordinary surgical lint which has been soaked in a hot, saturated solution of boracic acid, and then hung up to dry. It is thus rendered an efficient antiseptic, and, as the boracic acid is non-volatile, it retains this property. It should, however, never be applied next a wound *dry*, as its germicidal power is greatly increased by moisture. It is usually tinted pink by means of litmus to distinguish it from ordinary lint, and is often covered with an excess of boracic acid crystals deposited as the lint cools. It is exceedingly absorbent of discharges. In every way boracic lint is a most valuable material, being cheap and handy, only requiring to be moistened to furnish a fairly efficient antiseptic dressing for all minor injuries, such as cut hands, scalp wounds, small ulcers, and so on. It also forms a good deep dressing in more important cases. Another use to which it is often put is to cover the limb before applying a plaster case or extension strapping. Boracic lint is preferred to plain for this purpose, being toxic to fleas and other body insects—a point of great importance in our out-patient departments.

Advantages.—(1) Cheapness; (2) fairly efficient antiseptic; (3) almost universal applicability; (4) very absorbent; (5) toxic to fleas, etc.

GAUZE.—1. *Carbolic Gauze.*—This is a rough unbleached muslin, which has been rendered antiseptic by being charged with a mixture of carbolic acid, resin, and paraffin. The paraffin prevents the gauze adhering, while the resin fixes the volatile carbolic acid, and so prevents, to some extent, the evaporation of it so long as the gauze remains dry and below the temperature of the body. At one time it was largely employed as a deep dressing, but is now almost entirely used for making bandages.

2. *Plain* or *Surgical Gauze* is a loose cotton cloth rendered absorbent by having its oily matter removed by boiling in soda. It is soft, open and porous, and for its bulk absorbs a large amount of discharge. It is cut into strips, and folded so as to make pads six or eight layers thick, and about 4 inches square. It is antisepticised by being boiled, and then kept in 1 in 20 carbolic till used. As 1 in 20 carbolic is apt to irritate the skin, the gauze-pad should be wrung out of some less irritating antiseptic before being applied to the wound as a deep dressing. These pads are of great use, as they can take the place of protective, or be used as a deep dressing, or even as sponges. In the practice of aseptic surgery (p. 51) these pads are used as sponges and as dressings (dry) after being sterilised by steam.

3. *Double Cyanide Gauze or Mercuro-Zinc Cyanide Gauze.*—Lord Lister used plain gauze charged with the double cyanide of mercury and zinc, which is a fixed non-irritating and reliable antiseptic. It should be kept in glass jars slightly *damp* with carbolic acid. If dipped in corrosive sublimate before being used, a triple salt is formed, which is but a feeble antiseptic, and is, moreover, exceedingly irritating, sometimes producing vesication of the skin.

4. *Sal-alembroth Gauze* contains 1 per cent. of sal-alembroth, which is a combination of corrosive sublimate with ammonium chloride. It is tinted with aniline blue, and should be wrung out of 1 in 40 carbolic before being used.

5. *Iodoform Gauze* is prepared in varying strengths from 10 per cent. to 20 per cent. or higher. It is very largely used for stuffing tubercular and septic cavities and as a dressing. It can be readily prepared for ward use by boiling strips of gauze for an hour, and then soaking them in 1 in 20 carbolic, after which *sterilised* iodoform powder is rubbed into the meshes of the gauze. It is said to relieve the pain of burns.

6. *Iodoform Worsted.* — For draining septic cavities, sinuses, etc., several lengths of plain four-ply white worsted, sterilised by boiling, and then impregnated with sterilised iodoform, are exceedingly useful. This material drains better than iodoform gauze.

7. Gauze impregnated with *eucalyptus*, *salol*, or *thymol*, is also used by some.

There are one or two other substances which are in constant use in surgical practice which may be referred to here.

OILED SILK OR PROTECTIVE consists of thin sheets of oiled silk coated on both sides with copal varnish to render the silk impervious to fluid. Over this a layer of carbolised dextrine is painted, but as the carbolic soon volatilises from the dextrine, it loses its antiseptic properties. It is not used nearly so much nowadays as it used to be. Its object is to prevent adhesion of the other dressings to the edges and surface of the wound, to protect the raw edges of the wound from irritation by carbolic or other antiseptics, and to facilitate the escape of discharge, which soaks out all round its edges, and is thus more evenly distributed in the wool. This is still further aided by having the protective perforated with small holes. When a drainage-tube is being used, a hole is cut in the protective and the tube drawn through it, the protective preventing the safety-pin irritating the skin. In dressing large *healing* ulcers of all kinds, but especially those resulting from burns, it is of great importance that the margins should be very gently dealt with. It is here that the healing process is going on, and it is evident that if any dressing be applied which will adhere to the wound, this delicate epithelium will be removed at each dressing, and the healing process consequently retarded. To prevent this, the growing epithelial margin should be covered with thin strips of protective carefully purified.

Thin sheets of *tinfoil* may be used for the same purpose. This material is specially useful for covering skin-grafts.

GUTTA-PERCHA TISSUE.—As its name implies, this is a very thin sheet of gutta-percha. It is used to put outside deep dressings or fomentations when it is desired that these should remain moist, as it prevents evaporation of the fluid in the dressing. Non-antiseptic, it requires purification before being used, but must not be dipped into *hot* lotion, which softens and destroys it. Excellent finger-stalls can be made with gutta-percha tissue one or two layers thick. The edges are easily fixed by a drop of chloroform, or better still, by the flame of a lighted match. It has been found useful also for making small ice-bags to apply to a hernia cerebri, and for other purposes.

MACINTOSH OR PINK JACONETTE is a thin cotton cloth with a layer of indiarubber waterproofing over it, invented by Syme. Like gutta-percha tissue, it is used to prevent moist dressings becoming dry by evaporation. Its chief use, however, is to protect the patient's clothing and the bed during an operation or at dressing. For this purpose it is cut into sheets about a yard square, the edges being left unhemmed. It must never be folded up while damp, as the adjacent surfaces adhere and it is spoiled. Carefully avoid sticking pins into macintosh, as the holes made allow lotion to run through, and permit of evaporation from fomentations, etc.

Sheets of *white macintosh* are much used nowadays to cover over the area of operation. Pink jaconette is preferable for this purpose, as its colour contrasts with that of the carbolised or sterilised towels, and one is less liable to lay instruments, sponges, etc., on it than on the white macintosh, which is scarcely recognisable from the towels.

BANDAGES AND SLINGS will be treated of later. Suffice it now to say that there are certain bandage materials which are antiseptic—*e.g.*, carbolised gauze, double cyanide of mercury and zinc gauze, and domette which has been impregnated with sal-alembroth, and others which are non-antiseptic, such as plain cotton and ordinary domette, and one or other of these materials will be selected according to the nature of the condition under treatment, having regard to whether or not an antiseptic is indicated.

CHAPTER VI.

LOTION BASINS AND OTHER APPLIANCES.

BEFORE going further it may be convenient to mention the various tins, basins, and other appliances usually found in a surgical ward, and the uses to which these are put.

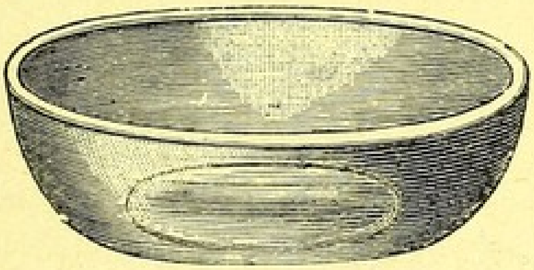


FIG. 5.—ROUND GLASS LOTION BASIN.

1. *Lotion Basins* (Fig. 5).—These may be made of glass or enamelled tin; they are of various shapes and

FIG. 6.—KIDNEY-SHAPED BASIN.

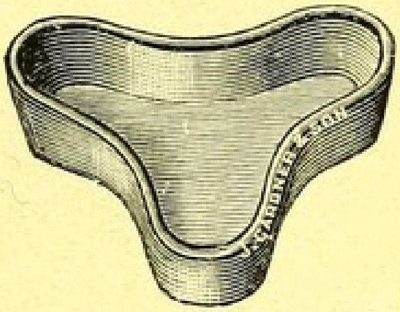


FIG. 7.—CLEAR GLASS PUS BASIN, THREE-CORNER SHAPE.

sizes. They should never be filled more than half full with lotions.

2. *The Kidney-shaped Basin* (Fig. 6) is described by its name. It is a shallow glass or enamelled vessel, used to catch up discharges as they escape, *e.g.*, pus from a large

FIG. 8.—BLEEDING CUP.

abscess. On account of its shape it can be accurately applied to the surface of almost any part of the body, so preventing any soiling of the patient's clothes or sheets.

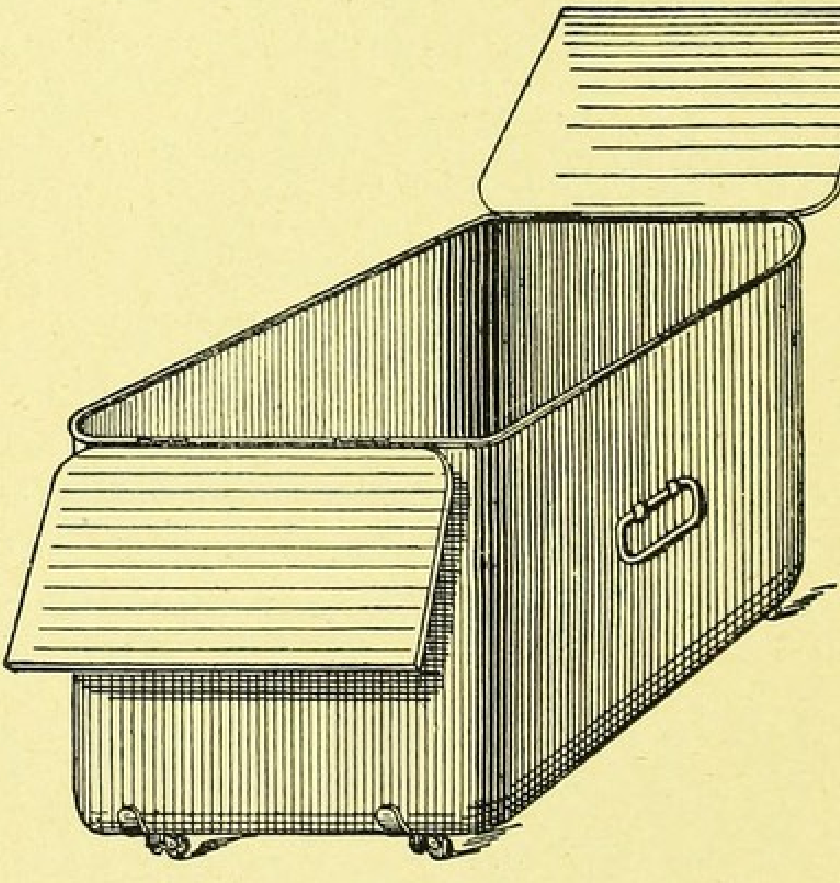


FIG. 9.—BOX FOR SOILED DRESSINGS.

A three-cornered dish is also useful for this purpose (Fig. 7). These and all other dishes which are brought into contact with wounds should be thoroughly purified with carbolic (1 in 20) lest they carry germs on to the wound.

3. *Bleeding Cups* (Fig. 8).—These small saucer-shaped dishes, although not now employed for their original purpose, are still very useful, and should be found on every ward table. They are made of glass or tin, and are usually graduated, so that the quantity of discharge caught in them may be measured. They are often used in place of the kidney-shaped basin, the same precaution being taken with regard to purifying their edges. They

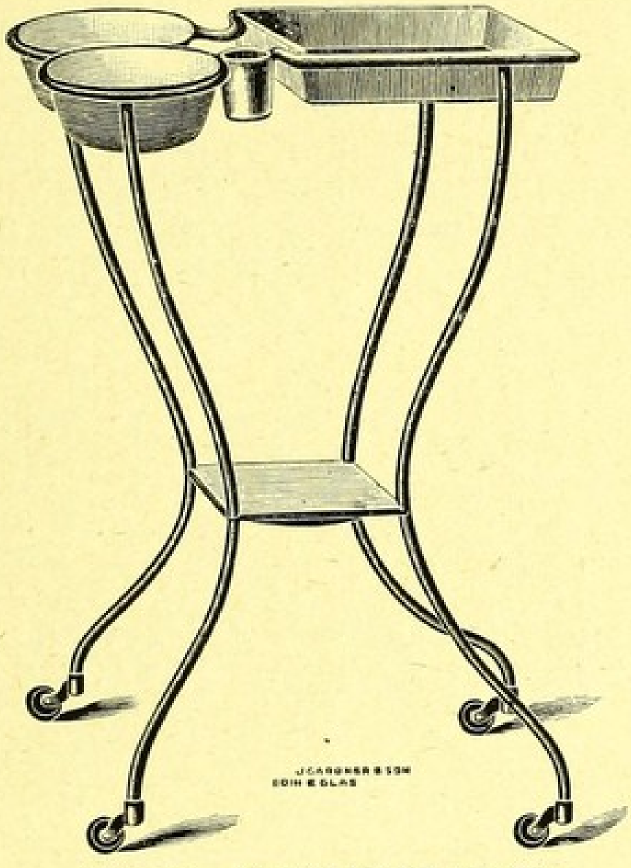


FIG. 10.—INSTRUMENT STAND.

are found useful receptacles for the parts removed at operations, *e.g.*, excised parts of joints, tumours, and so on.

4. *Leg Tray*.—This is a long, shallow, oval tray, used in dressing wounds of the leg. At the upper end is a broad flange hollowed out to permit of the thigh resting on it, while the lower part of the leg lies over the tray, into which all discharge and lotion escape.

5. *The Soiled-Dressing Tray* is a large shallow tray, placed under the bed or operating-table to receive the dressing removed from the patient and any other refuse which may require to be disposed of during the procedure. When the dressing is finished the tray should *at once* be removed from the ward and emptied, the soiled dressings being burned, and the macintoshes, etc., washed, purified, and dried.

6. *Soiled-Dressing Box.*—A large enamelled iron box with folding lid is used for the reception of soiled dressings (Fig. 9).

7. *Instrument Trays* of glass or white porcelain are used for placing instruments in during an operation (Fig. 13).

8. *An Instrument Stand,* which is placed near the operator, is very convenient for holding instruments, sponges, and lotions when assistance is limited (Fig. 10).

CHAPTER VII.

WARD TABLE OR TROLLEY AND DRESSING TRAY.

HAVING indicated the various materials and utensils in every-day use, and some of the more important practical points in connection with each, it may be convenient to

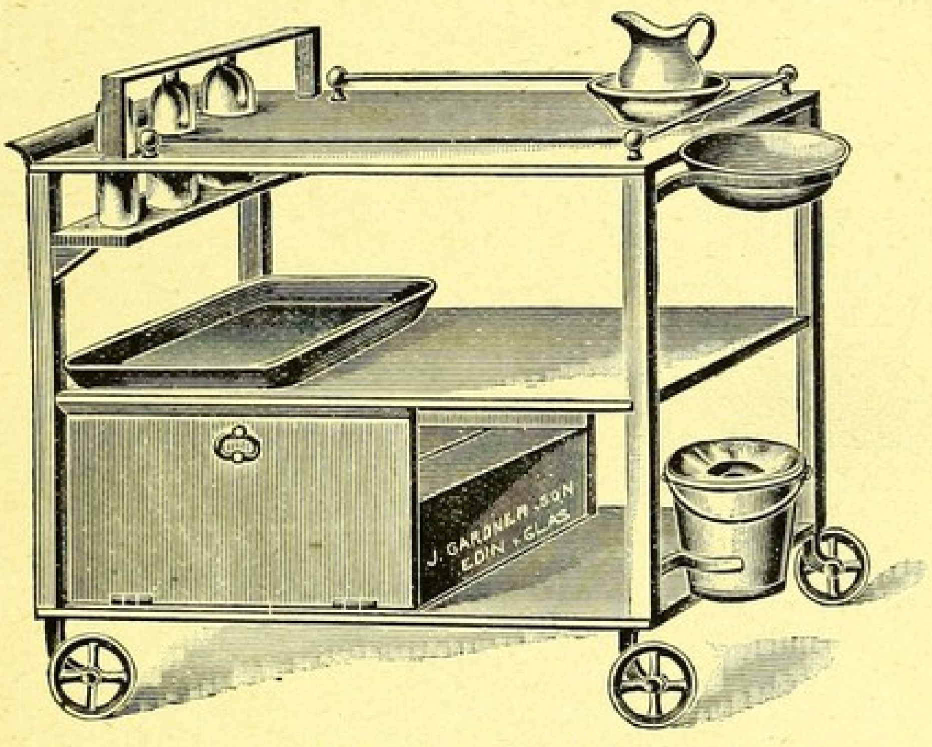


FIG. 11.—WARD TROLLEY.

recapitulate in a tabular form the furnishings of a ward trolley (Fig. 11) or table and dressing tray.

Ward Table.—The arrangement of the ward table is so much a matter of individual taste, that one cannot lay down rules with regard to it. On it should be found:

A Winchester jar of carbolic lotion (1 in 20).
" " corrosive lotion (1 in 1,000).
" " biniodide (1 in 2,000).
" " boracic lotion, saturated.
" " lysol (1 in 100).
20-ounce jar of corrosive lotion (1 in 500).
A small wide-mouthed bottle of pure phenol (liquefied).

All these should have glass stoppers, and be carefully labelled. They should all be marked 'Poison,' and must not be within the reach of children.

Eucalyptus oil (1 in 6).
Unguent for urethral instruments.
Vaseline.
Boracic ointment.
Zinc ointment.
Glycerine.

These should be in wide-mouthed glass bottles, containing about 4 ounces of each.

Boracic powder.
Iodoform.
A mixture of these.

These should be in wide-mouthed glass bottles, covered with fine gauze firmly fixed on with an india-rubber band, for dusting.

Drainage tubes.
Pads of plain gauze.
Iodoform gauze.
Iodoform worsted.
Antisepticised safety-pins.

The tubes and gauze are best kept in wide glass jars (Fig. 12), about 6 inches high and 4 inches in diameter; the pins (to be used only for transfixing drainage tubes) in a small glass bottle with a stopper. The carbolic lotion in which all these are kept should be frequently changed, as it loses in strength by volatilising.

A small box containing sulphate of copper (bluestone).

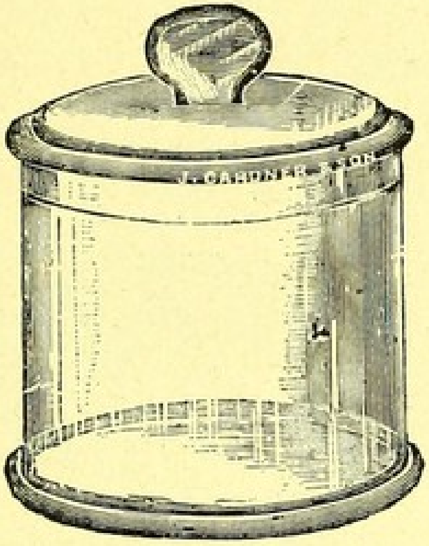


FIG. 12.—GLASS JAR WITH STOPPER GROUND INSIDE.

In addition there should always be at hand:

Four to six lotion basins of different sizes (plain and enamelled).
Two kidney-shaped basins.
Two bleeding cups.
One leg-tray.
One soiled-dressing tray or box.
One pail with close-fitting lid for hot water.
One pail to hold soiled lotions, etc.
One Higginson's syringe.
One brass or glass syringe.

Dressing Tray.—This may be of wood or tin, about $1\frac{3}{4}$ to 2 feet long, by 1 foot broad, and about 2 inches deep. A cabinet (Fig. 22) is sometimes used. It should contain a supply of:

Plain surgeon's lint.
Boracic lint.
Protective.

Gutta-percha tissue.
Gauze bandages (carbolised and double cyanide).
Domette bandages (plain and sal-alembroth).
Linen bandages (plain).
Adhesive plaster.
Safety-pins.
Measuring tape.
Corrosive wool and wood-wool tissue (in tin boxes with close-fitting lids).
Several mackintoshes.

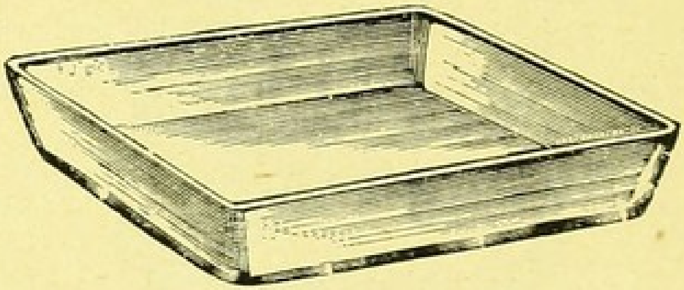


FIG. 13.—CLEAR GLASS INSTRUMENT TRAY.

Instrument Tray (Fig. 13).—For use in the wards, it is convenient to have a small glass tray containing:

A pair of scissors.
A pair of dressing forceps.
A pair of sinus forceps.
A pair of dissecting forceps.
A probe.
A bistoury.

These should be boiled each morning, and kept while in use in 1 in 20 carbolic. If used for a septic case, they should be boiled before being again used.

CHAPTER VIII.

AN ANTISEPTIC DRESSING.

A Simple Antiseptic Dressing.—Having now considered the general principles of antiseptic surgery, and the means at our disposal of applying these principles, we shall go on to study the practice itself. It is the duty of the dresser or nurse to make all the preparations necessary for the dressing of a case by the surgeon when he makes his ward visit, and this includes not only the preparation of the patient himself, but of all the dressings, lotions, instruments, etc., that may be used. There is no way in which a nurse can show her capabilities better than in the performance of this apparently simple duty. She must take every precaution that the patient is not unduly exposed, or wearied more than is absolutely necessary; and she must make certain that she has everything at hand that can possibly be wanted, so that there will be no delay during the dressing by things having to be sent or searched for. She must also carefully watch the steps of the process as it goes on, and *anticipate* the surgeon's wants. This 'faculty of anticipation' is one which must be cultivated by all who take part in surgical work, whether as assistant, dresser, or nurse. It should be the aim and ambition of a surgical nurse never to require to be asked for anything during the dressing, but always to have the required article ready to the surgeon's hand just at the moment it is needed. This is of importance to the patient as well as to the surgeon, because many people, and especially women and children, are much more frightened than pained by being dressed, and their fears are increased if there is a constant conversation going on between the surgeon and the nurse as to what is being done. The less talking that goes on at the dressing the better. If by any chance the nurse should have forgotten something, and should notice her mistake just when the dressing is beginning, she should take some opportunity of going to rectify it when her services are not required. She should not rush off immediately she notices the omission, just, perhaps, when she is wanted to hold a limb, or remove a bandage, but should wait till some part of the dressing which will engage the surgeon's attention for some little time, and then she can quietly and quickly go, her absence, perhaps, never being observed.

The main points to be attended to in the performance of an ordinary simple antiseptic dressing are:

1. *The comfort of the patient*, which must be the first care; and

2. '*Antiseptics*,' which includes the 'surgical cleanliness' of the nurses, dressers, and surgeon, as well as the sterility of the dressings.

To Prepare the Patient.—Let us suppose that the wound to be dressed is that resulting from a severe crush of the leg below the knee. The patient is to be protected from draughts, as well as from the gaze of other patients, by the ward screens. One should be careful in arranging these to make sure that they stand firmly, and are not in danger of being knocked over; and also that plenty of room be left all round the bed, so that doctors and nurses may move about without knocking against the screens. Try to arrange the doorway between the screens, so that those inside may reach it from either side of the bed without passing one another. The most convenient place is usually opposite the foot of the bed. No more of the patient's body is to be exposed to the air than is absolutely necessary, especially in cold weather; the bed-clothes being arranged so that only the injured limb is uncovered, and only as much of it as is sufficient to render access easy.

To Protect the Bed.—This will be done by covering as much of the bed as comes within the area of operations with mackintosh waterproof; and it will be found an advantage to fold up the edges all round so as to form a kind of gutter, that any lotion spilt on the mackintosh will not find its way on to the sheets. The same end may be attained by sewing a roll of wool into the edge of the mackintosh all round, forming a thick border.

Carbolised Towel.—Over the mackintosh is spread a towel which has been soaked in 1 in 20 carbolic and wrung out. In cold weather a sterilised dry towel is more comfortable for the patient. The object of this is to have an antiseptic surface next the wound, so that if by any chance it comes in contact with the bed, septic contamination is rendered impossible. Instruments, sponges, and dressings can be laid with safety on this towel. The precaution of the dipped towel is one which is not always taken, even in hospitals where the antiseptic system is supposed to be carried out in all detail; and some surgeons open abscesses with nothing but a mackintosh on the bed, and from this they lift their instruments, sponges, and drainage-tubes. No one supposes that a mackintosh is antiseptic, or even aseptic, and it seems unreasonable that a wound should be douched with carbolic lotion and covered with antiseptic dressings while such a simple and obvious precaution as the carbolised towel is systematically neglected. The towel has another advantage, that it prevents soiling of the sheets by absorbing a considerable quantity of the lotion which runs off the wound. From a nurse's point of view this is a sufficient reason for using it, even should she feel that it is not her place to suggest the antiseptic precautions to her chief. When the leg-tray is used, the mackintosh should be laid under it, and the carbolised towel over it, so that by the former the sheets are protected, while the latter secures an antiseptic surface next the wound, without interfering with the escape of lotion into the tray.

Personal Cleanliness.—As it is the duty of the dresser or nurse to hand up the dressings to the surgeon, it is of the utmost importance that they themselves should be 'surgically clean.' By this term is meant that they should be free from every kind of septic germ which, gaining access to the wounds, might do harm. If then the nurse should have been working with anything likely to be a fruitful source of sepsis, such as an abscess or ulcer, she should change her apron before assisting at an aseptic dressing. Under all circumstances she must purify her hands. Observe, we do not say 'wash' her hands; that is not sufficient for surgical purification. She must carefully purify with soap, turpentine, or soda, and tepid water, use the nail-brush freely, thoroughly rub the hands all over with spirits of turpentine, which is a powerful antiseptic, and is not injurious to the skin, and then dry with a fresh clean towel. A final wash in lysol, 1 in 100, or carbolic, 1 in 20, completes the purification.

If the nurse has occasion to touch the limb, especially if near the wound, or any dressing or instrument which goes into contact with the wound, she must not neglect first to dip her hands. This word 'dip' is rather unfortunate in this connection. Too often the hands are only dipped. They should be thoroughly rubbed over with the lotion, with the aid of a swab of wool. It may appear to be carrying antiseptics too far to insist on these minutiæ, but if we are going to adopt antiseptic principles at all, no details are too insignificant to claim our attention.

If it be necessary that the nurse's hands should be pure, it is evidently at least equally important that the surgeon's should be. It is the nurse's duty to see that the necessaries for this are ready—a liberal supply of tepid water, soap, turpentine, powdered carbonate of soda, a nail-brush, and a clean sterilised towel. Cold water should never be used for this purpose, even in warm weather, because it is not so good for cleaning the hands, and it cools them down and renders them uncomfortable to the patient.

The Lotion.—It will depend on the nature of the wound and the taste of the surgeon what particular lotion is used in each case. Let us suppose that carbolic (1 in 20) is what is wanted. Take two enamelled lotion basins, and put into each a quantity of 1 in 20 carbolic, adding an equal quantity of tepid water to bring it down to the proper strength. Tepid water is added in preference to cold, being more comfortable for the patient. Do not use more than half fills each basin. Into one basin put a small amount of corrosive wool or gauze to use as a swab for washing the wound. Sponges should never be employed in ward dressings, as, being used for all sorts of cases, they simply become a vehicle for spreading sepsis. The lotion in the second basin is to be used for the deep dressing to be applied, or for syringing out the wound, and into it nothing that is soiled may be put. If corrosive or biniodide be used, 1 in 1,000 is diluted with equal parts of tepid water, just as is done with carbolic; but with boracic it is better to heat the full strength lotion than to furthur dilute it with water.

Syringing of Wounds.—Without here discussing the advisability of syringing wounds, we shall only say that it is not to be made a routine practice in the dressing of wounds and cavities. In many cases it does far more harm than good. A few words as to how it should be done when necessary. There are many kinds of syringe available, but perhaps the best for all purposes is the Higginson, fitted with a long narrow metal or glass nozzle, which may be passed to the bottom of a wound. By it you can get a constant stream, the strength of which can readily be varied, and the flexible tubes allow it to be applied in any direction.

Of the barrel syringes, perhaps the best is that made of glass. It is cheap, can be used with corrosive sublimate, is easily kept clean, and the presence of air in it is readily detected. Whichever form of syringe is employed, it is most important to expel all air from it before introducing it to the wound, as the air may carry with it the elements of sepsis. With the Higginson's syringe, the best way to make sure of the absence of air is to keep the weighted end of the tube in a considerable depth of lotion, expelling all air from the tubes by running a stream through for a short time. When using the barrel and piston syringe, fill it very slowly, and when the piston-rod is withdrawn to its full extent, hold the nozzle straight up in the air. This enables what air is in the barrel to rise to the surface. Now push up the piston-rod till a jet of fluid escapes and expels the air in front of it. Do not be deceived by a small jet which often comes at the very first push in a badly working syringe; wait till a full stream comes from the nozzle. Having filled the syringe and expelled the air, place it in the second basin with the nozzle well under the lotion, so that no more air may enter. In using the syringe, introduce the nozzle to the deepest part of the wound, so that the direction of the stream is from within outwards.

Removal of Old Dressing.—Having thus prepared the patient and all the requisite materials, the next step is the removal of the old dressing. It is unnecessary to insist on the importance of gentleness in this, not only to avoid causing the patient unnecessary pain, but also to prevent undue movement of parts in which the maintenance of rest is of immense importance in the treatment. It is often the duty of the nurse to steady the patient's limb during dressing, and she must always purify her hands before doing so, and try to hold the part in as comfortable a position as possible. Perhaps the most comfortable way for the patient in holding a leg is to seize it by the great toe, and support the heel with the other hand. The domette bandage should be rolled off by simply reversing the movements of putting it on. A bandage should never be removed by seizing the loose end, and describing circles round the patient's foot, coiling it up into a rope. The deeper bandages may be cut off along the front of the limb by short snips of sharp scissors, as they are not to be used again. The wool should be taken off, as it was put on, in layers, and this should be done gently. Wool is more easily removed dry than wet, so that, unless it is sticking into the wound, no lotion should be put on the wool. In removing the deep dressing, raise the upper edge, and by a stream of lotion gradually float up the rest.

Drainage-Tubes.—These are usually removed at each dressing, cleansed, and re-introduced if necessary. In the case of deep or tortuous wounds it is well to leave the tube in position for two or three days, otherwise it is often difficult to re-introduce it. When removing a drainage-tube, carefully note the exact direction it takes in the wound, so that you may know how to re-introduce it. Should you experience any difficulty in doing this, a probe passed into the lumen of the tube, making it stiff, will often facilitate its passage. Some means must always be taken of preventing the drainage-tube slipping completely into the wound, especially when dealing with cavities like the pleura or peritoneum. Even in quite superficial wounds masses of granulations sometimes grow up, completely concealing the end of the tube, which might

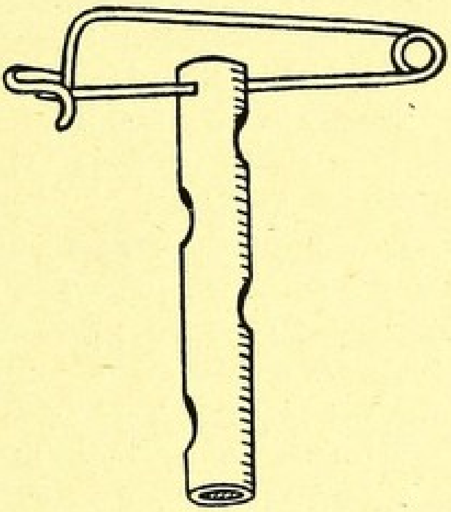


FIG. 14.

easily be overlooked. Perhaps the simplest method is to transfix the tube with a sterilised safety-pin (Fig. 14). It is a safe rule to remove, or at least shorten a tube, when the wound forms an exact mould of it, or when the granulations begin to push it out of the wound.

Washing the Wound.—A very common mistake made by students and nurses in washing the wound is to clean up all the skin around the actual wound first, and then with the same swab to rub over the granulations. In other words, they carefully gather up all the refuse lying around, and deposit it on the raw surface of the wound. Of course, the proper method is to clean the wound thoroughly at the very first, and having done so, never again to touch it. Then remove all the *débris* from the surrounding parts, and proceed with the dressing.

Protective.—The parts having been thoroughly cleaned, the application of the fresh dressing is to be proceeded with. As a rule, some form of protective is placed next the wound, and that most commonly used is Lister's *oiled silk*. As we have already seen, this has the disadvantage of not being reliably antiseptic. As sold, it is between folds of tissue-paper, and it should not be removed from these till just before it is to be used. Only cut as much as is required, and put it at once into antiseptic lotion, wash it thoroughly, and apply it directly from the lotion to the wound.

When oiled silk protective is not used, small pads of *surgical or plain gauze* take its place. These have been boiled and kept in 1 in 20 carbolic, and so rendered thoroughly antiseptic. The carbolic should be washed out of the gauze by dipping it in some less irritating lotion. These pads of gauze, in addition to being antiseptic, have the advantage of being absorbent of discharge, while they do not stick into the wound like wool.

Antiseptic Powder.—In the case of septic wounds, over the protective (sometimes under it) is dusted some antiseptic powder—iodoform, or boracic acid. But aseptic wounds should not be so dusted. It is unnecessary and dangerous.

Deep Dressing.—When gauze is used in place of protective no further deep dressing is necessary, but with oiled silk it is customary to apply some moist, absorbent material just outside of it. The deep dressing may either be allowed to dry, or may be kept moist by a layer of gutta-percha tissue over it, according to circumstances. One of the most useful deep dressings is a four-ply square of boracic lint wrung out of the lotion used for the dressing, which is found to absorb a large quantity of discharge. Outside the deep dressing another dusting of powder may be put, should the discharge have a bad smell.

The Wool.—This has already been so far prepared in arranging the dressing-tray. It is there in large thick squares, but it must not be applied so to the wound. The quantity used will be proportionate to the size of the wound and the amount of discharge expected. On the one hand it is necessary to guard against extravagance in the use of this rather expensive material, whilst on the other one must equally avoid a niggardly and false economy which saves wool at the expense of antiseptic efficiency. Rather use too much than too little wool. There are one or two points to be attended to in applying the wool at a dressing. Never lift a piece of wool from the tray or box and put it straight on to a wound; always split it up so as to get a fresh surface. The object in thus splitting up the wool is threefold: (1) In order that you may have a fresh surface, on which no dust or germs may have landed to put next the wound; (2) that the wool may lie in more accurate apposition with the surface, so that it will not slip, and expose the wound to the air; and (3) that being loose and porous, the discharge will easily soak up into the wool, and not cake and form a hard, impermeable layer next the wound.

In cases where a large amount of discharge is expected it will be well to use a wood-wool dressing, taking the same precautions as to securing a fresh surface. It is more absorbent than ordinary corrosive wool, and this property more than compensates for the inconvenience caused by the excess of dust it gives off, which can be obviated by having it made up in sheets covered with fine gauze—wood-wool tissue.

Bandages.—Over the wool should be put some form of antiseptic gauze bandage to hold the dressing in position, either the gauze charged with the double cyanide of mercury and zinc introduced by Lord Lister, or the older carbolised gauze of the same surgeon. Attend to the following points in connection with this bandage. As carbolic acid is a volatile substance, and as the bandage will doubtless have lain in the tray for a day or two at least, the outer layers will probably have lost their antiseptic properties, and will have had dust landing on them. The first foot or so of a gauze bandage should always be torn off before handing it to the surgeon. Select an appropriate width of bandage, and be careful to unroll a few inches of it before handing it up, as this enables the surgeon to get started with the bandage at once, a thing which is not easy when a firm roll is given him, and, as is very often the case, he has only one hand available for applying it. As a rule, a domette bandage, charged with sal-alembroth, a non-volatile antiseptic, is applied over all to secure the dressing and to support the whole limb.

Safety-Pins.—The bandage is fixed by means of safety-pins, of which a liberal supply should always be ready, as it is often necessary to fasten the bandage at several places, especially about the head, chest and pelvis.

Few people insert a safety-pin properly. The pin should run in the long axis of the bandage. If fixed across the bandage the tension twists the pin round, the last turn gets quite loose, and the other turns soon follow.

The dressing is now finished, the patient must be made comfortable again, and the soiled dressings, mackintoshes, etc., removed.

To make the Patient Comfortable.—First remove the mackintosh and dipped towel, and be careful in doing so to gather up the four corners, and then the intervening edges, to prevent the lotions and discharges soiling the sheets. Then quickly cover up the patient ; see that the bed-clothes do not press on the injured limb ; and if they do, put in a 'cage' to prevent this. Should the patient complain of being cold, you may put a hot bottle beside him, taking care that it is not so hot or so near the limb as to do damage. Never put a hot bottle close beside an unconscious patient, a very old person, or one who has had a very severe injury to his limbs, as it is liable to do harm.

Disposal of Soiled Dressings.—What is to be done with the soiled dressings which have been taken off? The domette bandage should be *at once* removed from the ward and put into a basin of carbolic. However clean it may appear to be, it must on no account be rolled up and put into the dressing-tray or used for another patient. If unstained, it may be used again for the same patient; but in wounds which it is important to keep aseptic—and there are few indeed which it is not—it is better never to use a bandage twice without having it thoroughly washed in antiseptic between times. Everything else should be at once burned, if this be possible; and if not, it should be removed to some place where it can contaminate nothing. On no account collect all the old dressings of the day in the ward, and remove them together at night. The carbolised towel should also be washed before being again used, and the mackintoshes must be washed with carbolic and thoroughly dried before being folded and laid aside. The dressing-tray should be tidied, the wool-boxes closed, and the whole covered over with a clean towel till again required. In some hospitals it is the duty of the dresser or nurse to mark on the chart at the proper place the word 'Dressed,' and any remarks necessary; and this should be done *at the time*, otherwise it is apt to be forgotten and to lead to mistakes.

CHAPTER IX.

ASEPTIC SURGERY.

WHEN Lister had demonstrated that the inflammatory and suppurative conditions which so often complicate surgical wounds depend on infection by bacteria, he at once realised that the perfect conditions for surgical work would be such as permitted of the total exclusion of all micro-organisms not only from the wounds themselves, but from everything which came into contact with them. At first, however, this was impossible, and he had to depend upon the use of *antiseptics* to destroy the bacteria which under the then existing circumstances were inevitable. As our knowledge of the life-history, mode of action and effects of bacteria has increased, and our technical skill has improved, we have gradually been learning to discard antiseptics in wounds made through healthy skin, and to rely on various means of keeping them germ-free.

This *aseptic* method of operating is the natural and logical development of the antiseptic system, and is, as I have said, the realisation of Lister's ideal.

The rationale of aseptic surgery is based upon the following propositions: (1) Healthy tissues contain no bacteria; (2) wounds in healthy tissues tend to heal spontaneously; (3) antiseptics, being all more or less irritant, interfere with their healing; (4) therefore, *if organisms be excluded*, antiseptics in a wound are not only unnecessary, but even hurtful.

It will therefore be seen that the aseptic system is essentially a *preventive* one. Any bacteria which may accidentally reach the wound meet with no resistance beyond that of the tissues in which they find themselves. The necessity for the most scrupulous care to avoid all sources of infection will therefore be obvious.

Surgical cleanliness in its most absolute form must be rigidly practised, and all the precautions of the antiseptic system must, if possible, be increased.

Every avenue by which organisms may reach the wound must be considered and guarded.

1. *Infection by the Air.*—It is now recognised that the risk of infection from the air was in former times much exaggerated, and that unless dust is actively stirred up by shaking curtains or blankets, or by dusting just before an operation, this source of organisms may be ignored.

2. *Infection by Water.*—Ordinary tap-water swarms with micro-organisms, but if it be boiled for ten minutes, they are all destroyed. No water which has not been *boiled*, therefore, may be used for any purpose whatever in the practice of aseptic surgery.

3. *Infection from the Skin of the Patient.*—It is now well known that the surface, and also the deeper layers, of the skin, especially the sweat-glands and ducts and the hair-follicles, harbour innumerable micro-organisms. It is therefore necessary to eliminate these as far as possible before undertaking an aseptic operation. Twenty-four hours before operation the part is thoroughly washed with soap and water, and if necessary shaved. The natural grease of the skin is removed by washing with soda, turpentine, or lysol (1 in 100). A towel soaked in 1 in 20 carbolic is placed over the area of operation, covered with a layer of mackintosh, and left on over-night. On the morning of the operation this process is repeated, and a weaker carbolic towel (1 in 40) left on till the operation begins. After the patient is under chloroform, the part is once more washed with lysol to remove all loose epithelium, and with 1 in 20 carbolic or Lister's strong mixture, and then dried with sterilised gauze.

4. *Infection from the Hands of Surgeon, Assistants, and Nurses.*—This is now recognised as one of the most fruitful

sources of wound-infection, and it is impossible to overestimate the importance of all who take any part in an operation purifying the hands most thoroughly. The arms should be bare to the elbows, cuffs and sleeves being discarded. Every surgeon has his own preference for methods of purifying the hands, and some have elaborated the process to such an extent that a profound knowledge of chemistry is essential to carry out its details. Personally, we have found that a thorough use of hot water, soap, turpentine, *and a nail-brush*, followed by lysol 1 in 100, and finally 1 in 20 carbolic, is quite efficient. A metal nail-cleaner should, in addition, be kept ready on the wash-hand basin (Fig. 15).

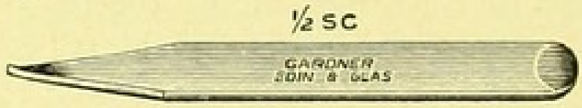


FIG. 15.

The hands having been purified must be kept pure, and nothing which is not sterile should be touched under any pretext whatever by those who are to take an intimate part in the operation. A basin of lotion should always be within reach, so that the hands may be washed at once should they be contaminated in any way. Nothing but constant and intelligent practice will eliminate this particular source of wound-infection.

5. *Infection from Clothes of Patient or Operators.*—All the bed-clothes in the vicinity of the operation wound must be covered with mackintosh, over which are spread large dry towels sterilised by steam. The surgeons and assistants should wear large aprons similarly sterilised.

6. *Infection from Instruments.*—Next to the hands, perhaps the most fertile source of infection is the instruments. Those made entirely of metal must be boiled for ten or fifteen minutes, and then transferred directly into water sterilised by boiling. The knives should not be boiled, as their edges are thereby spoiled. A careful washing with 1 in 20 carbolic is sufficient. Other instruments which cannot be boiled must be soaked for some time in 1 in 20 before being used. Drainage tubes of india-rubber or glass,

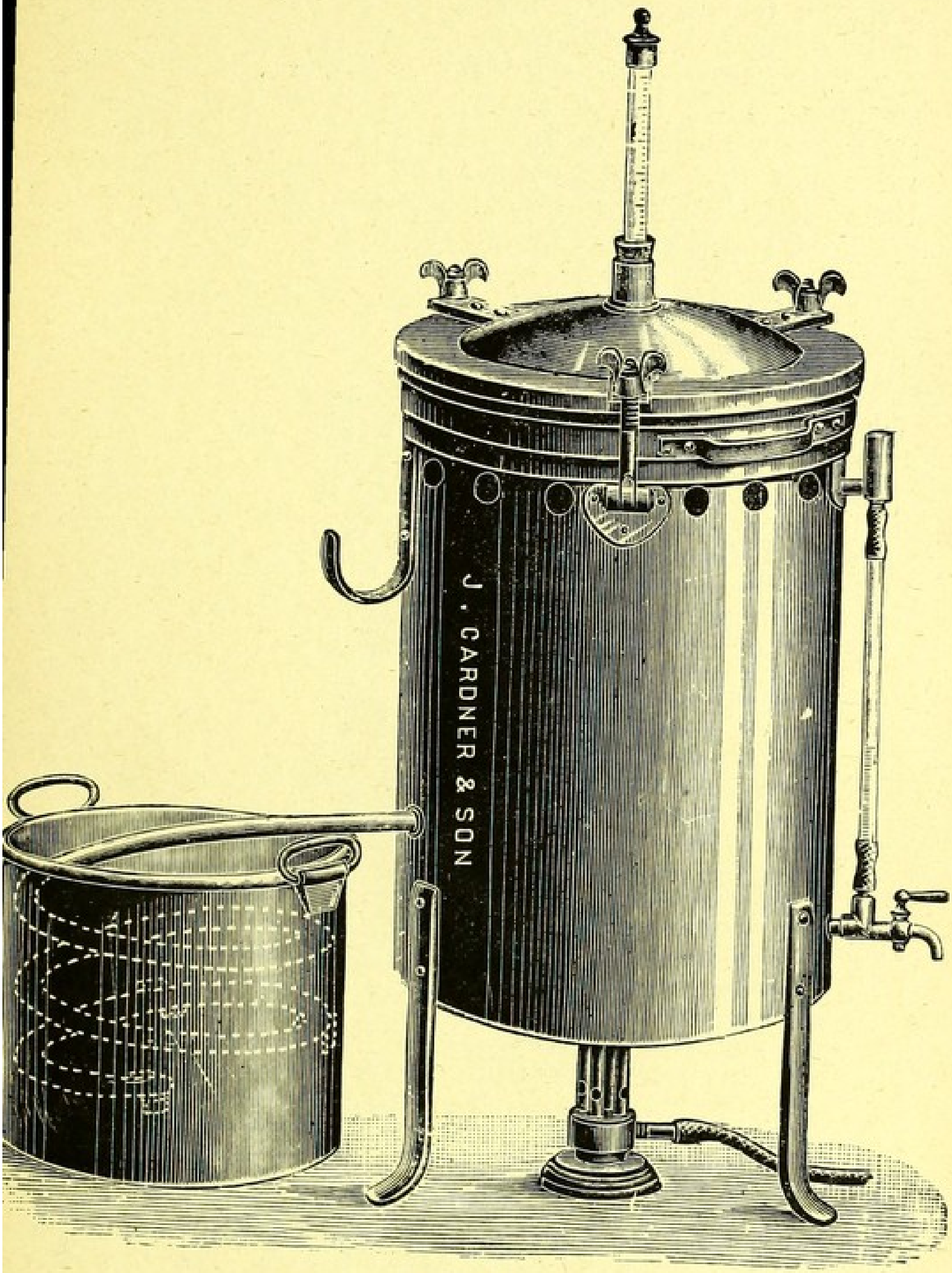


FIG. 16.

although seldom used in aseptic cases, may be sterilised by boiling. (See also p. 66.)

7. *Infection from Ligatures and Sutures.*—The means of sterilising the different materials used as ligatures and sutures are referred to at p. 92. It is well to keep in mind that the less catgut is handled the better. It should therefore be left in its original bottle till the moment it is required, and taken out by the surgeon himself, or by the

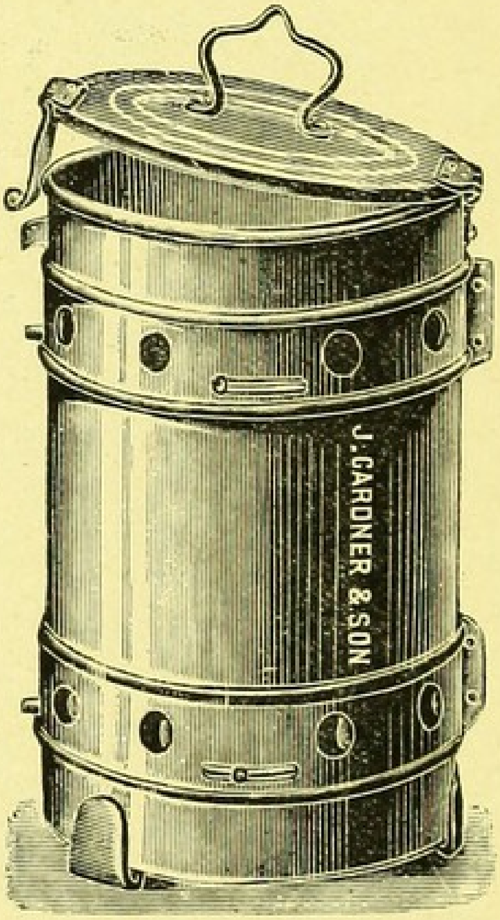


FIG. 17.

instrument clerk with sterilised forceps, and passed to the surgeon. In this way only the surgeon's fingers touch it.

8. *Infection by Swabs or Sponges.*—Natural sponges are never used in aseptic operations. Dry pads of gauze, or artificial sponges which have been sterilised by steam, take their place, and the nurse who passes them up should lift them out of the box with a pair of forceps, so as to avoid possible infection from her hands. If wanted moist, they

should be wrung out of normal salt solution or boiled water.

9. *Infection from the Dressings.*—Sterilised gauze and antiseptic wool forms a perfectly reliable dressing.

Sterilisation by Steam.—We have made frequent reference to the sterilization of gauze, towels, etc., by steam. This is simply done with Lautenschläger's steriliser (Fig. 16). The dressings to be sterilised are placed in the tin boxes (Fig. 17), which have numerous holes in their sides capable of being closed by means of a sliding inner case. These boxes are placed in the steriliser, which consists of two copper cylinders, one inside the other, with a space about an inch wide between them. This space is half filled with water, which is boiled by means of a burner underneath. A strong lid, through which a thermometer passes, is screwed on to the top. The steam generated by the boiling of the water in the space between the cylinders enters the interior through holes at the top of the inner cylinder, and percolates through all the dressings, escaping at the bottom by a small pipe which is led into a vessel containing cold water, where it condenses. The temperature is kept for about an hour at 100° C., and the steam being under a pressure of about one-thirtieth of an atmosphere, complete sterilisation is insured. The boxes are then removed, and the holes closed, rendering them air-tight and dust-proof.

CHAPTER X.

MANAGEMENT OF A SURGICAL OPERATION.

AFTER what has already been said of the importance of antiseptic details in connection with surgical dressings, it would be needless repetition to say more in speaking here of operations.

Operating Theatre.—This room should be large, well ventilated, and, if possible, lighted from the roof as well as by windows. It is of the first importance to see to the sanitary condition of the room in which an operation is to be performed. Early in the morning the floor, walls, and if necessary the roof, should be rubbed over with a *damp* cloth, the windows widely opened, and the theatre thoroughly aired. This having been done, the fire is kindled, and proper ventilation secured and maintained. If it be particularly important that the air be thoroughly aseptic, *e.g.*, in cases in which the peritoneal cavity is opened, one or two carbolic-spray engines may be kept working for an hour or two before beginning the operation. Haegler's observations seem to show that the chief use of the spray is to moisten the dust particles of the atmosphere, and so cause them to fall to the ground, as a shower of rain clears the air by carrying down dust, germs, and other impurities. At the same time everything is moistened, and so dust is not raised by movements in the room. The temperature of the room should be about 65° F., and there must be no draughts. The further arrangement of the theatre will depend greatly on circumstances, such as the size and shape of the room, the arrangement of the light, the number of assistants available, and the presence or not of spectators, and must consequently be left to the good sense

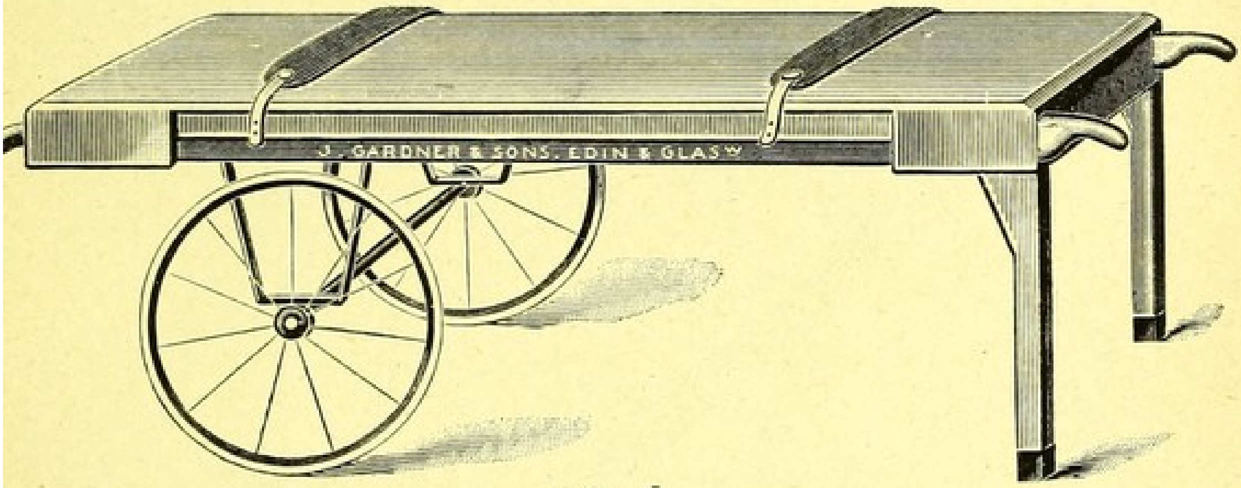


FIG. 18.

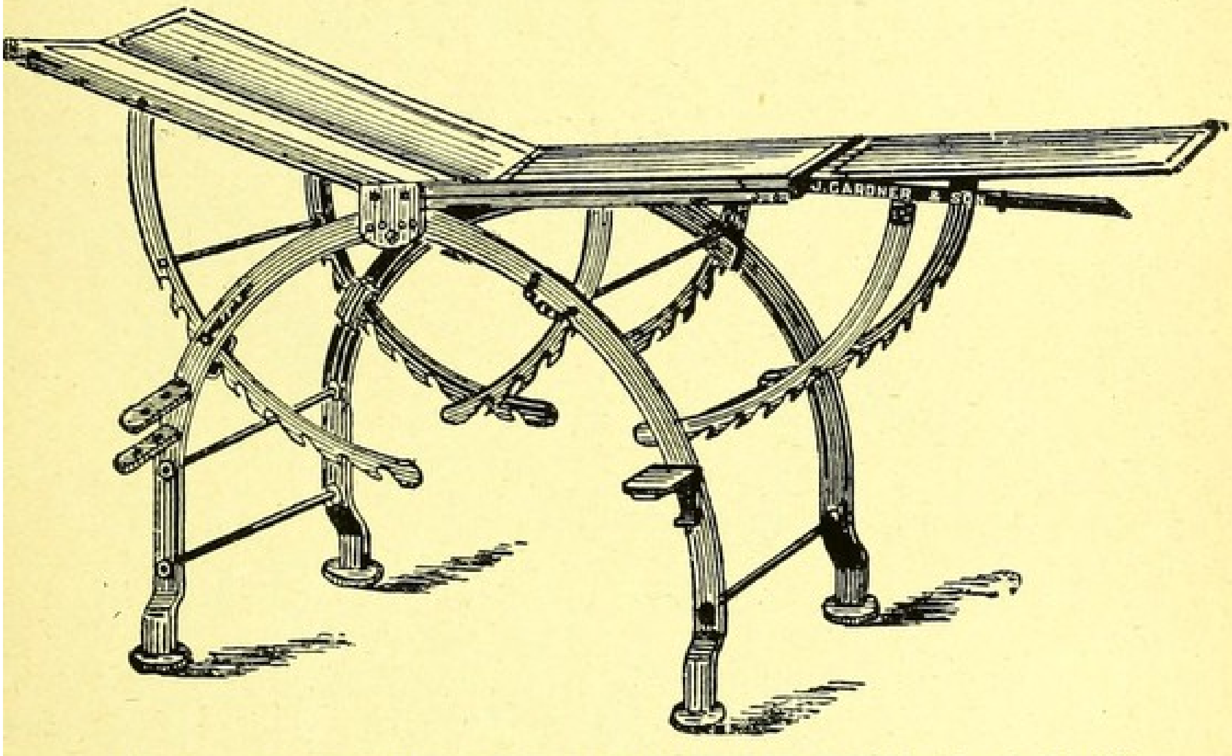


FIG. 19.—OPERATING TABLE, TOP IN THREE PIECES SO AS TO GO INTO DIFFERENT ANGLES.

and management of the nurse. For purposes of description, however, we may assume a large teaching hospital, where there is no lack of assistance, and where there are usually a considerable number of spectators at operations.

Operating Table.—In the centre of the theatre stands the operating table. This may be either a fixture, or arranged on wheels, so that the patient may be comfortably placed on the table in the ward, wheeled to the theatre, and the

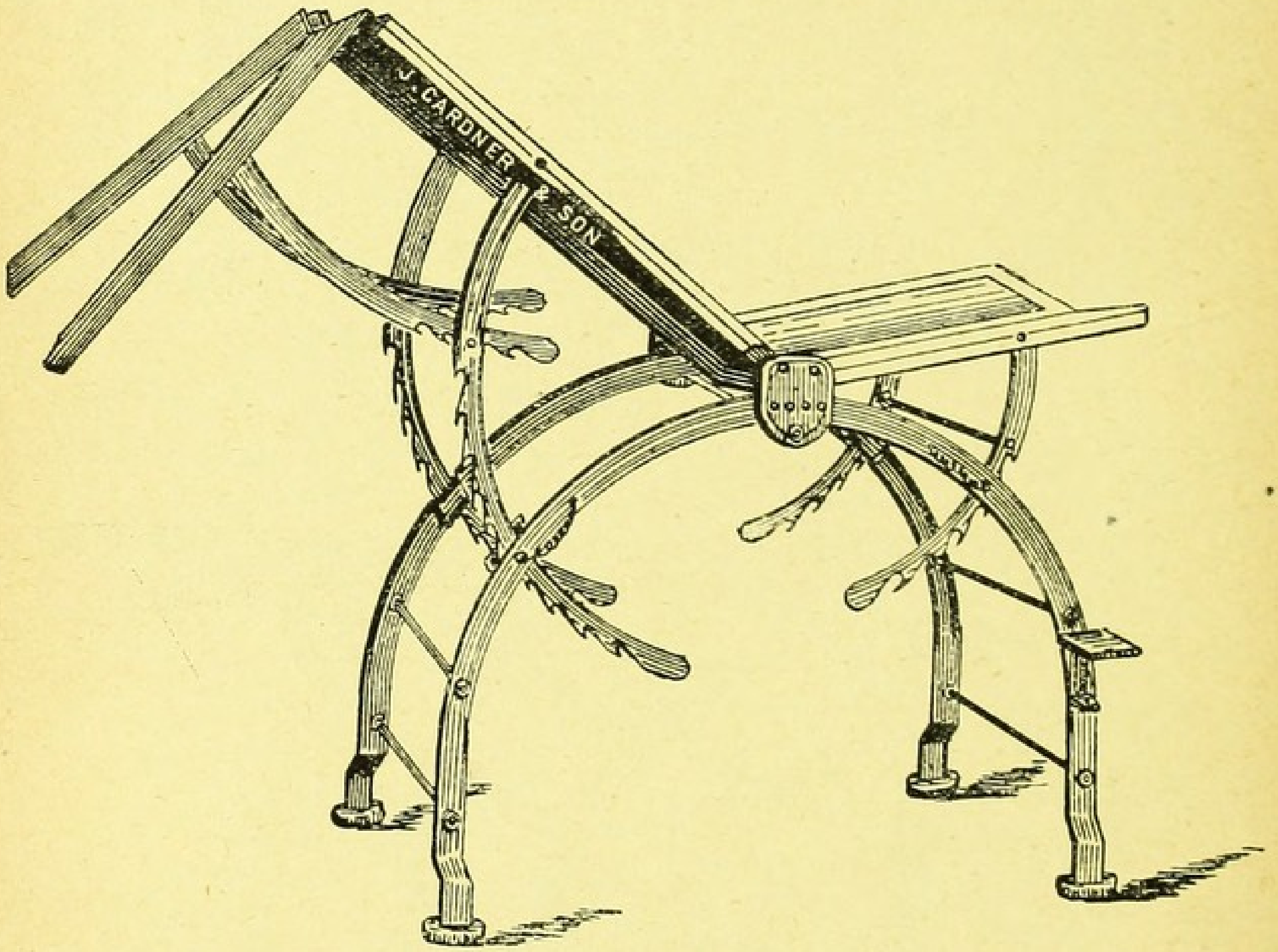


FIG. 20.—SAME TABLE ADAPTED FOR TRENDELENBURG POSITION.

administration of chloroform commenced at once. This means of transferring the patient from the ward to the theatre is a great improvement on the stretchers or basket. A most convenient table is in use in most of the wards of the Royal Infirmary, Edinburgh (Fig. 18). It consists of a light but strong table, mounted on light carriage wheels with moderately strong springs. The wheels are furnished with india-rubber tyres, which enables them to run smoothly and quietly. The legs are similarly finished. The table is so balanced that the weight of the patient is never sufficient to cause it to tilt up, and the head being towards the wheel end it can very readily be depressed should any accident occur during the administration of the anæsthetic. The handles by which the table is wheeled are supplied with hinges, so that during the operation they can be folded

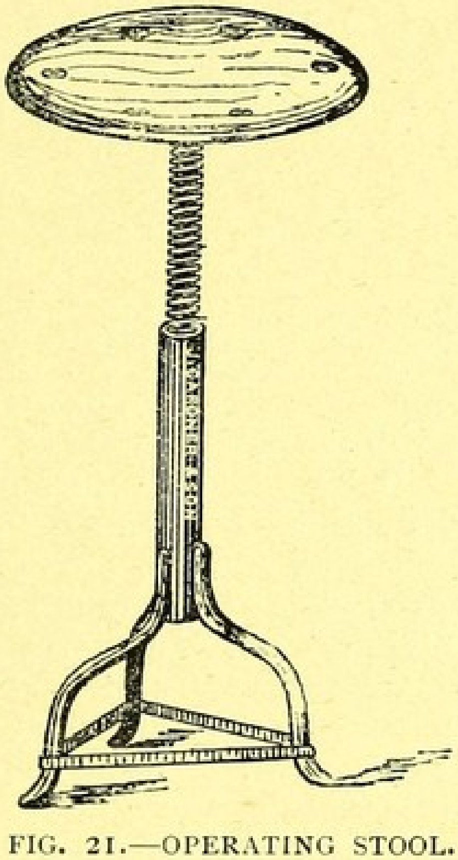


FIG. 21.—OPERATING STOOL.

out of the way, or they may be made to telescope along the sides. Running along the sides are two brass bars, on which slide broad leather belts for securing the patient. The table is 6 feet long, about 3 feet high, and $1\frac{3}{4}$ feet broad. It is covered with a thin, firm, hair cushion.

Many varieties of operating table are in use. That illustrated in Figs. 19, 20, shows a table so constructed that the head may be lowered or raised to any angle; one or both leg-pieces may be similarly altered, or, if necessary, the patient may be placed in the lithotomy or the Trendelenburg positions without difficulty (Fig. 20).

An *operating stool*, capable of being raised or lowered, is useful in perineal operations (Fig. 21).

To 'Set the Operating Table.'—Spread on the cushion a thick sheet of india-rubber, and over this a double fold of blanket. On this the patient lies, and he is covered with one or two blankets, as may be necessary. Under his head is put a firm hair pillow, feathers being too soft. The pillow should have a mackintosh pillow-slip under the linen one to prevent blood or lotion spoiling it. It will be found convenient to have a broad belt passing over the patient's chest and another just above his knees, not only to prevent him slipping off the table on the way to the theatre, but also to restrain his struggles while the anæsthetic is being administered.

Caution.—Be particularly careful, however, not to pull the strap round the chest tight lest you should interfere with respiration. It should never be so tight that you cannot pass your arm between it and the chest wall. You will find that a strap when fixed just above a patient's knees prevents struggling very much better than when placed below the joints.

Clove-Hitch Garter.—It is often found necessary to fix a patient's hands and feet out of the way during an operation, and this is very conveniently done by means of knitted 'clove-hitch garters' passed round the wrists and ankles, and then tied to the legs of the table. These must always be tied in a reef-bow, *never in a knot*, as it may become necessary to release the limb very quickly at any moment, *e.g.*, for the purpose of carrying on artificial respiration. These garters are closely knitted with ordinary strong wool, are about 7 or 8 feet long and about 2 inches broad. They have the advantage over an ordinary cotton bandage, which is generally used, of being soft and slightly elastic, and so do not hurt the skin, and when put on as a clove-hitch they cannot possibly become tight enough to strangulate the limb. A clove-hitch is made by making two successive loops in the same direction and placing one behind the other (Fig. 319).

Side-tables.—On these are placed the lotions, sponges, instruments, etc. Sometimes only one table is available, and everything must be kept on it; but, when possible, it is of advantage to have one on each side of the operating table, in order that the lotions, instruments, and sponges—which are necessarily moist and likely to cause a mess—may be kept away from the dry dressings and the anæsthetic tray. These side-tables should be about the same size as the operating table, and are conveniently placed about 4 feet from it.

In describing these we may speak of them as the 'Lotion Table,' the 'Dressings Table,' the 'Anæsthetist's Table,' and the 'Instrument Table.'

CHAPTER XI.

THE LOTION TABLE.

THIS may be arranged to suit the tastes and convenience of the dresser or nurse whose duty it is to attend to it; but it is well to adopt some systematic arrangement, and to adhere to it, as by doing so the finding of anything asked for will be greatly facilitated. However arranged, on this table should be found a jar of each of the following lotions:

Carbolic acid, 1 in 20.
Corrosive sublimate, 1 in 1,000.
Biniodide of mercury, 1 in 2,000.
Boracic acid lotion, saturated.
Lysol, 1 in 50.
In addition:
Six or eight lotion basins.
Two kidney-shaped basins.
Two bleeding cups.
Six or eight mackintoshes (pink jaconette).
Six or eight carbolised or dry sterilised towels.
Six or eight clean dry towels.
A dozen sponges (natural or artificial).
A supply of hot water.
A supply of cold water.
A slop-pail.
A soiled dressing tray, placed under the table.

A nail-brush. A bottle of spirit of turpentine. A quantity of powdered carbonate of soda.	For purifying the patient's skin.

The Lotions.—Prepare (1) a basin of lysol, 1 in 100. (2) A basin of carbolic, 1 in 20, for purifying the skin of the patient, and for the surgeon's hands. In it should be placed a nail-brush and a swab of wool. (3) Two basins (enamelled) of carbolic lotion, 1 in 40, or other lotion, for use during operation, a swab of wool in each. These must be changed so soon as ever a brownish deposit appears in the lotion. (4) Two or more basins of carbolic for washing sponges, or swabs, also to be frequently replenished. All the lotions should be diluted with tepid water. In preparing these, it should always be made a rule to put the *lotion* into the basin first, so that should the other ingredient by any chance be forgotten, the error shall be on the side of antiseptic safety. I have already indicated the necessity of purifying the edges of kidney and bleeding tins before bringing them in contact with a wound.

The Sterilised Towels.—A number of these should be prepared with 1 in 20 carbolic lotion, and wrung out just as they are required. They cannot be made too dry. They should be handed up spread out on a mackintosh, and should cover over the whole area of operation. A few spare towels and mackintoshes should be kept ready to prepare if required.

The Sponges.—Remove the sponges from the jar of 1 in 20 carbolic in which they are kept, and after squeezing them dry, place them in a purified solution-tin, covered over with a dipped towel. During the operation they must be handed up to the surgeon as dry as they can possibly be made. If plunged at once into carbolic lotion when received back from the operator saturated with blood, the albumin of the blood will be coagulated, and the small stringy masses of fibrine produced are only removed with great difficulty. To obviate this, the blood should first be washed out in plain water, and the sponge subsequently passed through 1 in 40, and then 1 in 20 carbolic before being used again. One should be particularly careful never to hand up a sponge direct from the plain water, which is not antiseptic. Corrosive sublimate blackens sponges. Sponges should invariably be counted before operations in which a large cavity is opened—*e.g.*, the abdominal or thoracic cavities—and the number in use written on a slip of paper, and on no account may a sponge be torn during the operation. Before the wound is closed, they should be counted again, lest any be left inside. If a sponge fall on the floor, it must be put aside altogether, and not permitted to be used again till it has been thoroughly purified. In cases in which the discharge is putrid, sponges should be discarded entirely, and swabs of wool or gauze used instead.

Artificial Sponges.—Exceedingly useful artificial sponges may be made by cutting ordinary four-ply white Alloa yarn into small pieces about two inches long, wrapping a handful of these loosely in a double layer of gauze, and tying the neck tightly with a piece of the worsted. These pads are boiled for an hour in plain water, and then stored in 1 in 20 carbolic till required. They are very absorbent, elastic, and absolutely reliable as to asepticity (Cotterill).

Cleansing of Sponges after Operation.—The sponges should be taken from the lotion as soon after the operation as possible, and all the blood and pus removed from them by repeated washing with water, until the latter remains unstained by blood. They are then transferred to a strong solution of carbonate of soda (washing-soda), and left there for twenty-four hours, that all grease may be dissolved out of them. At the end of that time they are once more washed in clean water, and replaced in 1 in 20 carbolic till again required. It is well to keep two complete sets of sponges, in order that a periodical purification can be carried on without interruption. The following directions for cleansing sponges, which have been in use for some time, are given by Caird and Cathcart in their 'Surgical Handbook': (1) Free them from grease by steeping in a concentrated solution of washing-soda; (2) then soak for twenty-four hours in permanganate of potash 1 gr. to 1 oz., and wash again in clean water; (3) soak in 1 per cent. solution of commercial salt of subsulphite of soda, with 8 per cent. pure concentrated hydrochloric acid (in 24 oz. of water, ʒi of the soda, and ʒii of the acid) until (in about a quarter of an hour) they have become white; (4) again wash in water until scentless, and store in 5 per cent. (1 in 20) carbolic acid.

Preparation of Operation Sponges.—It may be convenient here to give some directions as to how sponges are made fit for use in surgical operations. Having secured Turkey sponges of the best quality, very close in texture, and about the size of a closed fist, they should be thoroughly washed in hot water and then dried. They must then have all the sand and calcareous particles removed by pounding them with a mallet on a firm table to reduce the grits to a powder, and washing this out by alternately passing them through very hot and cold water till the latter remains quite clean. The beating should be carried on for half an hour at a time, and must be repeated till not a single gritty particle is to be found in the sponge. They are then placed in 1 in 20 carbolic, where they should remain for at least a fortnight before being used, the lotion being changed once or twice in that time.

To Prepare Sponges for Sponge-Grafting.—The finest sponge should be chosen. The calcareous particles are removed by steeping it in dilute nitro-hydrochloric acid, and any excess of acid is removed by means of a dilute solution of potash or ammonia. The sponge is then antisepticised by 1 in 20 carbolic, and is ready for use.

Material for Cleansing the Skin of Patient.—The nail-brush, turpentine, and soda are used for purifying the skin of the part to be operated upon. The carbolised towel, which is always applied for some hours before operation, softens the superficial epithelium, and by means of powdered soda and the nail-brush this effete epithelium is softened and removed, and with it the manifold germs contained in it. This is followed by spirit of turpentine, which is a good solvent of fat and oil, in addition to being an antiseptic.

CHAPTER XII.

THE DRESSINGS TABLE.

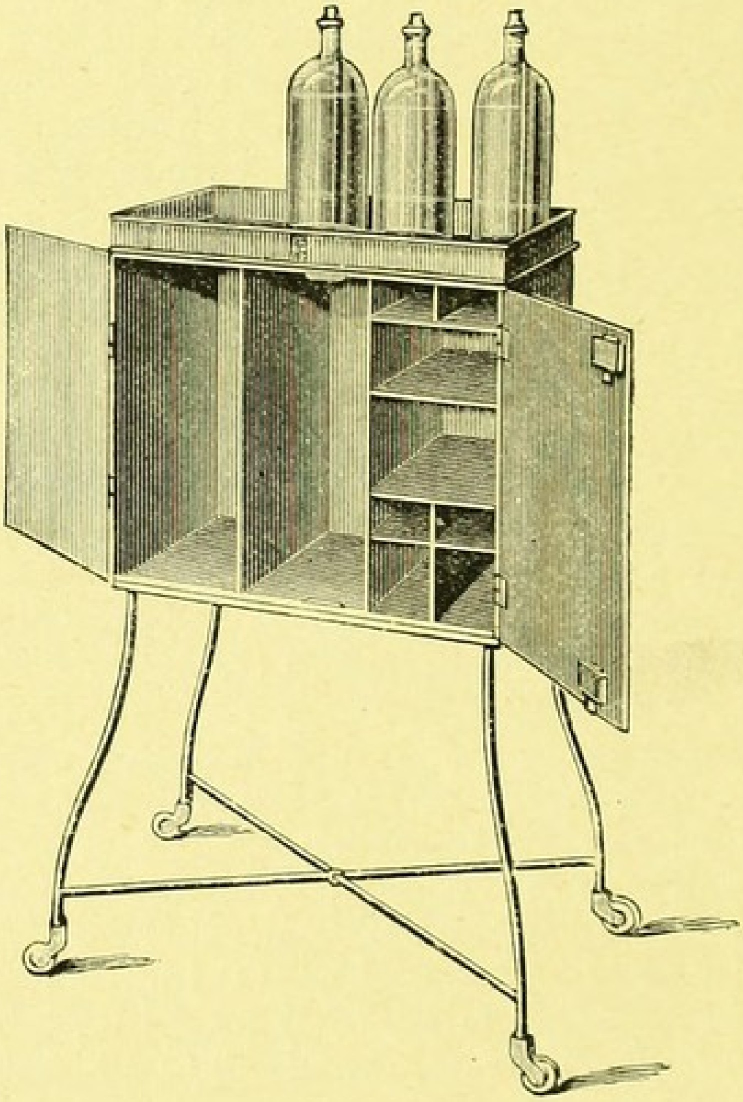


FIG. 22.

THE *contents of the Operation Dressing Box or Table* differ very slightly, if at all, from those of the ward dressing tray already described.

They are:

1. A supply of plain lint.
2. Boracic lint.
3. Gutta-percha tissue.
4. Oiled-silk protective.
5. Carbolised gauze bandages.
6. Double cyanide bandages.
7. Domette bandages.
8. Cotton bandages.
9. Adhesive plaster.
10. Four clove-hitch garters.
11. Safety-pins.
12. Wool boxes, containing:
    (*a*) Corrosive wool;
    (*b*) Wood wool.

Fig. 22 illustrates a convenient form of dressing cabinet.

CHAPTER XIII.

THE ANÆSTHETIST'S TABLE.

Anæsthetist's Table.—The contents of this will, of course, vary according to the anæsthetic employed. They should embrace:

1. Two bottles chloroform.
2. Two bottles ether.
3. One bottle 'A.C.E.' mixture.
4. Chloroform drop-bottle.
5. Folded towel or inhaler.
6. Ether inhaler.
7. Small pot of vaseline for face.
8. Tongue forceps.
9. Clean towel.
10. Small basin.
11. Hypodermic syringe charged with ether.
12. Several hypodermic syringes (uncharged).
13. Bottle of eucalyptus oil for sterilising these.
14. Two minim glasses.
15. Supply of brandy.
16. Strong solution of ammonia.
17. Capsules of nitrite of amyl.
18. Solutions of cocaine, 5 per cent., 10 per cent., 20 per cent.

Hypodermic Syringes.—There should always be several of these on the table. It is quite exceptional to find a hospital hypodermic syringe fit for use, and as there is almost no appliance which is wanted on such short notice, it is most important that it should be ready and in working order. A syringe may be wanted (1) to inject a solution of morphia and atropia before the operation, as this is supposed by some surgeons to render the administration of chloroform safer by diminishing sickness, preventing reflex stoppage of the heart, and diminishing pain; (2) to inject ether subcutaneously, should the patient faint or the heart's action become feeble. For this purpose a syringe should always be filled with ether before the operation is begun, and placed near the administrator.

To fill a hypodermic syringe, remove the wire stilette from the needle, pour a quantity of ether into a measuring-glass, fill the barrel of the syringe *without the needle*, then screw on the needle, expel air from the apparatus, and place the syringe, with the needle upwards, close beside a bottle of eucalyptus-oil ready for use.

Cocaine is used as a local anæsthetic, the stronger solutions—10 per cent. and 20 per cent.—being painted on to mucous surfaces, such as the nose and throat; while the 5 per cent. solution is injected hypodermically before performing minor operations of short duration. About 5 minims should be injected, and this repeated once or twice if necessary, the needle left *in situ*, and unscrewed each time to avoid unnecessary pain in reinserting it. Its use is sometimes attended with dangerous symptoms, hence it must be employed with caution.

Local anæsthesia for minor operations is sometimes obtained by injecting a solution of Eucaine B in normal salt solution into the tissues.

CHAPTER XIV.

THE INSTRUMENT TABLE.

General Instruments.—The tastes of different surgeons, and the large variety of tools at their disposal, render it

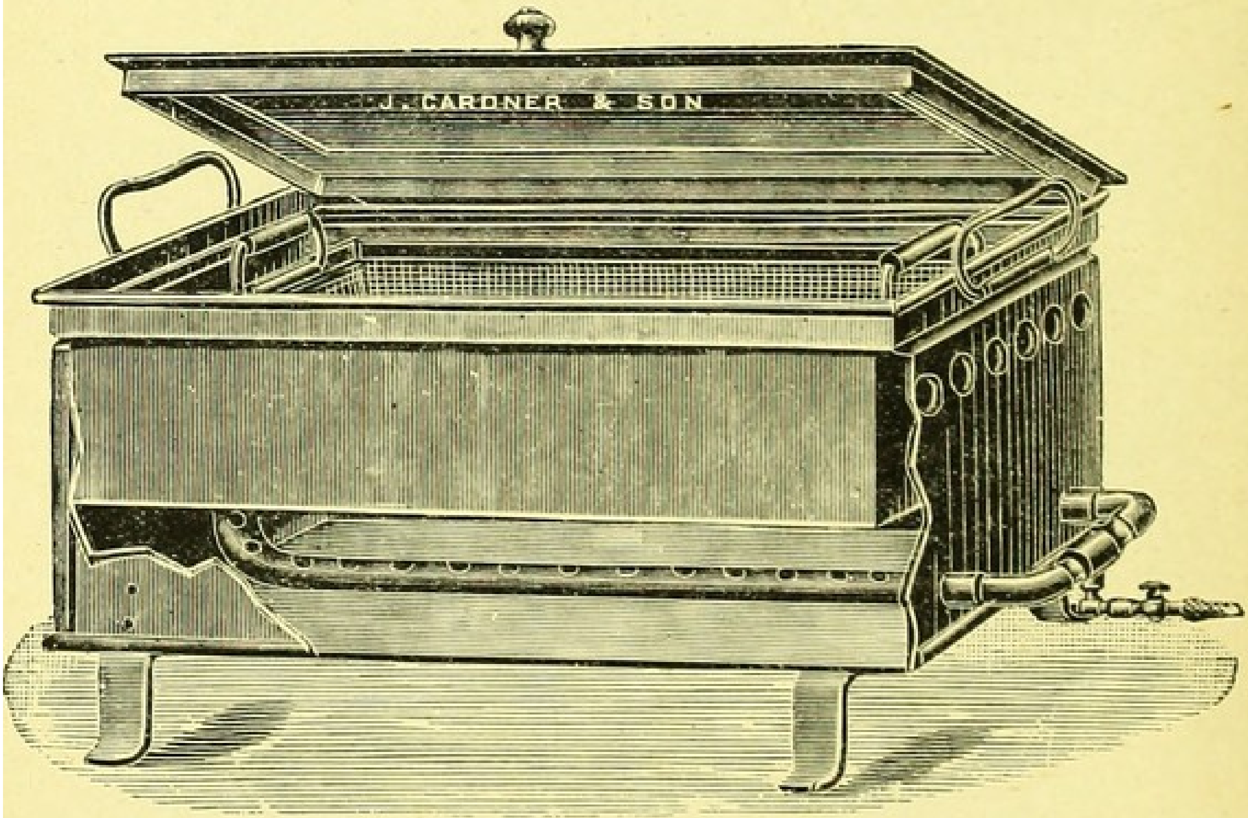


FIG. 23.—SCHIMMELBUSCH'S APPARATUS FOR STERILISING INSTRUMENTS IN SODA SOLUTION.

impossible to lay down hard and fast rules as to what instruments are to be laid out for a given operation. This can only be done by one who has a knowledge not only of the steps of the operation, but also of the complications and emergencies which may arise during its performance. In arranging for an operation, it is advisable that every instrument which by any chance may be required should be carefully selected and sterilised by being subjected to a high temperature, either by boiling in water in which some ordinary washing soda is dissolved or by steam.

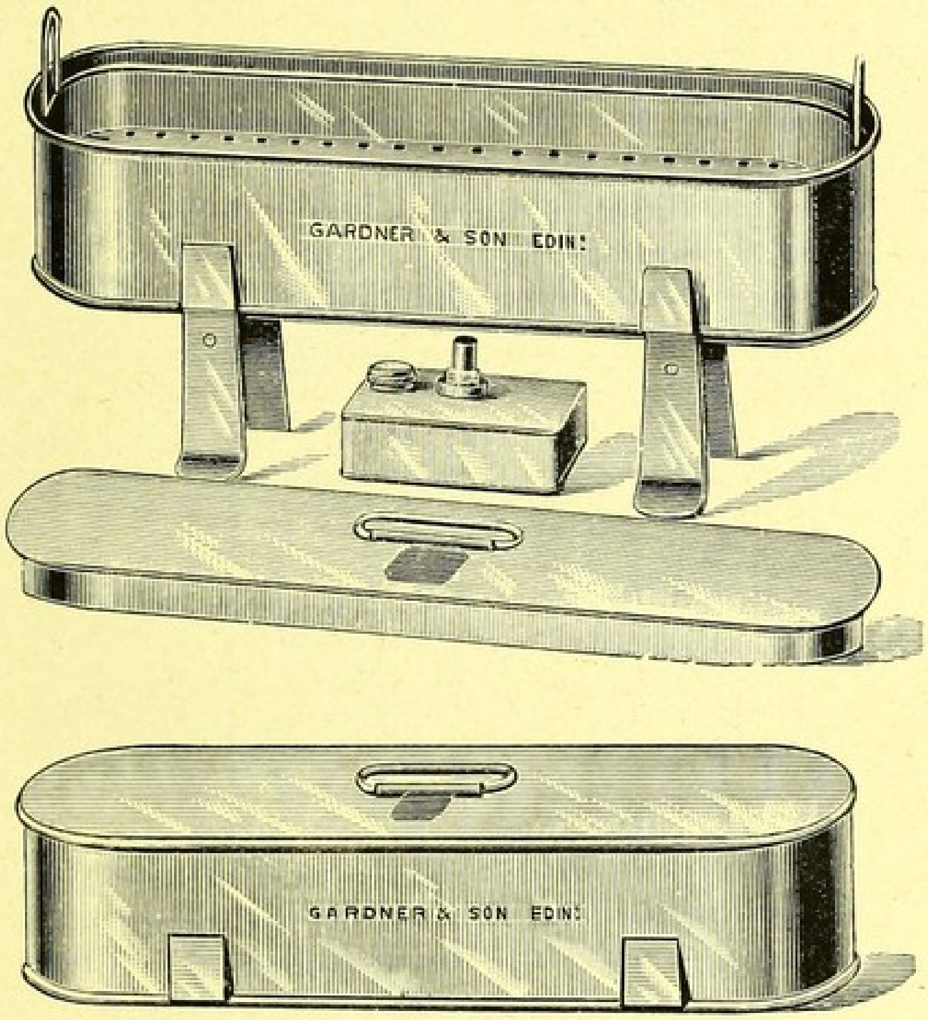


FIG. 24.—CAIRD'S STERILISER, WITH TRAY, FOLDING LEGS, AND SPIRIT LAMP.

Sterilisation of Instruments.—Various instrument sterilisers have been devised. That of Schimmelbusch (Fig. 23) is very complete, but somewhat complicated. Caird's (Fig. 24) has the advantage of simplicity, and as it comes to pieces it can be compactly packed, and carried in the surgeon's hand-bag for private operations.

Another convenient steam steriliser is that devised by Mr. C. W. Cathcart, of Edinburgh, which is practically a water-bath, with an arrangement by which the steam generated in the space between the walls may be introduced to the inside chamber. To prevent rusting of the instruments, they are heated to the boiling-point before

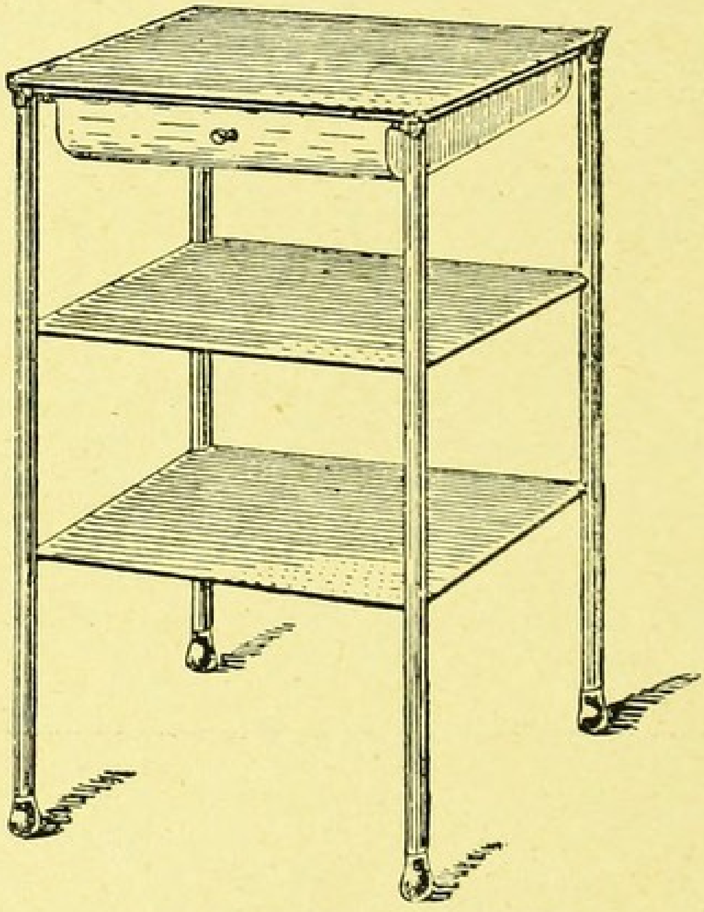


FIG. 25.—INSTRUMENT TABLE.

the steam is admitted, and so condensation does not take place on them; and, in addition, the carbonic acid gas which is essential to the process of rusting is driven off in heating the inner chamber.

The instruments are transferred *directly* from the steriliser to shallow porcelain or metal trays containing 1 in 20 carbolic, in which they lie till required, covered over with a carbolised towel. Just before the operation begins, a

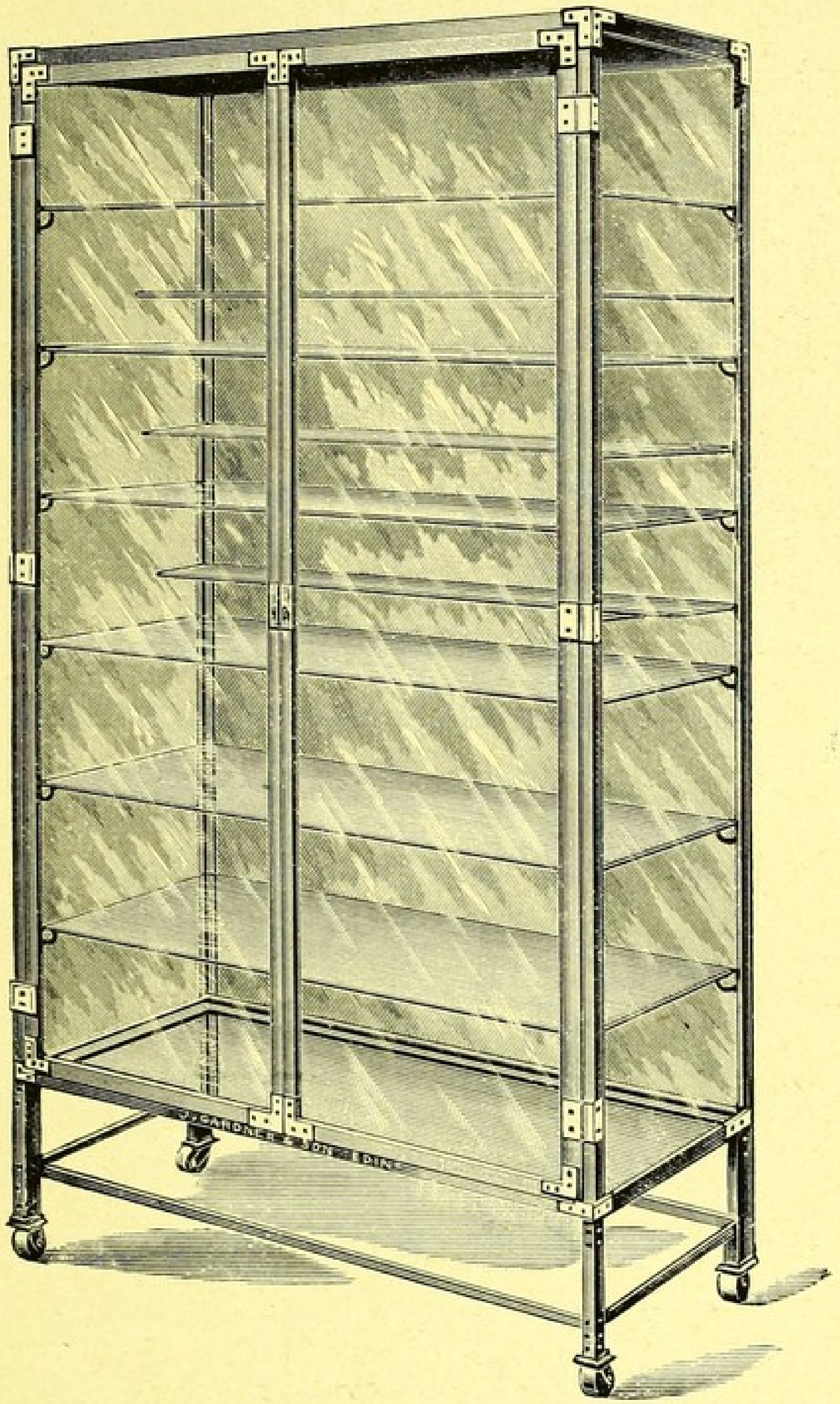


FIG. 26.—INSTRUMENT CABINET.

quantity of warm water is added to the 1 in 20, so as to bring it down to about 1 in 100. In aseptic operation, sterilised water is all that is required for the instruments after they have been boiled.

The bottom of the tray in which the knives lie should be covered with a sheet of indiarubber or lint to protect their edges.

The *instrument clerk*, or whoever has charge of the instruments, must carefully purify his hands and arms before handing up the instruments to the surgeon: and, on receiving them back, he should clean off all blood or pus with a swab of wool and lysol before replacing them in the tray. This is especially necessary in the case of serrated instruments, such as artery-forceps, saws, etc.

After the operation the instruments are steeped in a solution of soda, scrubbed with a nail-brush, dried, and replaced in the cabinet (Fig. 26).

CHAPTER XV.

GENERAL INSTRUMENTS.

THERE are certain instruments which should be in readiness at almost every surgical operation. The particular size, shape, or pattern will of course vary with the nature of the operation and the preference of the surgeon.

1. *Scissors.*—Various patterns are shown in the illustrations.

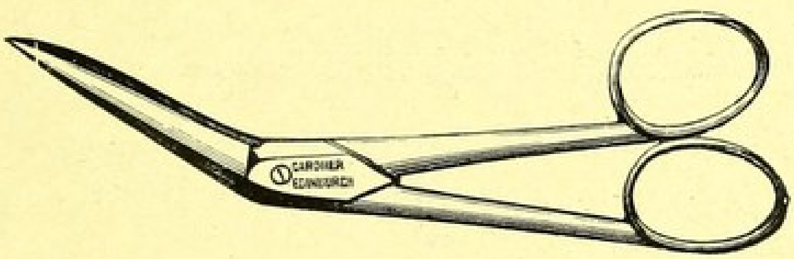


FIG. 27.—ANGLED DRESSING SCISSORS.

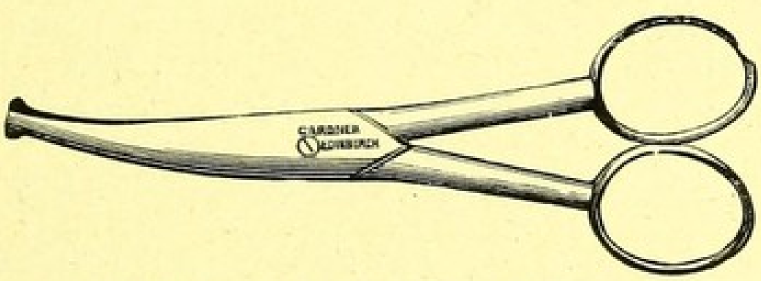


FIG. 28.—CURVED DRESSING SCISSORS.

2. *Probes.*—These are used for various purposes, chiefly to explore sinuses to detect their extent, direction, and contents. They should only be employed when the finger

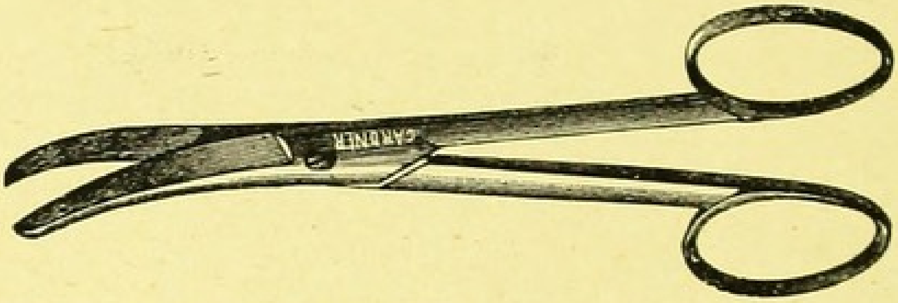


FIG. 29.—CURVED DRESSING SCISSORS, BLUNT POINTS.

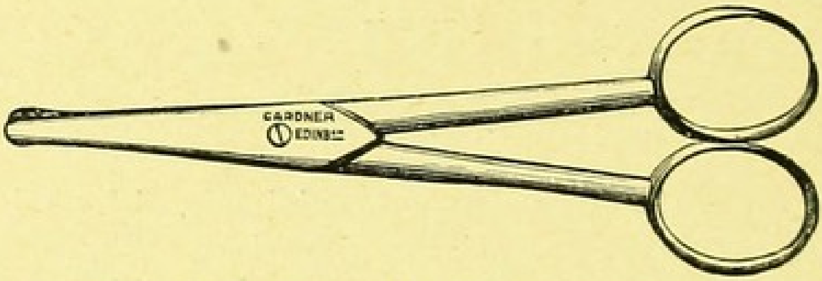


FIG. 30.—STRAIGHT DRESSING SCISSORS, PROBE POINTS.

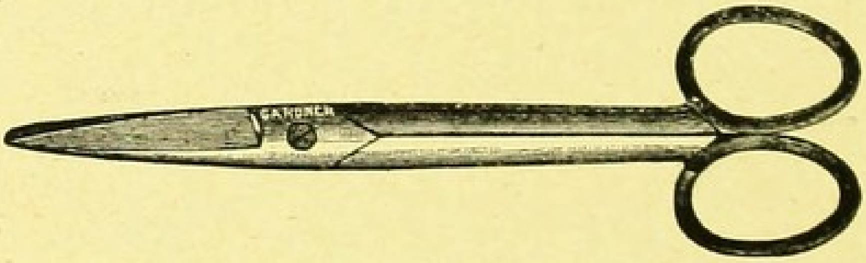


FIG. 31.—STRAIGHT DRESSING SCISSORS, BLUNT POINTS.

of the surgeon is not available, either on account of the small size or great depth of the sinus, as no information derived by the use of the probe is to be compared in value to that given by 'the educated finger.' This applies especially to such conditions as scalp wounds, where it is

FIG. 32.

of great importance to ascertain the conditions of the bone, and where the wound in the soft tissues may sometimes be enlarged rather than trust to the probe as a diagnostic agent. The ordinary short silver probe (Fig. 32) supplied in every pocket case is the type of this instrument. It is about 6 inches long, rounded, with a slightly bulbous point at one end, and at the other flattened out and furnished with a large needle-eye. Being of silver, it may be made to take any shape desired.

The Gun-shot Probe, as its name implies, is used to follow up the track of a bullet. It is several times as long and as thick as the smaller probe, but otherwise identical with it.

For the same purpose Nélaton introduced his *bullet probe* (Fig. 33) furnished with a small porcelain head, on which a

FIG. 33.

black mark is left by the lead, and thus any source of error such as might arise by touching bone or other hard substance is eliminated.

Spiral Probes, made of a fine continuous steel wire, have been used to follow up the sinuous track of a bullet; but their utility is limited, and the difficulty of keeping them aseptic is a great disadvantage.

Shield's Probe is an exceedingly useful instrument. It combines a probe, grooved director, and aneurism needle in one instrument (Fig. 34).

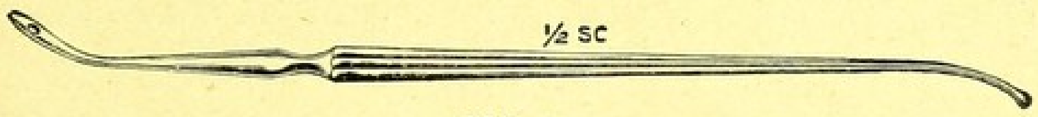


FIG. 34.

3. *Directors* are narrow, blunt-pointed instruments about 6 inches long, furnished with a deep groove down the

FIG. 35.

centre, along which a bistoury may be passed, and the extent and direction of an incision thus be accurately determined. The *ordinary director* is used in opening up a sinus, or in opening an abscess by Hilton's method. At one end it is hollowed out so as to form a blunt spoon or scoop (Fig. 35).

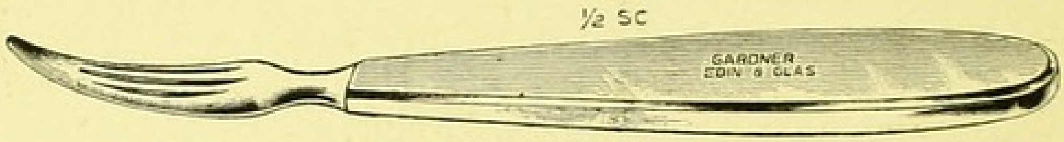


FIG. 36.—KOCHER'S TISSUE SEPARATOR.

4. *Dressing Forceps* are of various patterns, some resembling artery forceps, but without the catch on the handles. Others resemble polypus forceps, but are serrated only half-way up the blades (Fig. 37).

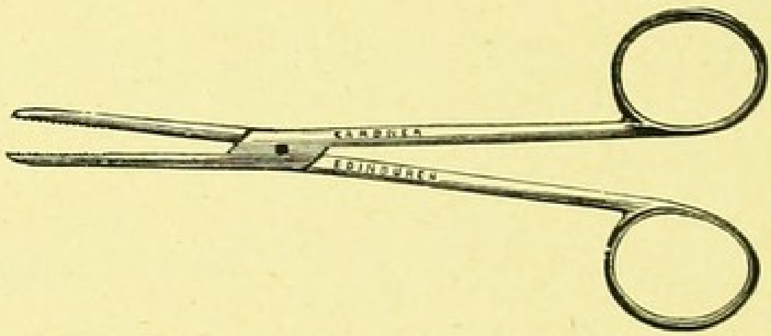


FIG. 37.—DRESSING FORCEPS.

5. *Sinus Forceps* (Fig. 38) have long, narrow, tapering blades, serrated at the point for a very short distance. They are used to pick out small substances, such as frag-

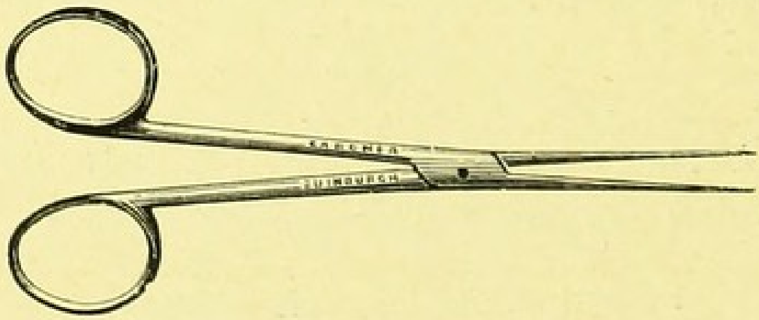


FIG. 38.—SINUS FORCEPS.

ments of dead bone from a narrow, deep sinus, or for introducing drainage tubes into a deep wound, care, however, being necessary lest the sharp points damage important structures. They also serve to introduce small fragments of silver nitrate into the bottom of long sinuses which refuse to heal.

6. *Dissecting Forceps* (Fig. 39) are very often required at operations.

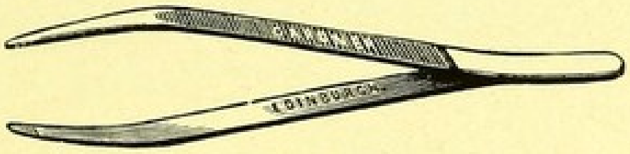


FIG. 39.

7. *Retractors* are used to separate the lips of a wound during an operation, to hold aside, and so remove from danger important structures, such as large vessels or nerves, or to steady a tumour while being dissected out. The simplest form of retractor is a short, broad sheet of copper, which may be bent so as to form a hook of any size. Another is made of wire, which will also bend to any desired angle. Various forms of steel hooks are also used (Figs. 40, 41). They are made in sets of different sizes.

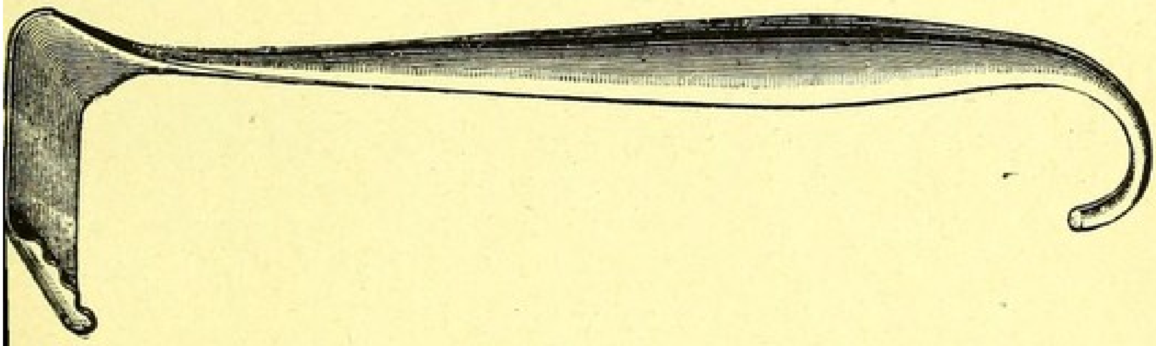


FIG. 40.

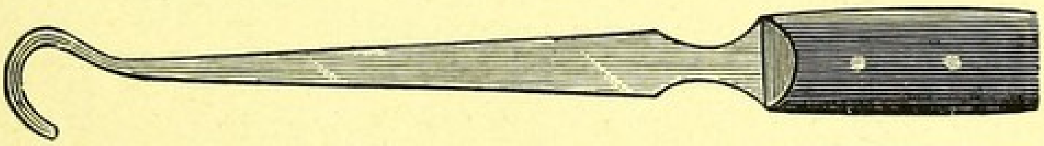


FIG. 41.

8. An ordinary *Razor* is very often required to shave the part to be operated on.

9. An *Aneurism Needle* (Fig. 42) should always be in readiness. It is a blunt-pointed, curved needle, mounted

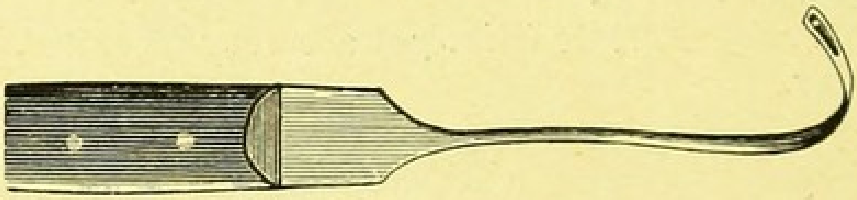


FIG. 42.

on a handle, and is used to pass a ligature round a blood-vessel, as well as for other purposes.

10. *Needles* are employed to sew up wounds, whether made by accident or by the knife in the course of an operation. Some surgeons prefer a straight needle, which differs from an ordinary sewing needle in having the blade

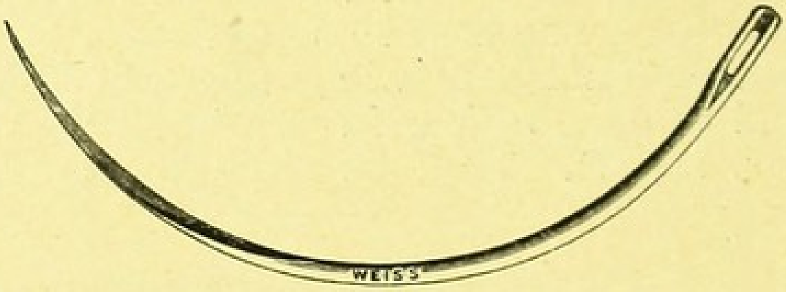


FIG. 43.

somewhat flattened from side to side, and the eye considerably larger. Many use the half-curved needle, while perhaps that most frequently employed is the curved needle, on account of the greater ease and rapidity with which sutures may be inserted by it (Fig. 43).

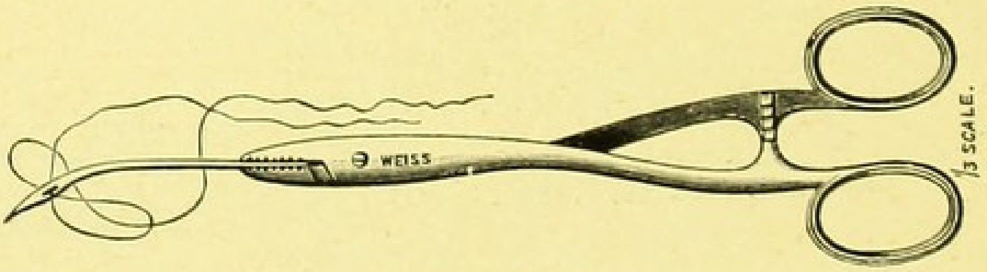


FIG. 44.

11. *Needle-Holders* are, as a rule, dispensed with by ordinary surgeons, but by some they are found to be of

advantage, and many patterns have been introduced, characterised, however, more by the ingenuity of their mechanism than by their practical utility. Some are made to be used with any form of needle, *e.g.*, Fig. 44, which represents a pair of dressing forceps, which may also be used as a needle-holder, being adapted with a longitudinal groove into which the needle fits. Figs. 45 and 46 represent two forms of needle-holder used by

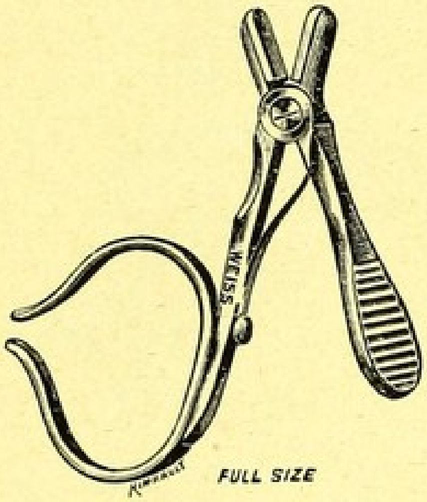


FIG. 45.

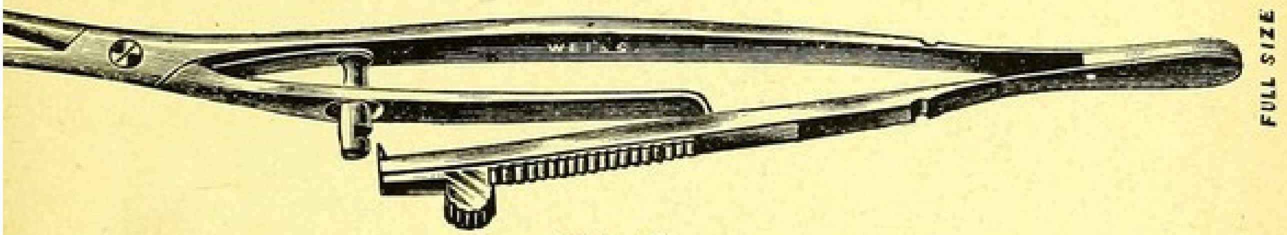


FIG. 46.

ophthalmic surgeons. The Hagedorn needle-holder can only be used with the flat-bladed needles employed by that surgeon.

Instruments Used to Prevent Hæmorrhage.

Tourniquets are used to arrest or prevent hæmorrhage. Before applying a tourniquet the limb should be emptied of blood as thoroughly as possible. This may be done by simply elevating it for a few minutes, or by applying Esmarch's elastic webbing from the distal extremity towards the trunk, thus driving the blood out. This having been done, the first turn of the tourniquet must be applied very quickly and firmly, so as at once to arrest all circulation through the limb. If this be not done it will only arrest the venous return without interfering with the arterial supply, the result being engorgement rather than depletion of the part.

(*a*) *Esmarch's Tourniquet for the Bloodless Operation* (Fig. 47) consists of two parts—a strong elastic bandage and a thick piece of elastic tubing, fitted at one end with a few chain links, and at the other with a hook, by means of

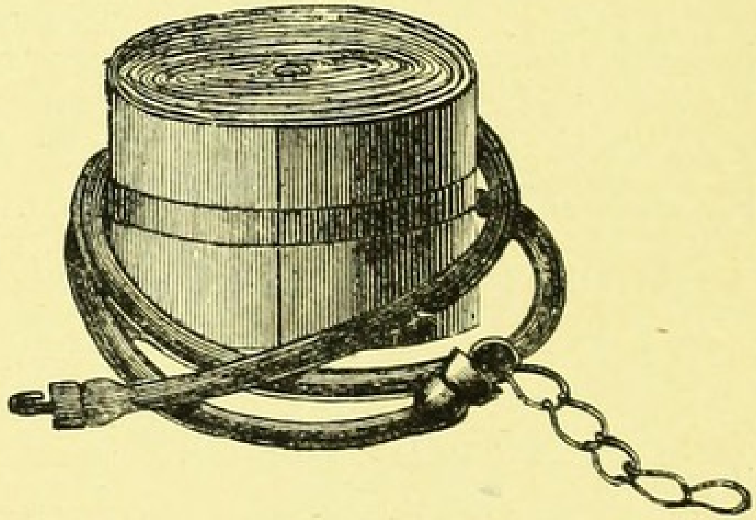


FIG. 47.

which it is secured. The elastic bandage is applied tightly round the limb from below upwards to drive all the blood out of the vessels. At the upper limit, just above the seat of amputation, the powerful tubing is fixed, and so prevents the entrance of blood into the part on the removal of the bandage. The tubing should be applied over a few turns of *wet* cotton bandage to prevent injury to the skin or slipping of the tourniquet. By this means the part to be removed is rendered absolutely exsanguine, and not only does the patient lose no blood at the operation, but after it he has proportionately more blood in his body than he had before. The disadvantage of this instrument is that it cannot be slackened gradually to ascertain if all vessels have been tied, as with Petit's screw tourniquet.

(*b*) *Foulis' Elastic Tourniquet* (Fig. 48) consists of a piece of strong indiarubber tubing about 2 feet long, and furnished with a simple catch. The tube is stretched and passed once or twice round the limb, and then fixed into

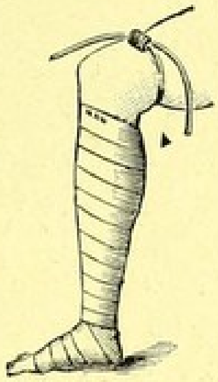


FIG. 48.

the catch. The limb should be elevated for a few minutes to allow it to become devascularised, a turn or two of moist bandage *loosely* rolled on, and over this the tourniquet rapidly and tightly applied. With Foulis' tourniquet

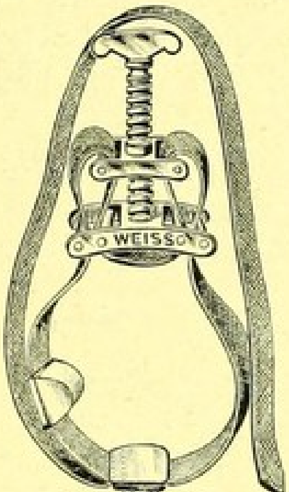


FIG. 49.

the vessels when cut do bleed a little, but this is to some extent an advantage, as it enables the surgeon to see and secure them before removing the tourniquet.

(*c*) *Petit's Screw Tourniquet* (Fig. 49) is more complicated in construction than the others, but equally simple in principle. It consists of a metal frame of two plates perforated by a screw, and threaded through these is a strong inelastic belt fitted with buckles, and a pad to go over the main artery of the limb. One or two points must be attended to in fitting up this instrument. (1) To ensure that the band is properly threaded into the brass plates, it must pass twice through each outer division in the under plate, and not at all through the inner division. If properly threaded, no brass is visible on the under surface of the instrument, while, if wrongly done, the inner bar on each side is seen. (2) Be careful before beginning to thread the tourniquet that the buckle is turned so that it will catch when placed on the limb. (3) Approximate the two plates before beginning to apply the instrument. This tourniquet is also applied over a turn or two of moist bandage, and the pad is placed over the main bloodvessel of the limb, so that when the screw is brought into action the blood-supply will be cut off as thoroughly as possible. The great advantage of Petit's instrument over most others is that it may be slackened gradually, and so any vessels which have escaped the surgeon may be seen, the screw tightened again, and these tied without undue loss of blood to the patient.

(*d*) *Elastic Webbing* of any sort may be used as a tourniquet, being put one layer over the other; the point of importance being to apply the first turns rapidly and very tightly.

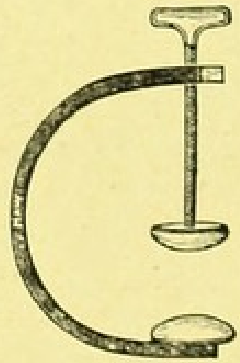


FIG. 50.

(*e*) *Lister's Tourniquet* (Fig. 50) is for compressing the abdominal aorta.

(*f*) *Davy's Lever* (Fig. 51) is used to compress the aorta and the iliac arteries through the rectum, but is a dangerous instrument.

Instruments for the Arrest of Hæmorrhage.

Of the older instruments used to arrest hæmorrhage may be mentioned the *Tenaculum* (Fig. 52),

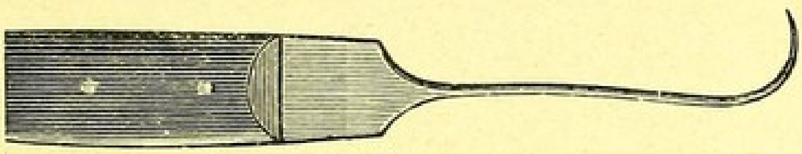


FIG. 52.

a sharp hooked instrument with a wide curve, with which the bleeding artery is transfixed and pulled out of its bed while a ligature is applied.

Assilini's Forceps, a double tenaculum, acting with a spring, are seldom if ever used now.

Torsion Forceps (Fig. 53) are employed to seize and then to twist arteries. This method of arrest-

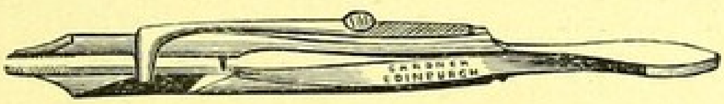


FIG. 53.

ing hæmorrhage was first prominently advocated by Mr. Bryant, who has employed it very largely in his practice. The forceps have flat parallel finely-serrated blades, secured by a sliding catch; they are applied either in the line of the divided vessels, or, better, at right angles to it, and then turned five or six times round, so as to rupture the inner coat of the vessel, and so arrest the flow of blood. They should be left on for a few minutes after twisting till the clot has fairly formed inside the vessel.

FIG. 51.

Liston's Catch Forceps (Fig. 54) in shape resemble ordinary dissecting forceps, but they are furnished at the point with sharp teeth, which interlock, and in the middle

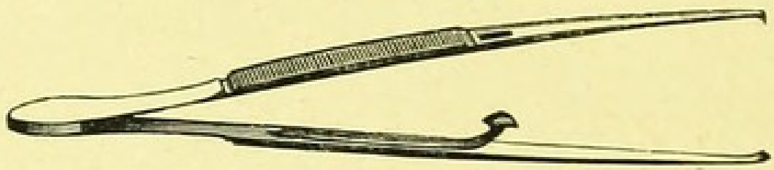


FIG. 54.—LISTON'S ARTERY FORCEPS.

with a spring catch, by means of which they retain their hold on the vessel, and so may be left for some time. The ligature should be applied well above the point at which the vessel is seized, especially if it be a large trunk, as bleeding is apt to take place from the wound in the vessel-wall made by the forceps.

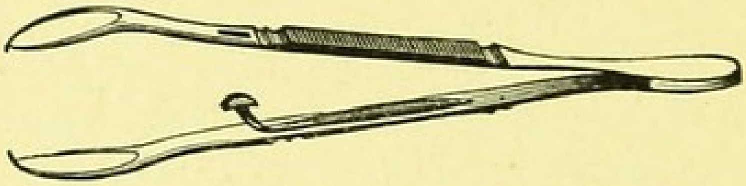


FIG. 55.—WAKLEY'S ARTERY FORCEPS.

A modification of these forceps by Wakley has the blades broadened out and fenestrated, so that the point becomes conical, which facilitates the application of the ligature (Fig. 55).

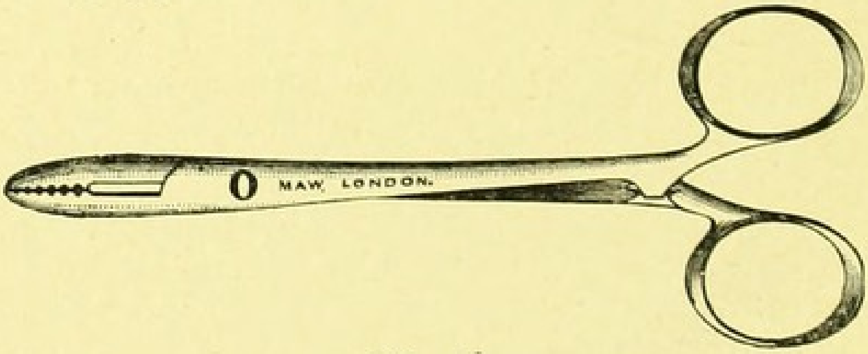


FIG. 56.

Pean's Forci-pressure Forceps (Fig. 56) differ from those of Sir Spencer Wells only in having the blades separable (for purposes of cleanliness), and in having the joint about half-way down the blade. These forceps are more apt to spring off the vessel when left hanging than those of Wells, otherwise they are equally good.

Spencer Wells' Forci-pressure Forceps (Fig. 57) are perhaps the most generally used instruments for the arrest of

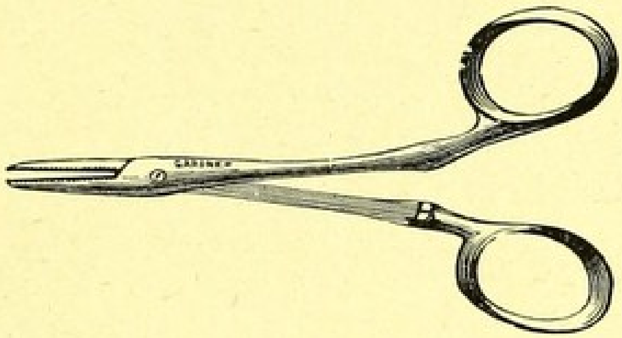


FIG. 57.—SPENCER WELLS' ARTERY FORCEPS.

hæmorrhage. They have the advantage of being very readily applied, and of holding securely even large vessels. If left on for a few minutes, the pressure exerted by them arrests bleeding from smaller arteries; they may be used as torsion forceps, or a ligature may be applied, according to the taste of the surgeon.

Kocher's Forceps (Fig. 58) have long narrow serrated blades, with a truncated end, fitted with mouse-tooth catch. They are exceedingly useful.

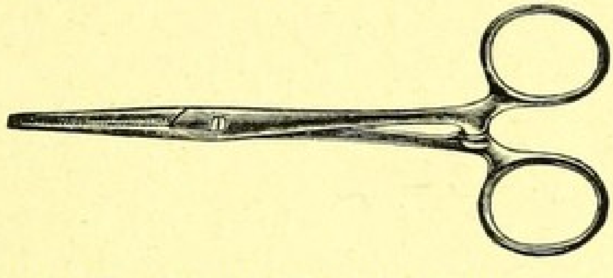


FIG. 58.—KOCHER'S ARTERY FORCEPS.

Greig-Smith's Forceps (Fig. 59) have short conical blades, deeply grooved on their inner aspect.

Various forms of small portable instruments have been devised for applying to small bleeding vessels, but are not much used in hospital. Of these may be mentioned the

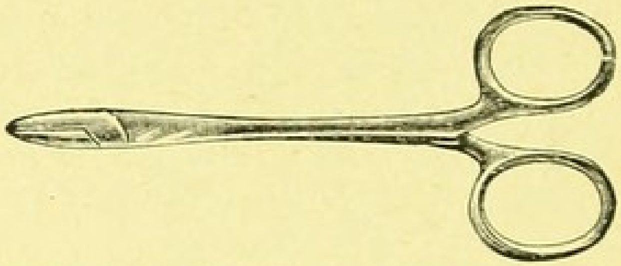


FIG. 59.—GREIG-SMITH'S ARTERY FORCEPS.

Serre-fine, or twisted wire forceps, chiefly used in France, *Dieffenbach's Bull-dog Forceps* (Fig. 60), and *Maw's Artery Forceps* (Figs. 61, 62).

FIG. 60.

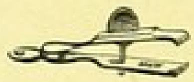


FIG. 61.

FIG. 62.

Acupressure Needles were introduced by Sir James Simpson as a means of arresting hæmorrhage, but have been almost entirely given up.

METHOD OF COMPRESSING THE CHIEF ARTERIES.

One or two hints as to the control of hæmorrhage by digital compression may not be out of place here. This is usually called for in cases of emergency, and as there is nothing so alarming as a sudden and profuse hæmorrhage, it demands no small amount of presence of mind and coolness on the part of the nurse. In selecting the point for applying pressure, it is essential that the vessel should be lying over and close to a bone which will furnish the necessary resistance.

The principal vessels in which this can be done are: (1) the *femoral*, or the chief artery of the thigh, to compress which pressure should be made in a direction slightly upwards and backwards, over a point in the middle of the front of the thigh high up in the groin (Fig. 63). Here the vessel is pressed against the brim of the pelvis.

This artery may be compressed as far down as the lower third of the thigh by pressing it outwards and backwards against the femur, but on account of the muscularity of the limb here, it is less satisfactory than pressure in the groin.

It is very difficult to control hæmorrhage by pressure

FIG. 63. (AFTER ESMARCH.)

lower in the leg than this, on account of the depth of the vessels and their free communications with one another.

In the upper extremity pressure on the *subclavian* artery effectually stops all circulation through the limb. The

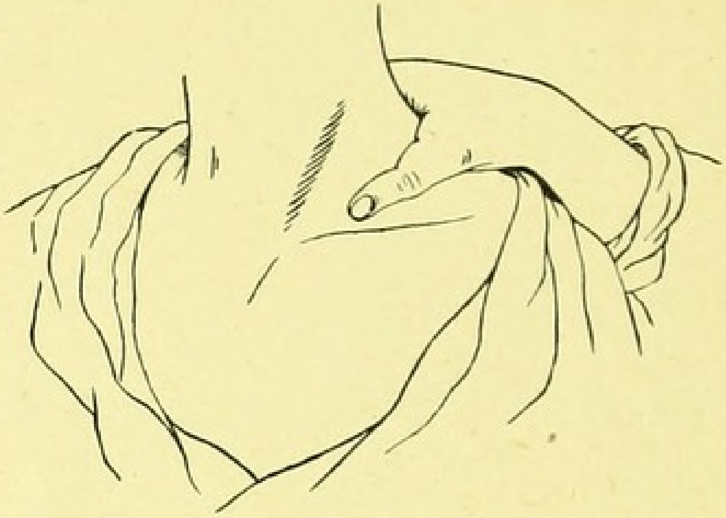


FIG. 64. (AFTER ESMARCH.)

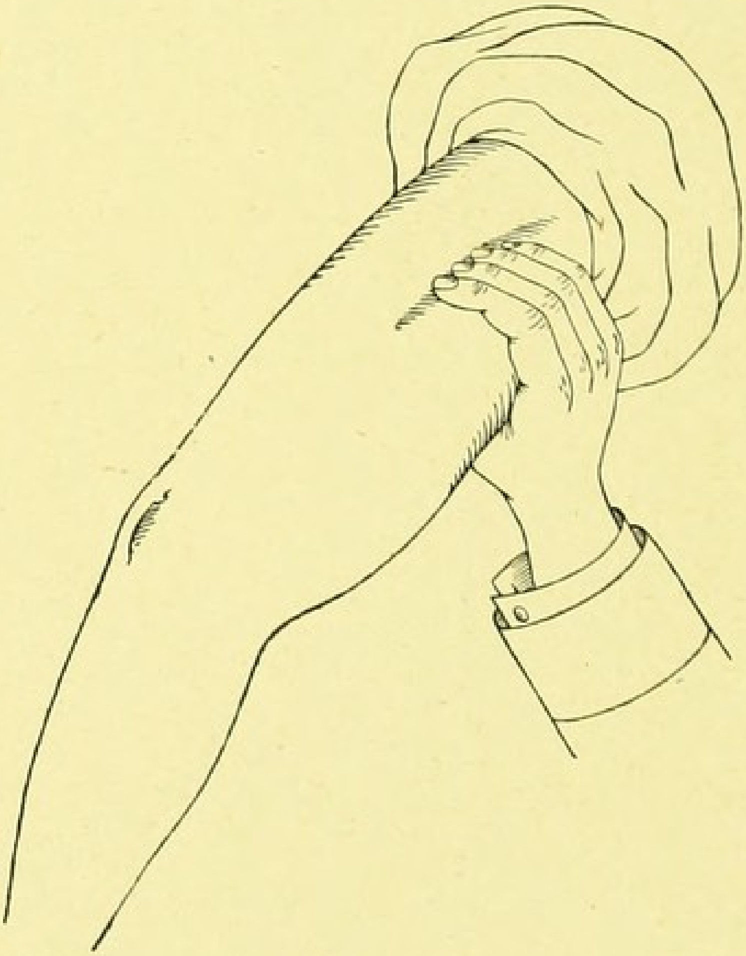


FIG. 65.

artery is controlled by pressing the thumb deeply into the middle of the hollow above the clavicle or collar-bone, when the vessel is pushed against the first rib (Fig. 64). In compressing a patient's *left* subclavian, stand on his left side and use your *right* hand, and *vice versâ* for the other side. To control the *axillary* or *brachial* arteries in the upper arm, pressure is directed outwards and backwards so as to get the vessel between the fingers and the humerus (Fig. 65). Lower in the arm digital compression is ineffectual.

The *common carotid* artery, which supplies the head with blood, may be controlled in the neck by pressing inwards and backwards between the larynx and the internal edge of the sterno-mastoid muscle against the vertebral column.

Bleeding from the scalp may be checked by pressure over the *temporal* artery in front of the ear, and from the face by compression of the *facial* as it crosses the lower jaw about an inch in front of the angle. The vessels which supply the lips are best controlled by grasping the whole substance of the cheek between the finger and thumb at the angle of the mouth.

CHAPTER XVI.

KNIVES.

THERE are very many forms of knives used in surgery, and we cannot attempt to do more than describe a few of the commoner and more generally useful of these.

Scalpels (Fig. 66) are of various sizes and shapes, have a short, broad blade, with a sharp point, and are chiefly used

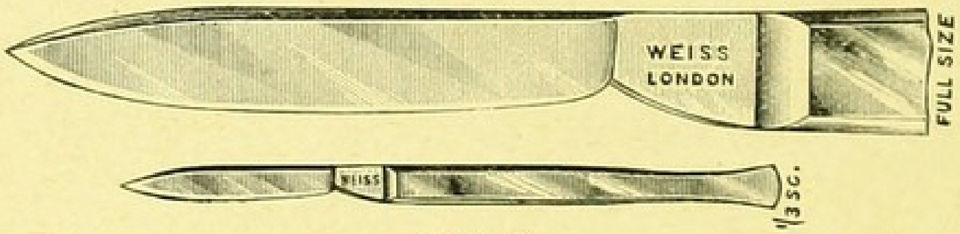


FIG. 66.

surgically in dissecting out tumours, etc., where very great care is necessary to avoid injuring important structures, such as bloodvessels and nerves.

Bistouries are somewhat like scalpels, but, on the whole, are longer, especially in the blade, which is narrow in proportion to its length. They are used in making long incisions in the skin, or in performing small amputations, such as fingers, toes, and so on.

Varieties are indicated by their names, *e.g.*, straight sharp-pointed bistoury (Fig. 67); straight probe-pointed bistoury (Fig. 68); curved sharp-pointed bistoury (Fig. 69); curved probe-pointed bistoury (Fig. 70). Those with probe points are used in parts where there is danger in introducing a sharp-pointed instrument—for example, in splitting up a

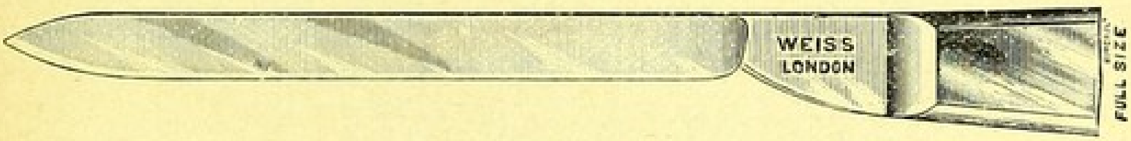


FIG. 67.

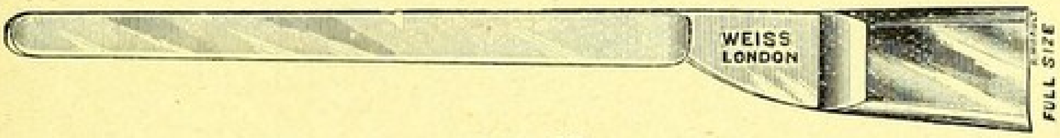


FIG. 68.

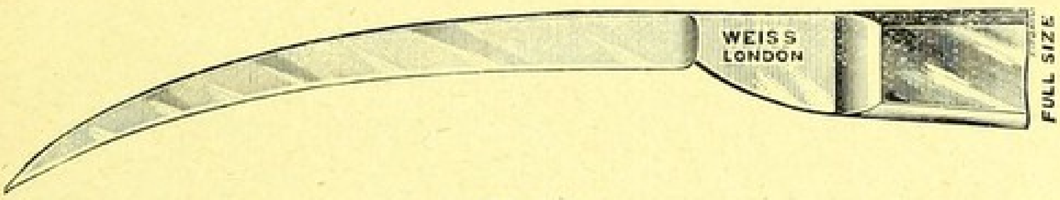


FIG. 69.

FIG. 70.

long sinus near any large bloodvessel or other important structure.

Amputating Knives are of very various sizes and patterns, some having a single cutting edge (Fig. 71), others cutting

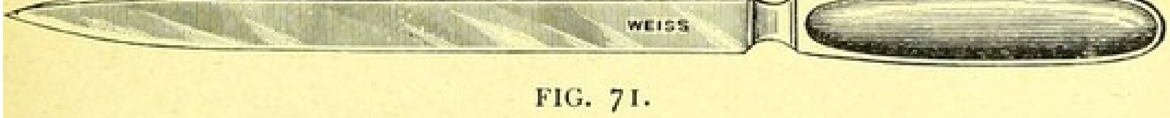


FIG. 71.

with both edges; some with sharp points, some rounded, and so on, varying according to the operation and the taste of the operator.

Syme's Amputating Knife (Fig. 72) was used by that surgeon in performing his amputation at the ankle-joint.

It is a short, strong, broad-bladed knife, with a very thick back and a large handle, like other amputating knives.

FIG. 72.

Abscess Knives.—1. *Syme's Abscess Knife* (Fig. 73) has a short, somewhat sickle-shaped blade, which is bevelled

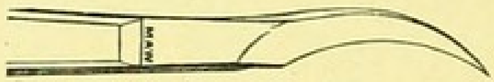


FIG. 73.

off at the sides. When thrust into an abscess, the point always tends to make its way to the surface again.

2. *Paget's Abscess Knife* (Fig. 74) consists of a thin, narrow, straight blade, attached to its handle by a thin metal stem.

FIG. 74.

3. *Von Graefe's Cataract Knife* (Fig. 75) is used by some in opening small abscesses. It is particularly suitable for

FIG. 75.

children and nervous women, as its size does not alarm them.

Tenotomy Knives (Fig. 76), as their name implies, are

FIG. 76.

used for cutting tendons, the operation being done subcutaneously. They may be sharp or probe-pointed, are short, thin, and narrow, and only cut with one edge. Of course, the probe-pointed knife can only be used after the skin wound has been made by the other. It is used as a protection against wounding bloodvessels, etc.

Special *Hernia Knives* are seldom used by most surgeons, a curved probe-pointed bistoury serving the purpose equally well. Their function is to divide the constricting band in cases of strangulated hernia, and for this purpose they are fitted with a long, curved, rounded stalk, about 4 inches long, having a very short cutting edge situated about an inch from the point, which is also blunt. On the back of the stem there is a rough area, by which the surgeon may determine exactly the position of the cutting portion of the edge when he is using it. (See p. 170.)

CHAPTER XVII.

LIGATURES AND SUTURES.

LIGATURES are used to tie bloodvessels, sutures to stitch up wounds. Various materials are in general use for both purposes—silk, catgut, and kangaroo-tendon being chiefly used as ligatures; whale-gut, horse-hair, and silver wire as sutures.

(*a*) *Catgut* has the great advantage over some other forms of ligature of being absorbed by the tissues, so obviating the necessity of its removal by the surgeon, or by ulcera-

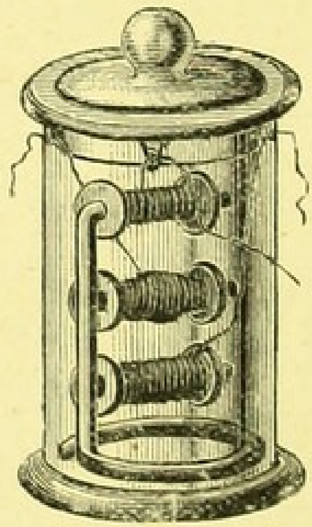


FIG. 77.—CAIRD'S GLASS SUTURE JAR.

tion. It is made from the intestine of the sheep, which is first scraped so as to leave only the sub-mucous layer, and then dried and cut into strips of appropriate length and breadth. It is then antisepticised by means of chromic or carbolic acid, and kept either in carbolic and glycerine (1 in 10), or in eucalyptus, juniper, or some other essential oil, or in absolute alcohol. The preparation of reliable catgut is one of the most difficult problems in aseptic surgery. Many surgeons prefer to prepare their own catgut, others are content with that prepared for them by reliable makers. The less catgut is handled the better; it should therefore be rolled in short lengths on glass

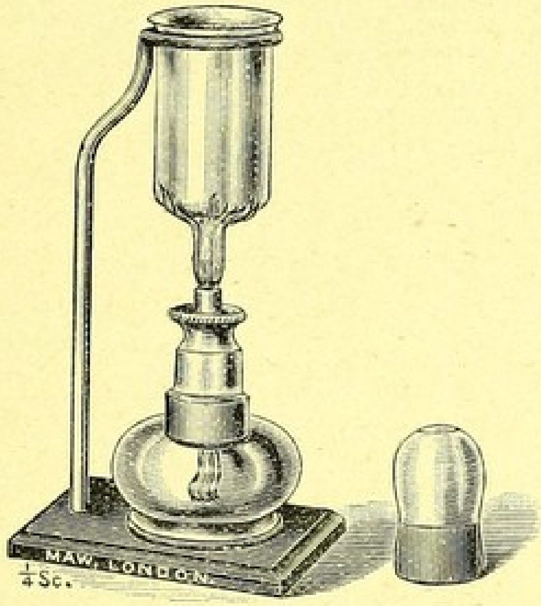


FIG. 78.—LIGATURE OR SUTURE STERILISER.

spools and removed from the stock bottle by the operator himself. Any portion not used should be put into a special bottle and reserved for cases which are not strictly aseptic. If kept in properly made jars (Fig. 77) the required length may be cut off without removing the spool.

(*b*) *Whale-gut* has the same advantages as catgut, and is largely used as ligatures and sutures.

(*c*) *Kangaroo-tendon* is prepared from the strong tendon of the tail of that animal, and has the advantage of being very strong, and, as a rule, thoroughly reliable.

(*d*) *Silk* may be used for either ligatures or sutures provided it has been thoroughly antisepticised by being kept for at least twenty-four hours in strong carbolic before being used. Silk may be further purified by being boiled (Fig. 78) or subjected to steam in a steriliser for half an hour, and then soaked in 1 in 20 carbolic till wanted. To enable the boiling water to reach every strand of the silk, it may be rolled loosely on an open wire frame (Fig. 79).

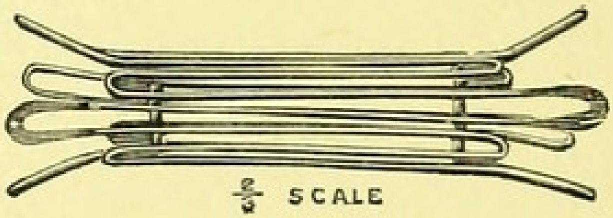


FIG. 79.—CAIRD'S WIRE REEL FOR SILK.

When perfectly aseptic, Lister has shown that it can be absorbed by the tissues, although the process is very slow. As a rule, it acts as a foreign body and ulcerates out in the discharges; hence no more than is absolutely necessary should be left in the wound.

(*e*) *Horse-hair* is used for sutures in wounds where there is little tension, or where it is desirable that no scar should be left by the stitches—for example, in face wounds. It is not readily absorbed, but is very easily and painlessly removed. Unfortunately, prolonged immersion in antiseptic fluids renders it very brittle, so that we have to rely chiefly on cleansing it just before it is required. Experience shows that this is usually quite sufficient.

Silkworm or Fishing-gut is stronger than horse-hair, and is used for the same purposes.

(*f*) *Silver Wire* is employed in wounds where there is considerable tension on the edges, and usually in the form of *button sutures*. The buttons, which are to prevent the wire cutting out through the skin, are oval pieces of sheet lead, with projecting wings on each side, and a small hole in the centre. The wire having been passed through the skin with a stout 'wire needle,' each end is passed through the hole in a button, and one end having been fixed by being twisted round the wings, the edges are approximated, and then the other end of the wire is fixed in the same way. Usually the edges of the wound between the deep sutures are united by superficial sutures of horse-hair or catgut. The buttons are kept in carbolic.

Each of these materials should be kept in a jar similar to that used for the drainage-tubes, containing 1 in 20 carbolic, except the horse-hair, which may be kept dry.

Caution !—Before the operation is begun the stopper should be removed from each of the jars, and the edges washed with a swab of wool to remove the dust and its accompanying germs which have been landing on them since last used. If this precaution be neglected, when a ligature is being withdrawn it will collect all this dangerous matter and convey it to the wound. Too great care cannot be taken to prevent ligatures or sutures touching the clothes of the dresser or nurse, or of others standing around.

Needles.—These are of various sizes and shapes, some being straight, others curved (Fig. 43), half curved, and so on. Special needles are used for silver wire, having a groove running from the eye to the blunt end, in which the wire lies. Some needles have two eyes, the thread being passed through one and then through the other, thus guarding against its coming out.

Needles should be kept in a wide shallow glass tray, 5 or 6 inches in diameter and 1½ inches deep, with a lid, rather than in a pin-cushion. The advantages are—(1) that they can be kept cleaner; (2) they can be kept sharper; and (3) they are less likely to be lost.

The needle must be securely threaded, and the suture tested before being given to the surgeon.

The Drainage-Tubes.—The most commonly used material is indiarubber tubing perforated along its sides at intervals of about ¾ of an inch, the diameter of the hole being about a third of the circumference of the tube. Decalcified bone and strands of catgut have the advantage of being absorbable, and therefore not necessitating dressing of the wound for their removal. Glass and metal tubes are also used. All drainage-tubes should be kept immersed in 1 in 20 carbolic in glass jars, about 6 inches high and 4 inches in diameter, with close-fitting stoppers. A drainage-tube must always be prevented from slipping into a wound by transfixing it with a sterilised safety-pin (Fig. 14), a stock of which should be kept in carbolic glycerine for the purpose.

Syringes.—The uses and methods of employing the various forms of syringe have already been treated of.

SECTION II.

SURGICAL OPERATIONS—SPECIAL NURSING

CHAPTER XVIII.

A SURGICAL OPERATION.

In this chapter we shall consider the nurse's duties preparatory to and during a surgical operation.

1. *The Preparation of a Patient for Anæsthetics.*—In the case of a patient who is in the habit of leading an active life out of doors, it is always wise before subjecting him to a serious surgical operation to keep him in hospital for a few days, that he may get accustomed to his altered conditions and his new surroundings. The last day or two of this probation may be spent entirely in bed. He should at the same time be specially dieted, fish, chicken, milk puddings, and similar light nourishing diet, being indicated. Special attention must be paid to the excretory functions, notably the alimentary tract. The bowels should move regularly and naturally, and if this does not occur spontaneously, it must be secured by administering suitable medicines under the doctor's orders. On the evening immediately preceding the operation the patient should have a large dose of castor-oil (say, a tablespoonful and a half for an adult, or a dessert-spoonful for a child), and about four o'clock the next morning the night-nurse should give a large enema of soap and water, to insure com-

plete evacuation of the bowels. Supposing the operating hour to be 10 a.m., about 6 a.m. a light breakfast consisting of a cup of tea and some plain dry toast may be given, but he should have *nothing* after this. In the case of children, and not unfrequently in adults, it is necessary to watch that food is not obtained surreptitiously, as it is difficult to persuade them that this prolonged fast is necessary.

In very old and feeble patients, of course certain allowances must be made. Carefully regulating the bowels by small doses of cascara for a few days will dispense with the necessity for a large purge, and a small plain enema in the morning will suffice. Such patients, too, may have beef-tea, beef-juice, brandy, and similar fluid supports, but nothing solid. The necessity for these precautions being carried out to the letter will be evident, in view of the dangers of sickness and vomiting during anæsthesia.

Prevention of Chloroform Sickness.—Chloroform sickness may be prevented in a certain number of cases by giving a capsule containing $\frac{1}{10}$ grain of cocaine, $\frac{1}{6}$ grain of menthol, and $\frac{1}{4}$ grain of carbolic acid, before the administration, and another just after the patient comes out (P. H. Maclaren).

2. *The Preparation of the Part to be Operated on.*—On the evening before operation the skin, if unbroken, should be washed with soap and water, to which some soda has been added, to dissolve the superficial epithelium, and to remove oil and grease. It is then covered over with a carbolised towel (1 in 20), kept moist by a layer of mackintosh, which softens the superficial epithelium, and enables it and its contained germs to be easily removed before beginning the operation. It is often an advantage to shave the part before applying the carbolised towel, but in the case of nervous patients this may be left till after the anæsthetic has been administered.

Taking the Patient to and from the Theatre.—When available, a wheeled table (Fig. 18) is by far the best means of removing a patient from the ward to the operating theatre. As this also serves as an operating table, the patient can be quietly and comfortably arranged in the ward, so that as soon as he arrives in the theatre, the administration of the anæsthetic may be commenced before ever he has had time to become alarmed by the preparations made for the operation. As a general rule, it is not advisable to administer the anæsthetic in the ward before taking the patient into the theatre. In transit between the two places any accident, such as the patient fainting, or choking on vomited matter, may happen and escape notice, or, even if noticed, the requisite means of treatment may be unavailable, with the most serious results. When a stretcher has to be used, the patient should be carried as steadily as possible, the bearers 'breaking the step' to avoid the uncomfortable swinging which results when they keep in step. Repeated shifting of the patient from one conveyance to another is undesirable in taking the patient back to bed, when he is in a partly unconscious condition, suffering from shock, and very probably has some wound which will be injured by moving. It is here that the wheeled table is particularly useful. Under no circumstances should a patient ever be propped up in the sitting posture immediately after an operation, because the weakened circulation may not be sufficiently strong to carry blood to the brain, the patient will faint, and even a more dreadful result may follow. This danger always exists in patients under anæsthetics, and one must be ever on one's guard. It is a common thing to see a semi-anæsthetised child lifted in a nurse's arms and carried from the theatre. If this be properly done it is quite a safe procedure, but in nine cases out of ten it is not. The child is seized with one arm around its neck, the other behind its knees. The head hangs over the arm which supports it, while the limp body doubles up and hangs between the two arms. In this position, although the head is hanging, it is by no means the most dependent part of the body, as it should be. The buttocks are the lowest parts, and the position is perhaps the very best that could be wished for to allow the blood to gravitate into the abdomen and pelvis, so depleting the brain and causing fainting. Alarming accidents are sometimes caused in this way, which may be obviated by taking care that the head is the most dependent part of the patient's body.

The Nurse's Duties towards Patients during Operation.—It is an invariable rule that a nurse should accompany every female patient to the theatre, and remain with her throughout the operation. It is comforting to the patient, and many of her fears are dispelled when she has by her a friendly nurse, whom she has come to know and trust, rather than a host of strangers. The patient's dress should always be arranged, so far as is possible, before leaving the ward. For example, when the operation is in the region of the shoulder or chest, the bed-gown should be removed from these parts, and a blanket take its place till the operation is begun. In operations about the face and neck, especially in females, much discomfort is caused to the patient, and no less trouble to the nurse, by the hair getting soiled and matted with blood and lotion. This is very easily obviated by covering the whole head with an india-rubber bathing-cap, and this by a dipped towel. A female patient's hair should never be plaited and then coiled on the back of her head, because it becomes very painful when she has to lie for a long time resting on it. Other arrangements of the dress or coverings of patients to prevent chilling or undue exposure are obvious. When the patient is weak and collapsed, or very old, hot bottles should be placed on the table, care being taken that they do not interfere with the surgeon, and that they are not likely to fall off the table. A good plan is to have the central part of the cushion on the operating table replaced by a tin tank filled with warm water, and covered by three or four layers of blanket *securely fixed* in position.

The Anæsthetic.—Although it is seldom required of a nurse that she should be able to administer anæsthetics, it is only right that she should have a general idea of the action of these, the dangerous conditions arising during their administration, and, above all, the means of treating them. From the student of medicine no subject deserves more careful study than that under consideration. As everyone knows, chloroform and ether, the most commonly employed anæsthetics, are given mainly to prevent the patient suffering pain, whether it be the pain of a surgical operation or of parturition. They are also given sometimes to overcome muscular action, *e.g.*, in the reduction of dislocations in very strong men. No patient should have an anæsthetic administered to him unless he has been properly 'prepared' for it (p. 97), except, of course, in cases of accident, where this is obviously impracticable.

CHLOROFORM.—There are three important points with which it is necessary to be well acquainted regarding the administration of this anæsthetic: (1) its physiological action; (2) the proper method of administration; (3) the dangers likely to arise, and their treatment.

1. *Physiological Action.*—Chloroform acts first by stimulating the nervous system, and later by depressing it; there is an early period during which the patient has delusions, struggles violently, and is hyperæsthetic, and then follows a period of stupor, with relaxation of muscles and blunting of the sensations. It must be borne in mind, moreover, that chloroform poisons the brain centres in a definite order, and that we only desire this process to go to a certain limit within which the patient is safe. The order is: (1) Paralysis of voluntary motion; (2) paralysis of sensation; (3) paralysis of reflexes—these stages are to be attained; (4) paralysis of respiration; (5) paralysis of heart, which of course must be avoided. Sometimes accidents occur which apparently disarrange this regularity of action, but these are due to some intercurrent condition, and not to chloroform itself. Having attained the first three stages, it must be remembered that only a very little more is needed to reach the remaining two, and that the patient is in a very dangerous condition, and one which requires the anæsthetist's undivided attention. Chloroform, being a cumulative poison, should be administered with extreme caution, as the patient may have taken a good deal more than is indicated by his general condition. Fortunately, however, it is also a volatile poison, so that, should the limit of safety have been overstepped, by carrying on artificial respiration for a sufficient time to enable the excess to volatilise, the respiratory and cardiac centres will resume their functions.

2. *Method of Administration.*—The chloroformist has quite enough to do with his own work, and must on no account try to assist with anything else, or to see the operation. The patient, when thoroughly under, is at the brink of the grave, and a single step may place him beyond recall. Before beginning the administration, the patient should be made quite comfortable, lying on his back with a hard pillow under his head. He must have nothing in his mouth, such as false teeth, sweets, tobacco, etc. Everything about his neck and waist must be quite loose to facilitate respiration. Chloroform is a heavy vapour, and so falls on to the patient's face, irritating the skin, and to prevent this irritation a thin layer of vaseline, or some such ointment, should be smeared over the face.

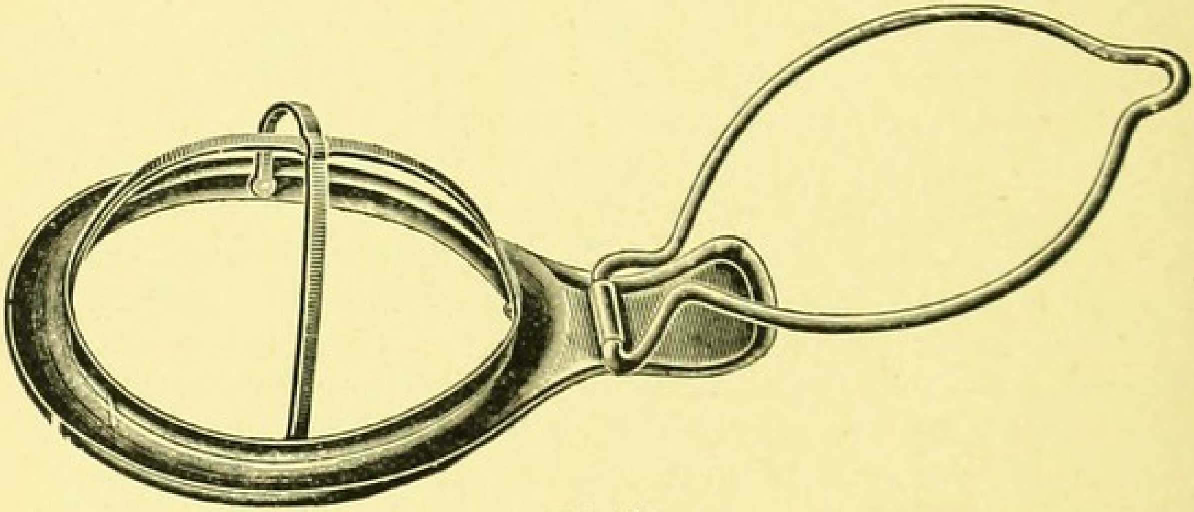


FIG. 80.

No special inhaler is necessary, a towel folded into a square and placed over the face being quite sufficient. Some surgeons, however, prefer a special apparatus. A simple inhaler is made of a small wire mask, over which is stretched a layer of thick flannel (Fig. 80). Success in administering chloroform, however, depends, not on the apparatus used, but on the person using it. Were more attention given to the physiological action of chloroform, and less to the machinery by which it is administered, fewer calamities would disgrace the pages of medical literature. A few drops of chloroform are sprinkled over the surface of the towel, and the patient is asked to take long breaths. Children usually hold their breath, and refuse to take the chloroform, and the best way to manage is to tell them to blow it away, or to get them to cry, when the resulting deep inspiration effects the desired end. Do not hurry the patient much at first, and should he feel inclined to choke, remove the towel for a second or two and give him a breath of fresh air. Chloroform is only safe when mixed with about equal parts of air. When the patient is struggling it is not advisable to resist him, as it only increases the trouble; guide his movements, and the struggling stage will be quickly passed. Patients who have been addicted to alcohol usually present exaggerated struggling phenomena, with sometimes tonic or clonic rigidity of the whole body lasting for a few seconds, and sometimes even epileptiform attacks. When once the struggling stage is passed in these cases it does not recur.

No one sign that the patient is under is infallible, and he must be tested in several ways to make sure:

(*a*) *Muscular Relaxation* indicates that he is at least partly under. This is tested by raising a limb and seeing whether or not it falls limp on being left unsupported.

(*b*) *Loss of Local Sensibility* may be tested by pinching or pricking the skin, *e.g.*, at the seat of operation.

(*c*) *The Abolition of the Reflexes* is most conveniently tested by touching the conjunctiva of the eye, when, if no spasmodic closure takes place, the patient is presumably under. This is by no means a trustworthy guide, especially in children, and should be employed much less than it is. The constant touching of the conjunctiva so often practised by some anæsthetists is frequently followed by troublesome inflammation of the eye.

The patient once thoroughly under, the operation is begun, and the anæsthetist must devote his whole attention to his work. On the one hand, the patient must not be allowed to come out; and on the other, he must not be put too deeply under.

A vigilant watch must be kept on the general appearance of the face—the colour of the cheeks, lips, and ears. So long as the natural colour of the face persists, with red lips and ears, all is well; but excessive pallor or lividity are indications of approaching danger, which dare not be neglected.

The condition of the respiration is of the utmost importance. It is conveniently observed by placing the hand over the mouth and nose of the patient, when the rapidity and force of the respiration may be judged by the breath of hot air expelled at each expiration. This is a very delicate test, and slight variations are readily detected by a careful observer. Stertorous breathing is an indication of complete anæsthesia, although not of necessity a sign of danger; but if the breathing become shallow and irregular, or gasping and sighing, too much chloroform has been given. The action of the pulse is to be observed rather as an indication of the patient's general condition than of the effect of the chloroform.

3. *Dangers and their Treatment.*—(*a*) *Difficulty in Respiration* may be due to some foreign body getting into the larynx, such as false teeth, a piece of tobacco, or some vomited matter from the stomach; or it may be due to the paralysed tongue falling back and interfering with the entrance of air to the lungs. In the former case, the larynx should be explored with the finger, the patient's head being turned on one side to admit of anything falling into the cheek; in the latter, the tongue should be seized with forceps and forcibly drawn out, thus opening up the glottis. The same result is obtained by turning the head on one side and pulling the chin forward, so that the lower teeth project in front of the upper ones. Sometimes the breathing is interfered with by the glottis closing through paralysis of the small muscles of the larynx itself. The symptoms of this condition are lividity and a peculiar crowing, croup-like sound. Pull forward the chin, seize the tongue with forceps, and withdraw it so as to open the glottis.

(*b*) *Failure of the Heart* is usually due to reflex shock, the operation having been commenced before the patient was properly under, or when he was coming out, or to his having fainted from some other cause. To prevent this accident the patient may have some stimulant before the administration is commenced. On no account should a patient who is partially under chloroform ever be placed in the sitting posture. This is one of the most common causes of sudden death under chloroform. It is not death from chloroform, but rather from chloroformist. Should the patient faint, his head must at once be depressed by holding him up by the heels if possible. Raising the foot of the table is usually sufficient. Give a hypodermic syringeful of ether or brandy, apply strong ammonia to his nostrils, flip him with wet towels, and, if it be at hand, apply the constant current. Never use an induced interrupted current which by stimulating the vagus nerve inhibits the heart.

(*c*) *Vomiting* is only dangerous in so far as it furnishes foreign bodies which are very apt to get into the air-passages. The act itself also interferes to some extent

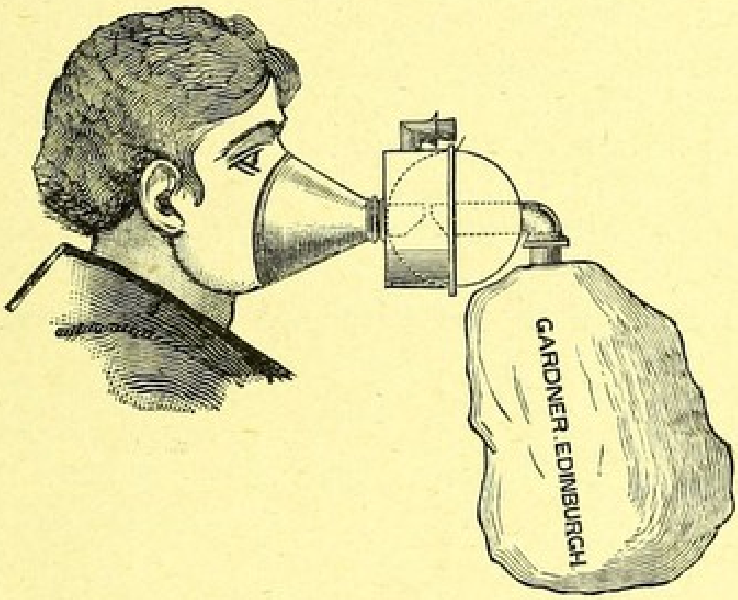


FIG. 81.

with breathing, but it stimulates the heart. The administration must be discontinued if the patient has anything in his stomach to vomit, *i.e.*, if he is not prepared for chloroform. If he is prepared, on the other hand, and his stomach is empty, the sooner he is under the sooner the reflex act will cease.

ETHER has long enjoyed a reputation over chloroform for safety. It is preferred by many on account of its stimulant action on the heart. It causes more struggling than chloroform, and in some patients the after-sickness and headache are more severe. In administering ether some form of inhaler is almost always used, as it is so very volatile that much is wasted with a towel. When given by the 'open method,' in which the ether is mixed with fresh air, Alli's inhaler is employed. This consists of a wire framework, on to which is threaded a length of flannel or domette bandage, and the whole is enclosed in an india-rubber case. By this method the patient takes a long time to go under, and struggles very much. By the 'closed method,' on the other hand, the anæsthesia is rapidly and quietly produced, by causing the patient repeatedly to breathe and rebreathe the same air, with a gradually increasing proportion of ether vapour. This is effected by means of Ormsby's or Clover's inhaler (Fig. 81). Ether is a highly inflammable vapour, and must never be allowed near a light.

'*A.C.E. Mixture*' consists of alcohol (absolute), one part; chloroform, two parts; ether, three parts. It has the combined advantages of ether and chloroform, the alcohol being added for pharmaceutical purposes. It should be freshly prepared, as the mixture decomposes readily.

Chloroform Drop-Bottle consists of a small bottle furnished with an aperture which permits the contained fluid to escape in very small quantity. It is used to save chloroform, and to enable the administrator to judge better of the amount he is giving.

Tongue Forceps.—Ordinary artery catch-forceps (Fig. 54) are used to pull forward the tongue should it fall back and interfere with the respiration, or should there be any other cause interfering with the free entrance of air to the lungs. They should always be at hand, and perhaps the most convenient place to carry them is attached to the collar of the coat or apron-strap. In seizing a patient's tongue a good strong grip should be taken through the middle of the organ, to avoid tearing pieces out of the edges, as invariably happens if one attempts to take a narrow hold.

A clean towel and *solution-tin* are kept ready in case of sickness, and should be within reach of the chloroformist.

While the operation is going on the patient's bed should be prepared for him, fresh sheets, blankets, and pillow-cases, thoroughly aired, being put on it. Next the mattress an ordinary sheet is placed, and over this a large thick mackintosh, and then the draw-sheet, on which the patient is laid. For the first few hours after coming from the theatre he should have a blanket next him. This may be removed and replaced by a sheet when the shock has passed off. Outside this, one or two blankets and a cover make up the complement of bedclothes. Before the patient is put into bed it should be thoroughly warmed by means of several hot bottles placed under the blankets.

CHAPTER XIX.

TREATMENT AFTER OPERATION.

On the return of the patient to the ward, the blankets and hot bottles are removed from the bed. As gently, and with as little disturbance as possible, he is lifted on to the bed, and the blankets and bottles replaced at once, care being taken that a layer of blanket always intervenes between the bottle and the skin, lest he be burned, and, on account of his semi-anæsthetic condition, give no sign. If necessary, a cage is put over the wounded part, to remove the weight of the bedclothes from it. Only one pillow should be put under the head at first, and blocks should be ready on which to raise the foot of the bed should signs of syncope be given.

Chloroform Sickness.—On no account may the nurse leave the patient even for a moment till he is thoroughly out of the chloroform. In the less serious surgical operations, in which the patient does not suffer much from shock, as a rule the most troublesome immediate after-effect is chloroform sickness. Patients vary very much in the amount of suffering this causes them, as well as in the benefit they derive from the various methods of treatment. A good general rule is to allow the patient no food or drink for about four hours after regaining consciousness. Should he remain free from sickness during this time, he may have some small pieces of ice to quench the thirst of which he will most loudly complain. This may be followed by iced milk, potash, or meat-juice. If the sickness persist and be severe, starvation must first be tried as a means of treating it, and should this fail, the following may be tried in succession: (1) sucking small pieces of ice; (2) sipping very hot water; (3) hot fomentations applied over the region of the stomach; and (4) mustard and linseed poultice in the same place. The administration of such substances as bismuth, dilute hydrocyanic acid, etc., usually given to allay vomiting, are, as a rule, of no use in this condition. Morphia and cocaine given internally are, however, sometimes useful. They must never be given, of course, except by order of the doctor.

Nutrient Enemata.—In some cases the sickness yields to none of these means, and the continuous vomiting prevents the nutrition of the patient, and may even prove fatal. In such cases every effort must be made to avert this calamity, and one means of feeding the patient is by *nutrient enemata.* The rectum having been washed out with a small enema of hot water or boracic lotion, a small nutrient enema may be given. It must not exceed two ounces in quantity, or it will not be retained. A good recipe is: Take of brandy, one and a half tablespoonfuls; beef-juice, one dessertspoonful; warm water, one tablespoonful. This may be repeated in two hours, if necessary. It is often necessary to give some more direct cardiac stimulant than the brandy, when five or six minims of tincture of strophanthus added to the enema seems to act very well. Ordinary beef-tea is not absorbed by the rectal mucous membrane, and should therefore not be given as a nutrient enema.

Hunger and Thirst.—It is a safe rule not to give a patient anything to eat for four hours after operation. If there be no sickness by this time, a little fluid food in the form of milk, alone or with soda water, beef-juice, or a cup of tea with a biscuit or toast may be given, and repeated as often as necessary. After twenty-four hours ordinary diet may be given in moderation and with discretion in most cases. In abdominal cases special diet is indicated for longer periods.

Thirst is best relieved by warm fluids, or, when there is sickness, by the injection of four or five ounces of warm water into the rectum. Ice only relieves thirst for a short time, and is apt to induce flatulence. It should therefore be avoided, especially in abdominal cases.

Dryness of the Tongue and mouth is often relieved by painting with a mixture of glycerine and lemon water.

The Urine.—It is the duty of the nurse to see that the patient passes water within a few hours after operation. If the desire does not come on spontaneously, the necessity of attempting to empty the bladder should be suggested to the patient. Any inability to pass water or discomfort from a full bladder should be at once reported to the doctor, who will take means to give relief. The urine should be measured and kept for examination, the patient's name being marked on the bottle. The quantity passed in twenty-four hours should be marked on the chart.

The Bowels.—It is also part of the nurse's duty to see that the bowels act regularly after operation, and to note carefully the characters of the stool. In the first few days after operation drugs or enemata will only be given by the doctor's orders, but during the rest of the convalescence, in most cases, the nurse is expected to give simple laxatives or enemata, should the bowels be constipated. Diarrhœa will be treated by the doctor. The motions of the bowels should be regularly charted.

The *passage of flatus* by the bowel should also be noted, especially in cases of abdominal operation.

Pulse and Temperature. — The patient's pulse and temperature should be taken as soon as he has recovered from the effects of the anæsthetic, and marked on the chart with a note, 'after operation,' as these observations form a point of comparison with others to be subsequently made.

The *Normal Pulse Rate* is from 70 to 80 in adults, and 80 to 100 in children. It is felt most conveniently in the radial artery at the wrist. The nurse will count the beats for a minute and record the result on the chart. By practice she will learn to note variations in its strength, fulness and regularity, also whether all the beats are of equal force.

The *Normal Temperature* of the body is 98·4° F. In surgical cases the temperature is taken twice a day as a rule, and, as far as possible, the time should be regular, say, 8 a.m. and 8 p.m. In serious cases it is taken every four hours—say eight, twelve, and four. The mercury in the thermometer is shaken down below 97° F., and the thermometer is placed in position and left for five minutes. The temperature may be taken either in the mouth or in the axilla, but it should always be taken in the same place in a given patient, as the temperature in the mouth is normally about a degree higher than in the axilla. In the mouth the bulb is placed under the patient's tongue, and the lips are closed. After use the thermometer must be washed. The axilla should be dried with a towel before the thermometer is put in position, and care must be taken that it is in accurate contact with the skin, and not among the clothes. The arm is then folded across the chest and kept still. In children and restless patients the nurse must hold the thermometer in position all the time. To save time, thermometers which rise in half a minute are made, but they are very fragile and expensive. A patient should never be allowed to take his own temperature, and it is often advisable not to inform him of its variations. The temperature should always be charted at once.

Respirations.—In many cases it is necessary to record the number of respirations a patient takes in a minute. This is done by placing the hand on the chest, and counting the number of times it rises in that time. The patient should not know what is being done, as the breathing is so much under control of the will that he may, consciously or unconsciously, vary the rapidity. It is a good plan to hold the patient's wrist, as if counting his pulse, and lay his arm across the chest. The normal rate is from twelve to twenty respirations per minute.

Treatment of Pain.—The treatment of pain after operation must be left largely to the doctor, and on no account should a nurse administer drugs for this purpose on her own initiative. She may, however, often be able to add to the patient's comfort by slightly altering the position of a limb, loosening a bandage, or by other simple means.

The doctor will first look for any possible local cause for pain, and if possible remove it; or if none be found, he will administer some drug, probably morphia, which is the most certain for the relief of pain. This may be given either hypodermically in doses of $\frac{1}{6}$ grain to $\frac{1}{4}$ grain, or in the form of a suppository containing from $\frac{1}{3}$ grain to $\frac{1}{2}$ grain. The nausea which this drug so often gives rise to may be prevented by adding $\frac{1}{120}$ grain of atropine to the hypodermic injection.

Nervous restlessness and sleeplessness are best treated by bromides, chloral hydrate, sulphonal, trional, etc., but always by the doctor's orders.

Other Dangers arising after Operation.—Further precautions must be taken, depending on the nature of the operation and the condition of the patient after it. For instance, in cases of severe railway smash, where limbs have been amputated, there is considerable danger of *reactionary hæmorrhage,* by which is meant bleeding from a wound within the first few hours after operation—during the period of reaction. It may be due to a ligature slipping, or to some paralysed vessel which has not been tied regaining its tone after the patient begins to recover from the shock of the operation. In these days of anæsthetics and bloodless surgery this form of hæmorrhage is fortunately less common than it used to be when speed in operating was the great desideratum; but it does occur every now and again, and it must be most carefully watched for. In any case in which it is more than usually likely to occur, it is the doctor's duty to place a tourniquet in position, ready for the nurse to screw up tight should occasion arise; but if this be not done, then the nurse must rely on her knowledge of anatomy and surgical principles to compress the main artery above. That a hæmorrhage may not be allowed to go on for a time unobserved, stumps should be left uncovered by bedclothes, and the nurse should frequently examine the dressing, especially at its most dependent part, where the blood will first show itself. Red bed-jackets or gowns should never be worn by operation cases, as hæmorrhage on to them may remain unobserved. In many cases, however, it is for serous or purulent discharge rather than for blood that a look-out must be kept, and this is scarcely less important. Should either blood or discharge penetrate the dressing, the house-surgeon must be summoned and the wound dressed at once.

Subsequent Dressing after Operation.—An important question arises in the after-treatment of almost every operation: How soon and how often is it necessary to dress a wound? The less it is touched the better. The aim of antiseptic surgery is towards no dressing at all—that is to say, healing under the original dressing applied at the operation. Unfortunately, we have not yet reached the stage when this is possible in all cases, although it is often attained, and we must now consider the points which are to guide us in deciding as to whether or not we shall dress a particular case.

1. A wound must at once be dressed *if the discharge has come through the dressing*. This is necessary because of the danger of septic mischief reaching the wound by way of the discharge. The nurse should endeavour to anticipate the discharge reaching the surface, frequently examining the most dependent part of the dressing, by folding aside a few layers of the bandage. Should she find that it is within a short distance of the surface, a large pad of antiseptic wool, dusted over with iodoform, should be at once placed over the area, till preparations have been made for redressing the whole wound. This pad is only a temporary protection, and is not to take the place of a fresh dressing, as the organisms may have already gained access to the discharge, and will be *en route* for the wound.

2. Even when 'nothing is through,' as the phrase goes, *if the patient complain of much pain* in the part, the wound should be dressed. The discharge may not be getting away, a drainage-tube may have become blocked, a stitch may be too tight, and so on, and it is only by redressing that one can either find the cause of the pain or relieve it.

3. If there be *a disagreeable odour* from the dressing, it is safer to dress than to leave the wound.

4. When *drainage-tubes* are employed, it is necessary to dress the wound after a few days to remove or shorten them, even should everything be going well.

8

5. If on the second or third day after operation the patient's temperature rushes up to 102° or 103° F., and no general condition explains the rise, it will be well to dress, as the probability is that the wound has gone septic, and if so the sooner it is dressed the better. Of course, an unexplained rise of temperature at a later date should be investigated in the same way.

Causes of Rise of Temperature after Operations.—One of the reasons mentioned for dressing a wound after operation was 'an unexplained rise of temperature.' This leads us to consider the more common causes of elevation of temperature within the first few days of operation.

1. We are never alarmed if a patient's temperature goes up a degree or two on the evening of operation, as experience shows that such a rise is very common, without being an indication of any serious condition, and that the temperature soon falls again.

2. There is no commoner cause of a sudden rise of temperature in surgical patients than *constipation*, and one should always inquire into the state of the bowels before going further afield for an explanation. Should there be reason to suspect this as the cause, a free purge of castor-oil or Henry's solution, supplemented by a large enema of soap and water, will often settle the point. If the free evacuation does not bring down the temperature, some other explanation must be found.

3. *Tension* is another very common cause of elevation of temperature. A tight stitch, a blocked drainage-tube, bagging of pus, the caking of discharge in a deep dressing, or any other condition preventing the free escape of discharge, and causing absorption of toxines, very soon manifests itself by raising the temperature. Obviously the best way to treat such a case is to dress the wound and remove the obstruction.

4. Related probably to tension is the rise of temperature which one sometimes observes in cases where cavities have been stuffed with iodoform gauze or other *stuffing*, and in which the removal of the stuffing is usually followed by a fall in the temperature.

5. The onset of *sepsis*, or of any of the septic diseases,

such as erysipelas, septicæmia, etc., is usually ushered in by a sudden rise of temperature among other things.

6. The high temperature may be due to *some condition quite apart from the patient's surgical affection*, such as a chill, the onset of a bronchitis or pneumonia, or some such medical affection. The history and general condition of the patient, taken together with the physical examination of the chest or other region indicated, will be sufficient to decide the point. Allied to this set of causes is the rise and fall of temperature so common in tubercular patients, whether the surgical affection be of that nature or not.

7. *Excitement* of any kind is a not uncommon cause of elevated temperature in neurotic patients; for example, the receipt of bad news, the visit of a friend, the admission to the ward of a serious accident, or a death in the ward, may temporarily raise the temperature in some patients.

CHAPTER XX.

NURSING OF GENERAL SURGICAL CASES.

TREATMENT OF INFLAMMATORY CONDITIONS.—Almost any part of the body may become inflamed, and exhibit the classical signs of acute inflammation in the form of 'heat, redness, swelling, pain and tenderness, interference with function, and constitutional disturbance.'

The general principles of treatment in all inflammatory conditions are the same, although the precise method of applying them varies infinitely. These principles are: (1) to remove the cause, (2) to ensure rest, and (3) to diminish the quantity of blood in the part. The main cause of inflammation being septic infection, the importance of antiseptic treatment in inflammatory conditions becomes obvious. In Chapter XXIX. we shall discuss the methods of securing rest. Here we shall only briefly refer to one or two means of diminishing the quantity of blood in an inflamed part.

(*a*) *By Position.*—Elevation of limbs on splints, pillows, etc., to aid the return of blood by gravitation does much to relieve the symptoms of inflammation.

(*b*) *By Bleeding.*—The direct withdrawal of blood by opening a vein is not much practised nowadays, but its place is taken by dry or wet cupping.

In *Dry Cupping*, a few small pieces of blotting-paper, dipped in methylated spirit, are ignited and placed in a cupping-glass or small tumbler previously warmed, which is inverted and laid over the affected part. As the heated air in the tumbler contracts, the skin inside rises, and blood is drawn towards the part. To facilitate the rising of the skin, the inside of the tumbler should be well oiled at its edge.

In *Wet Cupping*, the skin is scratched with a scarifier (Fig. 82) before the cup is applied, so that the blood escapes.

The glass is removed by pressing one finger under its rim. To pull upon it causes excessive pain.

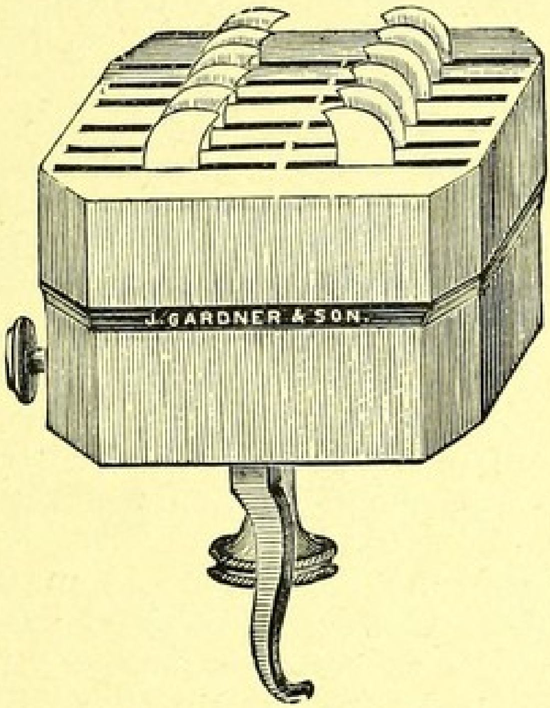


FIG. 82.

(*c*) *By Leeches.*—The part to which leeches are to be applied must be well washed. The leech is placed in a wineglass or test-tube, which is inverted over the part to be bled. They often bite better if the part is smeared with cream or sugar and water. The animal drops off when it has withdrawn as much blood as it can. If it is desired to remove it sooner, it should be sprinkled with a little salt, but should on no account be pulled off.

The application of warm moist aseptic fomentations will encourage the flow should this be desired. A simple dressing is all that is necessary after the removal of the leeches. It must be confessed that the use of leeches is scarcely consistent with aseptic principles in surgery.

(*d*) *By Hot Fomentations.*—A piece of thick flannel or lint is wrung out of very hot water, or, better still, boracic lotion, and applied to the part with a layer of mackintosh overlapping it in all directions to keep it moist and retain the heat. Antiseptics, *e.g.*, carbolic (1 in 20); stimulants, *e.g.*, turpentine; or anodynes, *e.g.*, opium, may be sprinkled on the surface of fomentations if indicated. Fomentations may be wrung out without scalding the nurse by being placed on the centre of a clean towel, which is folded over and held by the free ends.

It may be said here once and for all that the old-fashioned *poultice* of linseed, oatmeal, or bread has no place in the surgeon's armamentarium. It is a dirty and dangerous application, which must be avoided.

(*e*) *By Cold.*—The ice-bag is the simplest means of applying cold. Small pieces of ice are placed in an india-rubber bag and fixed in position over the inflamed part. It is essential that the bag should be replenished whenever the ice is all melted, otherwise the heat of the body warms up the water, and its action becomes that of a poultice, and will only do harm.

Continuous cold may be applied by means of Leiter's apparatus, which consists of a series of leaden tubes through which ice-cold water is kept constantly flowing. These may be moulded to any part of the body. The nurse's duty is to see that the supply of iced water is kept up and the flow maintained continuously.

A simple means of applying cold is to place a jug containing ice-cold water on a stand over the part, and by means of a few strands of worsted to keep up a constant dripping, the fluid being caught in a vessel below. This is only suitable for the limbs, *e.g.*, elbow or knee, etc.

Chronic Inflammation.—In the treatment of chronic inflammatory conditions, blisters, pressure, and massage are the principal means adopted.

Blisters may be applied in the form of plasters, *e.g.*, cantharides; or of pigments which are painted on, *e.g.*, liquor epispasticus or blistering fluid; or liniment of iodine, etc.

The part is first washed with soap and water to remove the natural grease of the skin. The plaster is applied, or the pigment painted over the area indicated by the doctor, care being taken that the fluid does not run. This is prevented by making a circle with oil or vaseline round the area. A pad of cotton-wool is laid over the blister. In three, four, or five hours the blister will have risen. If not, a hot fomentation will hasten it. The fluid is then run off by cutting the blister at the lowest point, allowing the cuticle to fall on to the raw surface. A simple dressing of boracic ointment, frequently renewed, is all that is necessary.

Pressure is best applied by means of imbricated strips of adhesive plaster, or by an elastic bandage over a thick pad of absorbent wool.

Massage.—The essential points to attend to in applying massage for chronic inflammatory conditions are: (1) to begin rubbing the healthy parts on the proximal side of the diseased portion, the strokes being upwards, to empty the veins and lymphatics, and so facilitate the absorption of the inflammatory products. (2) The hands of the rubber and the parts to be rubbed should be smeared with a simple ointment or oil. (3) In addition to the centripetal stroking of parts (*effleurage*), circular rubbing between the hands or thumbs (*massage à friction*) is useful in breaking adhesions and scattering inflammatory products; pinching, squeezing, and kneading of superficial parts (*pétrissage*) is also useful. *Tapotement*, or beating the parts with the hand or some soft instrument, is sometimes employed. (4) The time occupied varies from five to twenty minutes.

Burns and Scalds.—The treatment of burns and scalds very often falls to the nurse. The first thing to attend to when a burnt patient, say a child, whose clothes have caught fire, is admitted is to see that it is placed in a warm bed, with plenty of hot bottles round it. Some hot drink or some whisky is given, and if pain be severe, *by the doctor's leave* a few drops (two or three) of laudanum may be given. The clothes are then gently removed by cutting them off, and the burnt surface is carefully bathed with boracic lotion or 1 in 100 lysol. Blisters are cut, and the fluid allowed to escape. The raised epidermis should be removed. The best dressing to apply is a saturated solution of picric acid* lightly wrung out of pads of sterilised gauze or lint. These pads are laid all over the burnt area and for some inches beyond it, and are covered with a moderately thick layer of corrosive wool and a bandage. *No* mackintosh is employed.

The dressing need not be repeated for three or four days. In superficial burns all will be healed under one dressing. Any portion of the original dressing which remains dry and adherent need not be removed, but should simply have some picric acid solution run on to it. If there is any discharge under the dressing it should be removed, the surface gently bathed with boracic lotion, and the picric acid pads reapplied. Twice or three times a week is often enough to dress the burn.

Ichthyol, a 30 per cent. solution in water, is also a good dressing for burns. It is applied in the same way as picric acid.

Thiol, in watery solution, 1 in 4, or as a powder mixed with bismuth and iodoform, is also useful.

All oily and greasy dressings like carbolic oil, eucalyptus oil, carron oil, or boracic ointment, are to be avoided. They entirely fail to meet the requirements of modern antiseptic surgery, and have proved very unsatisfactory.

Burns are described as of six *degrees:* (1) redness or hyperæmia, (2) vesication or blistering, (3) partial destruction of true skin, (4) total destruction of true skin, (5) charring of muscle, (6) charring of bone.

Care must be taken in burns of the third and fourth degrees to avoid contraction of the cicatrix during healing by the use of splints, extension, or other appropriate apparatus.

SKIN-GRAFTING.—Various methods of grafting skin are employed with a view to hastening the healing of large raw surfaces, such as result from injury, operation, ulceration or burns. By skin-grafting cicatrices are obtained

* Take of picric acid, 1½ dram; absolute alcohol, 3 ounces; distilled water to 40 ounces. Dissolve.

which are more even, stronger, and show less tendency to contraction than those resulting from granulation.

The surface to be grafted must be thoroughly asepticised, the granulations being gently scraped with a sharp spoon, and the bleeding stopped by pressure, or by peroxide of hydrogen solution on pads of sterilised gauze.

The surface from which the grafts are taken is prepared in the same way as other parts to be operated upon (page 98).

There is no doubt that *Thiersch's Method* gives the best results. Long strips of the superficial layers of the skin, extending down to the Malpighian layer, are shaved off with a razor, and laid on the raw surface so as to cover it completely. Protective or fine tin-foil is placed over the grafts and an aseptic dressing applied, and changed on the fourth or fifth day for the first time. Subsequent dressings are performed every third day.

By *Reverdin's Method* small particles of skin about the size of a pin's head are planted on the granulating surface, about a quarter of an inch from one another, and dressed in the same way as in Thiersch's method. The grafts disappear in a few days, but most of them soon reappear as fine blue islands of epithelium, which gradually spread and blend till the surface is covered over.

Skin from the *lower animals*—dogs, kittens, or rabbits—gives very good results when successful, but it is less certain than Thiersch's method. The animal is first shaved, and the whole thickness of the skin is used. The hair does not grow again.

In all these procedures the greatest gentleness is necessary in the after dressings to prevent disturbing the young epithelium before it is firmly established.

Only the mildest antiseptics, *e.g.*, boracic lotion, or sterilised water, are used, and a splint to secure immobility is advantageous.

Bed-Sores.—No subject is of greater importance to the nurse than that of bed-sores, as on her depends their prevention. Every well-trained nurse feels herself disgraced when a bed-sore forms on one of her patients.

Bed-sores are specially liable to occur on patients who are very much devitalised from any cause whatever, but especially in such diseases as cause great wasting, much venous congestion, or where there is interference with the nervous supply to the skin.

When to these predisposing conditions are added long-continued pressure, moisture and dirt, bed-sores are certain to occur sooner or later.

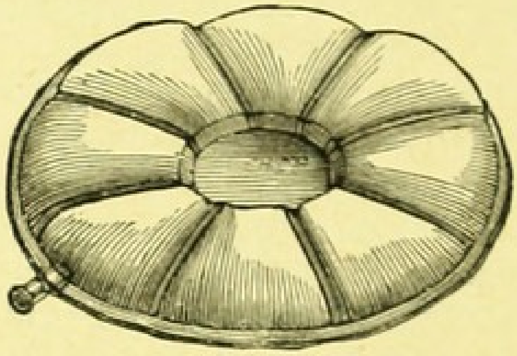


FIG. 83.

The patient's position in bed must be regularly changed by turning from one side to the other, by bending the limbs at one time and straightening them at another, by adjusting pillows or air-cushions (Fig. 83), so as to relieve pressure from time to time. Circular pads of cotton-wool should be placed over bony prominences, so as to distribute the pressure widely on surrounding parts. In very weak patients a water-bed is necessary. No patient is to be allowed to lie constantly in one position unless by direct orders of the doctor.

Absolute cleanliness and dryness are imperative. The parts most liable to develop bed-sores are the sacrum, buttocks, great trochanters, shoulder-blades, elbows, heels and ankle-bones. Regularly once a day, if not oftener, these parts are washed with soap and water, thoroughly dried with a soft towel, rubbed with methylated spirit, which is allowed to dry by evaporation, and then dusted with boracic powder. Oily applications are sometimes used, but are much less cleanly and satisfactory.

The first evidence of a bed-sore is a reddish-purple patch on the skin, which gradually gets darker, till it becomes almost black. Blisters may form on it, and at last the skin dies, and leaves a tough, gray slough, which very slowly separates.

The objects in treatment are to prevent the spread of the sore, to hasten the separation of the slough, and to facilitate the granulation of the raw surface left. Ordinary antiseptic dressings applied dry, such as boracic lint or gauze, or stimulant oily applications like balsam of Peru, or eucalyptus ointment, may be tried. Some surgeons remove the slough with the knife or sharp spoon, and treat the surface by ordinary antiseptic dressings or by skin-grafting.

AMPUTATIONS.—After amputations the nurse should place the stump on a pillow so that it is slightly raised above the level of the patient's body. A wire cage is placed over it, and the bedclothes so arranged that the part may be examined frequently without disturbing the patient unduly. Many surgeons prefer that the stump be left entirely uncovered by bedclothes for the first twenty-four hours. A sharp look-out is kept for the appearance of 'reactionary' hæmorrhage, that is, bleeding taking place when the patient begins to rally from the shock of the operation. It is most likely to show either on the face of the stump, or at the upper edge of the dressing. Should it occur, the doctor must be at once summoned, the nurse meanwhile compressing the main artery of the limb (page 84).

In septic wounds 'secondary' hæmorrhage may occur at any time during the suppurative process. It is usually very severe, and calls for prompt and cool-headed action on the part of the nurse. After calling the doctor, a tourniquet should be applied, or the main vessel may be controlled by digital pressure. In cases where this accident is liable to occur, a tourniquet, some artery forceps, and some silk or strong catgut should be kept in readiness at the bedside.

OPERATIONS ON BONES AND JOINTS—*Excisions of Joints.*—The after-treatment of cases of excision of joints depends on whether ankylosis or free movement is aimed at. If the former, then the parts are kept at absolute rest in a rigid apparatus till the desired end is obtained; but if the latter, *passive movement* must be carried out systematically from a very early stage in the case. After *excision of the wrist*, *e.g.*, passive movement of the fingers is commenced on the second day, whether inflammation has subsided or not, and continued daily. Care is taken to avoid disturbing the wrist while doing this by fixing the metacarpal bones. The other movements at the wrist-joint are gradually encouraged as the new joint acquires firmness.

In the case of the *elbow* joint the passive movement of the fingers and wrist should be begun on the second day, and of the elbow itself about the tenth day, the position in which the limb is afterwards bandaged being varied from day to day. After a time the patient is encouraged to use the joint with care, and to compel this in children it is often necessary to confine the sound arm in a bandage.

So in the *shoulder* joint the fingers, wrist, and elbow are exercised from the very first, and at the end of a fortnight the shoulder is gently moved. Various appliances must be extemporised to induce patients to use their joints after excision, due care being taken that the movements do not take place at joints other than those which it is desired to exercise.

After *fractures*, especially those implicating joints, passive movement is necessary to insure a useful limb, and must be carried on on the same principles as after excision.

Operations for Diseases of Bone, *e.g.*, osteomyelitis, necrosis, etc., do not call for special nursing.

Instruments used in Operations upon Bones and Joints.

Saws vary in size and shape, according to the particular part of the body in connection with which they are used.

The Ordinary Surgeon's Saw (Fig. 84) is used in dividing bones, *e.g.*, in an amputation of a limb. The blade is broad, the handle resembles that of a joiner's saw, and, as a rule, the back is made movable, so as not to interfere with the onward movement of the blade through a thick bone.

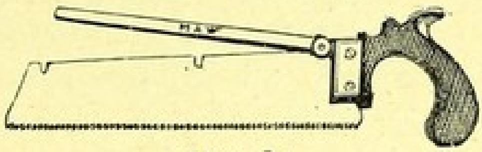


FIG. 84.

Metacarpal Saws (Fig. 85) are of various patterns: some bow-shaped, some short and broad, and others long and

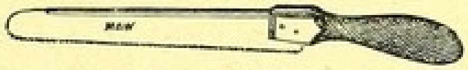


FIG. 85.

narrow. As the name implies, they are used to divide smaller bones, such as metacarpals or metatarsals.

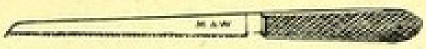


FIG. 86.

Finger Saw (Fig. 86) is still smaller, and is used to cut through the phalanges.

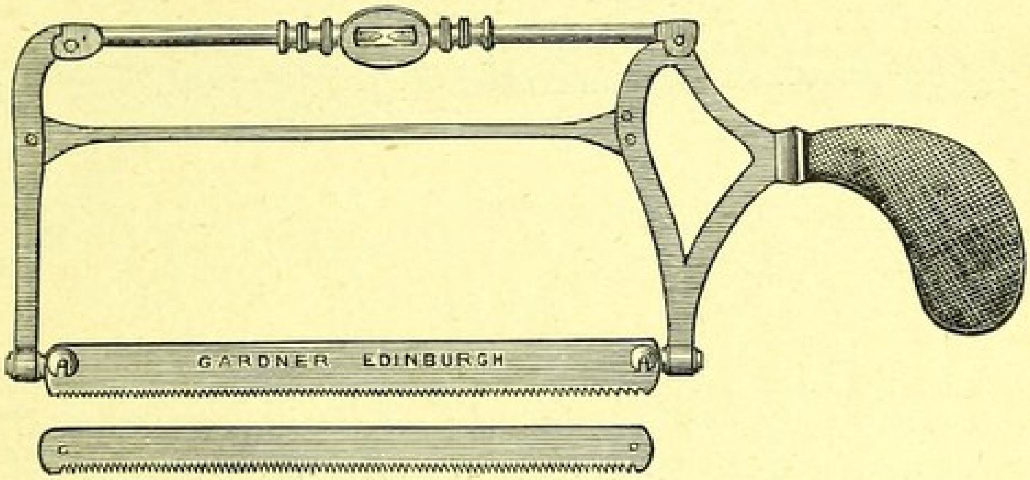


FIG. 87.

Butcher's Saw (Fig. 87), called after the surgeon who introduced it, consists of a narrow steel blade with fine teeth, set in a framework of metal, in which it can be turned so as to work in any direction, and from which it may be readily detached. It is chiefly useful in excising joints, the narrow blade permitting of the bone being sawn in a direction away from the bloodvessels.

The Bow-shaped Saw (Fig. 88) possesses some, but not all, of the advantages of Butcher's.

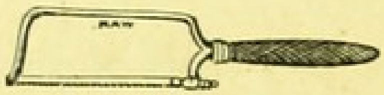


FIG. 88.

A *Chain Saw* (Fig. 89) is sometimes used for dividing the neck of the femur, round which it is passed by the aid of a specially-curved needle.

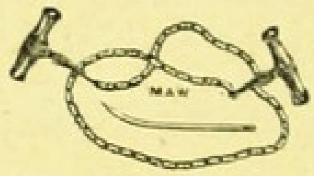


FIG. 89.

Adam's Saw (Fig. 90) is used specially for the operation of subcutaneously dividing the neck of the femur, intro-

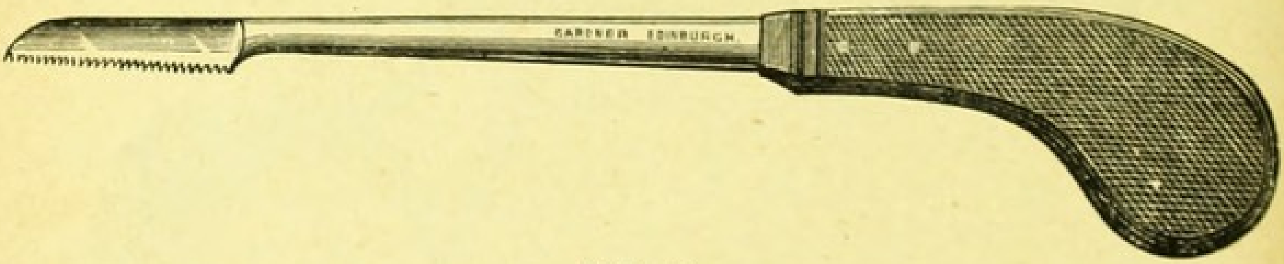


FIG. 90.

duced by that surgeon. It consists of a long rounded stem, the terminal part only of which is serrated, and a large handle like that of an ordinary amputating saw.

Macewen's Laminectomy Saw (Fig. 91) is used for operations upon the spine. It is so constructed as to be worked at almost any angle in a deep wound.

Probes are always necessary in such operations (p. 72).

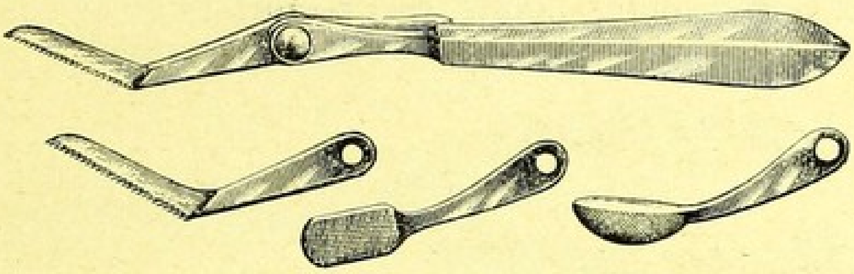


FIG. 91.

Periosteum Separators or *Elevators* are very often employed in operating on diseased bone, their use being indicated by their name. They are of various shapes

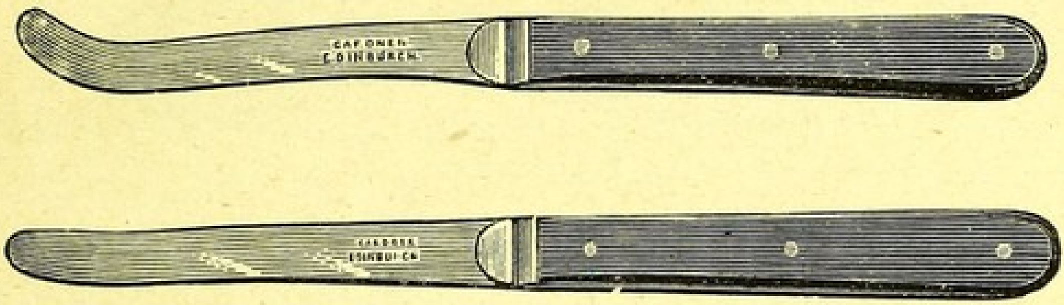


FIG. 92.

(Fig. 92), but all agree in having a blunt edge and a strong handle, the former to peel off the periosteum, the latter to give the necessary leverage. The pattern used by Professor Macewen, of Glasgow (Fig. 93), is of very general utility, affording great leverage, and taking up a small amount of room.

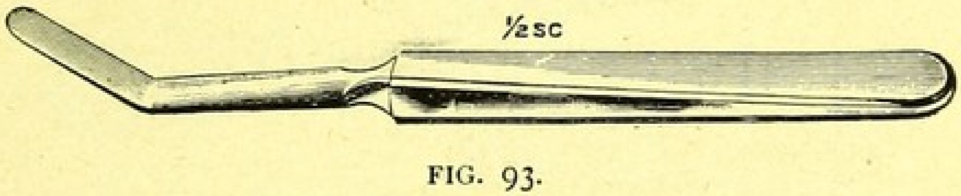


FIG. 93.

Forceps.—(*a*) *Necrosis* or *Sequestrum Forceps* (Fig. 94) are used to extract pieces of dead bone—sequestra—from a wound or sinus. They have an ordinary scissors-joint, have rough gripping-points, and require to be of considerable strength. They may be straight or curved.

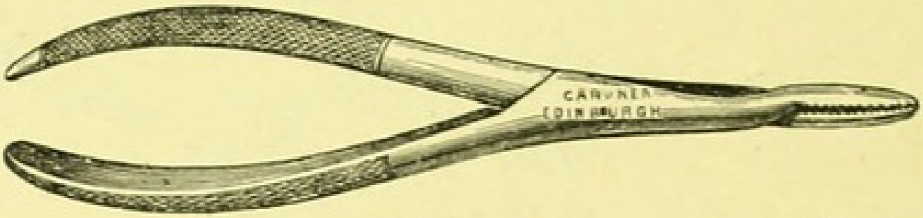


FIG. 94.

(*b*) *Lion Forceps* (Fig. 95), originally used by Sir William Fergusson in excising the upper jaw, may be employed in

FIG. 95.

almost any condition in which it is necessary to get a very firm grip of a piece of bone. The blades beyond the joint are more curved than those of necrosis forceps, and each terminates in four strong teeth, those of the two blades being opposed.

(*c*) *Gouge Forceps* (Fig. 96) are used to remove fragments of bone piecemeal rather than complete sequestra.

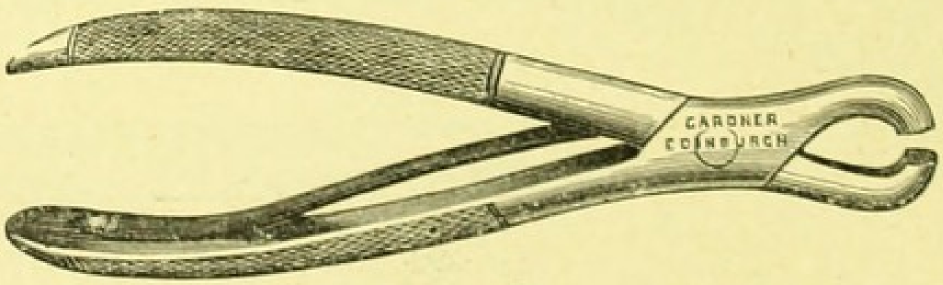


FIG. 96.

They practically consist of two gouges united so as to form forceps, and are exceedingly powerful. The edges are sharp, so that even hard bone may be readily pared down by them. Like others, they are made curved as well as straight.

(*d*) *Bone Forceps* or *Bone Pliers* (Fig. 97) are cutting instruments, and are used under various conditions, where

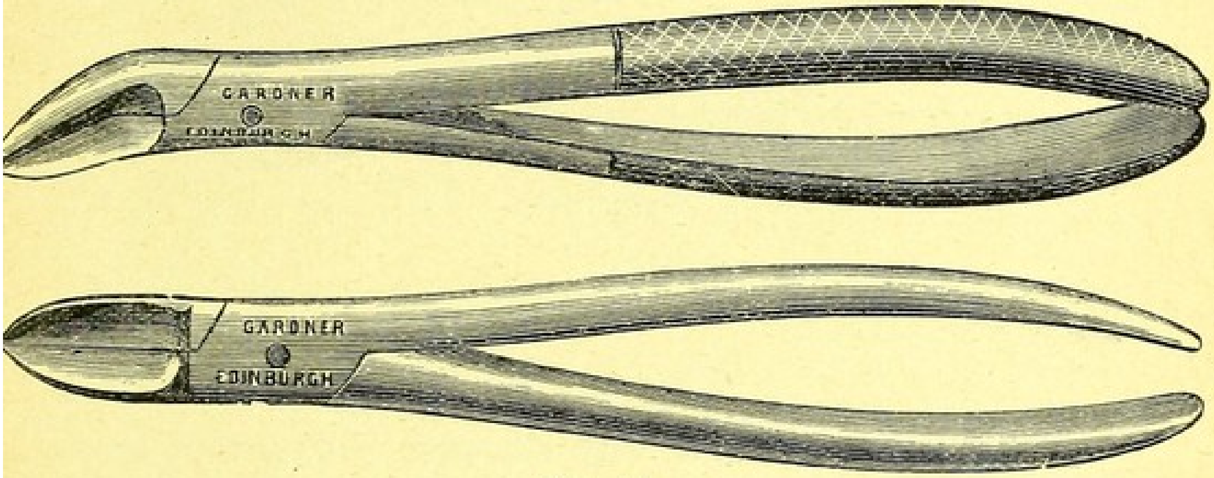


FIG. 97.

bones require division, taking the place of the saw in small amputations, such as fingers or metacarpals.

Chisels (Fig. 98) are used either to chip away portions of bone or to divide a bone completely through, the size

FIG. 98.

and shape of the instrument varying, of course, according to the purpose for which it is employed.

The most powerful and generally useful form of chisel is that introduced by Macewen, of Glasgow, for his operation of osteotomy, and hence sometimes called *Macewen's Osteotome* (Fig. 99). The whole instrument, blade and

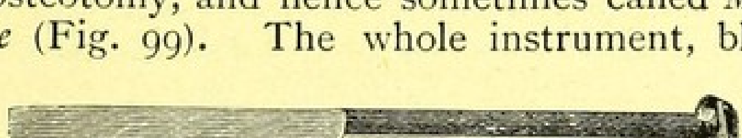


FIG. 99.

handle, is of one piece of metal; the blade, wedge-shaped, is bevelled equally on both sides, and must be of the best steel. It is graduated on the side to insure accuracy in dividing the bone.

Gouges (Fig. 100) are used to chip away pieces of bone, diseased or otherwise, or in opening the skull in some

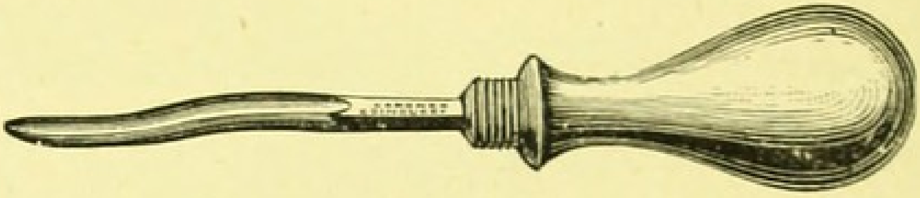


FIG. 100.

cases. They are simply chisels with grooved blades, and are of various sizes.

Trelat's Gouge is straight, with a long metal handle, while some others have ebony handles.

Mallets are used along with the gouges or osteotomes. They may be of steel or of wood.

Gimlets are used in surgery to pierce bones preparatory to wiring fragments together, *e.g.*, after fractures, and they should have an eye near the point, so that they may carry the wire through.

Sharp Spoons or Scoops.—These are often found useful in dealing with sinuses associated with diseased bone, and even in scraping the bone itself. They were originally used by Volkmann, and usually bear his name (Fig. 101).

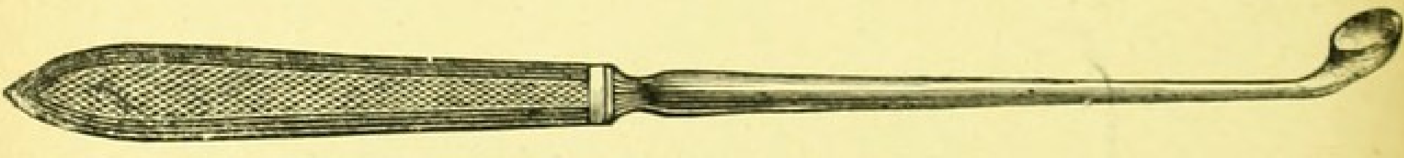


FIG. 101.

In some the spoon is round, in others oval, and the edges are just sufficiently sharp to remove diseased tissue, sparing that which is healthy. Preferably, the whole instrument is made from one piece of metal, so that it may be sterilised by heat without being damaged. This is the more necessary, as the sinuses and cavities in which it is employed so often swarm with septic and other organisms that there is danger unless great precautions are taken.

Lister's Spoon (Fig. 102) is a much shorter and stouter instrument, but otherwise resembles that of Volkmann. Other sharp spoons, much smaller than the above, are used in the treatment of lupus, where it is necessary to scoop out the contents of each tubercular nodule. These are sometimes called *lupus curettes*.

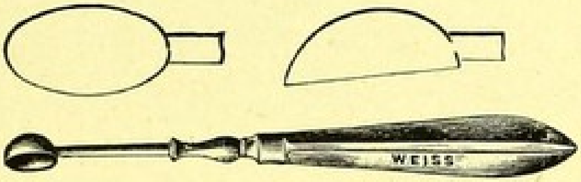


FIG. 102.

Drills are used to perforate bones preparatory to pegging or wiring fragments.

LIGATURE OF ARTERIES.—Large arteries are frequently ligatured in their continuity for various diseases, notably for aneurism, and one or two precautions are specially necessary in the after-treatment: (1) Most scrupulous antiseptic precautions. (2) The limb, slightly flexed, should be raised to favour the return flow of the venous blood. (3) The *temperature* should be kept up by enveloping the limb in cotton-wool and domette bandages, taking great care that no constriction takes place. In addition to this, hot-water bottles may be placed near the limb, but the temperature of the water must not exceed 100° F., lest gangrene be induced, owing to the enfeebled condition of the circulation. (4) Absolute and prolonged rest is essential to permit of organization of the clot in the aneurism and at the seat of the ligature.

The complications and risks to be guarded against are: (1) secondary hæmorrhage, which is usually due to sepsis, and therefore preventable; (2) gangrene of the limb beyond the ligature; and (3) inflammation and suppuration in the sac of the aneurism.

CHAPTER XXI.

NURSING OF SPECIAL CASES.

In certain serious operations much of the success depends on the after-treatment, and especially on that part of it which devolves on the nurse. In some of those special training is necessary, and in all of them experience in nursing ordinary cases is absolutely essential in one who is to take care of the subjects of them. An elementary knowledge of the condition for which the operation was performed assists the nurse greatly in intelligently performing her duties.

Head Cases.—A patient who has sustained a serious injury to his head—concussion of the brain or fracture of the skull—should, after being put to bed, as soon as possible have a free purge. If he can swallow, castor-oil or Henry's solution may be given; if he cannot swallow, a small drop of croton-oil in some sugar placed on the back of his tongue will serve the same purpose. These measures may be followed by an enema if necessary. The head should be raised on a moderately high pillow, the room darkened, and the patient kept absolutely quiet and undisturbed by visitors. Only fluid food, and that in small quantities, is given.

An ice-bag is of no use unless the head is shaved and the bag constantly retained in position. Even then it has perhaps more effect on the patient's friends than on the circulation inside his skull.

The general treatment of patients after operations on the skull and brain is the same as after injuries. During convalescence all mental efforts like reading, arguing, or playing games must be avoided. Picture-books rather than literature should be supplied to such patients.

Instruments used in Operations on the Head.

Instruments used in Trephining the Skull.—The operation known as trephining the skull consists in the removal of a circle of bone from the vault in order to obtain access to the contents of the cranium, or to facilitate the elevation of depressed fragments when the skull has been fractured. The instruments used in the successive steps of the operation are these: (1) A razor of the ordinary kind with which to shave the region of the head

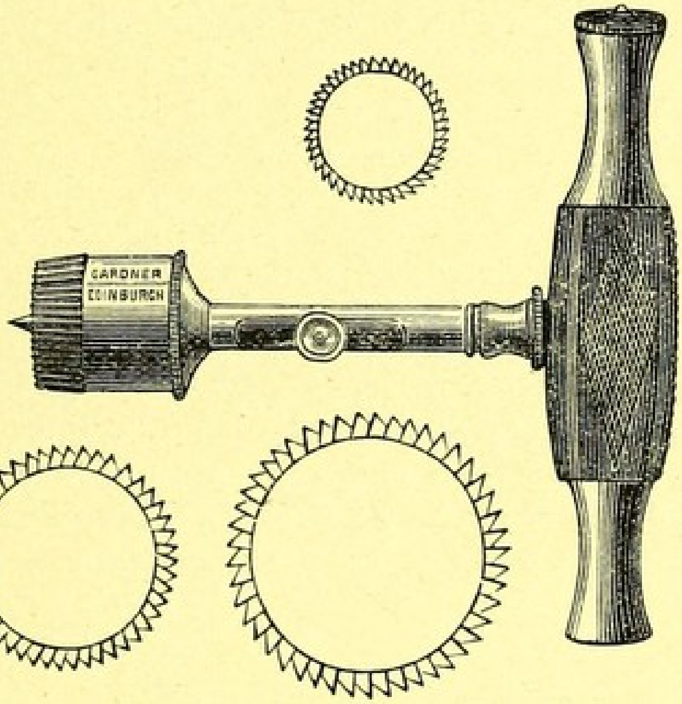


FIG. 103.

to be operated upon; (2) a scalpel, or small bistoury, to make the incision through the tissues overlying the bone; (3) a periosteum separator with which to raise the pericranium, as the covering of the skull bones is called; (4) blunt hooks to retract the edges of the scalp wound; (5) dissecting forceps; (6) artery forceps will be needed to secure the bloodvessels cut in making the scalp incision; (7) *the Trephine* is the instrument used to saw out the bone circle. It consists of a small round saw, varying in diameter from $\frac{1}{4}$ inch to 1 inch, mounted on a strong hollow metal shaft about $3\frac{1}{2}$ or 4 inches long, to which is attached at right angles a thick, strong handle. Running down through the hollow of the shaft is a movable centre-pin, which may be made to project beyond the level of the saw teeth, or be entirely withdrawn, as required. It is fixed in the desired position by a screw on the side of the shaft. In some instruments only the free edge of the blade is serrated, and in others the serrations are carried along the outer aspect of the blade (Fig. 103). In using the trephine the centre-pin is first projected from $\frac{1}{16}$ inch to $\frac{1}{8}$ inch beyond the level of the saw, and there firmly fixed. The point of it is then pressed into the centre of the area of bone to be removed, and in this way the saw is steadied until it has made a groove for itself in the bone. So soon as this has been accomplished the centre-pin is completely withdrawn, lest it should interfere with the onward progress of the saw, or, perforating the bone before the saw, injure the membranes of the brain underneath. The saw is men gradually worked through the bone with a rotatory thotion, as in using a bradawl, great care being necessary on account of the fact that the skull is not of the same thickness all over, and there is consequently a danger of one part of the circle being through early, and of the saw opposite that part damaging the membranes. To prevent

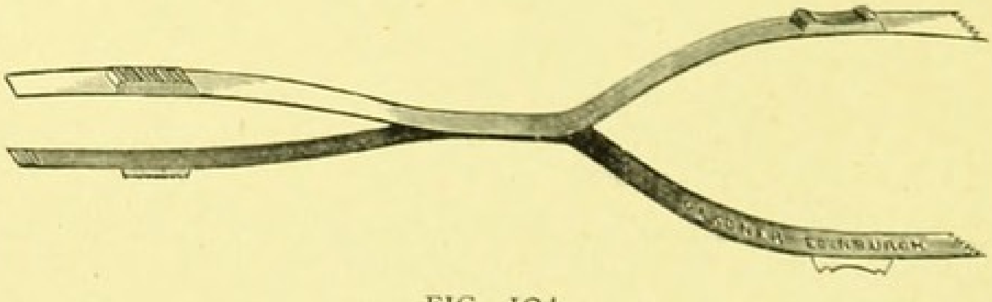


FIG. 104.

such an accident the trephine must be frequently removed and the groove measured all round. This is most conveniently done by an ordinary toothpick, blunted at the point, which also serves to remove the bone dust from the groove. (8) The bone being sawn through all round, the circle has now to be lifted out, and for this purpose the *Trephine Forceps* (Fig. 104) are employed. These are made on the same principle as dissecting forceps, but the blades are rounded so as to adapt themselves to a curved object. (9) An instrument called the *Lenticular* (Fig. 105) is some-

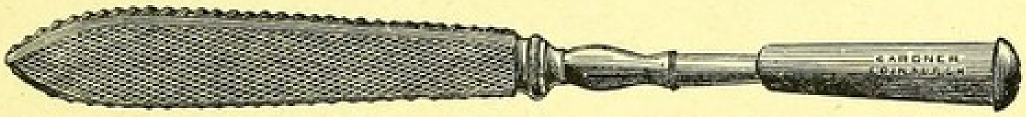


FIG. 105.

times used at this step of the operation to plane the edges of the hole in the bone. It has a stem with sharp edges which scrape off any projections, and these fall into a small basin-shaped button at the foot. It is not often used. (10) When the operation is performed for fracture

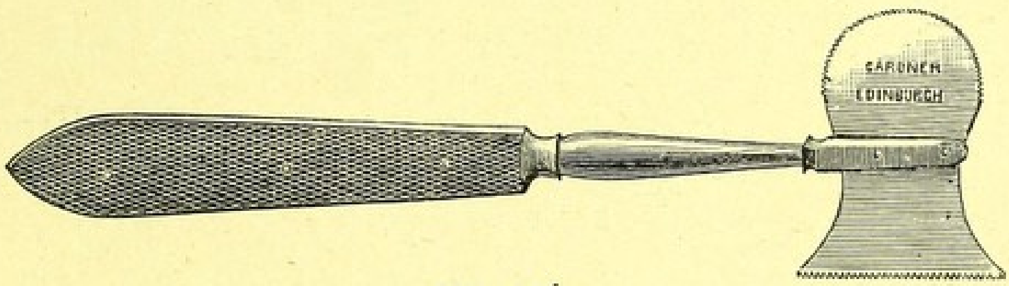


FIG. 106.

of the skull, it is often necessary to saw off projecting ledges of bone, and this is done by means of *Hey's Saw* (Fig. 106), which consists in two small saws of different shapes fixed on to a long, strong handle. (11) Another

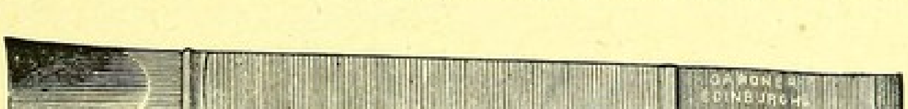


FIG. 107.

instrument also used in cases of fracture is the *Elevator* (Fig. 107), which is used to raise any depressed fragments of bone which are pressing on the subjacent brain. It is to be distinguished from the periosteum separator, being roughened on one aspect to prevent it slipping from under

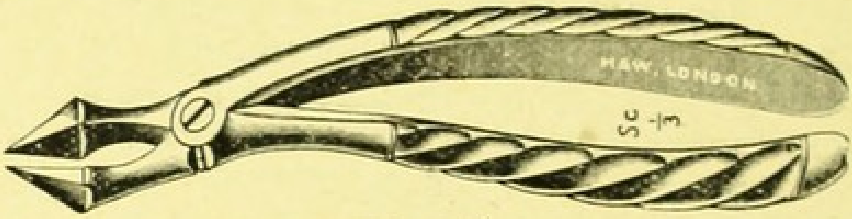


FIG. 108.

the bone. (12) The other instruments used in the operation will depend on the object for which it is being performed, *e.g.*, the removal of a tumour or foreign body, the

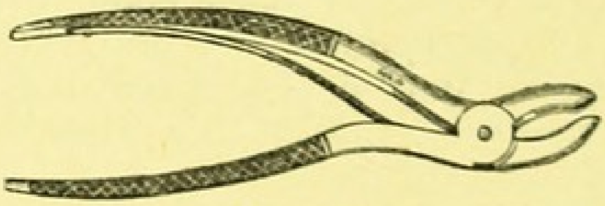


FIG. 109.

evacuating of an abscess, or the elevation of depressed bone. Figs. 108, 109, and 110 illustrate different forms of *rongeur forceps* used for cutting away pieces of the

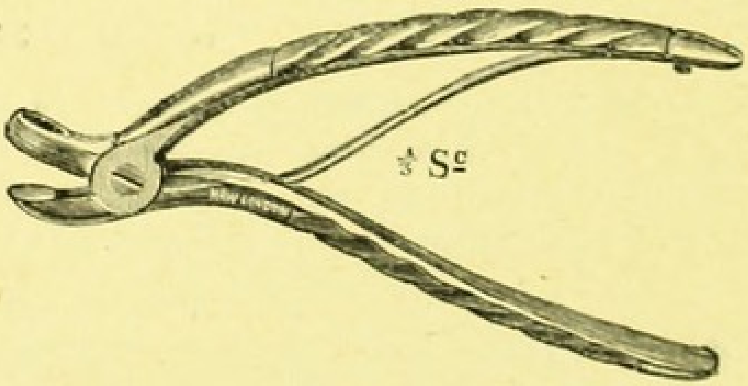


FIG. 110.

skull. In all conditions, as asepsis is the key to success, the greatest care must be taken in the purification of instruments, hands, dressings, etc.

In operations for the disease of *mastoid air sinuses* special chisels and gouges are used (Figs. 111, 112), with or without a mallet (Fig. 114).

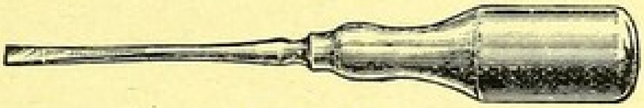


FIG. 111.

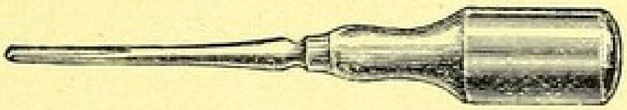


FIG. 112.

FIG. 113.

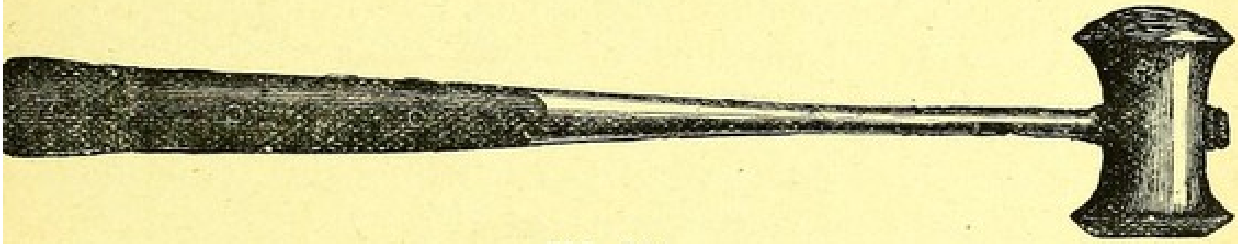


FIG. 114.

CHAPTER XXII.

TONGUE, JAW AND MOUTH CASES.

Excision of the Tongue or of the Upper and Lower Jaws.—The principal duties of the nurse in cases of this nature are :

1. *The feeding of the patient,* as much of the success of the operation depends on his being able to take a sufficient amount of nourishment to carry him over the early days. As his power of masticating is gone, and of swallowing much impaired, it is usually necessary to administer his food partially digested through a stomach-tube, passed either through the mouth or nose.

In *passing the stomach-tube* the patient is directed to hold his head well back, and to open his mouth wide. The forefinger of the left hand is passed far back into the pharynx to guide the tube, previously lubricated with glycerine, past the epiglottis. When the end of the tube has reached the back of the mouth, the patient is asked to swallow it, and as he does so it is gently pushed on, the head at the same time being brought into its natural position again. Care must be taken before introducing any food that the tube is not in the larynx or trachea. When it is so, in addition to the coughing of the patient, the sound of the air passing through the apparatus is sufficient indication of the fact. The patient is fed with peptonised milk, meat-juice, switched eggs, brandy, and so on; if necessary, supplemented with nutrient enemata.

2. *The mouth must be kept as clean and aseptic* as possible,

by frequently washing it out with Condy's fluid, boracic lotion, or izal (1 in 400). This may be done by a small sponge *securely* fixed to a wooden handle, or held in long forceps, or, better still, by a syphon arrangement (Fig. 273) fixed over the patient's head, so that a stream of lotion may be allowed to run in at one angle of the mouth and out at the other. Keeping the mouth sweet is of great importance, for several reasons: (*a*) it is very comforting to the patient; (*b*) it diminishes the risk of septic absorption and consequent septicæmia; and (*c*) it diminishes the risk of septic pneumonia, a very frequent cause of death in these cases.

3. When the lower jaw has been excised, *the tongue* loses its anterior attachment, and *is liable to fall into the back of the mouth* and block the air passages. Should this occur, the head must be turned on one side, or even face downwards, to permit of the tongue falling forward again. If this be not sufficient, it is seized with catch forceps and forcibly pulled forward.

4. Reactionary or secondary *hæmorrhage* is a source of danger in tongue cases. The nurse must be prepared to pass her finger well back into the mouth, and to press on the bleeding-point, while someone else goes for the doctor.

Instruments for Mouth.

Tongue Depressors are employed very frequently, and in quite simple procedures. When examining the condition of the fauces or pharynx, the tongue is very apt to become arched, and obstruct the view, and such a depressor as that shown in Fig. 115 is used to keep it down. The instrument is of electro-plated metal, consists of two blades of unequal size, united by a hinge-joint. Another form of instrument, *e.g.*, that by Turch (Fig. 116), is more convenient when the tongue has to be held down for any length of time during an operation. When manipulations are being carried out on the mouth and fauces, the finger of the surgeon is apt to be bitten, especially by children, and to prevent this the jointed finger protector

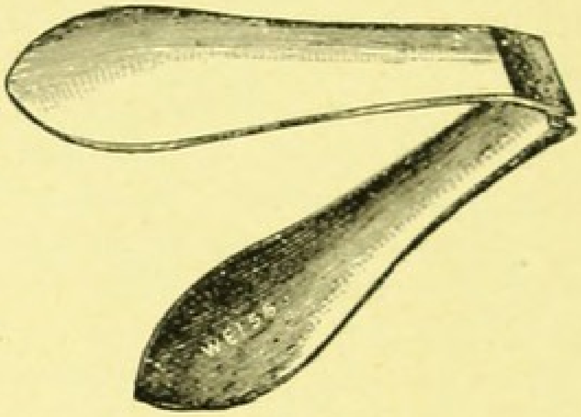


FIG. 115.

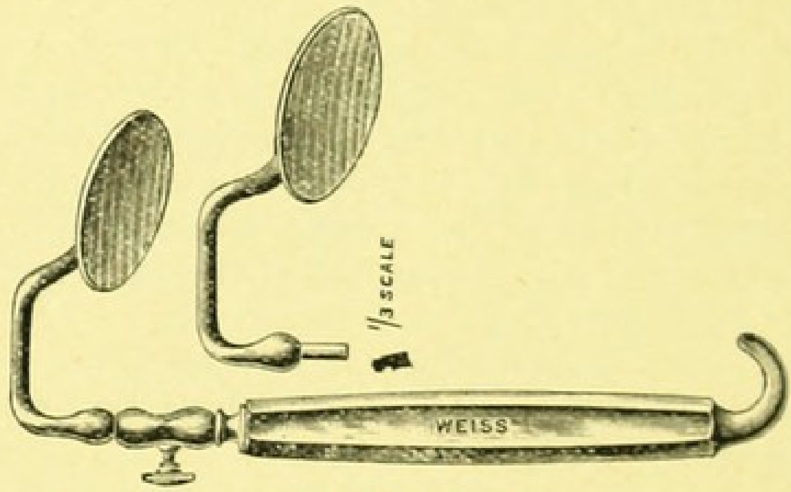


FIG. 116.

(Fig. 117), which at the same time acts as a gag, may be worn.

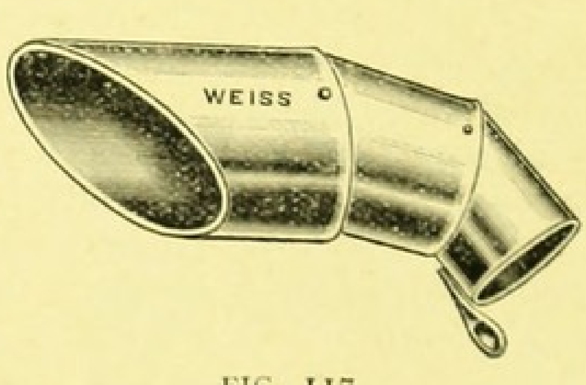


FIG. 117.

For keeping the mouth open during prolonged operations, various forms of *gag* are made use of, *e.g.*, that introduced by Fergusson, which is single, and kept at the desired width by means of a screw-button working on a rod. *Cotterill's Modification* (Fig. 119) is furnished with an appliance for retracting the cheeks on the opposite side. Fig. 118 illustrates his tongue-depressor. *Lister's*

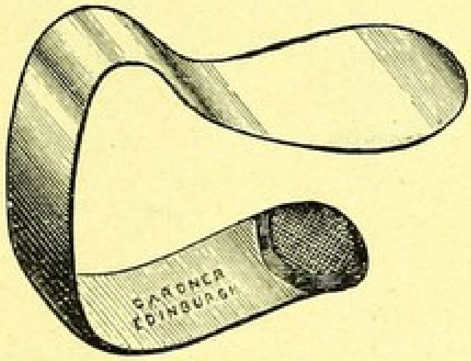


FIG. 118.

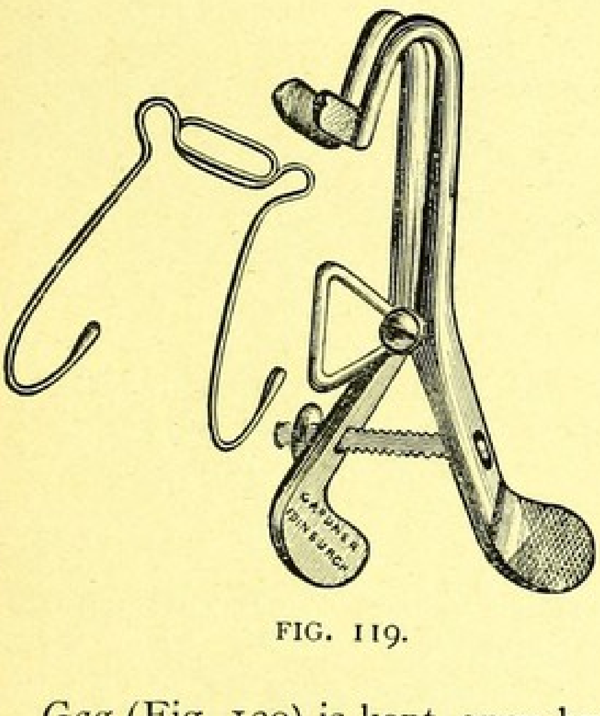


FIG. 119.

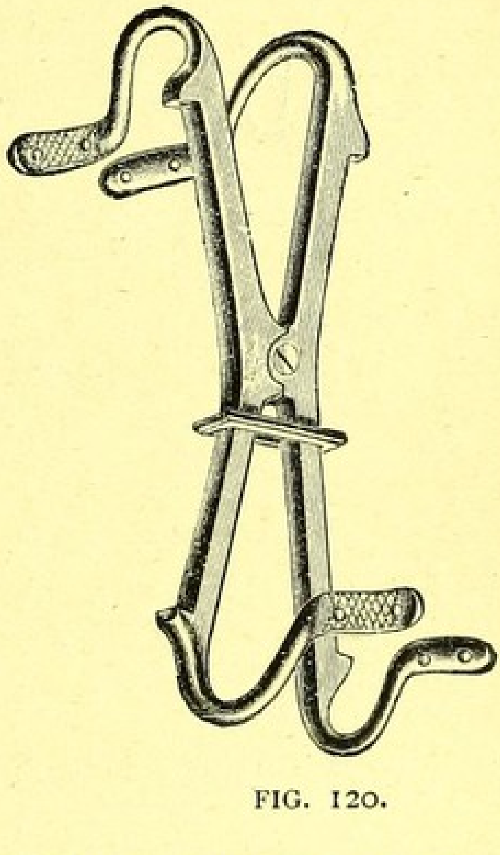


FIG. 120.

Gag (Fig. 120) is kept open by a steel ring sliding on the blades. It is double, the two ends being of different sizes. *Smith's Gag* (Fig. 121) is a more elaborate instrument, being adapted for both sides of the mouth. It is used in the operation for cleft palate. In certain classes of patients, *e.g.*, alcoholics and lunatics, it is often necessary

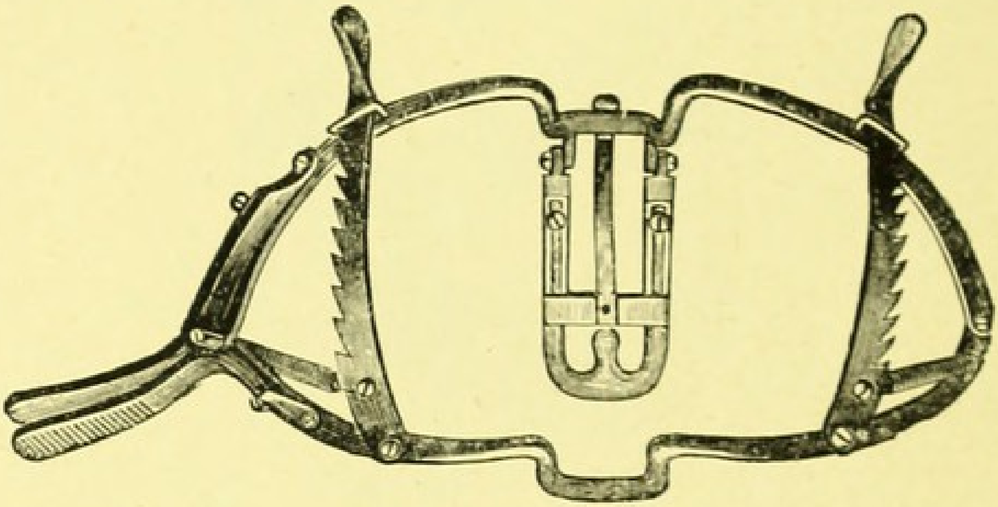


FIG. 121.

to forcibly open the mouth, in order, in the first class, to wash out the stomach ; in the other, to introduce food. For this purpose the wedge-shaped gag (Fig. 122) is

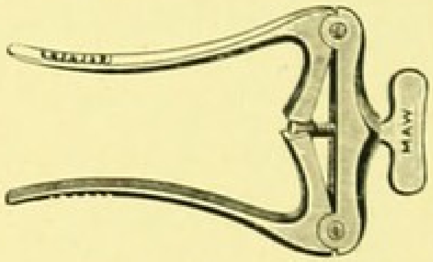


FIG. 122.

employed. The edge of the wedge is gently inserted between the teeth, and then by a powerful screw the blades are gradually separated, and the mouth thus opened.

Instruments Used in the Operation for Cleft Palate.

The mouth is kept open by a gag. The *knives* used for paring the edges of the cleft are mounted on long handles, and have a rounded metal stalk, the blade in some being at an angle with the stalk, in others straight. Many

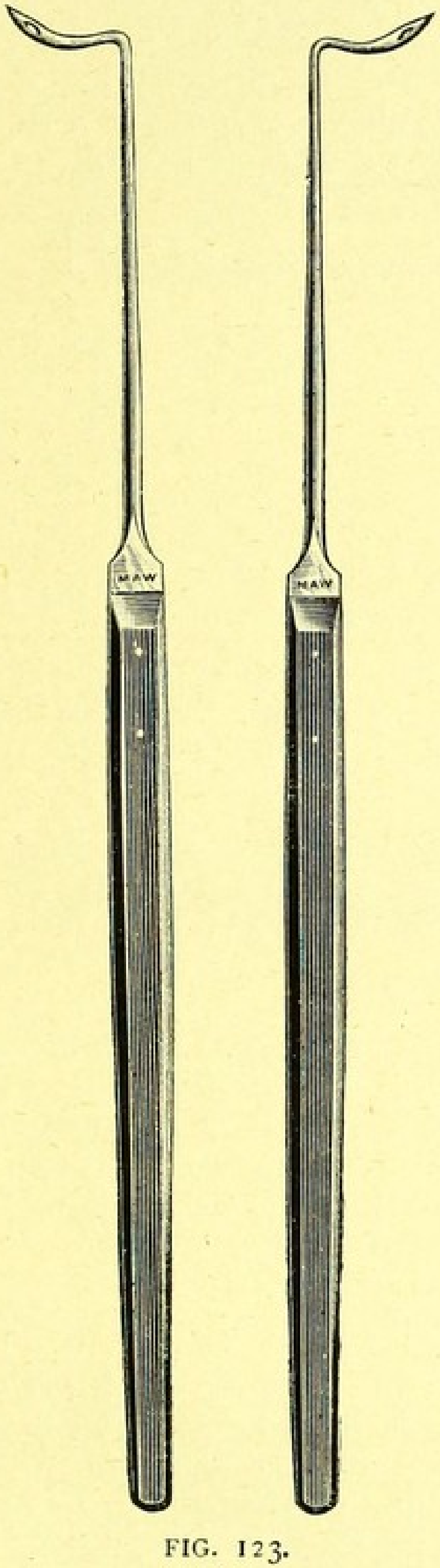


FIG. 123.

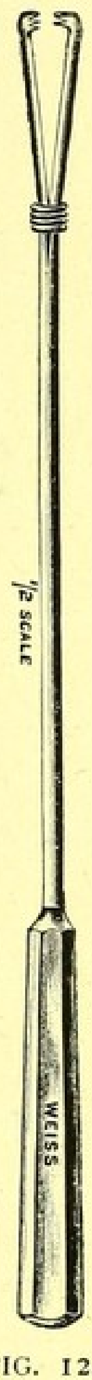


FIG. 124.

surgeons use an ordinary bistoury with a good long blade. The *needles* with which the stitches are passed are all more or less curved (Fig. 123). Some have only a single curve, while others are double-curved, and are in pairs, right and left. *Raspatories* or *separators* (Fig. 125) are

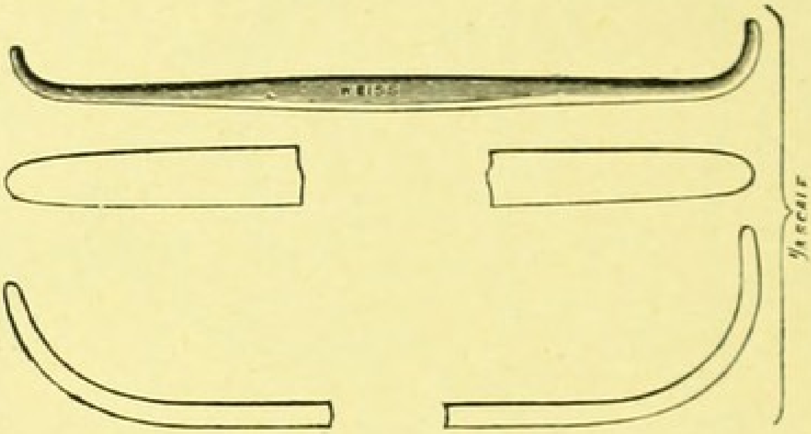


FIG. 125.

used to detach the soft tissues from the bone in order that the edges may be approximated. Various forms of *forceps* are employed to seize the tissues as the stitches

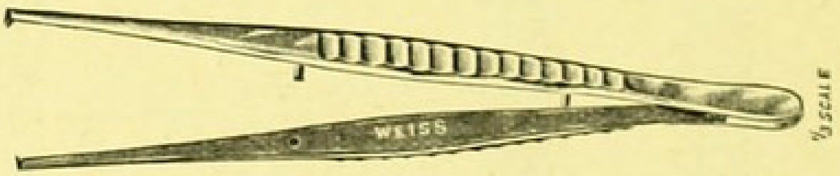


FIG. 126.

are being inserted and tightened (Fig. 126). To sponge the parts, a *sponge-holder* (Fig. 124) is found very useful. A small sponge is inserted between the toothed blades, and these are approximated by sliding up the ring.

Hare-Lip Pins are used in the plastic operations for the remedy of this deformity.

Instruments Used in Excision of Tonsils.

This simple operation can quite well be performed with an ordinary pair of vulsellum forceps and a curved probe-pointed bistoury, part of the blade of which is protected by a piece of sticking-plaster wrapped round it. Some surgeons, however, prefer a knife specially made for the purpose, the proximal end of which does not cut, and others use one or other form of tonsil guillotine (Figs. 127, 128).

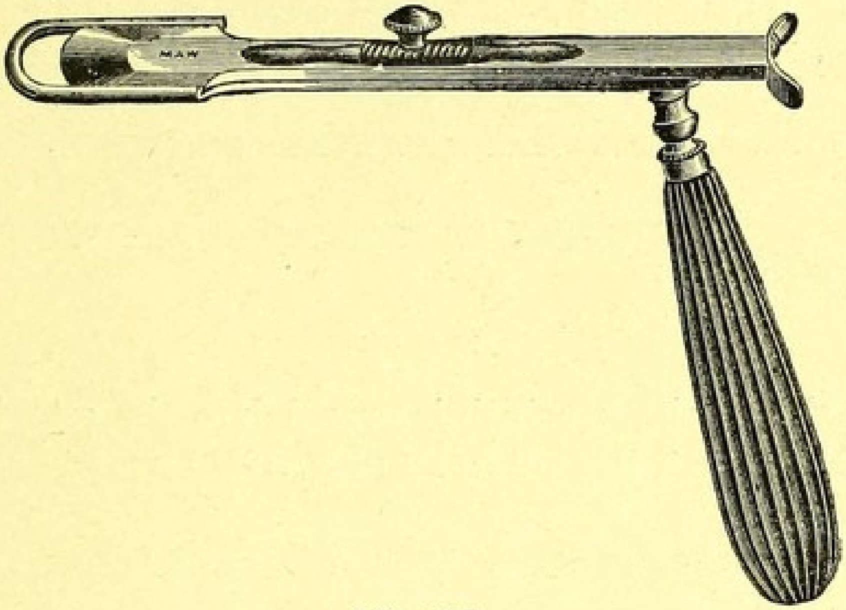


FIG. 127.

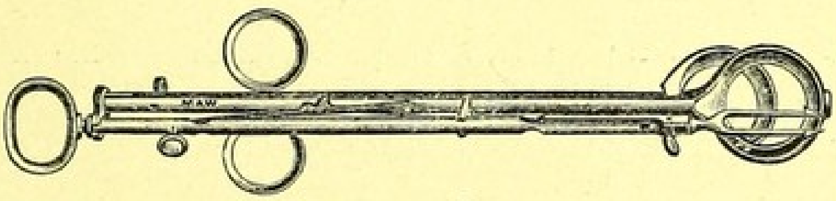


FIG. 128.

In removing the uvula, a gag, the vulsellum forceps, and a pair of curved probe-pointed scissors (Fig. 129) are necessary.

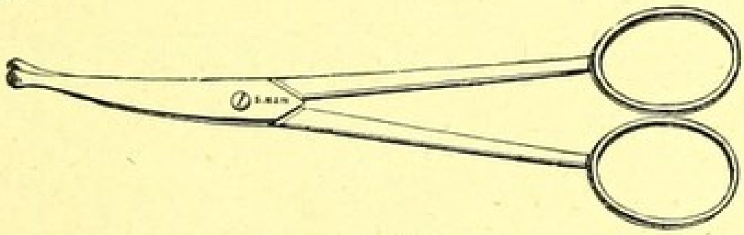


FIG. 129.

ŒSOPHAGEAL INSTRUMENTS.

Various forms and sizes of *bougie* are used in the diagnosis and treatment of affections of the œsophagus. Some of these are of uniform calibre, and are made of soft gum-elastic; others consist of olive-shaped balls, ivory or metal, fixed on to a whale-bone rod, and graduated to a scale. A combined *probang* and *coin-catcher* is illustrated in Fig. 130. The *umbrella-probang* (Fig. 131) consists of

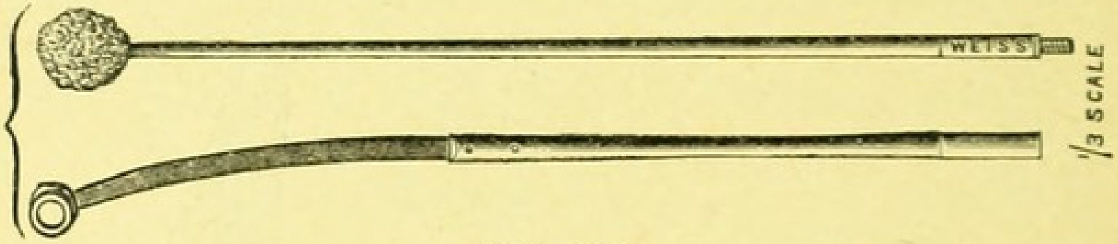


FIG. 130.

a bunch of bristles, which is passed into the œsophagus, and then by a mechanical arrangement opened out, so

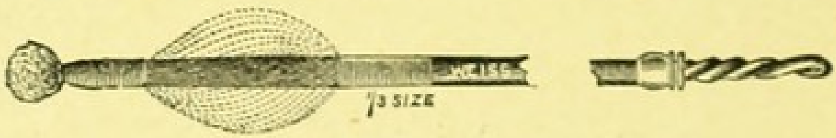


FIG. 131.

that on being withdrawn it brushes any foreign body, such as a fish-bone, out before it. For the removal of larger foreign bodies, *œsophageal forceps* of different patterns

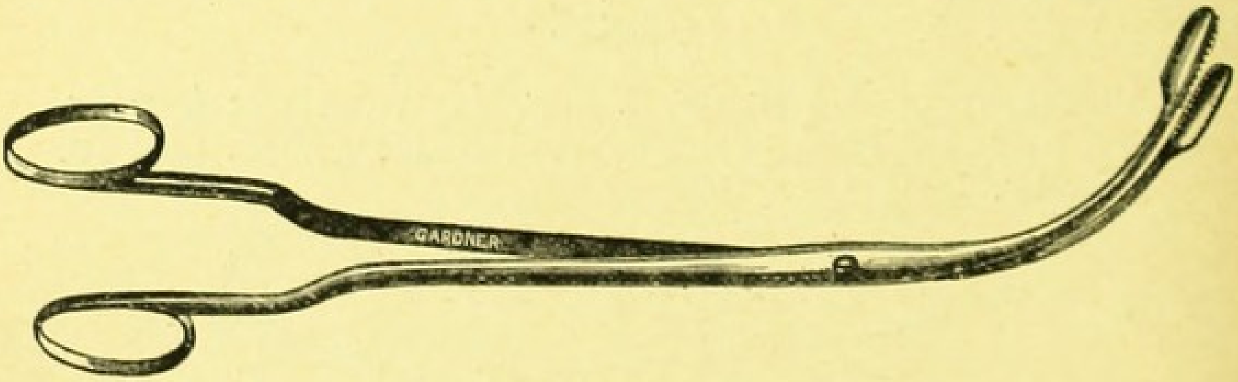


FIG. 132.

are employed, some opening laterally, others antero-posteriorly (Fig. 132).

Stomach-Pumps, etc.

Numerous arrangements, such as that shown in Fig. 133, have been devised with which to wash out the stomach, but perhaps the simplest and safest is an ordinary soft rubber tube, fitted to a metal or vulcanite funnel, and acting on the syphon principle (Fig. 134). Such an apparatus may also be used for feeding lunatics and others who refuse to swallow food, the tube for this purpose being passed either through the mouth or nose.

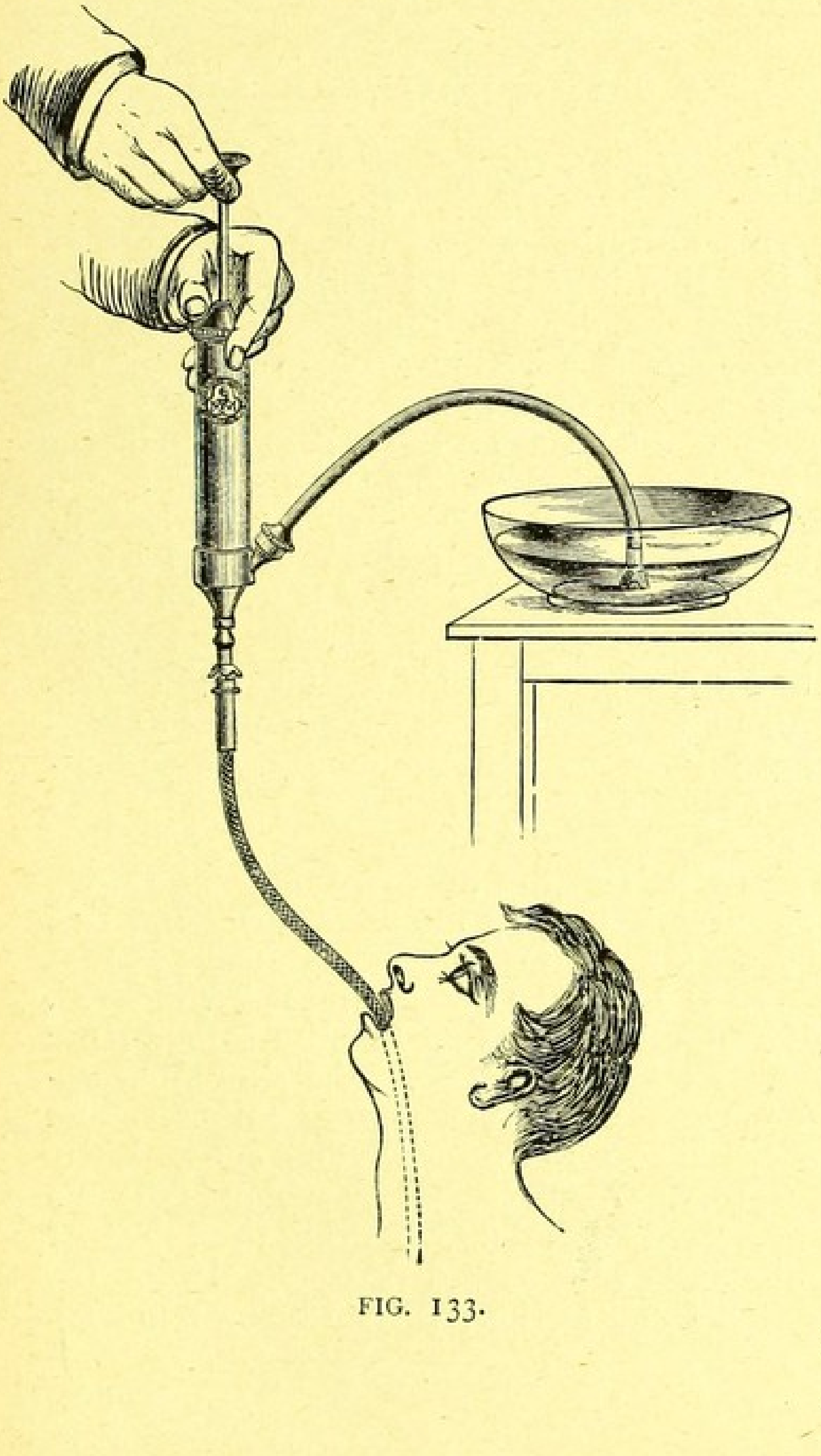


FIG. 133.

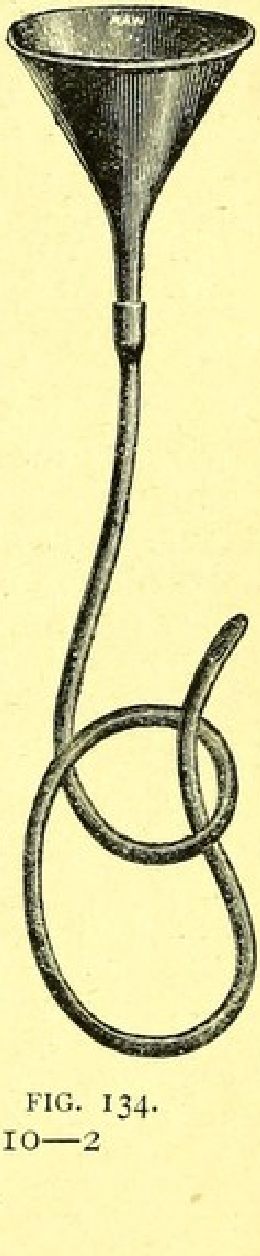


FIG. 134.

CHAPTER XXIII.

TRACHEOTOMY AND OTHER OPERATIONS ON THE NECK.

Tracheotomy.—This operation of opening the trachea or windpipe, and inserting into it a tube through which the patient breathes, is usually performed in children for diphtheria, although it is sometimes required for other conditions. The success of the proceeding depends as much on the after-treatment as on the performance of the operation itself. After the operation the patient is put into a bed surrounded by a tent, readily extemporised by screens and blankets, and the air in this is kept moist by one or two bronchitis kettles placed beside it. The temperature inside the tent should be about 70° F., and draughts are to be studiously avoided. The child must be fed frequently and regularly with stimulant food, such as brandy, meat juice, etc., and should the heart show signs of failing, strophanthus or digitalis may be added by the doctor. The keeping of the tracheotomy tube clear is the most important part of the nurse's duty. The tube, usually made of silver, is double, the outer one being tied into the trachea, while the inner one is loose inside it, that it may be removed and cleaned ; or should it get blocked, the patient can cough it out, and so breathe through the outer one alone. At first the inner tube should be removed very frequently, say every twenty minutes, and washed in carbolic lotion, the lumen being conveniently cleared with a feather. A solution of bicarbonate of soda (baking soda) in water is useful for cleansing the tube. At the same time the outer tube should be cleansed with the aid of soda solution and a feather, without being removed.

The excess of carbolic lotion should be dried off and the tube lubricated with glycerine before being reintroduced. One or two layers of gauze spread over the mouth of the tube filters the air and prevents the inhalation of dust, etc. The tube is left in as long as it is required, a point which will be settled by the surgeon.

Caution!—The nurse must take every precaution against being herself infected with the disease from which the patient is suffering. To this end she must avoid unnecessary handling of the child, especially kissing it, and, above all, should never get into direct line with its breath when coughing. She should frequently gargle her throat with Condy's fluid, or some such antiseptic, and, of course, should never take food in the patient's room. There is one great danger peculiar to cases of diphtheria of which warning must be given, and that is, sucking the tracheotomy tube. When this gets blocked, and all attempts with the feather fail to clear it, the temptation to relieve the great distress of the patient by sucking the tube is very great. Such a procedure, however, is quite irrational and highly perilous. A false membrane is blocking the air-passages, and diminishing the amount of oxygen getting into the lungs to aerate the blood; in other words, the patient's distress is due to the small amount of air in his lungs. The effect of sucking the tube is, first, to withdraw the remaining air from the patient, and if the sucking power is sufficiently strong, some of the obstructing matter may be withdrawn. As a rule, however, it is not, and the patient is left worse than he was found; not only so, but the nurse has run an enormous risk—a risk almost amounting to a certainty—of being herself infected. Not a few valuable lives, both of nurses and surgeons, have been lost in this way, and although the devotion to the interest of the patient which prompted the action is much to be commended, the foolhardiness of it is certainly not to be emulated.

Operations for Goitre, Tumours, or Glands in the Neck, etc.—After these operations the patient's head should be kept at rest by means of sand-bags, and great care should be taken while feeding him not to spill anything on the dressings. The chief complaints of such patients are pain on swallowing, troublesome, irritating cough which causes pain, occasionally difficulty in breathing, and sometimes the pulse is very rapid. Most of these symptoms soon pass off, being due to mechanical causes in the wound, especially the accumulation of fluids, blood and serum, pressing upon the nerves supplying the parts. The treatment of them lies with the doctor. The wound in these cases usually heals with remarkable rapidity.

Some Laryngeal Instruments.

The Laryngoscope.—This apparatus consists of several distinct pieces: (*a*) *The Reflector* (Fig. 135), which is fitted to the operator's head either by means of a forehead-band, or on a spectacle framework, and it is for the

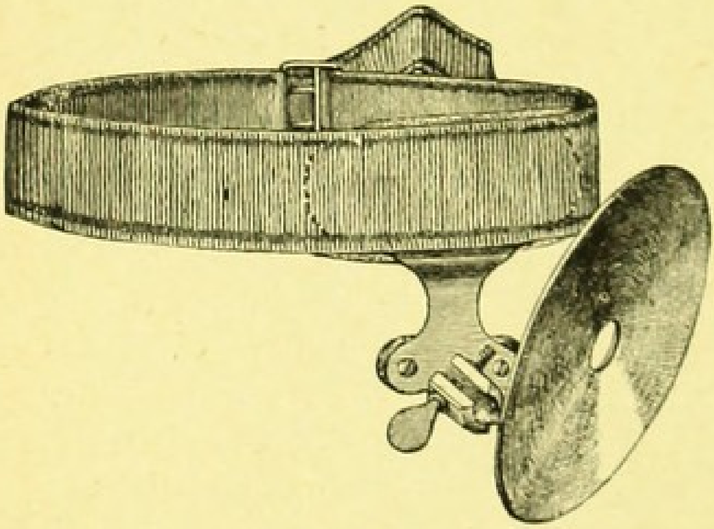


FIG. 135.

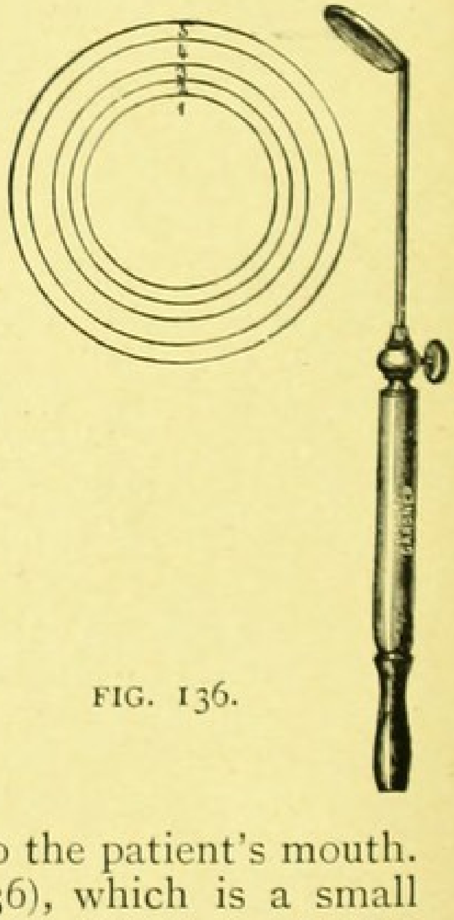


FIG. 136.

purpose of casting a bright light into the patient's mouth. (*b*) *The Laryngeal Mirror* (Fig. 136), which is a small round mirror fixed at an obtuse angle to a long slender stem, and in which the observer sees the reflection of the parts in the larynx. There are several such mirrors, of different sizes, all fitting into one handle. (*c*) For diagnostic as well as therapeutic purposes, probes and brushes may be fitted to the handle. A *Laryngeal Syringe* is used to inject substances such as menthol into the larynx, and *Laryngeal Insufflators* are employed when it is desired to apply a powder to the parts. *Laryngeal Forceps*

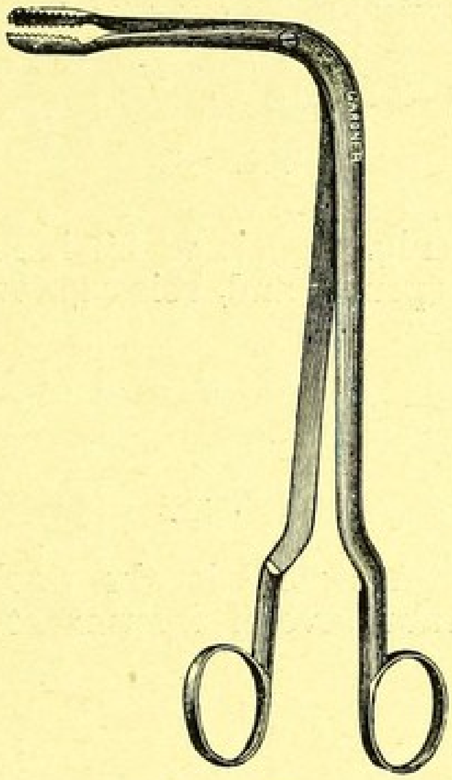


FIG. 137.

(Fig. 137), such as those of Mackenzie, are employed in various operations on the larynx. Some open laterally, and others antero-posteriorly.

TRACHEOTOMY INSTRUMENTS.

The operation of *Tracheotomy* may be performed with a very small number of instruments, and the less specialised these are the better. A small *scalpel*, the handle of which may be used as a *dissector*, several pairs of *artery forceps*, *retractors*, *dissecting forceps*, a *director*, and the *tracheotomy tube* are the essentials. A useful retractor for the edges of the incision in cases of emergency may be extemporised by bending two hairpins to the shape of the letter **S**, attaching one loop of each to an elastic band, while the other loops are inserted under the lips of the wound. The elastic passes round the back of the patient's neck, and its tension holds the wound open.

Other retractors in the shape of double hooks (Fig. 138) are used when assistants are available.

FIG. 138.

A *sharp hook* (Fig. 139) is useful in fixing the trachea while it is being opened, and, being grooved, it also serves as a director.

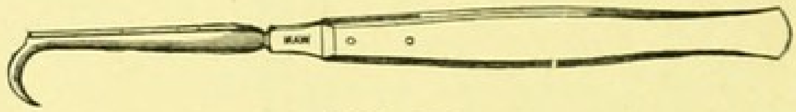


FIG. 139.

To open up the wound in the trachea in order to introduce the tube several instruments—*dilators*—have

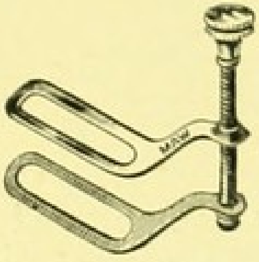


FIG. 140.

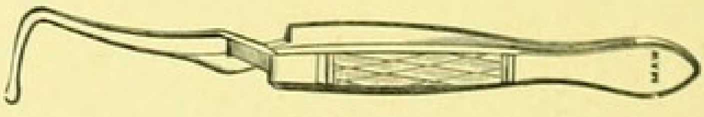


FIG. 141.

been invented, *e.g.*, Golding Bird's (Fig. 140), or Luer's (Fig. 141).

Of patterns of tracheotomy tubes there is no end, but the following are among the best: The *Ordinary Bivalve Tube* (Fig. 142), which consists of an outer and an inner tube, the latter a little longer than the former. The outer tube is fixed in position by tapes passed through the slits in its shoulder, and tied round the patient's neck. The inner tube is not fixed.

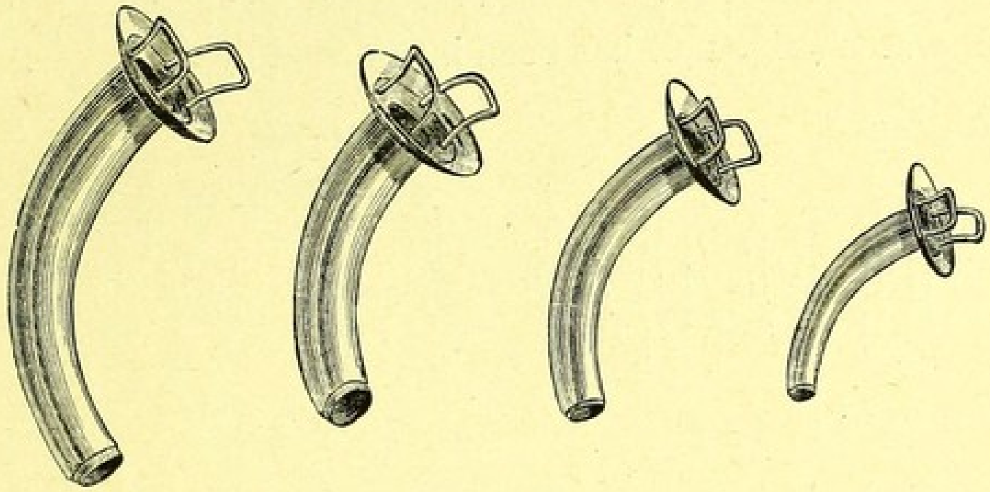


FIG. 142.

Bryant's Tube acts on a ball-and-socket joint, which gives it free play.

Durham's Tube (Fig. 143) is provided with a vertebrated pilot, which greatly facilitates its introduction.

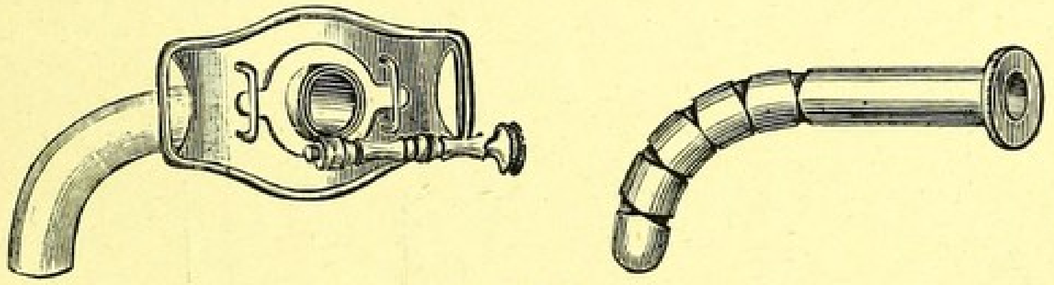


FIG. 143.

Parker's instrument (Fig. 144) has an angle on it to prevent the point causing ulceration of the trachea. For the same purpose Morrant Baker uses a tube made of india-rubber (Fig. 145).

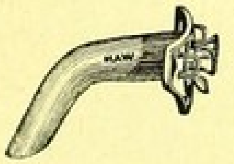


FIG. 144.

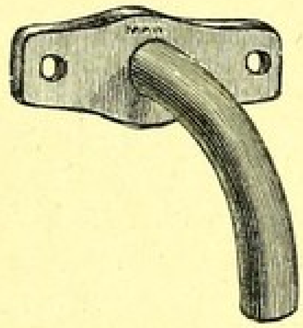


FIG. 145.

For *Intubation of the Larynx* a complicated and expensive apparatus (Fig. 146) has been introduced by O'Dwyer.

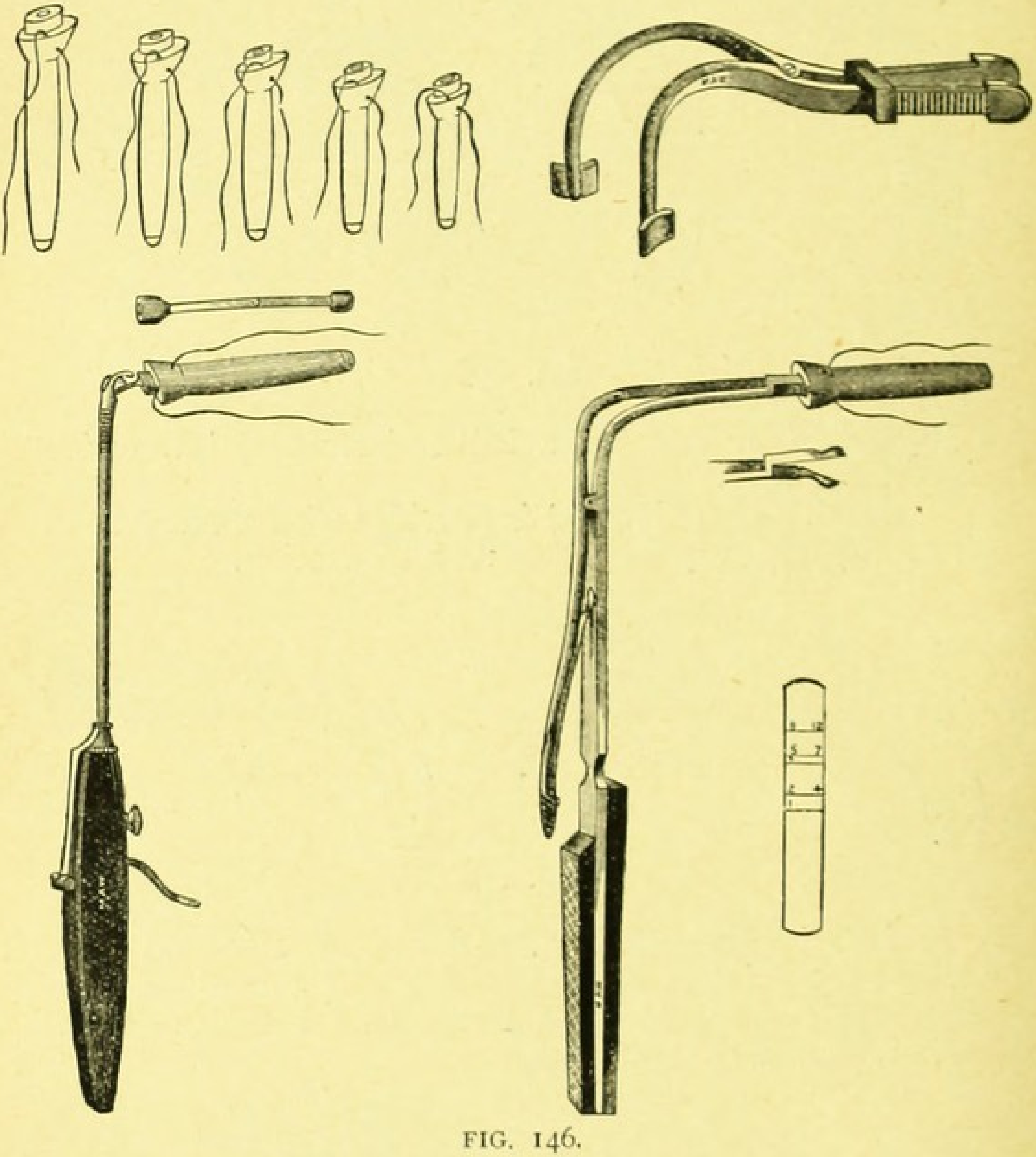


FIG. 146.

Professor Annandale attains the same end by means of a large-sized gum-elastic catheter, with a terminal aperture, and a stylet to give the instrument the proper curve. To prevent the patient biting and so occluding the tube, it is passed through a rounded piece of wood, such as an empty thread-spool.

CHAPTER XXIV.

SURGICAL CHEST CASES.

Fracture of Ribs.—The nurse's duty in connection with these cases is the preparation of the materials for treatment, which consists either in the application of a strong broad flannel binder or bandage, or else of *strapping*. For the latter method the requirements are: (1) About a dozen strips of strong adhesive plaster, about an inch wide, and long enough to go a little more than half-way round the chest; (2) a means of heating the plaster; (3) a broad domette bandage to apply over the strapping. The bands of plaster which overlap one another are applied *across* the ribs, and are fixed when the chest is in the position of expiration.

Empyæma.—The after-dressing of cases of operation for empyæma (pus in the pleural cavity) often falls to the nurse. The patient should be induced to lie on the affected side as much as possible to encourage free drainage of the pus. All movements should be slowly and carefully made. At dressing the tube is removed, and the patient turned on to the affected side, so that any accumulation of pus may be poured out. The nurse must never wash out an empyæmic cavity unless by the doctor's orders, and then should take care that the flow of fluid out of the chest is as free as the flow in, otherwise there is danger of interfering with the heart's action. Great care must be taken to secure the drainage-tube in position with a safety-pin, or by other means, as it is very apt to disappear into the cavity of the chest and cause much trouble. When the tube is removed for good a note should be made on the chart.

The Aspirator. — Fluid is often withdrawn from the chest, as well as from other cavities, by means of the aspirator (Fig. 147). Every nurse should be able to fit up this instrument. (1) Begin by fixing the stopper firmly into the bottle. (2) Notice that one of the terminals

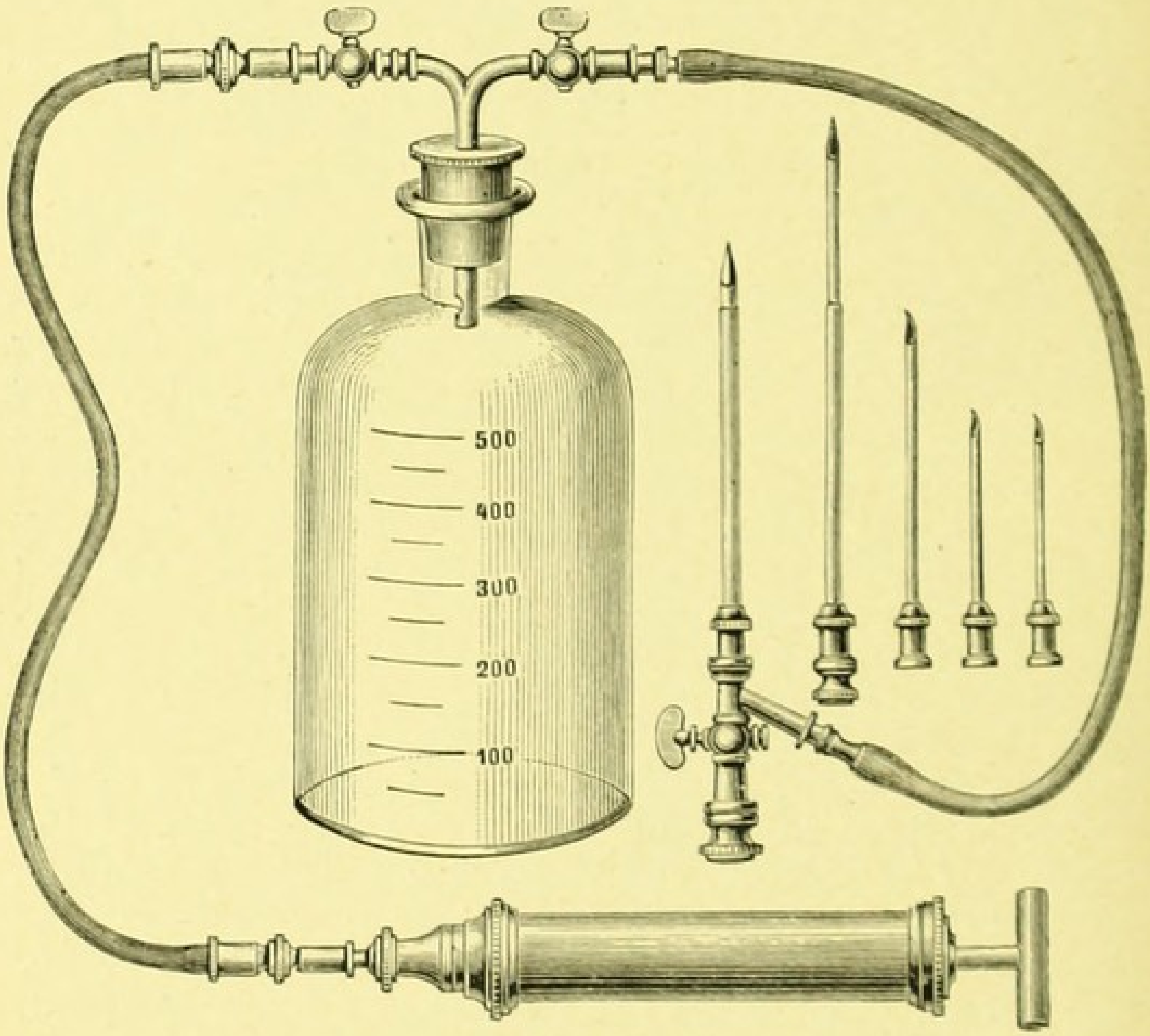


FIG. 147.

attached to the stopper is in the form of a socket, the other in the form of a peg. (3) Now take the two india-rubber tubes, and you will find that the terminals of one are pegs, of the other sockets. (4) Attach them to the opposite ends of the metal tubes, which pass through the stopper. (5) The free end of the rubber tube which has a socket is for the reception of the nozzle of the exhausting syringe. (6) Next take the small **Y**-shaped metal tube, and you will find that it has on it two sockets and a screw. (7) Take a cannula of the appropriate size for the purpose in view, and screw it on to this **Y**-shaped piece. (8) Then pass the corresponding trocar into the socket, which is furnished with a stop-cock. (9) Lastly, fix the free end of the second rubber tube into the remaining socket on the **Y**-shaped piece. The instrument is now ready for the formation of a vacuum in the bottle. To effect this, (1) close the stop-cock on the trocar side of the stopper, and open that on the syringe side. (2) Exhaust the bottle by means of the syringe. (3) Close the stop-cock on the syringe side, and remove the rubber tube on that side. (4) The trocar and cannula are now passed into the cavity to be aspirated, with the thumb firmly pressed on the *end* of the trocar. (5) The trocar is withdrawn as far as it will come, and the stop-cock on the **Y**-shaped piece closed. (6) Then the trocar is removed entirely. (7) By opening the stop-cock on the trocar side of the stopper the fluid in the cavity is brought into communication with the vacuum into which it is drawn. (8) Should the flow suddenly cease, a plug of lymph or blood-clot has probably blocked the trocar, which should be cleansed by passing in one of the blunt stylets, the stop-cock on the trocar side being meanwhile closed.

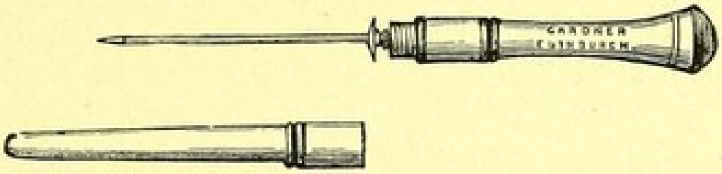


FIG. 148.

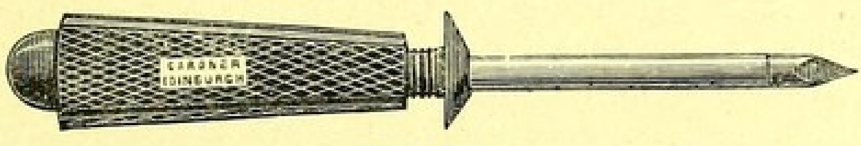


FIG. 149.

Exploring-Needles of various sizes are used to withdraw fluid for diagnostic or for therapeutic purposes (Figs. 148, 149).

CHAPTER XXV.

ABDOMINAL CASES.

THE after-treatment of cases in which the abdomen has been opened is carried out on the same lines as in other operations. Special care is taken that the patient lies quietly on the back, and makes no muscular effort of any kind in attempting to move in bed or use the bed-pan. Any such exertion is liable to open up the wound, or otherwise interfere with its union. The condition of the bladder is carefully watched, so that it is not allowed to become distended; and if there be difficulty in making water, the catheter should be used, rather than allow the patient to strain. Any distension of the bowels by flatus may be met by passing a stiff tube some inches into the rectum, and leaving it in position for ten or fifteen minutes. Food is withheld for twenty-four hours, and then peptonised milk, beef-juice, or other fluid nourishment, is given in small quantities.

The two great risks after these operations are hæmorrhage and peritonitis. Hæmorrhage is usually due to the slipping of a ligature, and comes on within twenty-four hours. It is evidenced by the rapidity and smallness of the pulse, with general pallor, and a falling temperature. Peritonitis may come on as early as eighteen or twenty-four hours after operation, but more frequently on the second or third day. The patient complains of pain and tenderness over the abdomen, the legs are drawn up to relax the abdominal walls, the face is pinched and anxious-looking, the pulse small, rapid and hard. The temperature may be sub-normal, or it may suddenly rush up to 103°-104° F.

Hæmorrhage and peritonitis must be treated promptly if benefit is to follow, hence the importance of the nurse being on the outlook for these complications in order that no time may be lost in summoning the doctor. For hæmorrhage the only treatment is to find the bleeding-point, and stop it by forceps or pressure from pads of gauze. For peritonitis, opening up the wound, washing out the peritoneal cavity with mild antiseptics and drainage, and locally hot anodyne fomentations, or the ice coil, are used. These remarks apply to all abdominal operations. There are a few special points referring to individual operations which may be mentioned here.

GASTROSTOMY, the operation of making an artificial opening into the stomach through which the patient may be fed, is performed when swallowing is impossible owing to some obstruction in the œsophagus. Usually a tube is fixed in at the time of operation, and it is important that it should not be allowed to come out for at least four or five days. The nurse must therefore be very careful in moving, dressing, or feeding the patient that the tube is not pulled upon or displaced.

The patient is fed through this tube, with the aid of a filler or funnel, every two, four, or six hours, according to circumstances. A suitable meal consists of two to four ounces of peptonised milk, with half an ounce of brandy; or two to four ounces of beef-tea with a switched egg, or malted milk.

As there is sometimes slight leakage of the stomach contents along the side of the tube, the nurse should apply a piece of lint spread with boracic or zinc ointment next the skin to protect it, otherwise it is apt to become very much irritated.

HERNIA.—(*a*) *Strangulated Hernia*.—In the condition of hernia or rupture a small portion of the bowel has escaped from the abdominal cavity through some weak point in the walls. The commonest localities in which such projections take place are the groin and the navel. The canals or openings through which these knuckles of bowel come are usually bounded by firm fibrous bands, and the gut is in constant danger of being nipped between these, giving rise to the condition of strangulated hernia. When this occurs the onward passage of the fæces is, of course, arrested. In addition, the blood-supply to the portion of bowel outside the constricting band is cut off, and this produces gangrene or death of it, with the result that the contents of the alimentary track escape into the abdominal cavity, giving rise to septic inflammation of the peritoneum or membrane lining the abdomen. If it be borne in mind that in strangulated hernia the bowel is as soft as a piece of wet blotting-paper, it will readily be understood that the patient's life is in imminent danger, and will show the importance of attending to some of the directions for the treatment given by the surgeon. The main indication in the treatment is to secure for this devitalised portion of intestine absolute rest. Now, as the work of the bowel is to absorb the digested food, and pass on the unabsorbable remains, the surest way of keeping it at rest is to starve the patient, so that there will be nothing either to absorb or pass on. The bowel may be still further quieted by the administration of opium, either hypodermically or by the mouth; but this, of course, will be done by the doctor. Opium is better avoided, if possible, in these cases. For the first day or two after the operation the patient must have nothing by the mouth save sips of water or small pieces of ice to suck; then a small quantity of milk may be given, and later still some light pudding and beef-tea. Avoid anything solid for at least a week, and, above all, do not give any laxative medicine whatever. If the patient be well at the end of eight or nine days, an enema followed by a moderate dose of castor-oil may be given, if the bowels have not already acted spontaneously.

(*b*) *Radical Cure of Hernia.*—The treatment of a patient who has undergone this operation differs from that which we have just considered only in the duration of the period of starvation. This depends on the fact that here the bowel itself is uninjured, the operation consisting merely in closing up the opening through which the hernia protrudes, with the object of preventing the patient ever having a strangulated hernia. The bowel must be kept at rest for a time to avoid the necessity for straining, which might burst open the wound in the skin and abdominal walls ; but this, although stringent at first, need not be so prolonged as in the more grave condition last described.

COLOTOMY is the making of an artificial anus in the lower portion of the large intestine. It is performed when there is a stricture of the rectum preventing the passage of fæces. As a rule, the operation is done in two stages : first the loop of bowel is brought out through an opening in the left iliac fossa, and fixed to the edges of this wound. In three or four days, after adhesions have formed and shut off the peritoneal cavity, this loop of bowel is opened and the fæces allowed to pass. During the period between the two stages of the operation the patient receives a minimum of food by the mouth. Rectal enemata may be given to clean the bowel and prevent the formation of hard lumps of fæces. Only a small opening is made in the bowel, otherwise the mucous membrane is apt to become extruded. As a rule, such an extrusion is easily returned by making firm pressure on it for a few minutes to empty it of blood. The bowels must be kept loose by diet or drugs, and enemata are frequently given to insure complete evacuation. The rectum is also washed out from time to time. Later the patient may get a vulcanite plug, which helps to keep the bowels under control.

OPERATIONS ON THE KIDNEY.—The kidney may be incised for stone or abscess, it may be fixed in position when it is unduly movable, or it may be removed. In the nursing of such cases special attention is paid to the urine, every drop of which must be carefully measured and kept for examination, as one of the great risks is suppression of urine, that is, failure of the kidneys to act. The patient must be kept very warm, so that the skin acts freely. He is allowed plenty of fluids to drink, and the bowels are kept open. Any evidence of urine soaking the dressing of the wound should be noted and reported to the doctor.

Some Intestinal Instruments.

In connection with operations for resection of intestine various clamps are employed to occlude the gut above and below the diseased part, *e.g.*, Lane's (Fig. 150) and Murphy's (Fig. 151).

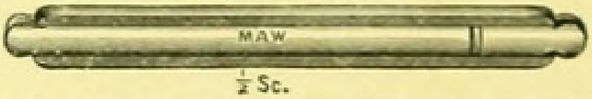


FIG. 150.

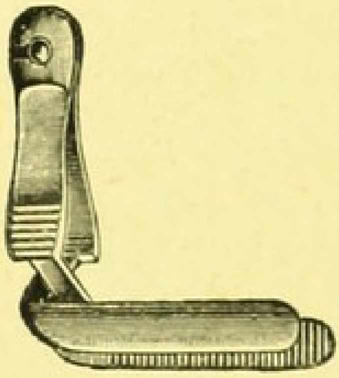


FIG. 151.

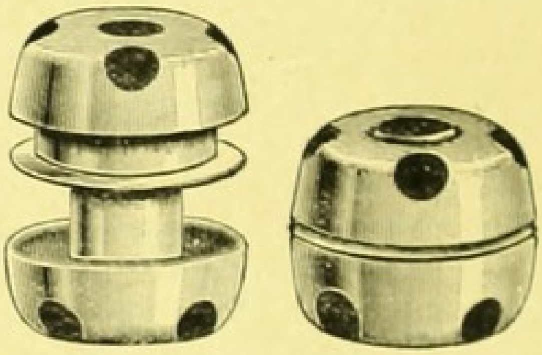


FIG. 152.

Murphy's Button (Fig. 152) is only one of many devices for approximating the severed ends of the intestine.

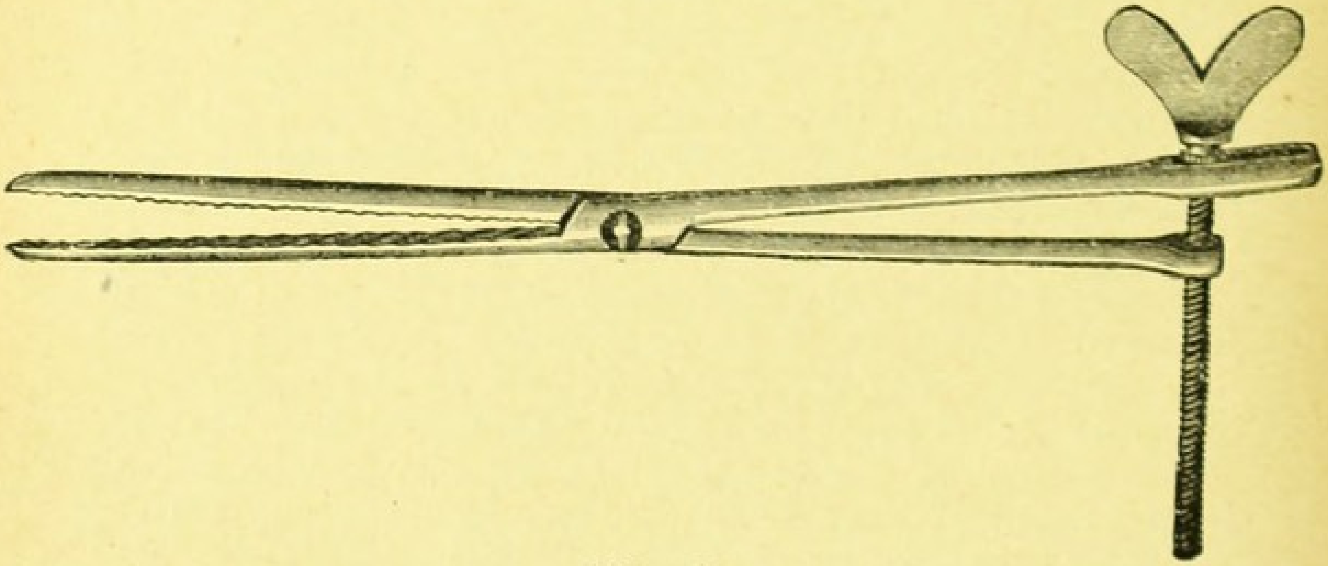


FIG. 153.

Dupuytren's Enterotome (Fig. 153) is used to destroy the eperon formed in connection with an artificial anus.

Instruments and Appliances used in connection with Hernia.

In addition to the instruments used in other surgical operations, the *Hernia Knife* (Figs. 154, 155) may be required.

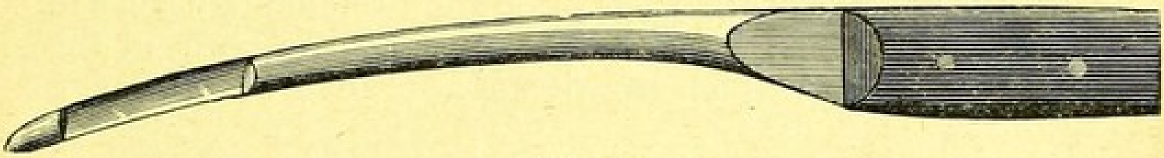


FIG. 154.

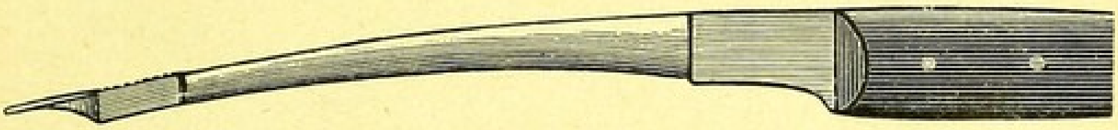


FIG. 155.

Macewen's Needles (Fig. 156) are used in the operation for the radical cure of hernia devised by that surgeon.

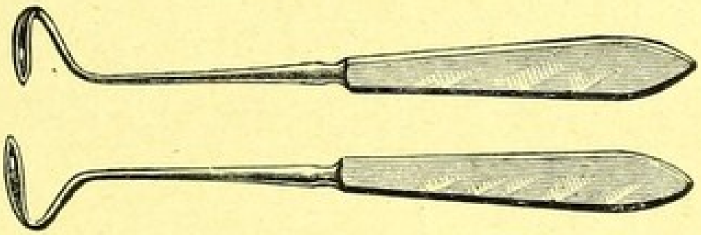


FIG. 156.

Spence's Hernia Director (Fig. 157), used to guide the knife to the constricting-band in the operation for strangu-

FIG. 157.

lated hernia, is about three times as broad as the ordinary director, and the groove is not so deep.

Key's Hernia Director (Fig. 158) is also broad, with a shallow groove, and in addition has a distinct curve on the blade.

FIG. 158.

Trusses.—These are used to retain a reducible hernia in the abdominal cavity, and so to admit of closure of the opening through which it protrudes.

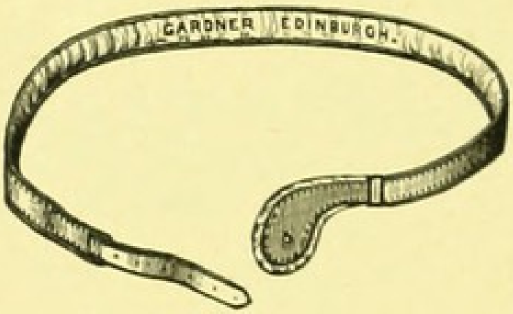


FIG. 159.

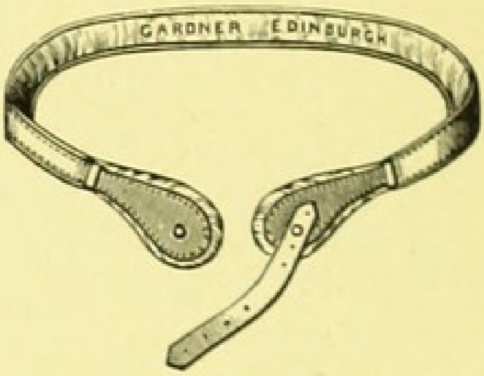


FIG. 160.

The commonest and most generally useful truss is that known as the *Circular* or *Spring Truss*, which may be adapted for one side or for both (Figs. 159, 160).

The truss should be applied before the patient gets out of bed in the morning, and should not be taken off till he

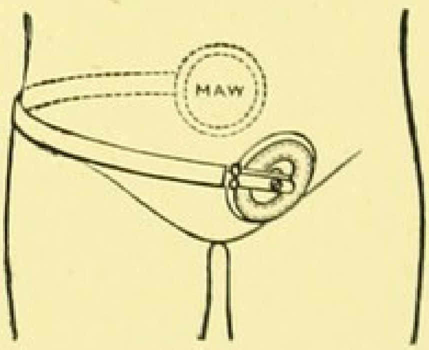


FIG. 161.

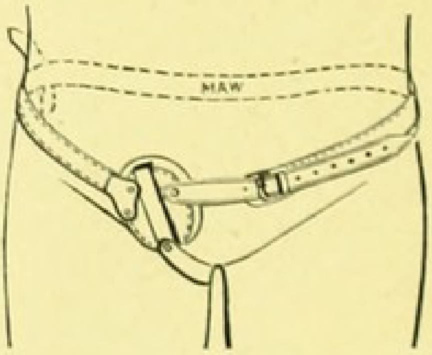


FIG. 162.

has lain down at night. In this way the hernia is never permitted to come down, and the opening gets a chance of becoming permanently occluded.

The Moc Main Truss (Fig. 162) is very comfortable to the patient, but less secure than the spring truss.

Salmon and Ody's Truss (Fig. 161) has its pad fitted on a ball-and-socket joint, which admits of close application, and prevents its displacement by movements of the patient. It has a posterior pad, which rests on the spine, and the spring passes round the side opposite to the hernia.

For umbilical hernia various belts and trusses are employed.

CHAPTER XXVI.

PELVIC CASES.

Injuries to the Pelvis, such as fractures, are chiefly dangerous from the fact that the bladder or urethra may be damaged by spicules of bone. The patient must be kept very still in bed, and special care is called for in the use of the bed-pan and in changing the sheets not to move the patient roughly. The catheter is often necessary.

Should urine have been extravasated before the patient's admission, many incisions will be made for its relief, and the nurse will have great difficulty in keeping the bed dry and the patient free from bed-sores. Frequent dressing, absolutely dry and smooth sheets, and dusting-powder will be of use.

Perineal Section is the operation of making an opening into the urethra for the relief of stricture, or for the removal of stone from the bladder (lithotomy). The nurse's duties will be chiefly in the direction of keeping the patient dry and in avoiding the formation of bed-sores. Special tubes are usually employed to drain the urine into some receptacle, but they are liable to get out of order.

Supra-Pubic Cystotomy. — This operation consists in opening directly into the bladder above the pubis. In some cases the bladder is closed again, and the urine drained away by the urethra ; in others a tube is inserted through the opening in the bladder. The difficulty of keeping these last cases dry is very great. It is, however, greatly facilitated by the use of Cathcart's syphon drainage apparatus (Fig. 163).

Lithotomy.—The operation known as lithotomy consists in opening into the bladder for the purpose of removing from it a 'calculus' or stone. This opening may be made either just above the pubis in the middle line—*supra-pubic lithotomy*—or through the perineum—*perineal lithotomy*—

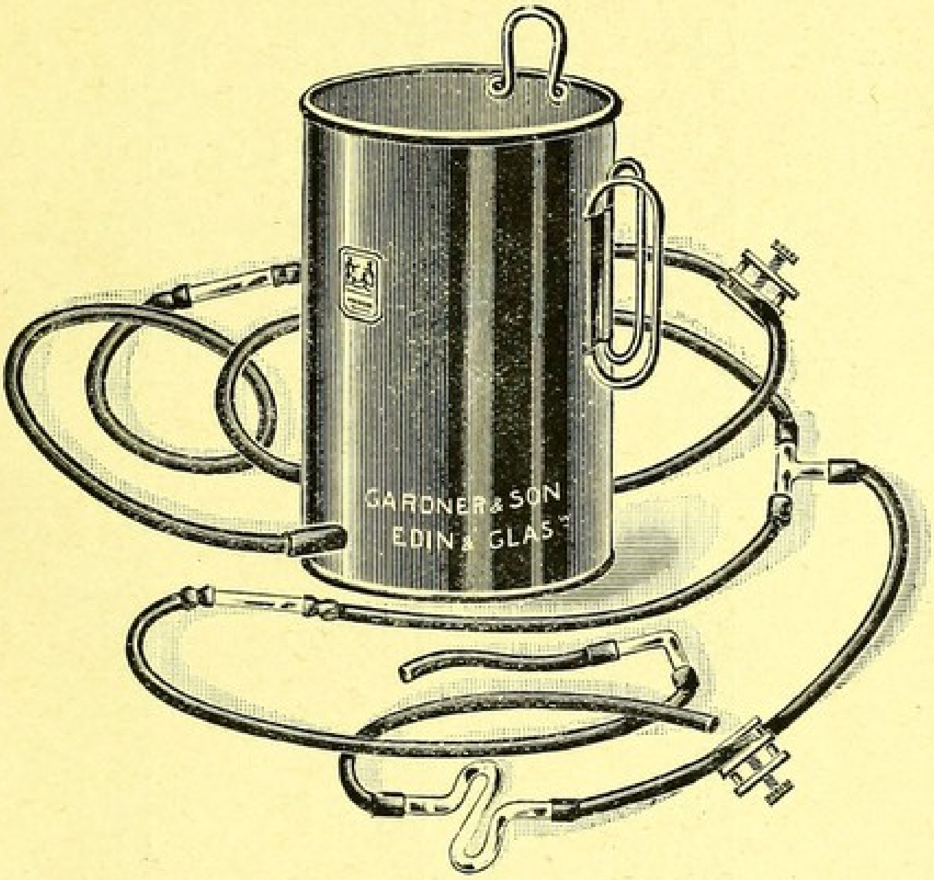


FIG. 163.

and when in this situation the incision may be *median*, or much more frequently is *lateral*.

Lateral Lithotomy.—Obviously the first step in this procedure is to determine whether or not a stone is present. This is largely decided by the symptoms and history of the patient, but cannot be made certain without the use of an instrument called the *Lithotomy Sound*. Of these there are several varieties, the more commonly used being

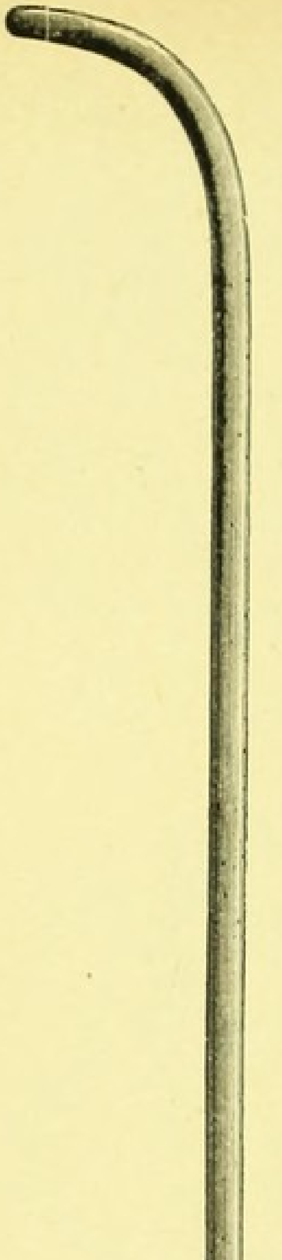


FIG. 164.

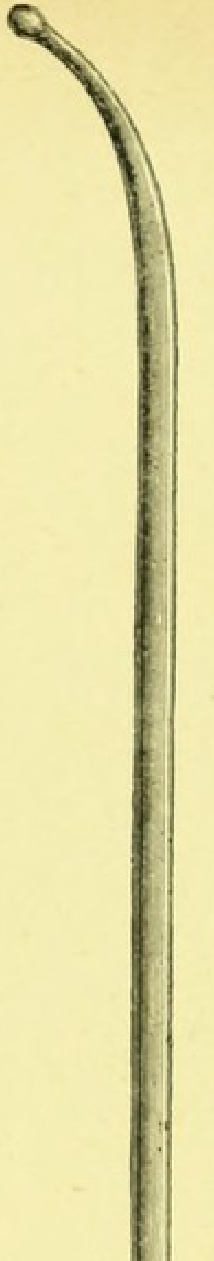


FIG. 165.

FIG. 166.

Liston's Sound (Fig. 164), which consists of a solid steel stem, with a curve somewhat smaller than that of a bougie. The handle is broad and flattened out laterally. *Lister's Sound* is made on the same model as the bougies of his name, but with a smaller curve (Fig. 165). *Sir Henry Thompson's Sound* (Fig. 166) is made of plated steel, with a straight stem and a very short, sharply-curved beak, which permits of the instrument being freely moved about inside the bladder, a proceeding which is further facilitated by the handle being small, rounded and fluted, so as to admit of fine manipulations being carried out. Some sounds are hollow, to permit of fluid being introduced

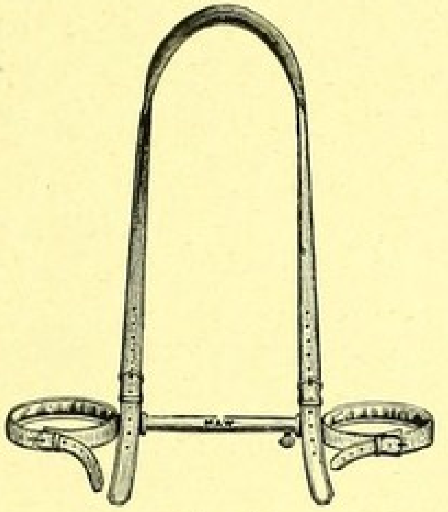


FIG. 167.

into or withdrawn from the bladder during the operation of sounding.

The presence of the stone being demonstrated, and an operation considered necessary, after the usual preparations for anæsthesia, etc., the patient has to be placed in what is known as the *lithotomy position, i.e.*, with the legs flexed on the thighs, and the thighs on the abdomen, the knees widely separated, so as fully to expose the perineum. The sole of the foot is placed in the palm of the corresponding hand, and fixed there by means of a soft but strong bandage. As it is of great importance that the patient should be kept steadily and evenly in this position all the time of the operation, an apparatus known as

Clover's Crutch (Fig. 167) has been devised to facilitate this. It consists of a transverse bar, which may be lengthened or shortened at will by a telescopic arrangement, fitted at each end with a circular padded strap. These straps are adjusted to the legs just below the knee, and the transverse bar keeps the knees apart. A long strap passes from one end of the transverse bar, up across the same shoulder, then crosses the back and comes out over the front of the opposite groin to be fixed to the other end of the bar. In this way the double flexion of the legs is kept up, and the desired position maintained.

The other appliances used in the operation are the *Lithotomy Knife*. Many varieties of this knife have been introduced at different times to render the danger of the operation less, but, as Erichsen says, 'they simply seek to supply by mechanical means that safety in the deeper incisions which may as readily be secured by a broad-bladed, straight-backed scalpel, if properly guided by a hand that is ordinarily skilful.' The two patterns which are most commonly used are *Liston's* (Fig. 168),

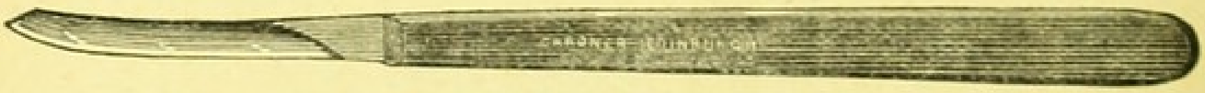


FIG. 168.

which has a cutting edge only in the anterior two-thirds, and a sharp point, and *Fergusson's* (Fig. 169), which is probe-pointed.

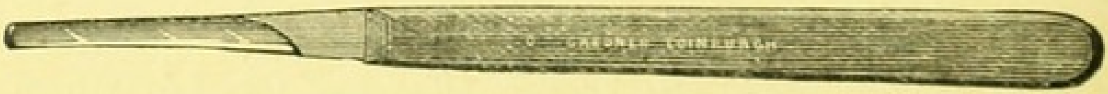


FIG. 169.

In order to open at once into the bladder, it is necessary that the surgeon should have some guide, and this is furnished in the shape of the *Lithotomy Staff*, which is a large, curved, steel instrument, with a broad, roughened handle. Throughout its lower half or two-thirds it has a deep groove on its left side, and it is this groove which guides the surgeon into the bladder. The instrument is passed in the usual way, and held in position by an assistant. The surgeon then feels it through the skin of the perineum, and cutting boldly down upon it, enters the knife into the groove and runs it straight home into the

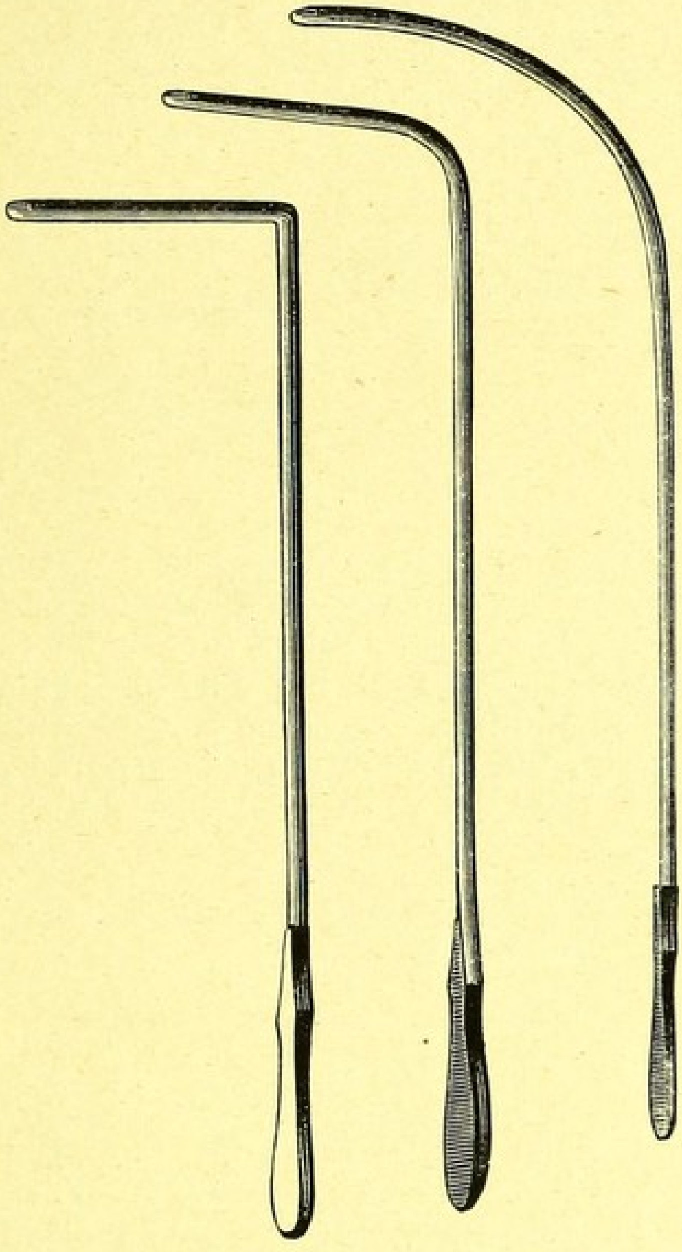


FIG 170. FIG. 171. FIG. 172.

bladder. Of this instrument there are several varieties, such as *Cheselden's Staff* (Fig. 172), the oldest and most generally used; *Buchanan's* (Fig. 170), which has the lower part set at a right angle to the stem; and *Chiene's* (Fig. 171), in which the right angle of Buchanan is rounded off.

The next instrument used in the operation is the *Lithotomy Forceps* (Fig. 173). These are large, strong forceps, with a scissors joint, the blades being spoon-shaped, roughly serrated on their hollow surfaces, and

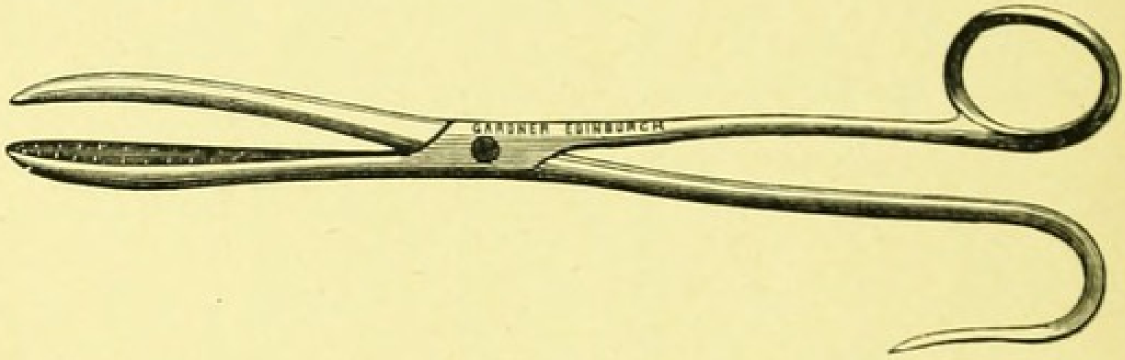


FIG. 173.

often lined with linen or wash-leather, to prevent the stone slipping. The handles have a ring on one side for the thumb, and a loop on the other, into which the fingers fit. Most forceps are straight, but curved ones are often found useful. Sometimes the stone is more conveniently removed by the *Lithotomy Scoop* (Fig. 174) than by forceps. This instrument is practically a single blade of the forceps,

FIG. 174.

which may or may not be roughened, set in a handle, or it may be double-ended. The finger of the surgeon acts as the second blade of the forceps. The stone having been removed, it is necessary to drain the bladder through the wound in the perineum for some days by the *Lithotomy Tube* (Fig. 175), which is a short, stiff tube of gum-elastic, with a terminal aperture, and provided with metal rings, with which to tie it into the bladder. It is of great importance that the tube should be stiff, because it it sometimes necessary to plug the wound tightly to stop bleeding, and, if a soft flexible tube be used, it will be occluded, and the drainage of the bladder interfered with. To facilitate this plugging of the wound, the tube is sometimes 'petticoated,' that is, surrounded by a piece of linen firmly tied round it near its internal end, and hanging loosely round the rest of it. Into the cul-de-sac thus formed wool or lint is tightly packed, and so pressure is exerted on the bleeding vessels. An indiarubber tampon is sometimes used (Fig. 176).

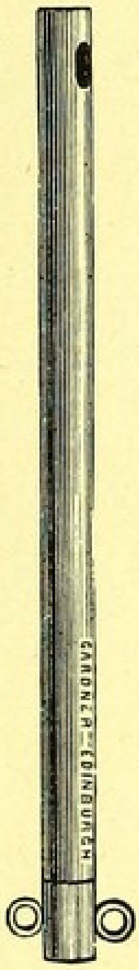


FIG. 175.

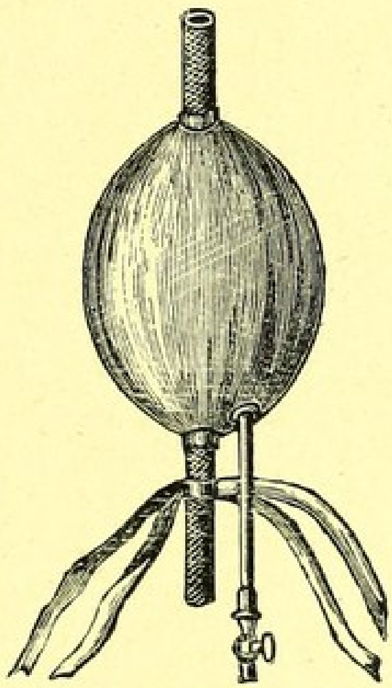


FIG. 176.

In this operation of lithotomy it is necessary to cut widely into the substance of the prostate gland which surrounds the most internal part of the urethra. This may be done with the knife in making the incision into the bladder, and the cut enlarged so far as needful on the way out, or a special instrument known as the *Gorget* (Figs. 177, 178) may be employed. The small probe-pointed

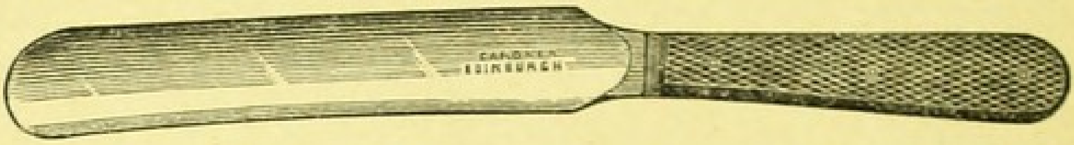


FIG. 177.

FIG. 178.

button at the point of the gorget is fitted into the groove in the staff, and as the instrument is pushed home into the bladder, it dilates the substance of the prostate gland.

For the *supra-pubic operation* of lithotomy several additional instruments are required. The bladder has to be filled with some tepid antiseptic lotion, *e.g.*, boracic acid. This may be done through an *ordinary catheter*, by means of a syphon, or with *Thompson's Hollow Sound*. Next, the bladder is pushed forward as far as possible from the rectum. To effect this, *Petersen's Indiarubber Bag* is passed into the rectum empty, and then filled with lotion, which is retained by a stopcock. The incision in the abdominal wall is made with an ordinary bistoury, and the bladder is exposed with the aid of a *Separator*. After the removal of the stone, most surgeons drain the bladder through the incision, some using an ordinary rubber or glass drainage-tube, furnished with a flat piece of rubber to prevent it slipping right into the bladder. Sir Henry Thompson has a specially constructed india-rubber tube with shield. Professor Chiene, of Edinburgh, uses a short glass tube, which is made to transfix a piece of large drainage tubing; the latter, lying across the wound, acts as a flange, and prevents the glass tube disappearing into the bladder. This has the advantage of being simple, efficient, and always obtainable.

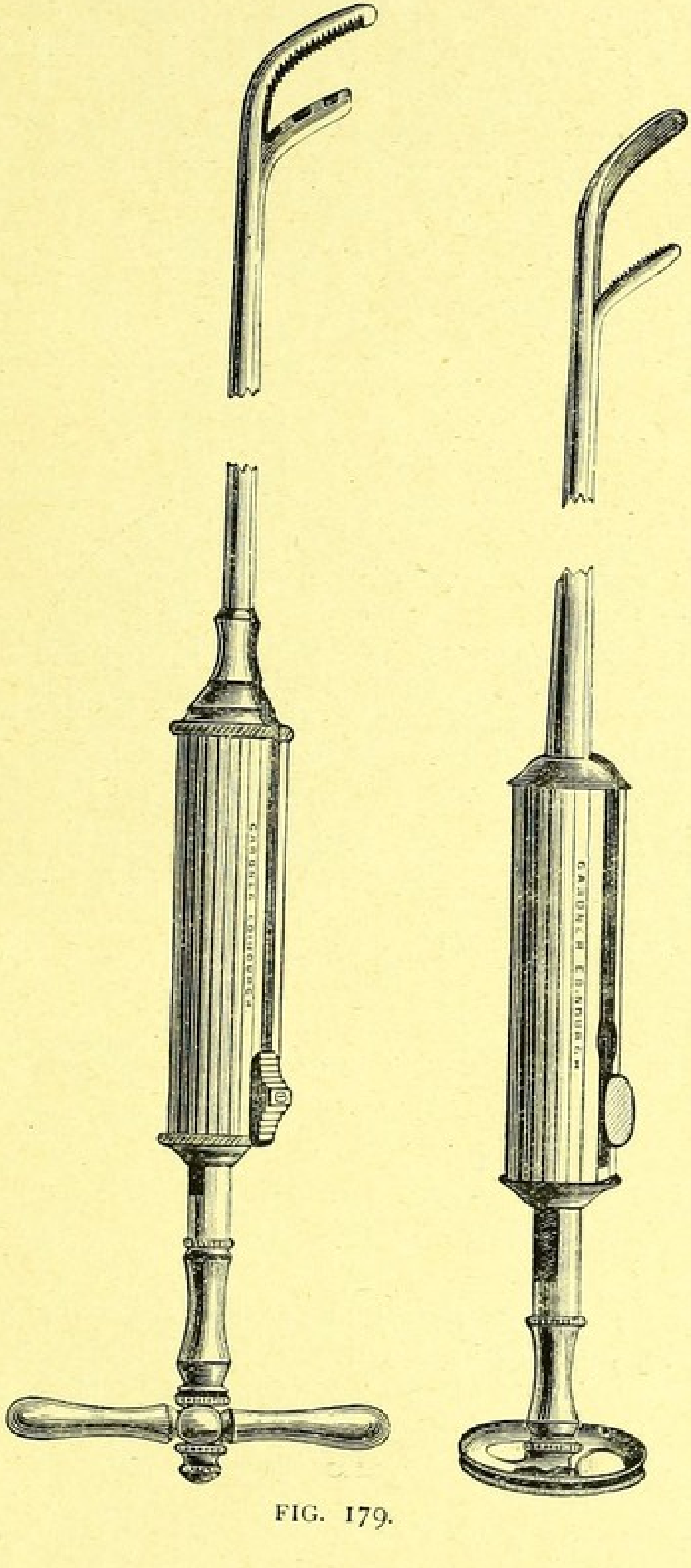


FIG. 179.

Lithotrity. — The operation of *Lithotrity* consists in crushing a stone to pieces inside the bladder, and then removing the fragments by a stream of lotion.

The presence and size of the stone having been ascertained by means of a *Sound*, the *Lithotrite* (Fig. 179) is

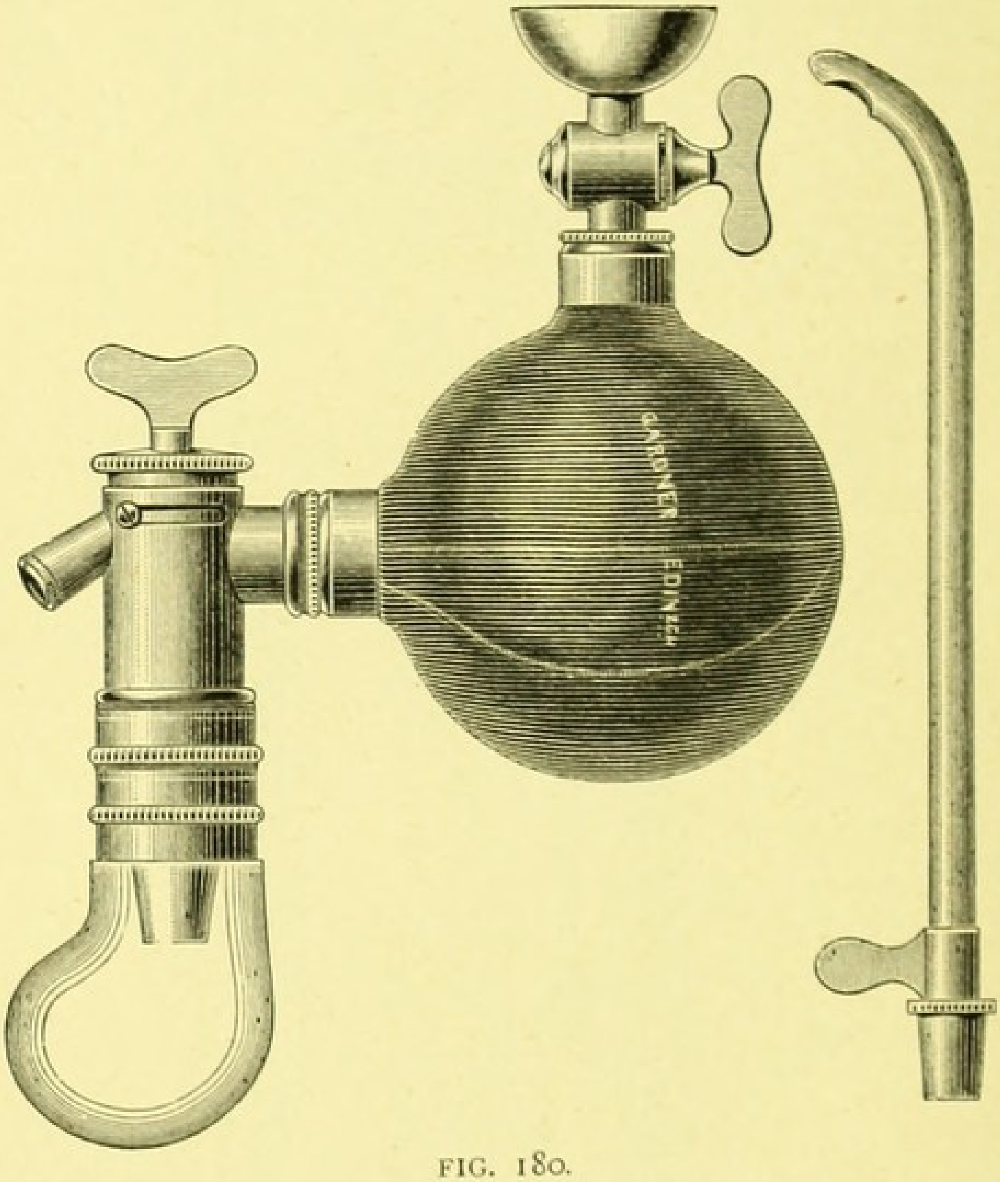


FIG. 180.

employed to crush it. This instrument consists of two blades, an inner or 'male' blade, which slides in a groove in the outer or 'female' blade. The stone is caught between the two blades, and slowly crushed by approximating them by a screw.

The débris is removed by means of an *Evacuating Catheter* (Fig. 180), which has a very large eye, and one or other form of *aspirator*, which is furnished with a trap-like contrivance which prevents the particles of stone re-

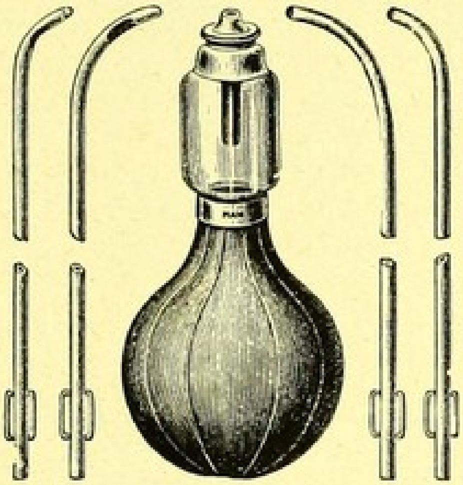


FIG. 181.

entering the bladder with the ingoing stream of lotion. Examples of *Aspirator* are Clover's (Fig. 180), and Thompson's (Fig. 181).

Instruments used in removing *tumours* from the bladder are illustrated in Figs. 182 to 185.

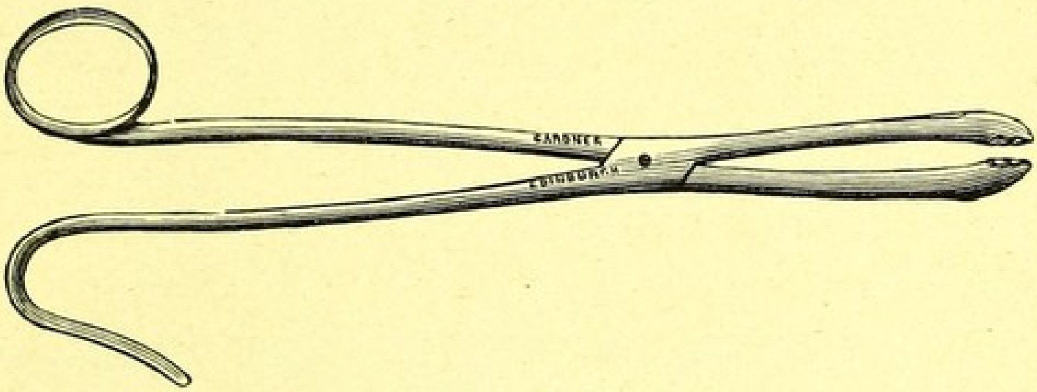


FIG. 182.

The *Cystoscope* (Fig. 186) is used to examine the inside of the bladder, which is illuminated by a minute electric lamp in the point of the instrument.

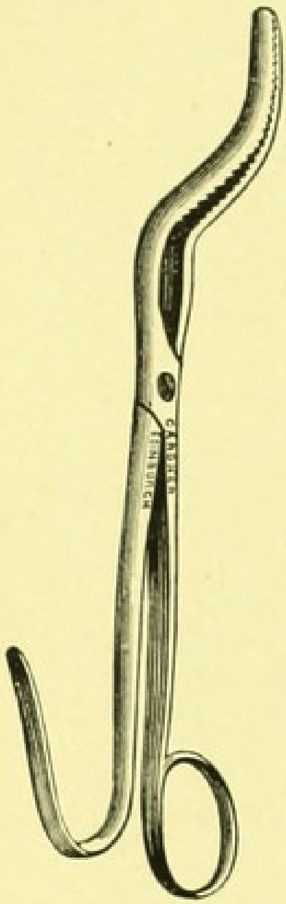


FIG. 183.

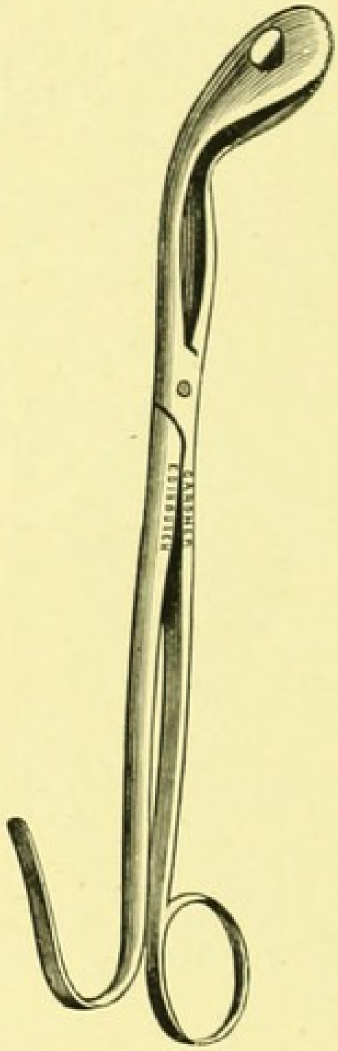


FIG. 184.

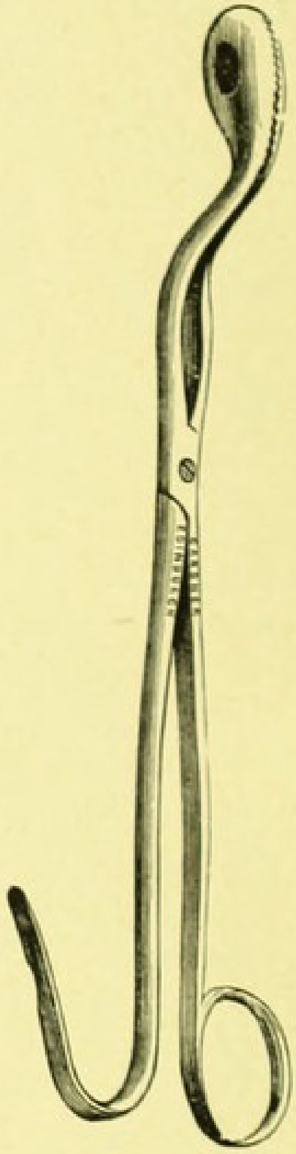


FIG. 185.

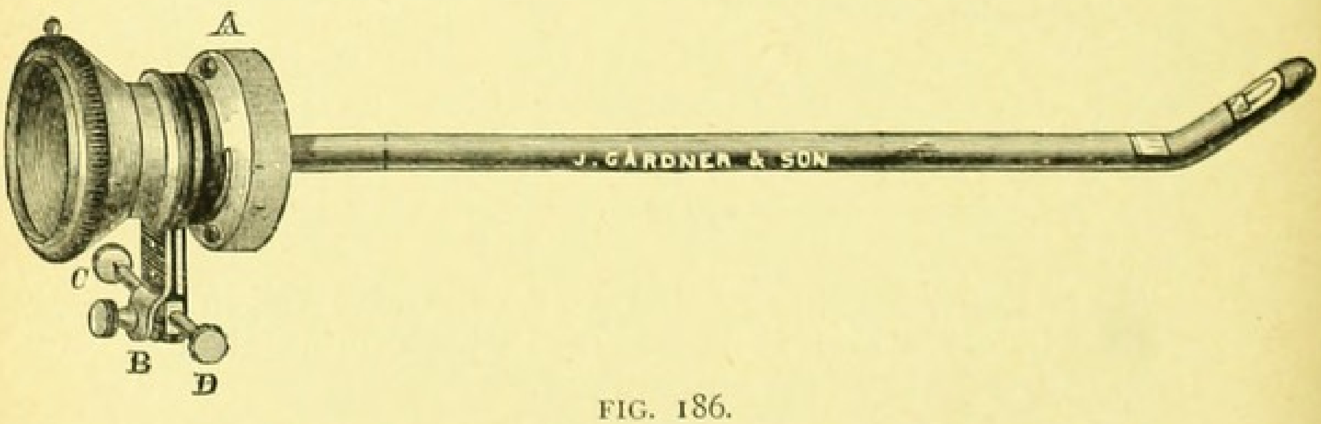


FIG. 186.

Passage of Bougies.—Bougies are graduated solid instruments used to dilate stricture of the urethra. The nurse should have ready (1) the box of bougies, (2) catheter oil to lubricate these, (3) warm carbolic (1 in 40) or boracic lotion to purify and warm them, (4) a swab of wool with which to purify the opening of the urethra. She should also (if it is the practice of the surgeon to give it) have a hot drink (hot milk, gruel, or coffee) ready immediately after the operation is over. This often prevents the patient having rigors after the passage of bougies. Some surgeons prefer bromides or quinine for this purpose.

Urethral Instruments.

Bougies.—These instruments are used for the dilatation of the urethral canal. They are made of various materials, some rigid, others soft and flexible, and are of different shapes, but all agree in being solid, or at least in not permitting of the flow of urine through them. They derive their name from the fact that wax tapers or *bougies* were previously used in place of specially-made instruments. They are about 12 or 13 inches long, and vary in diameter according to a set scale, each instrument having its size marked on it.

The *Ordinary Silver Bougie* resembles the silver catheter in every respect, save that it has no eye at the point, and is impermeable. It is of the same diameter throughout.

Lister's Bougies are of solid steel, and therefore of considerable weight, which greatly assists their passage along the canal, and renders force on the part of the surgeon unnecessary. These instruments are graduated so that the diameter increases by three sizes from the point upwards. Hence they come to be referred to as 'Lister's 2-5' or '10-13,' and so on, which means that at the point, which is made slightly bulbous for safety, the size is No. 10, and at the middle of the stem it has increased to No. 13. Of rigid instruments these are usually accepted as the best.

Various forms of pliable instrument are in use, *e.g.*, the *English Gum Elastic Bougie* (Fig. 187), which is made of

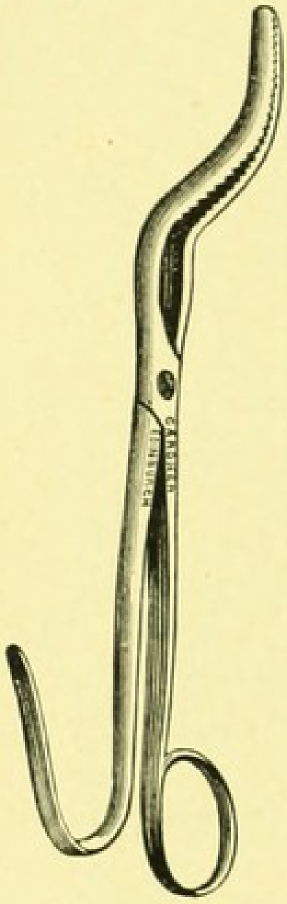


FIG. 183.

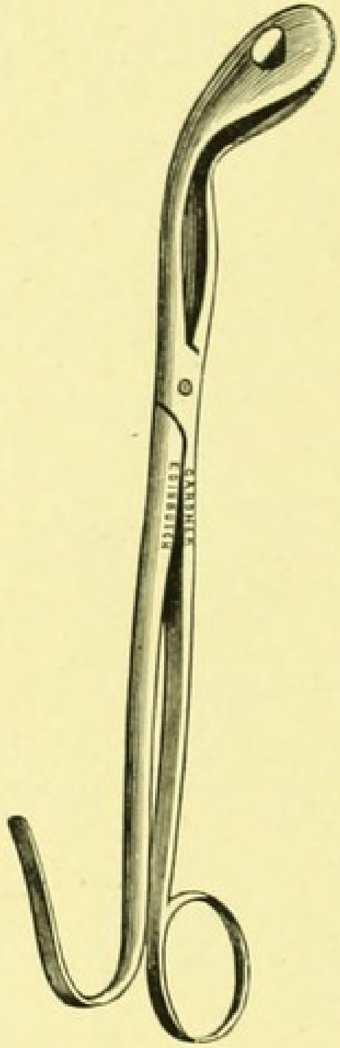


FIG. 184.

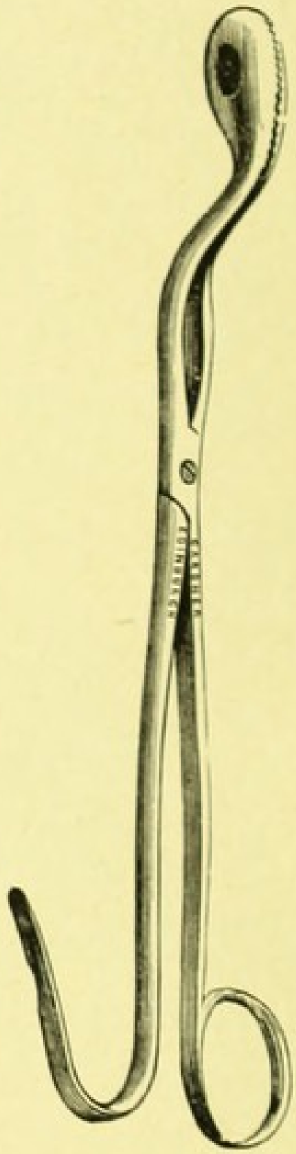
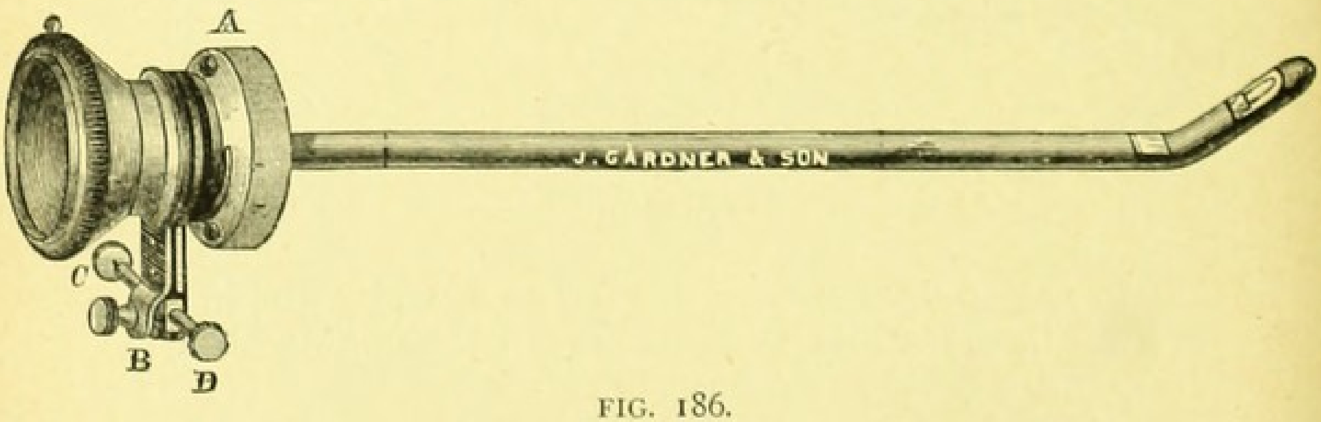


FIG. 185.



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Various forms of pliable instrument are in use, *e.g.*, the *English Gum Elastic Bougie* (Fig. 187), which is made of finely-woven silk, covered with several coats of brown copal varnish. It is of the same diameter throughout, and is rendered quite supple by being warmed to the temperature of the body. It may be made to take any 'set' desired by being left bent for a few weeks.

The French Gum Elastic Bougie (Fig. 188) is black in colour, and differs somewhat in shape from the English. It is made so that the stem gradually tapers away to a point in its lower third. An improvement on this is to have the tip rounded and slightly bulbous, which prevents hitching on any obstruction in the canal. This is the *bougie à boule* of the French.

The "*Acorn*" *Bougie* (Fig. 190) is mainly used as a diagnostic instrument. It consists of a long slender stem, fitted at the point with an acorn-shaped bulb. This is so formed that it passes pretty readily in through a stricture, but is distinctly caught on being withdrawn. In this way the exact position of the stricture may be determined, and by using instruments of different sizes an idea of the calibre of the tube at the strictured point may be obtained.

The "*Filiform*," or thread-like bougie (Fig. 189), as its name implies, is of very fine calibre, and is chiefly employed in cases of exceeding tight stricture, to determine whether or not the passage is at all permeable. If once passed it facilitates the introduction of larger instruments.

Other instruments, such as the *Ball-staff Bougie, bougie à ventre, bougie à ventre à boule,* are less frequently used.

Catheters.—These are hollow tubes made of different materials, and are used to empty the bladder. They are to be distinguished from bougies, which are solid, and are for the dilatation of the urethra. Almost every variety of bougie has its counterpart in the shape of a catheter.

The *Ordinary Silver Catheter* (Fig. 194) consists of a hollow tube, with a small 'eye' on its side, about ¼ of an inch from the point. In the older instruments the part of the catheter beyond the eye formed a *cul-de-sac* in which dirt, and therefore septic material, was apt to collect, and constituted a source of danger by introducing

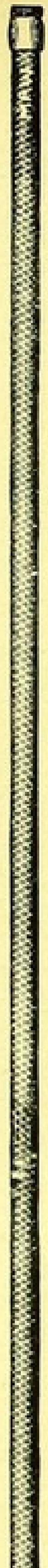

FIG. 187.

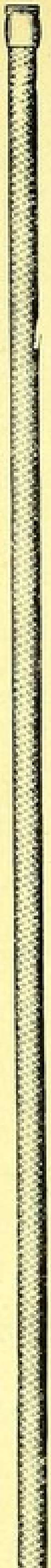

FIG. 188.

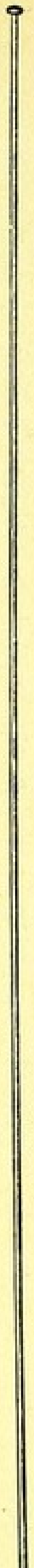

FIG. 189.

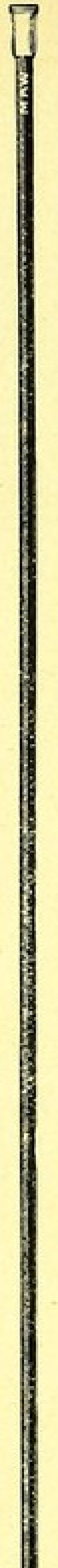

FIG. 190.

FIG. 191.

organisms into the urine, which is a highly putrescible fluid. In more recent days this disadvantage has been removed by making the point of the instrument solid. Near the other end of the tube there are two small silver rings, which are used when the instrument has to be tied into the bladder for constant drainage. Most catheters are furnished with a wire stylet. The lower fourth of the instrument is curved so that the point comes to be almost at a right angle with the axis of the stem. The sizes, according to the English scale, are from $\frac{1}{4}$ to 12.

The other catheters are all more or less flexible. The *Soft Rubber Catheter* (Fig. 195) is quite soft, and is employed when there might be danger of a more rigid instrument doing harm, *e.g.*, in old men who require to use the catheter habitually, and who have to pass it themselves.

Gum Elastic Catheters (English and French) resemble bougies of corresponding makes. They are quite flexible when heated to the temperature of the body, and are supplied with a wire stylet to give them the necessary amount of rigidity or the appropriate curve when being used.

The *Catheter à coudée*, or elbowed catheter (Fig. 191), is also made of gum elastic. About $\frac{1}{2}$ an inch from the beak it is bent at an angle of 45 degrees with the stem, and this bend is permanent. It is employed in cases of enlarged prostate.

The *Catheter bi-coudée* has a double bend near the beak.

The *Prostatic Catheter* (Fig. 196) is of silver, and has a very wide bend. It is also used in cases of enlarged prostate.

The *Filiform Catheter* is used to empty the bladder in cases of very tight stricture.

Female Catheters (Fig. 192) are short, with a slight curve. They are seldom used, the ordinary gum elastic male catheter being much more serviceable.

The *Double-barrelled Catheter* (Fig. 193) is used to wash out the bladder, the lotion passing in along one channel, and out along the other. It may be used with a syringe or syphon.

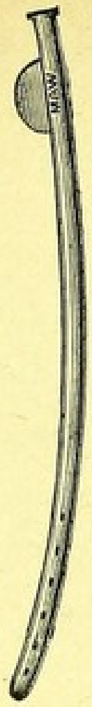

FIG. 192.

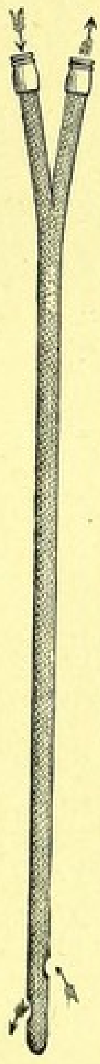

FIG. 193.

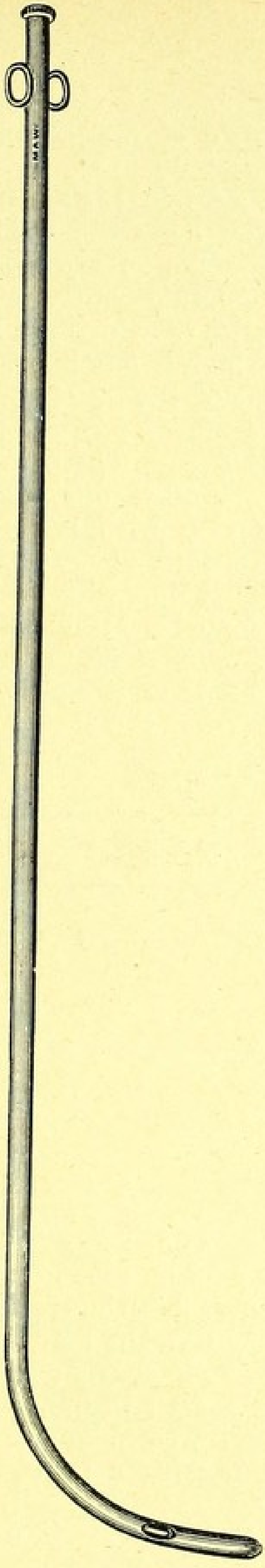

FIG. 194.

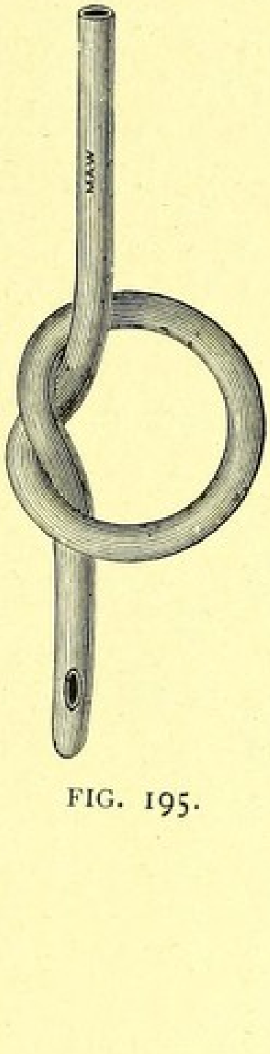

FIG. 195.

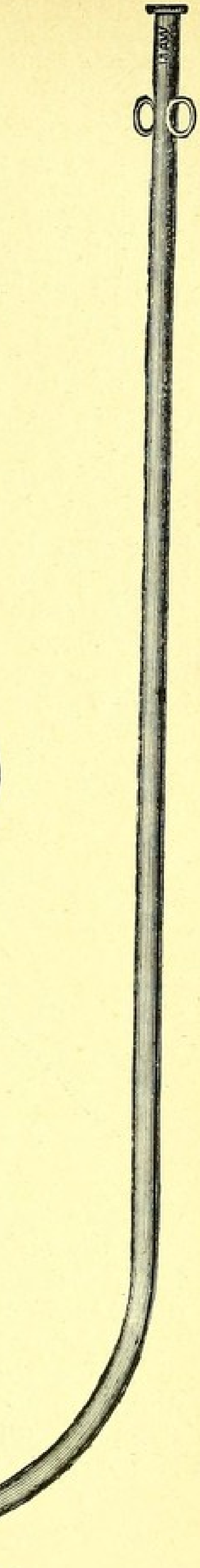

FIG. 196.

Other forms of catheter are used in certain operations *e.g.*, lithotrity, where the bladder has to be washed out to remove all fragments of the stone. Examples of these are Clover's and Bigelow's evacuating catheters (Figs. 180 and 181), the chief characteristics of which are their large bore and the size of the eye, which is much larger than in ordinary instruments, to permit of the free passage of the stones.

Instruments used in Urethrotomy.—There are certain cases in which stricture of the urethra does not yield to treatment by means of dilatation with bougies, and it becomes necessary to cut the strictured part of the canal and so restore its calibre. This operation is known as *urethrotomy*. The stricture may be attacked from the inside of the urethra—*internal urethrotomy*, or the cut may be made through the skin—*external urethrotomy*.

When the incision is made from the inside a very fine blade is introduced, and with great care is made to cut

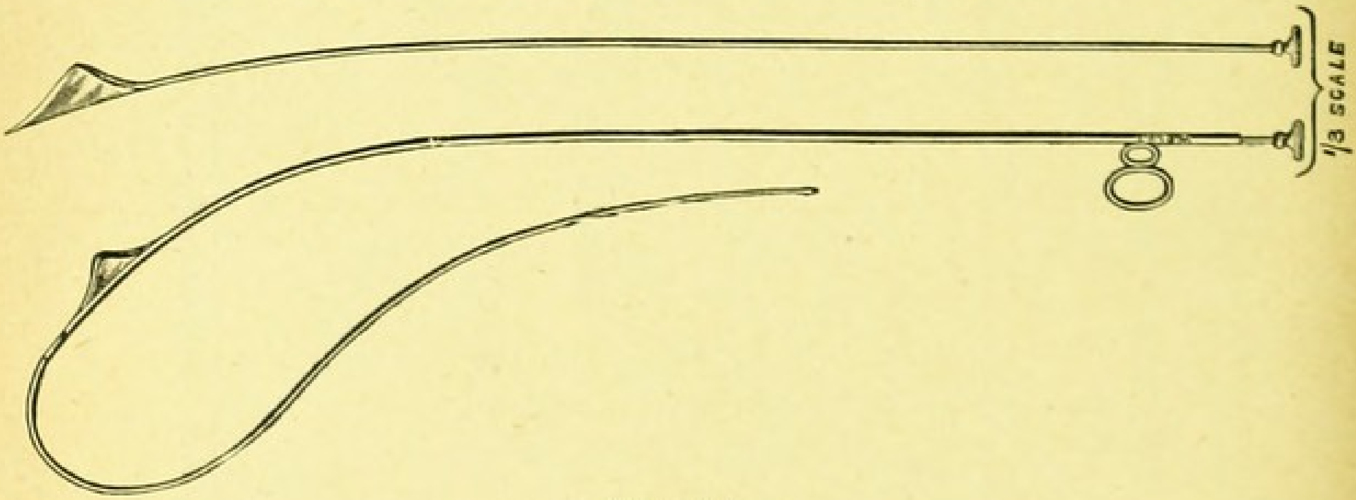

FIG. 197

only the strictured part. To insure accuracy and safety many instruments have been devised and great ingenuity displayed. Some of these cut the stricture from before backwards—that is, on the way into the bladder, *e.g.*, that of Maissoneuve (Fig. 197), which consists in (1) a fine filiform bougie, which can be passed through a very tight stricture; (2) on to this is screwed a small staff, in a hollow in which runs a stylet bearing a triangular shield.

This triangle or wedge renders the stricture tense, and from within it is pushed a sharp cutting knife edge, which splits the constricting fibres, and so re-establishes the lumen of the canal. Any fibres which may escape division as the instrument enters can be dealt with as it is withdrawn. This instrument has been modified and improved by Teevan.

Another set of instruments is arranged to cut the stricture from within outwards, but obviously very tight constrictions cannot be so dealt with, as such would not admit of the entrance of the staff with its concealed knife, and some of the instruments are so large that if they can be passed at all it almost argues that no operation is

FIG. 198.

necessary. Of instruments cutting from within outwards may be mentioned Sir Henry Thompson's modification of Civiale's instrument. It has a bulbous point, from which a blade can be projected (Fig. 198). Dr. P. Heron

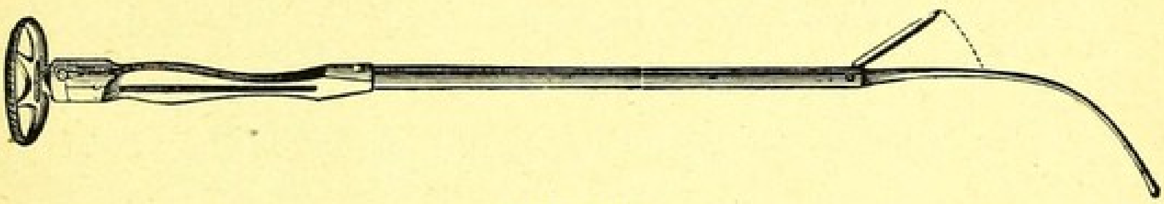

FIG. 199.

Watson, of Edinburgh, has also introduced an instrument working in this direction (Fig. 199). Otis, of New York, has a complicated instrument, consisting of two separable blades, which render the urethra quite tense, and when the knife is protruded it very readily splits the constricting fibres.

The operation of *external urethrotomy* is performed by the aid of a guide which is passed into the urethra, and being felt through the skin, is cut down upon. The most frequently used staff is that of Syme (Fig. 201). The

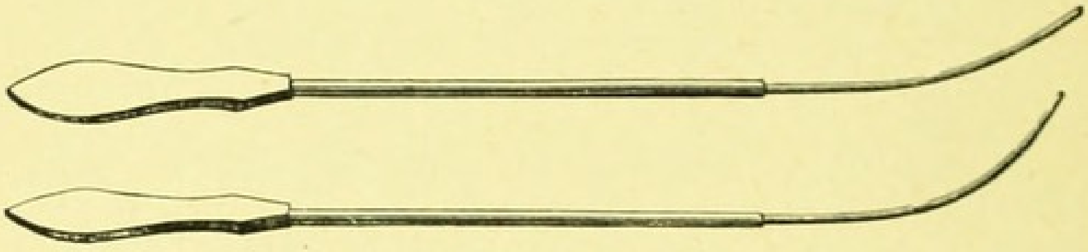

FIG. 201.

curved part of this instrument is about the size of a No. 2 bougie, and about 3 inches from the point it suddenly expands to the size of a No. 10 or No. 12, thus forming a distinct shoulder. The thin part is grooved on the convexity, the groove just reaching on to the shoulder and stopping there. The instrument is passed into the urethra with the patient in the lithotomy position, the shoulder is caught at the stricture, the surgeon cuts down upon the shoulder, introduces the point of his knife into the groove, and cuts through the stricture in a direction from within outwards. The staff is withdrawn, and an S-shaped silver catheter (Fig. 203) introduced through the perineal wound, and left for three or four days for drainage. The further treatment consists in regularly passing bougies at stated intervals to prevent recontraction of the stricture.

Mr. Wheelhouse performs external urethrotomy by cutting down upon a grooved staff (Fig. 202), which only reaches to the stricture, and then from the perineal wound he passes a fine probe-pointed director through the stricture, and on this divides the tight fibres. Drainage is carried out by a silver catheter passed through the meatus, and the perineal wound is allowed to heal up. Sometimes no instrument can be got through the stricture, and the urethra beyond has to be searched for in the perineum and opened—an operation of extreme difficulty.

Urethral Dilators.—It is sometimes advisable to rapidly

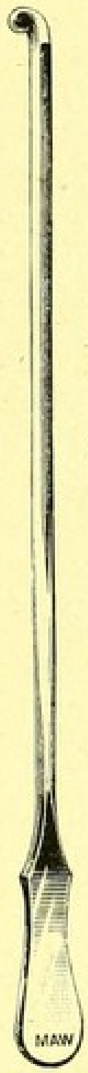

FIG. 202.

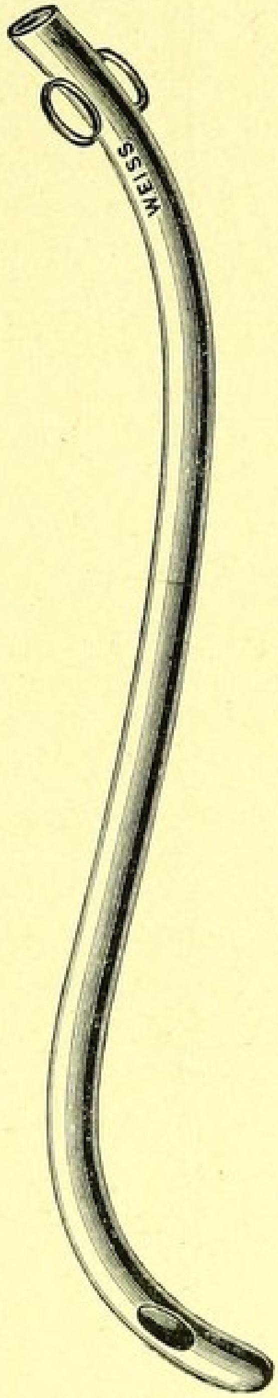

FIG. 203.

and forcibly stretch a strictured urethra, and there are several methods of doing so: (1) By means of sliding tubes. The instrument used by *Wakley* may serve as a

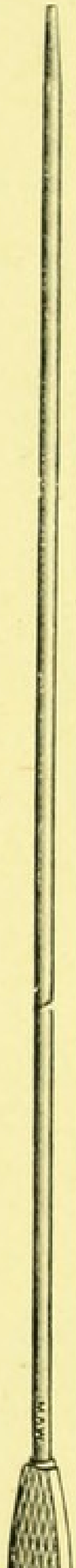

FIG. 204.

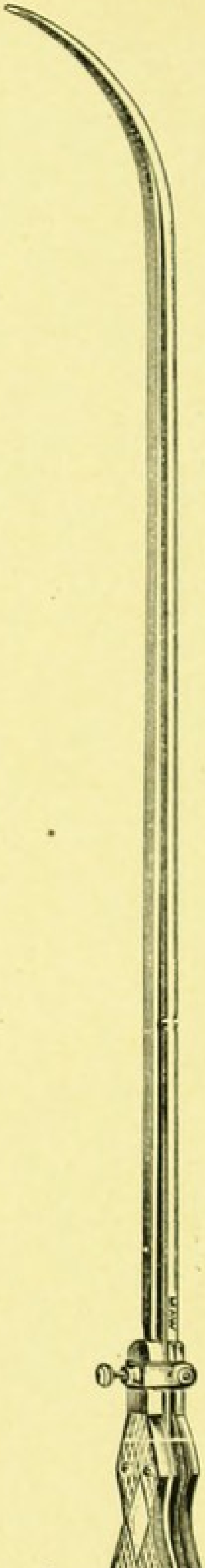

FIG 205.

type of this variety. It consists of a fine 'urethral guide,' which is first passed through the stricture, and then over this a larger tube is passed, and so on, one tube over another, till the urethra is expanded to its normal size.

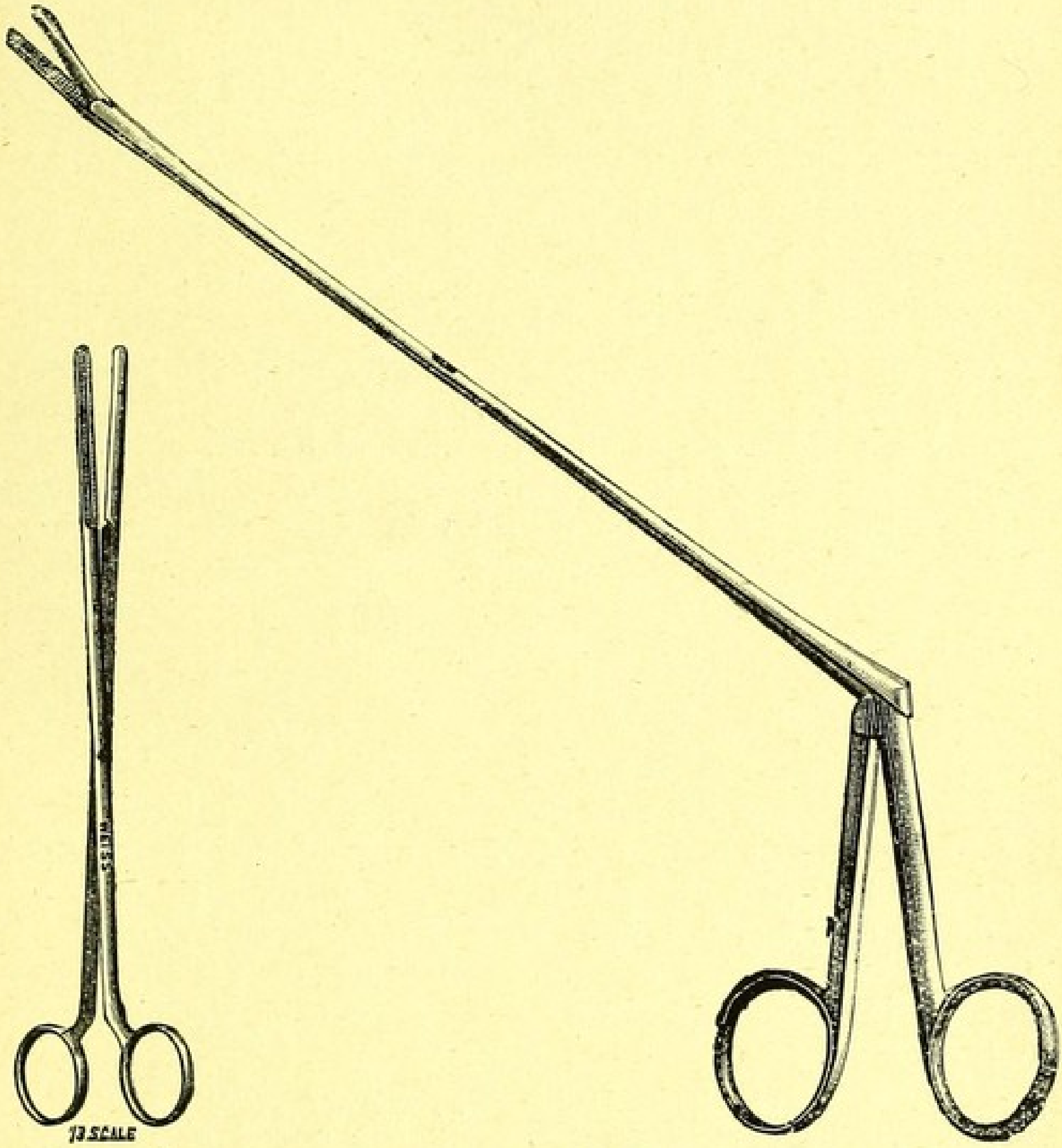

FIG. 206. FIG. 207.

(2) *Sir Henry Thompson's Dilator* consists of two blades, which may be separated by a screw at the handle. The dilatation should be very slowly effected, a few seconds elapsing between each two turns of the handle. (3) *Holt's*

Urethral Dilator acts on the principle of a wedge (Figs. 204 and 205). It is a split sound, having a fine steel wire between the two halves of the blade. The instrument is passed into the urethra, and when there one of a graduated set of wedge-shaped tubes is passed over this wire, and so forcibly separates the halves of the sound. It is claimed by the introducer that only the strictured part of the urethra is affected by the proceeding. This method of treating stricture is not free of danger, and in most cases may be replaced with advantage by either gradual dilatation or urethrotomy.

Urethral Forceps (Figs. 206 and 207) have long, narrow blades, and are used to remove impacted calculi or other foreign bodies from the urethra.

Various instruments have been used to apply substances locally to the mucous membrane of the urethra. For example, solid caustics may be applied by the aid of one apparatus, fluid caustics with another, and ointments by a third, which is fluted all round to receive the ointment. They are seldom used nowadays.

Operations on the Rectum.

Before any operation on the rectum, *e.g.*, for piles, fistula, or malignant disease, the bowels should be thoroughly emptied by drugs and enemata. The medicine should be given twenty-hours before the operation, and should be followed by several enemata, the last of which, given very early on the morning of the operation, should be of boracic acid.

After operation a morphia suppository ($\frac{1}{4}$ to $\frac{1}{2}$ grain) is given to relieve pain and to keep the bowel at rest. If possible, the bowels should be kept closed for four or five days, and then opened by castor-oil or Henry's solution and an enema of warm olive-oil.

Retention of urine is a common complication after these operations, and must be dealt with in the usual way.

Distention of the intestine with flatus is often troublesome, and may be relieved by passing a stiff tube, well lubricated, into the rectum and leaving it there for fifteen or twenty minutes.

Rectal Instruments.

1. *Specula* are used to separate the walls of the rectum so as to admit rays of light into the cavity to enable the parts to be examined, either for purposes of diagnosis or treatment. Direct sunlight or light reflected from an artificial source may be employed. Many forms of instrument have been introduced: some tubular, *e.g.*, Fergusson's (Fig. 208); others with two separate blades,

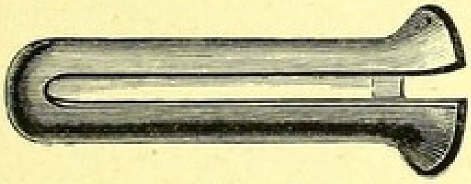

FIG. 208.

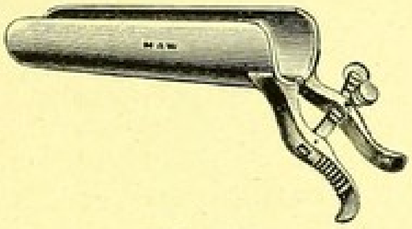

FIG. 209.

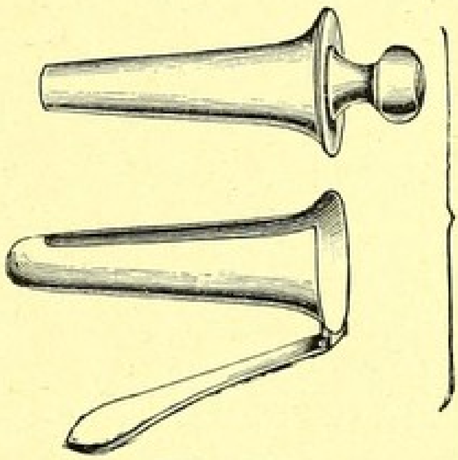

FIG. 210.

such as Maw's (Fig. 209); and others, again, with three or four blades, like Allingham's. Hilton's speculum (Fig. 210) is on the same principle as Fergusson's, but is furnished with a handle, and a plug to facilitate its introduction.

2. *Rectal Bougies* are employed to detect the situation and degree of a stricture of the rectum, and for its gradual dilatation when such is possible. They are graduated to a scale, are usually made of soft gum-elastic, and the points may be cylindrical, conical, or bulbous (Fig. 211).

3. *Rectal Dilators* are used to distend the tube more forcibly, the blades being separated by various mechanical arrangements.

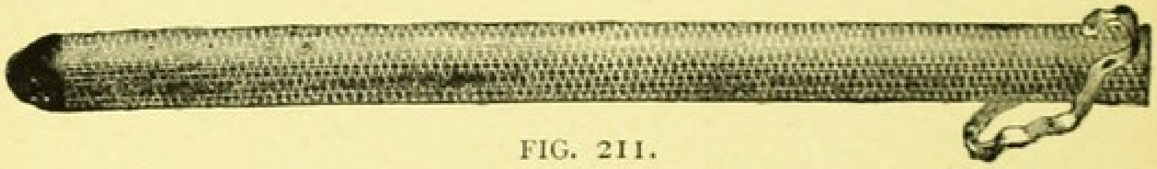

FIG. 211.

4. *Rectal Bistouries,* for the purpose of operating on such conditions as fistula in ano, *e.g.*, Bell's (Fig. 212), have been introduced, but are for the most part unnecessary.

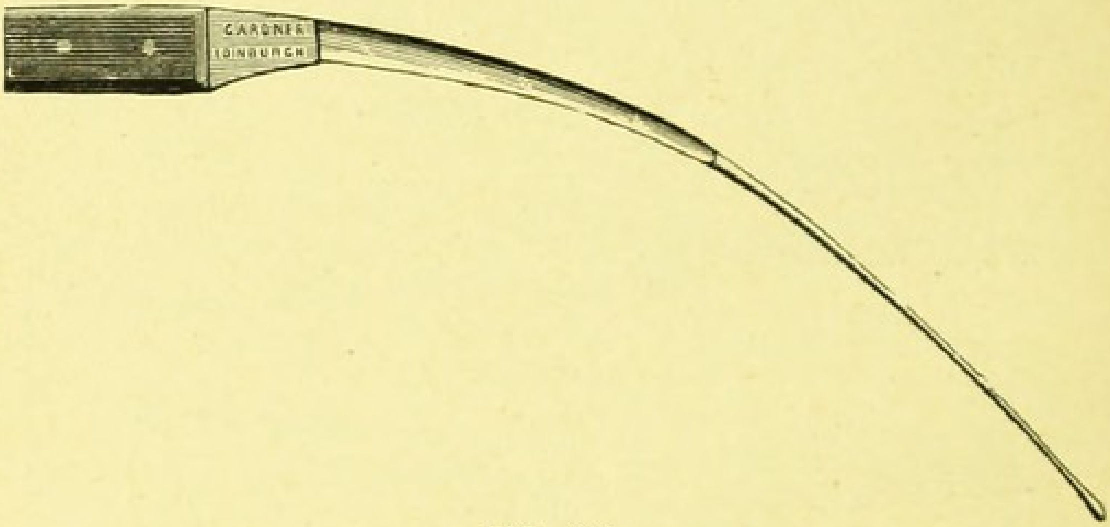

FIG. 212.

In the treatment of hæmorrhoids several special instruments are employed :

(*a*) *Hæmorrhoid Forceps* (Fig. 213) are used to seize and pull down the hæmorrhoids.

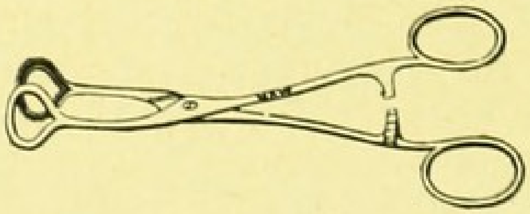

FIG. 213.

(*b*) *Hæmorrhoid Clamps.*—Of these there are a great variety. Some are used in conjunction with the cautery, *e.g.*, H. Smith's (Fig. 214), and Sydney Jones's (Fig. 215), a plate of ivory being placed between the metal and the skin to prevent the latter being burned.

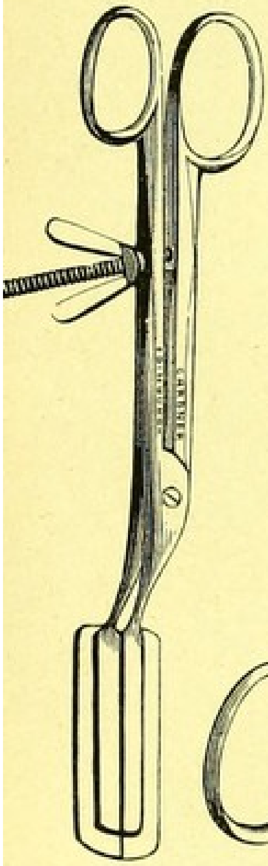

FIG. 214.

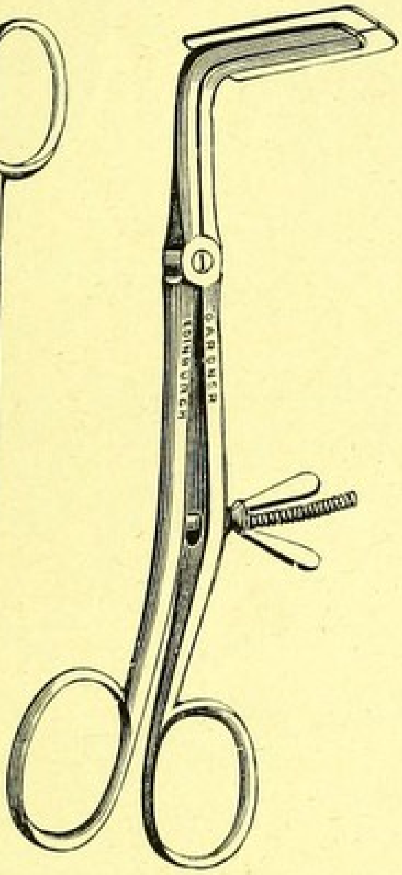

FIG. 215.

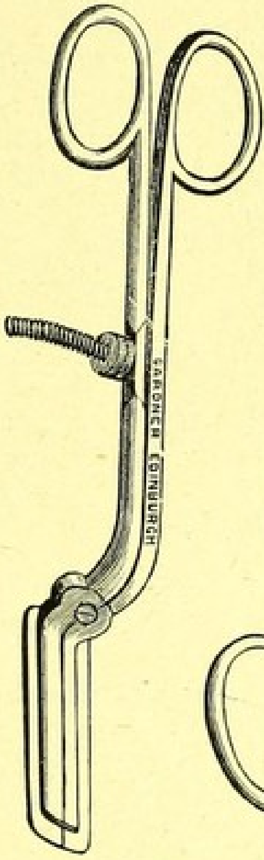

FIG. 216.

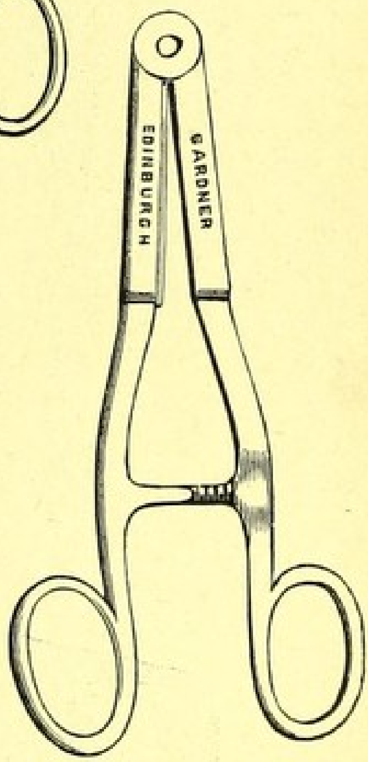

FIG. 217.

Others crush the piles sufficiently to prevent hæmorrhage when they are cut off by scissors, *e.g.*, Allingham's (Fig. 217).

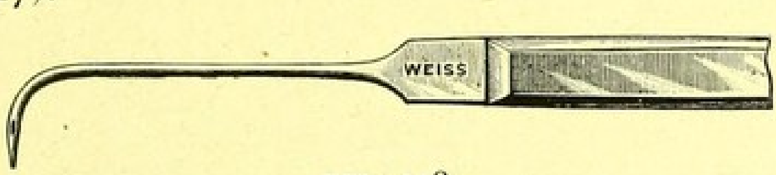

FIG. 218.

(*c*) *Cauteries* (Fig. 219).—Any form of cautery will do for treating piles, although several have been specially contrived for this purpose.

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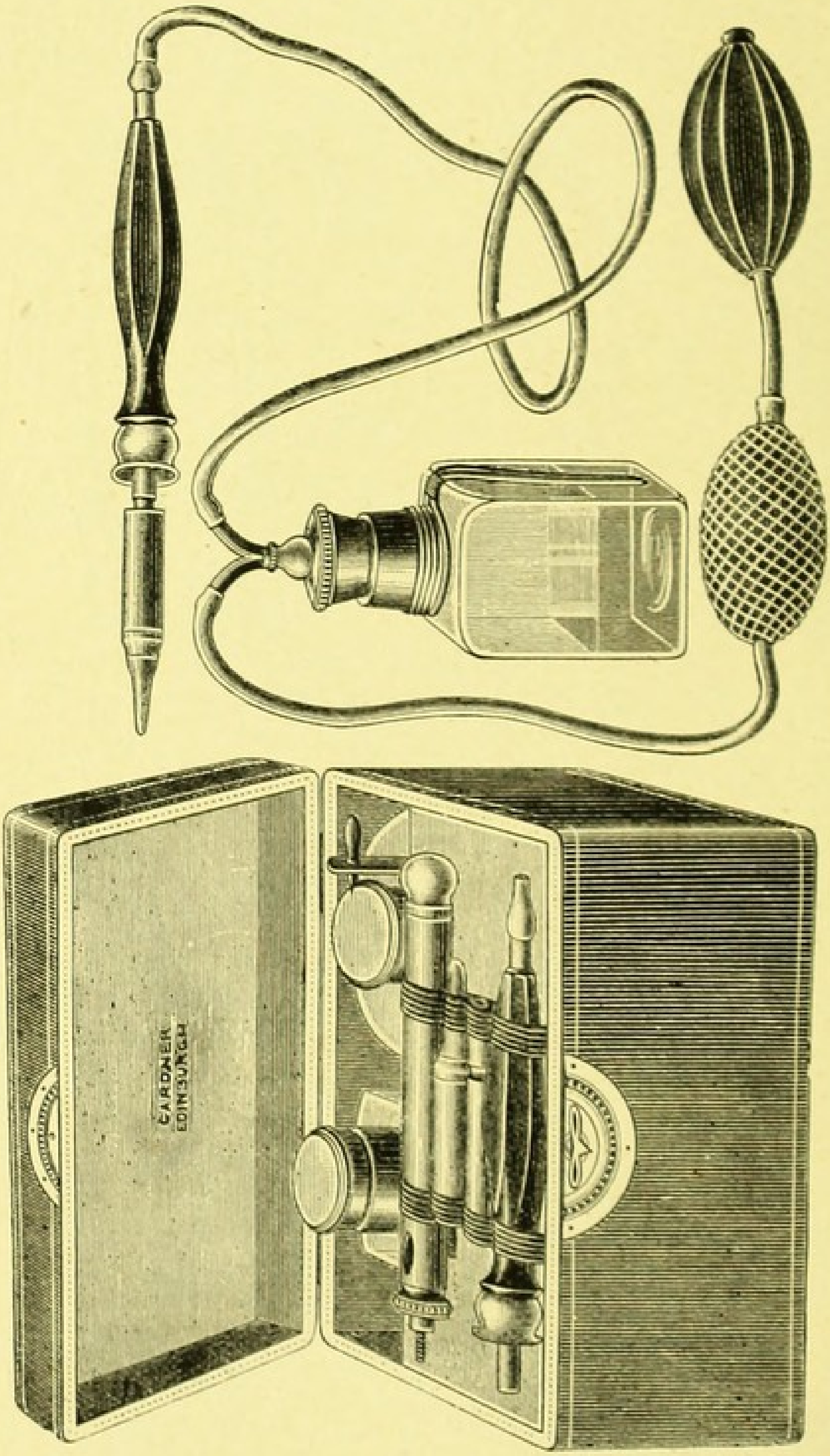

FIG. 219.

(*d*) *Hæmorrhoid Needle* (Fig. 218) is a long, sharp, curved needle fixed to a handle, and having the eye a short distance from the point. It is used to carry a

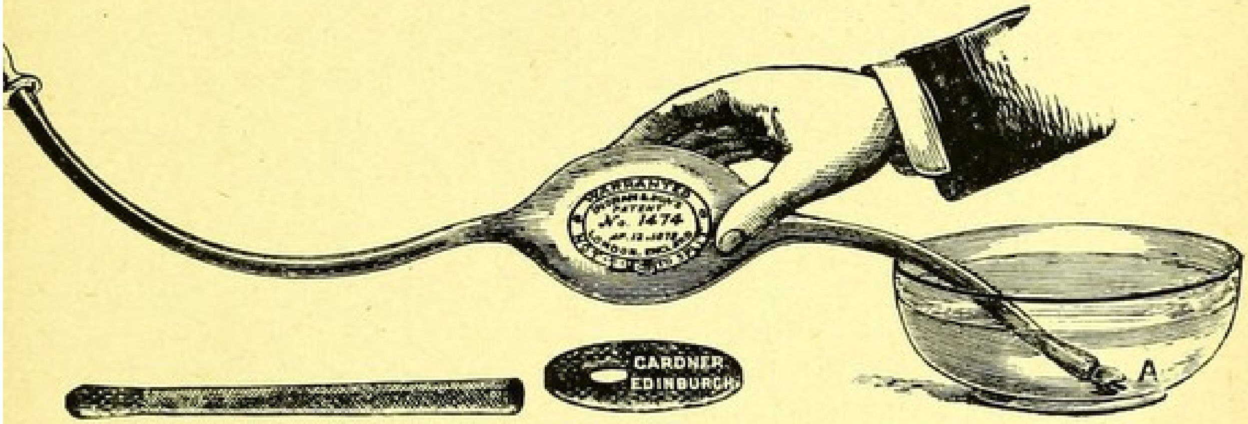

FIG. 220.

FIG. 221.

double ligature through the pile, which is then tied in two halves. Others are made after the pattern of cleft palate needles, with a double curve on them.

Enema Apparatus.

Of enema syringes perhaps the simplest and the best is the ordinary Higginson's syringe (Fig. 220). Others are more complicated, without any corresponding advantage. Some act on the syphon principle, and are very useful. For the administration of nutrient enemata the instrument most convenient is a simple india-rubber bag with nozzle (Fig. 221).

Other instruments used in operations on the rectum, such as hooks, scissors, directors, and so on, do not require special mention.

Bed-Pans vary much in shape and material, the *wedge-shaped* and the *slipper* being the commonest.

CHAPTER XXVII.

OVARIAN AND UTERINE OPERATIONS.

THE main indications in the after-treatment of these cases are, to give the bowel absolute rest, to avoid sickness and vomiting, which may cause the wound in the abdominal wall to burst open, and, above all, to insure the most perfect asepsis. To secure the first two objects the patient must be kept on very low diet for the first few days. After being put back to bed, she should have nothing for the rest of that and all the following day, save a few sips of tepid water to allay her thirst. Should there be sickness, the water may be given cold. No food is given till the patient has passed flatus, and at first she has it in very small quantities at short intervals. At the end of forty-eight hours of this regimen the diet may be gradually increased, milk and potash, beef-juice, chicken tea, light puddings, etc., being in turn given. The bladder has in some cases to be emptied by the use of the catheter, which must be previously sterilised with the utmost care; but the patient should be encouraged to make water without artificial aid if possible. At the end of a week, should the bowels remain closed, a gentle purge aided by an enema may be given. The stitches in the abdominal wound are usually taken out at the end of a week, and a dose of castor-oil should be administered, and the patient's linen changed the night before to prevent the necessity for undue movements soon after the removal of the stitches. Morphia is only to be used in the treatment of these cases when absolutely indispensable.

Some Gynæcological Instruments.

Gynæcologists have gone to great lengths in devising special instruments for the operations which they perform. We cannot do more here than illustrate a few of those which are most typical or more generally used.

Vaginal Specula.—The ordinary *Fergusson's Speculum* (Fig. 222), which is made of silvered glass covered exter-

FIG. 222.

nally by vulcanite, and is specially useful in examining and applying medicaments to the cervix uteri. The *Bivalve Speculum* (Fig. 224) has the disadvantage of allowing the vaginal walls to get between the blades and obstruct the view. The *Duckbill*, or *Sim's Speculum*

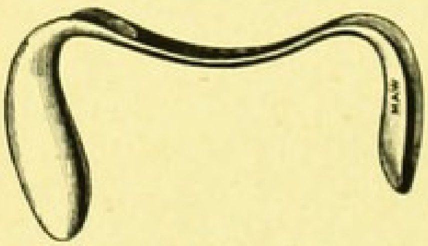

FIG. 223.

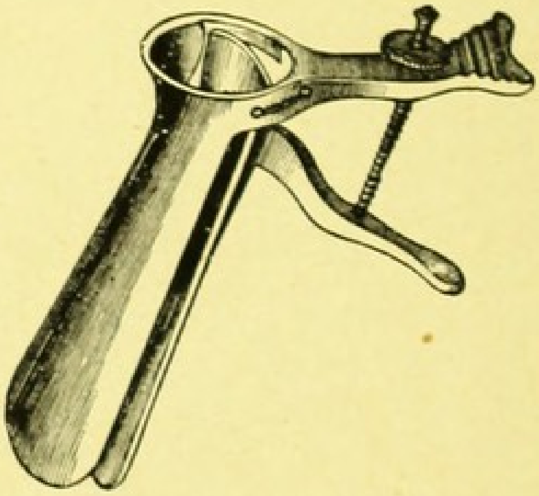

FIG. 224.

(Fig. 223), is much used in operations, as is also *Neugebauer's* instrument (Fig. 225).

The *Uterine Sound* (Fig. 226) is flexible, with a probe point, and a knob 2½ inches from the point to indicate the normal length of the uterus, and other graduated marks.

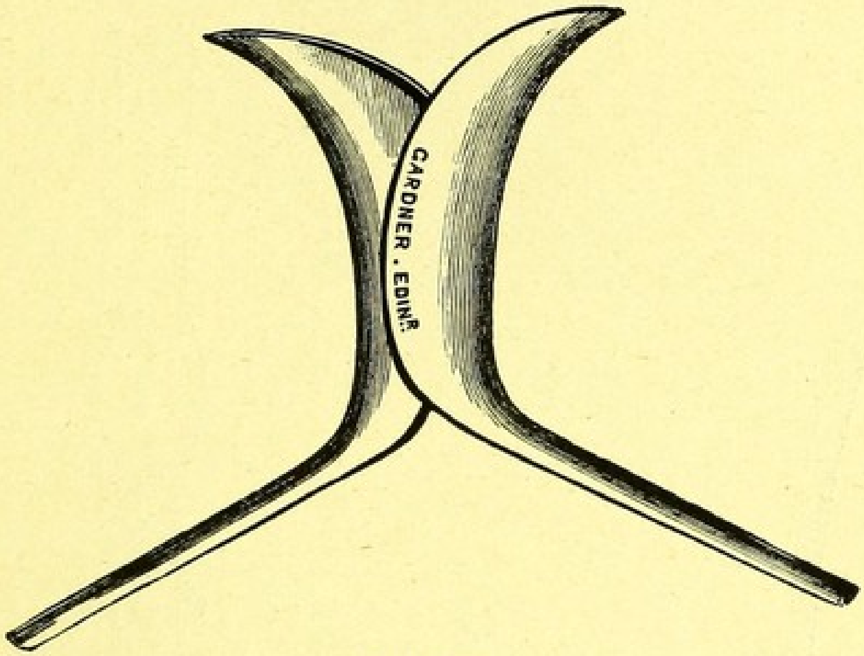

FIG. 225.

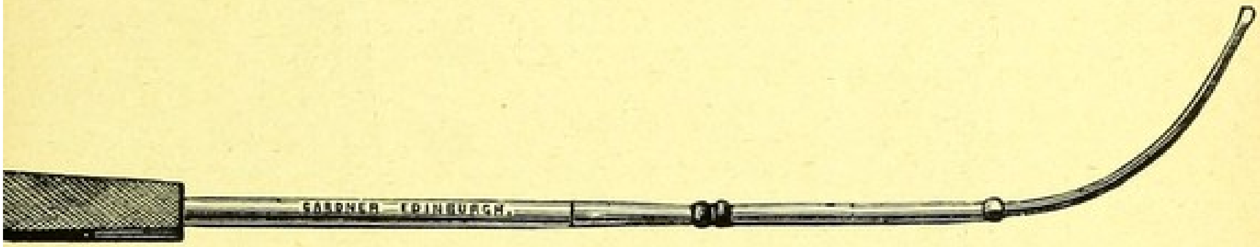

FIG 226.

Dilators.—Many forms of these are employed for dilating the cervix (Figs. 227 to 230).

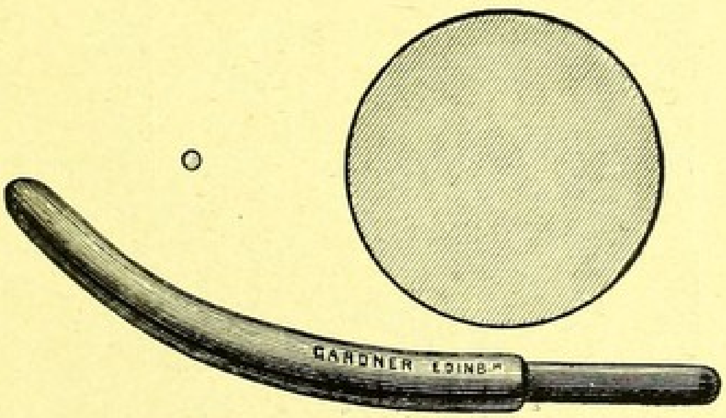

FIG. 227.—HEGER'S DILATOR.

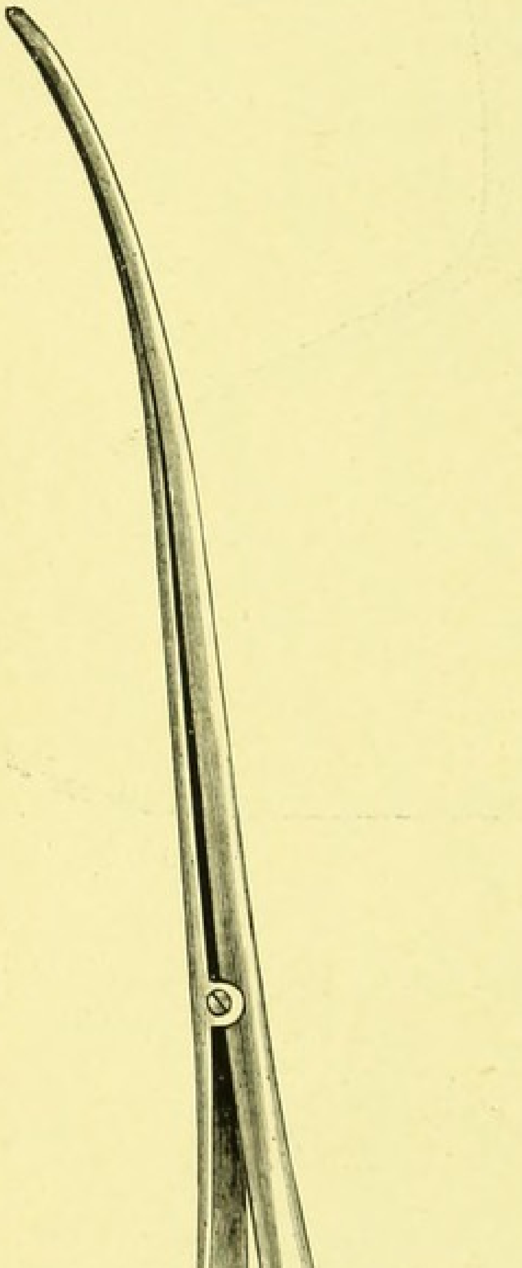

FIG. 228.—SIMPSON'S DILATOR.

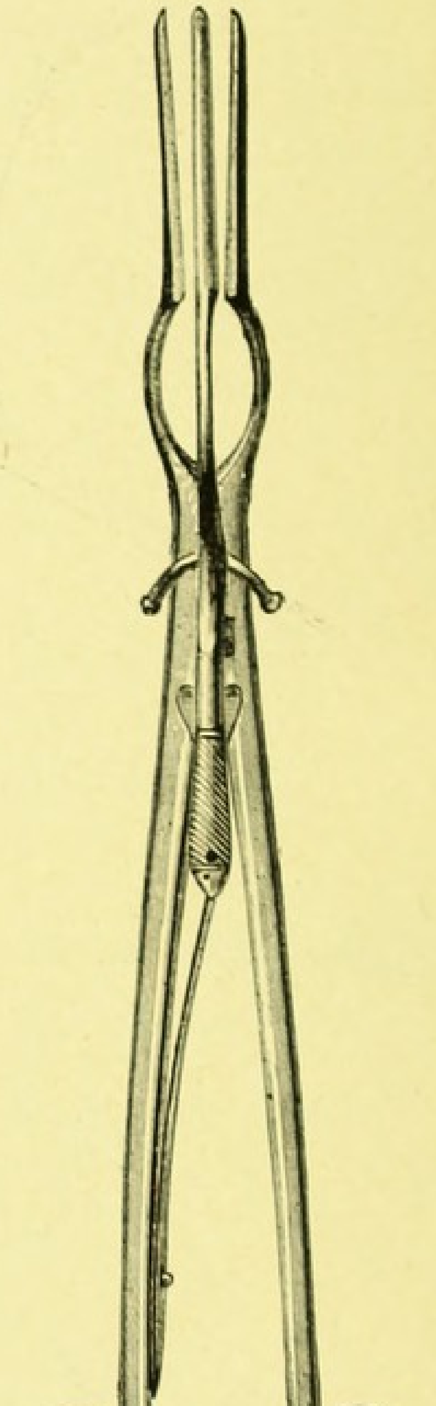

FIG. 229.—PALMER'S DILATOR.

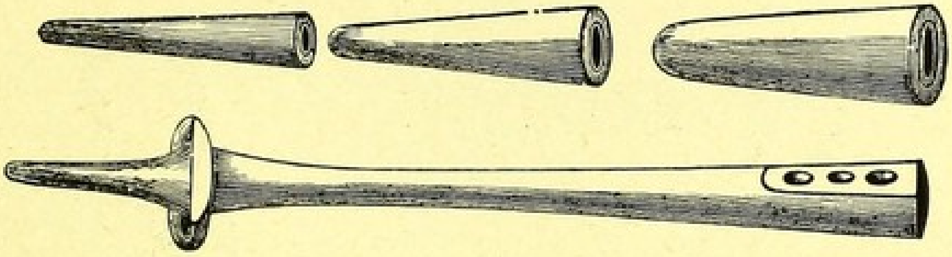

FIG. 230.—LAWSON TAIT'S DILATOR.

Various forms of *tent* are also used:

FIG. 231.—LAMINARIA (A SPECIES OF SEAWEED).

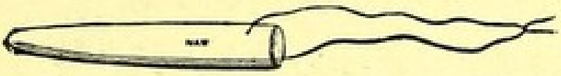

FIG. 232.—CARBOLIZED SPONGE.

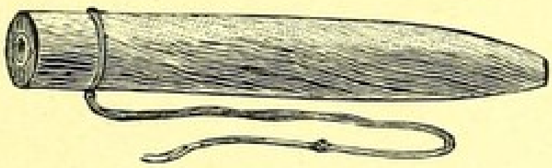

FIG. 233.—TUPELO, MADE FROM THE ROOT OF AN AQUATIC PLANT.

VARIOUS INSTRUMENTS.

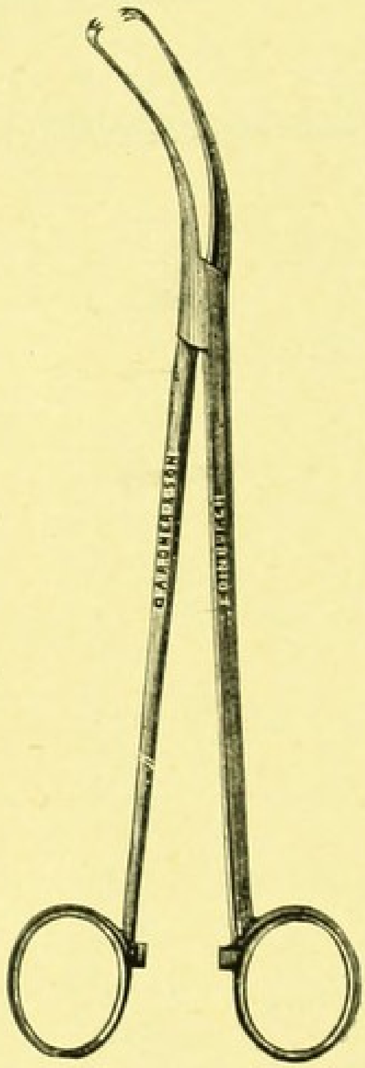

FIG. 234.—BREWIS'S VULSELLA.

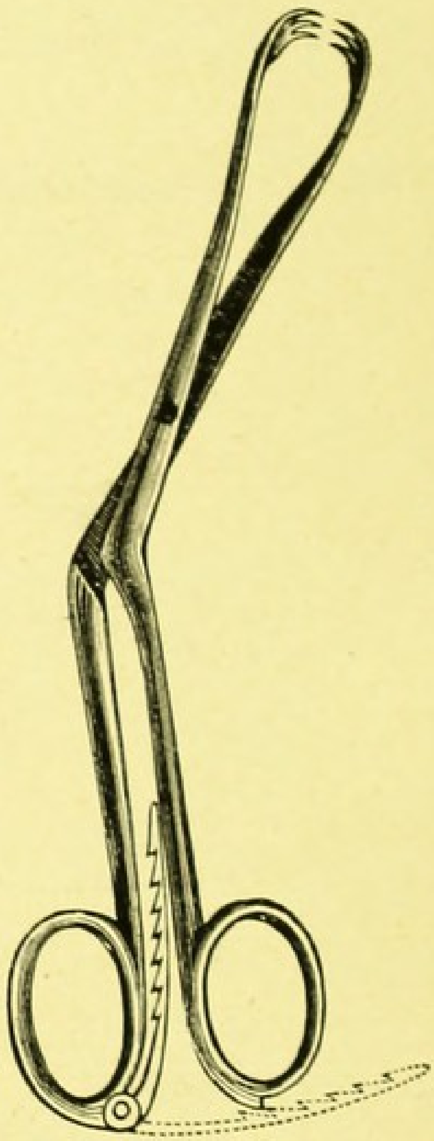

FIG. 235.—HART'S VULSELLA.

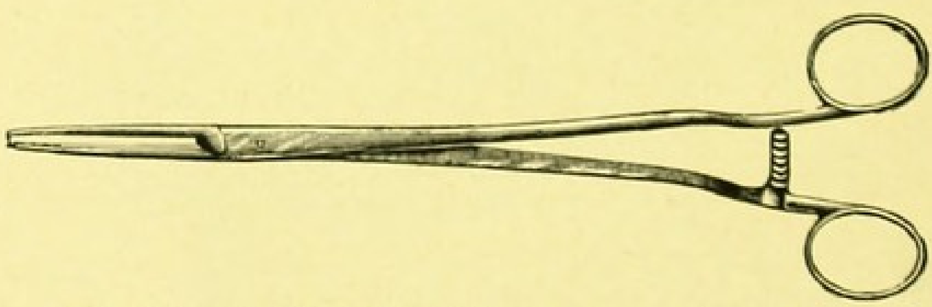

FIG. 236.—MILNE MURRAY'S VULSELLA (STRAIGHT.)

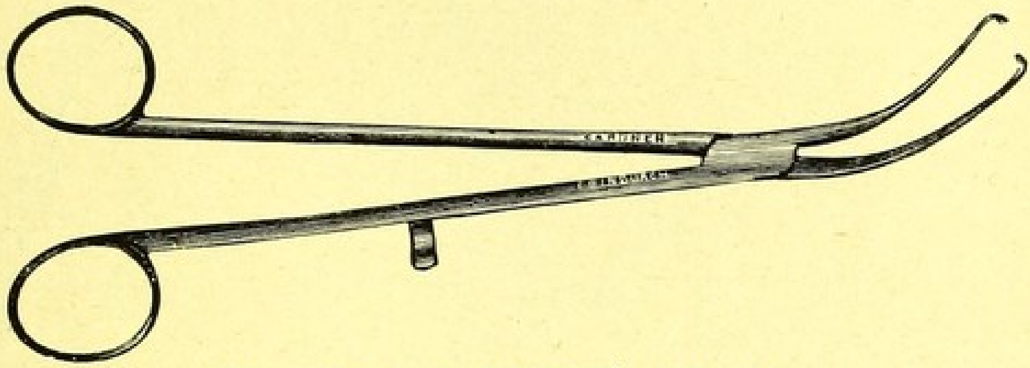

FIG. 237.—A. R. SIMPSON'S VULSELLA.

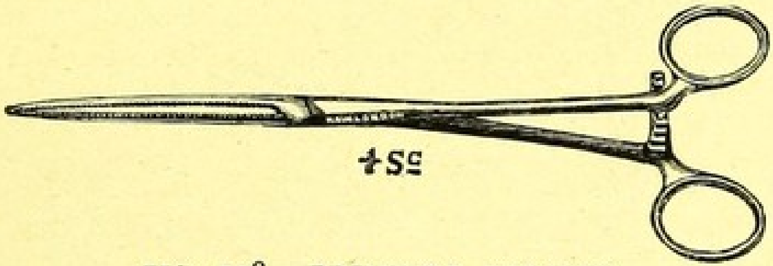

FIG. 238.—PRESSURE FORCEPS.

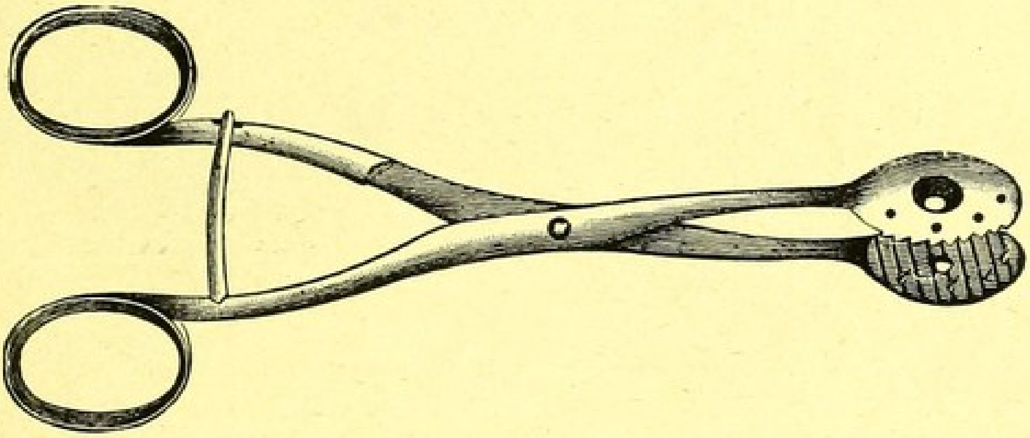

FIG. 239.—NELATON'S CYST FORCEPS.

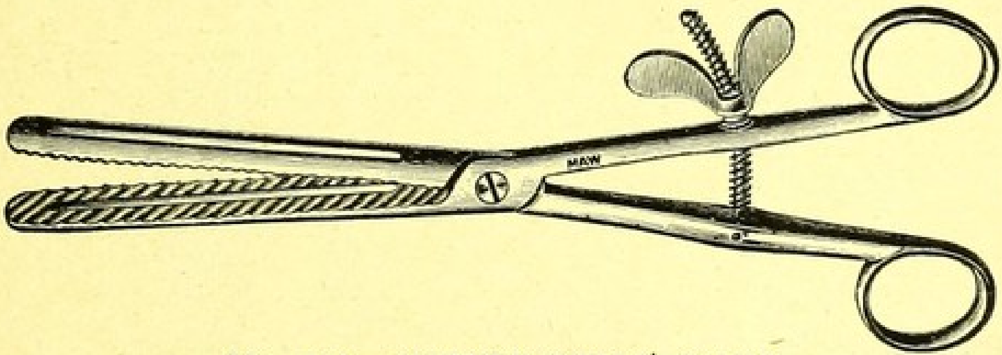

FIG. 240.—SPENCER WELLS' CLAMP.

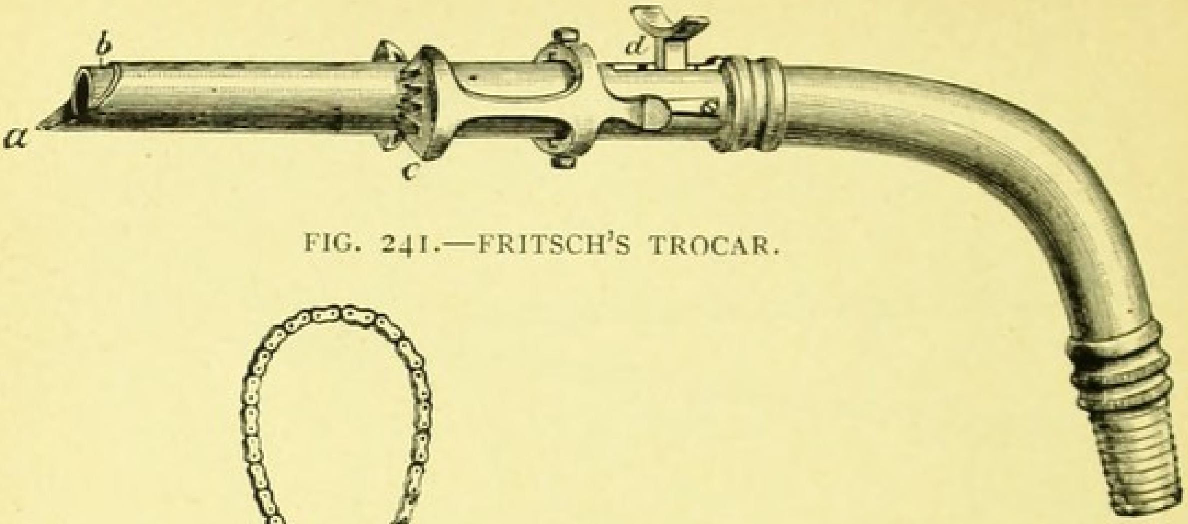

FIG. 241.—FRITSCH'S TROCAR.

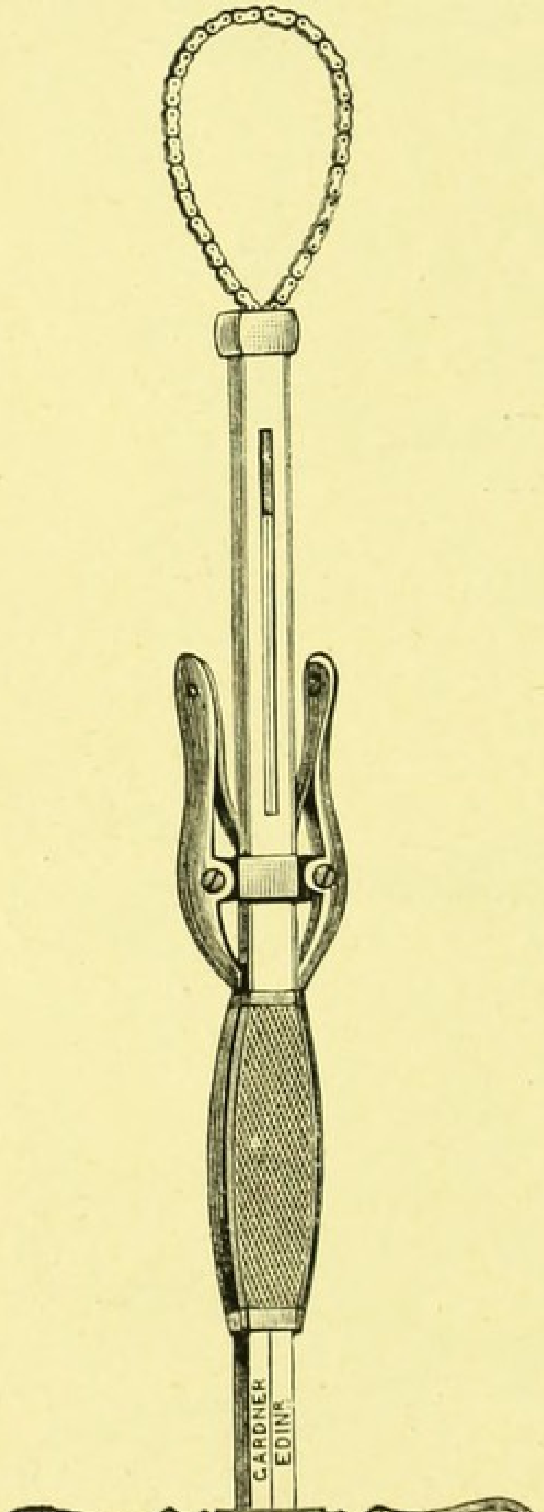

FIG. 242.—CHASSAIGNAC'S CHAIN ECRASEUR.

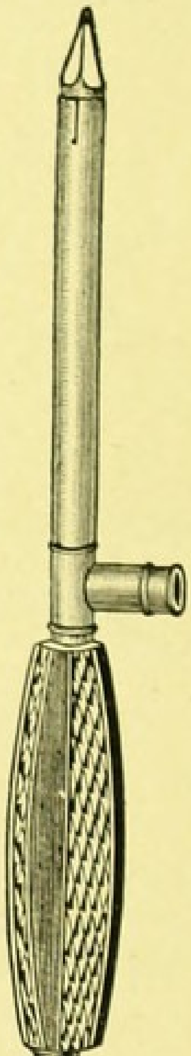

FIG. 243.—SPENCER WELLS' SYPHON TROCAR.

FIG. 244.—MARTIN'S UTERINE CURETTE.

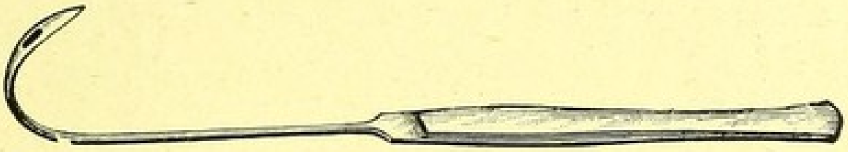

FIG. 245.—CROOM'S PEDICLE NEEDLE.

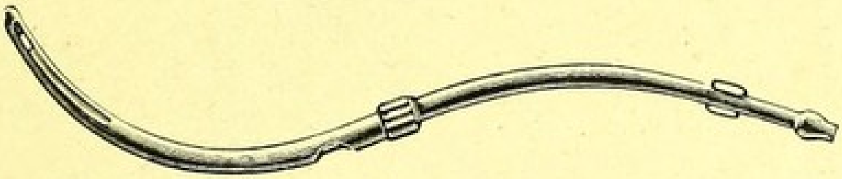

FIG. 246.—BOZEMAN'S UTERINE PIPE.

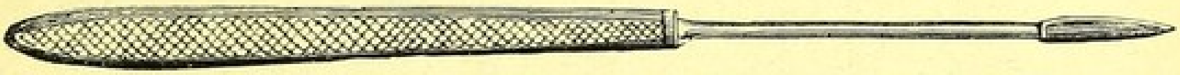

FIG. 247.—VAGINAL FISTULA KNIFE (STRAIGHT).

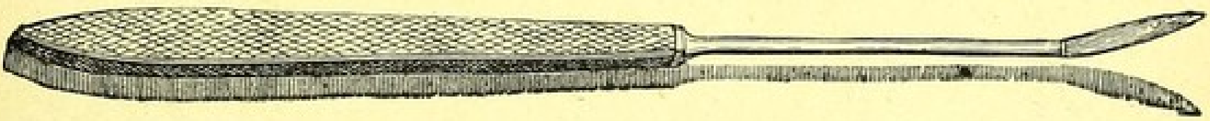

FIG. 248.—VAGINAL FISTULA KNIFE (CURVED).

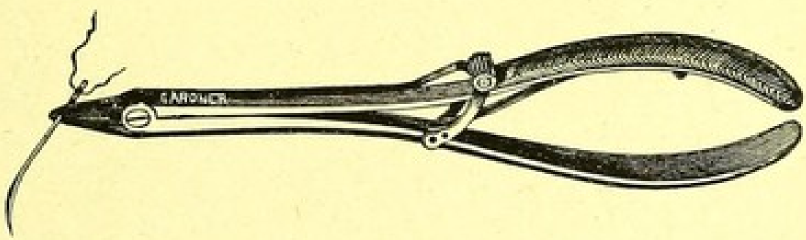

FIG. 249.—NEEDLE HOLDER.

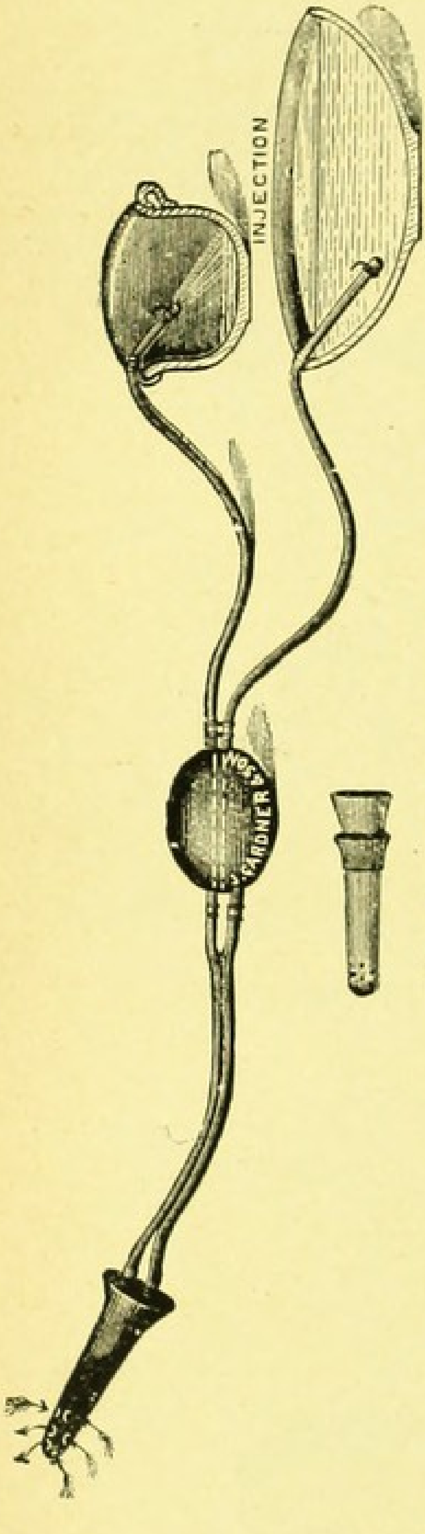

FIG. 250.—VAGINAL DOUCHE.

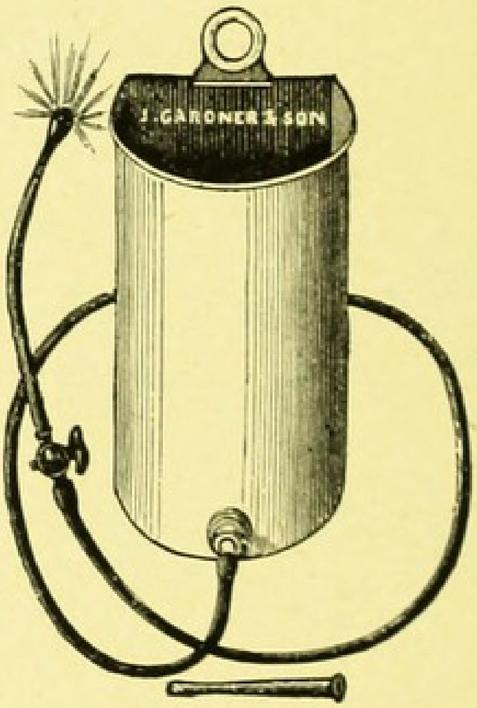

FIG. 251.—VAGINAL DOUCHE.

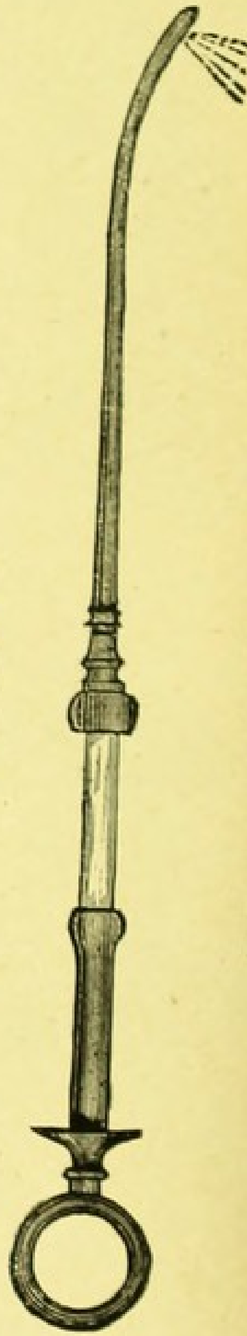

FIG. 252.—INTRA-UTERINE SYRINGE.

CHAPTER XXVIII.

AURAL, NASAL, AND OPHTHALMIC CASES.

THE general principles of nursing these cases are very much the same as for ordinary surgical cases. For details the reader is referred to special works dealing with these subjects.

SOME AURAL, NASAL, AND OPHTHALMIC INSTRUMENTS.

AURAL INSTRUMENTS.—In connection with the diagnosis and treatment of affections of the ear, the following are the principal appliances in ordinary use:

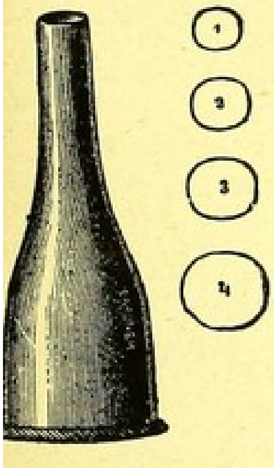

FIG. 253.

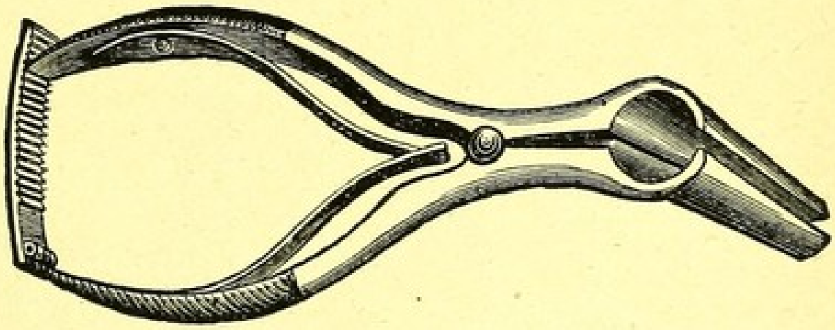

FIG. 254.

Aural Specula (Fig. 253) are short conical tubes of different sizes, some being made of metal, others of

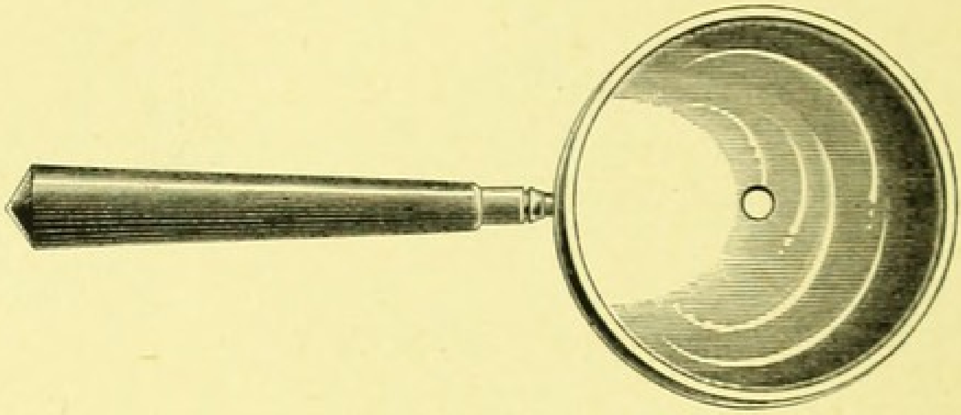

FIG. 255.

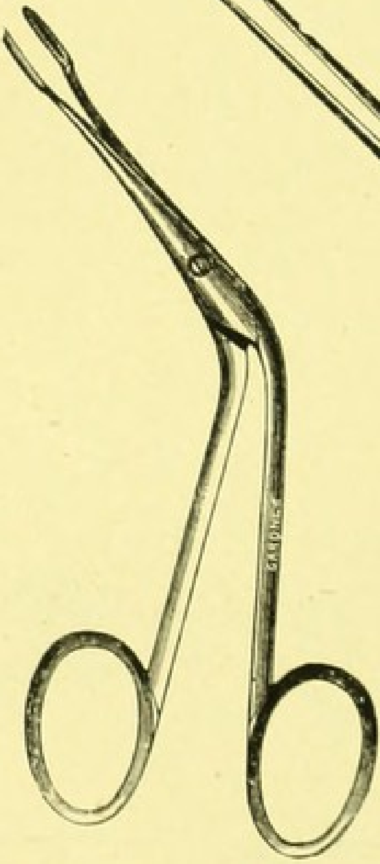

FIG. 256.

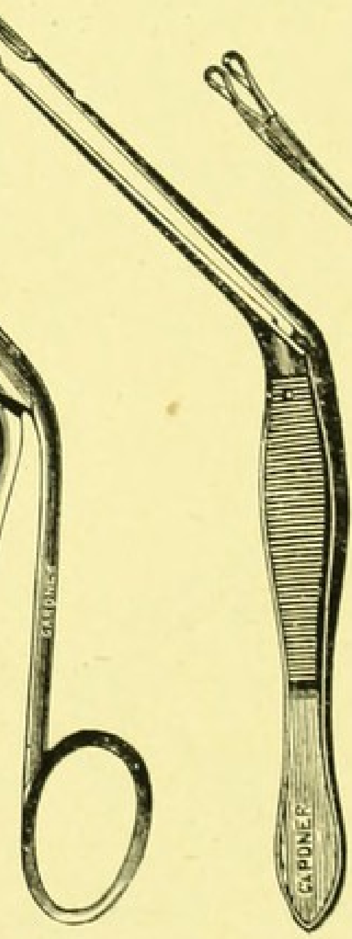

FIG. 257.

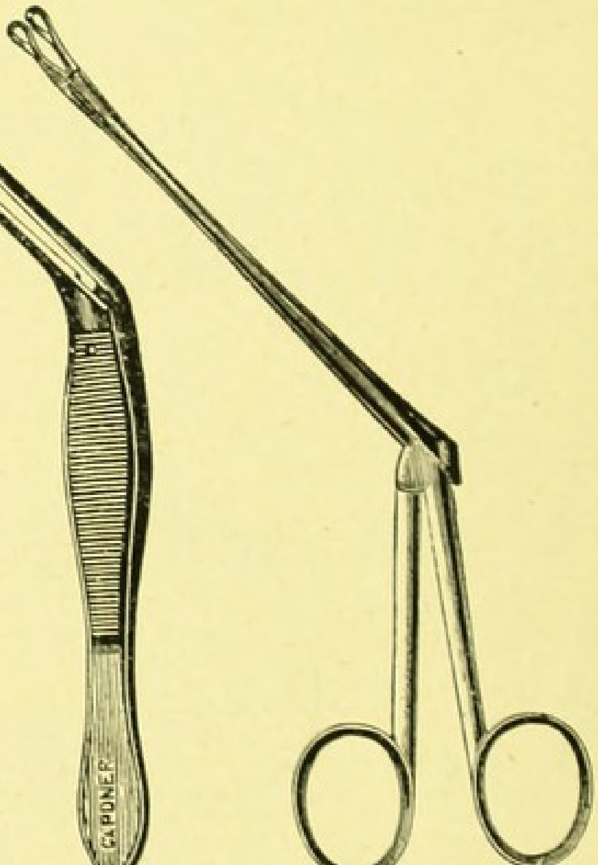

FIG. 258.

vulcanite. They are employed to examine the outer ear and the tympanic membrane, and to facilitate this some are mounted on handles and have separable blades, whereby the canal may be dilated (Fig. 254).

They may be used with direct sunlight, but usually some form of mirror or *reflector* (Fig. 255) is employed to illuminate the parts. The laryngoscopic reflector may be

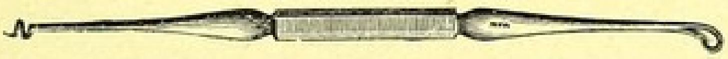

FIG. 259.

employed, but one with a shorter focal distance is preferable.

Aural Forceps (Figs. 256-258) are used to remove foreign bodies from the ear, and for other purposes. They should have an obtuse angle on their blades, so that the observer's hand will be out of the line of vision.

Other contrivances have been introduced with which to remove foreign bodies from the ear, such as hooks, scoops, screws, etc. (Fig. 259), but none of these should be used

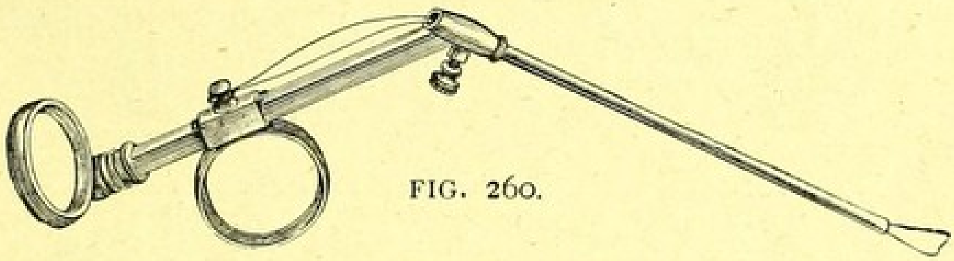

FIG. 260.

until a free and full stream of lotion has failed to dislodge the body.

For removing small tumours and polypi, *Thomas's Snare* (Fig. 260) is very suitable.

The *Eustachian Catheter* (Fig. 261) is used in conjunction with *Politzer's Bag* (Figs. 264, 265), and with the *Otoscope* (Fig. 262).

An important part of the treatment of many ear conditions consists in systematic syringing. For this an ordinary brass syringe (Fig. 263) may be used, the ear being drawn well upwards and backwards, and the nozzle placed against the roof of the canal.

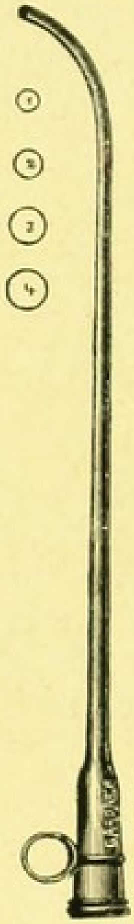

FIG. 261.

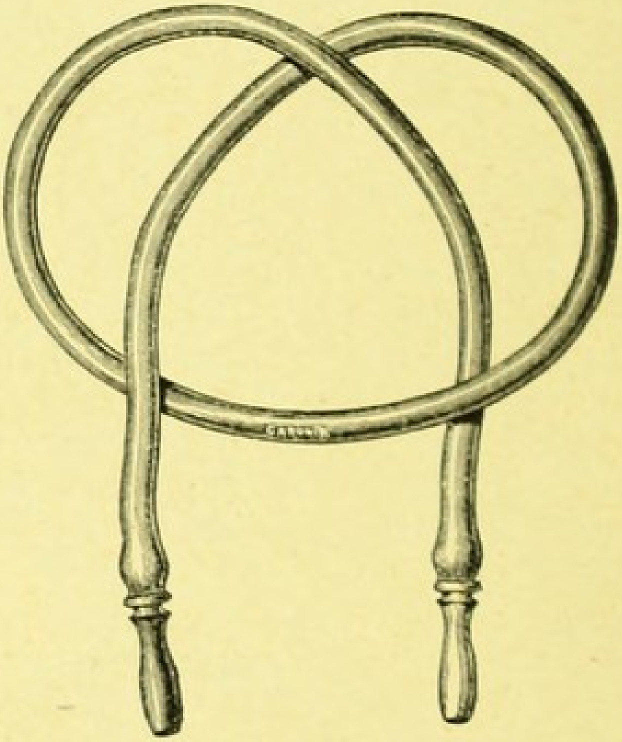

FIG. 262.

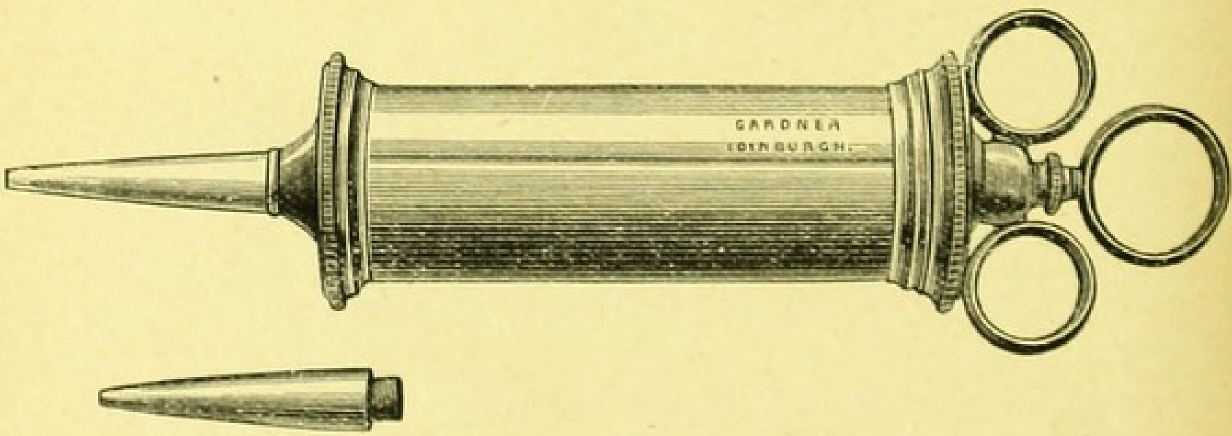

FIG. 263.

Gruber's Knives (Figs. 266, 267) are for cutting the tympanic membrane.

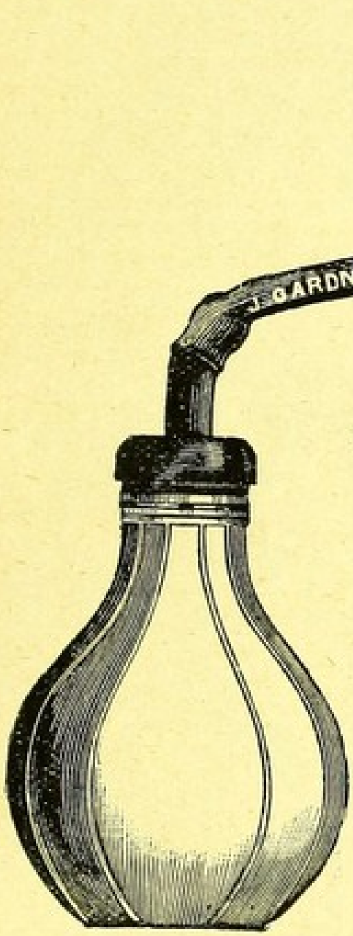

FIG. 264.

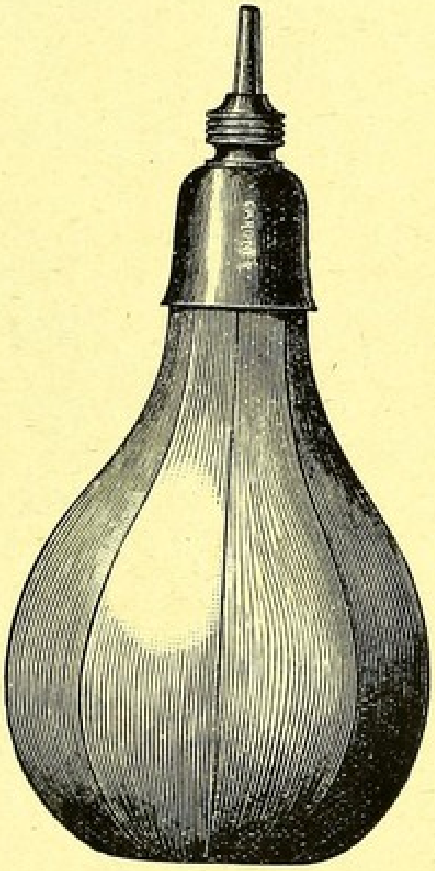

FIG. 265.

FIG. 266.

FIG. 267.

NASAL INSTRUMENTS.—*Specula*.—Here again a great many forms of instruments for diagnostic examination have been introduced—*e.g.*, *Frankel's Nasal Speculum* (Fig. 268), that by *Lennox Browne* (Fig. 270), the *bivalve* pattern (Fig. 269), and many others.

For the examination of the posterior nares a special mirror—the *Posterior Rhinoscope* (Fig. 271)—is used.

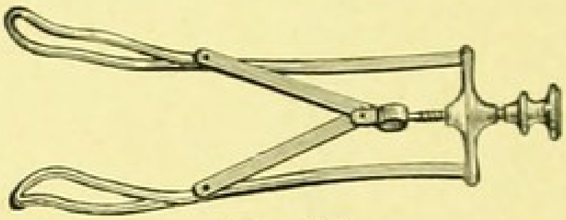

FIG. 268.

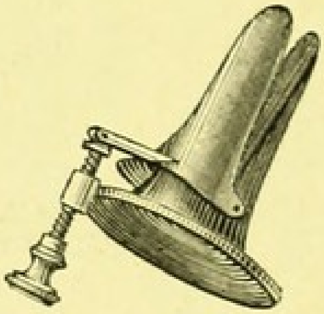

FIG. 269.

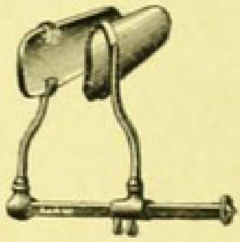

FIG. 270.

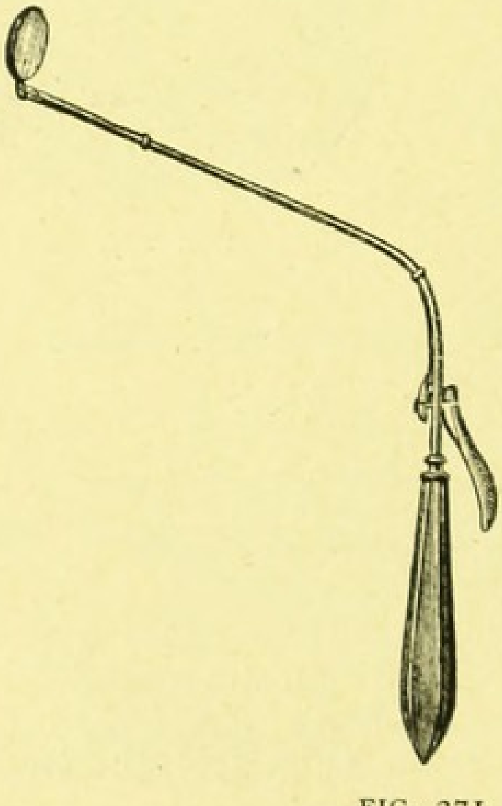

FIG. 271.

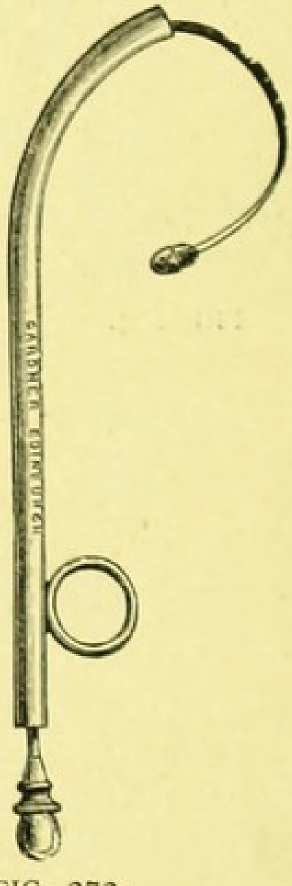

FIG. 272.

Belloc's Sound (Fig. 272) is used in plugging the posterior nares. It consists of a hollow curved stem containing a piece of watch-spring. To the latter a thread is fixed, and the sound being passed along the anterior meatus of the nose, the spring is released by a screw at the end, and it curls into the mouth, carrying the thread with it. The thread is seized and the sound withdrawn. A suitable plug is now attached to the string, pulled into position, and retained there.

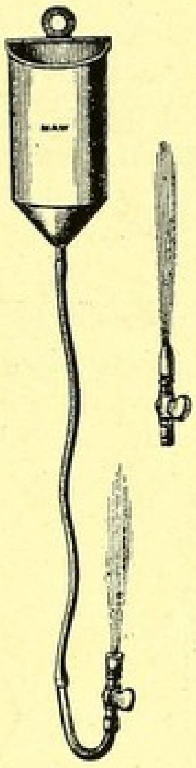

FIG. 273.

Polypus Forceps are strong-bladed forceps, of the same pattern as dressing-forceps, but the blades are longer, and serrated throughout on their inner aspect. Various forms of snare and écraseur are employed for the same purpose as the forceps.

A simple and efficient form of *Nasal Douche* is shown in Fig. 273.

Eye Instruments.—To describe the numberless appliances used in connection with ophthalmology is beyond the purpose of the present work. Suffice it to mention one or two of those most frequently employed.

The *Spring Speculum*, with a screw-stop, is most generally useful (Fig. 274). Desmarre's *Retractors* (Fig. 275) are

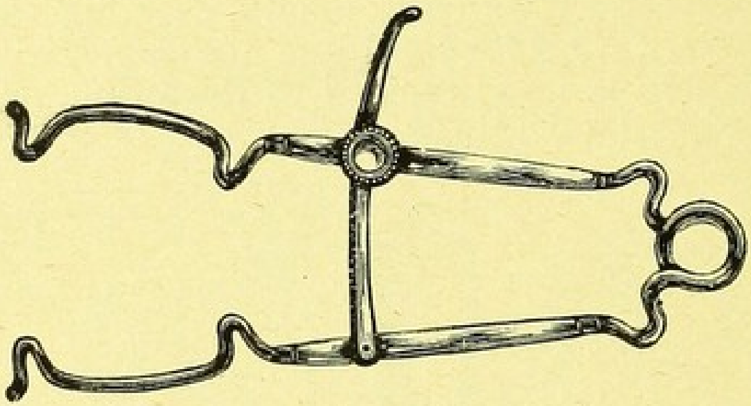

FIG. 274.

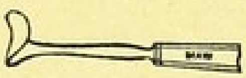

FIG. 275.

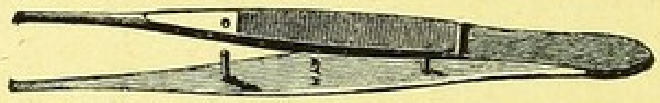

FIG. 276.

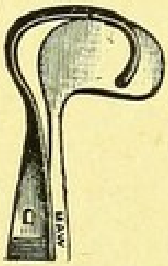

FIG. 277.

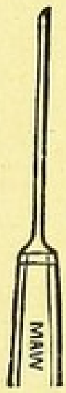

FIG. 278.

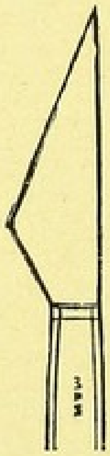

FIG. 279.

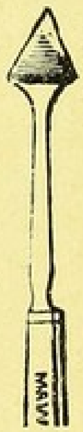

FIG. 280.

much used. The uses of *Fixation Forceps* (Fig. 276), *Capsular Forceps, Iris Forceps*, and *Entropium Forceps* (Fig. 277), are sufficiently indicated by their names.

Of *Knives* we have the following: *Canaliculus Knife* (Fig. 278), *Cataract Knife* (Fig. 279), *Linear Cataract*, or

Von Graefe's Knife (Fig. 70), and *Iridectomy Knife* (Fig. 280).

The *Scissors* used in different operations are suitably shaped, *e.g.*, *Excision Scissors* (Fig. 282), *Strabismus Scissors*,

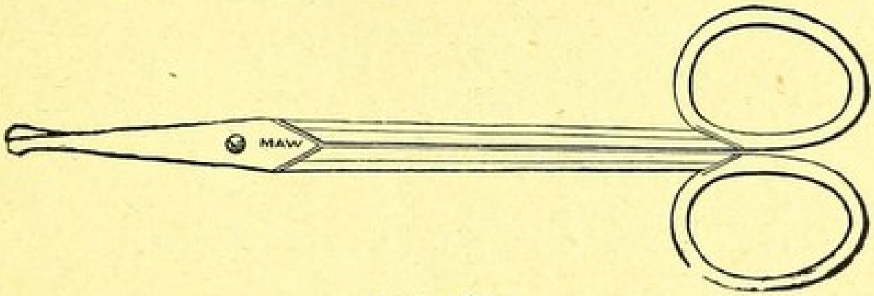

FIG. 282.

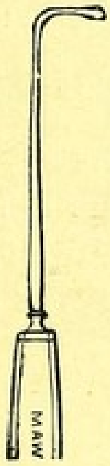

FIG. 283.

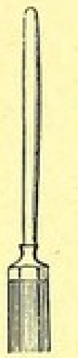

FIG. 284.

and *Iris Scissors*. The *Strabismus Hook* (Fig. 283) is used to catch up the tendon to be divided in operating for squint. The *Corneal Spud* (Fig. 284) is for removing foreign bodies from the cornea.

NOTE.—For a detailed description of Eye Instruments, see 'Ophthalmic Nursing,' by Sydney Stephenson, M.B., F.R.C.S.E., etc. (London: The Scientific Press, Limited.)

SECTION III.

THE USE OF REST IN SURGERY

CHAPTER XXIX.

EXTENSION APPARATUS.

'THE first and great requisite for the restoration of injured parts is rest.' This was the dictum of John Hunter, and surgeons have all come to acknowledge its wisdom, and to act upon it. Periodic rest is a physiological condition, and at regularly recurring intervals the tissues of the body are recuperated by the cessation of their respective functions. As used in surgery, the word 'rest' means something more than simply a state of physical repose, and implies the absolute abrogation of function for the time being in the tissue or organ. For instance, to give surgical rest to a joint, it must be rendered quite immovable; to rest a muscle, the joints on which it acts must be made rigid; to rest the eye, light must be entirely excluded from it; or to rest the stomach and small intestines, all nutriment must be administered through other channels than that of the mouth.

The great importance of rest in the treatment of surgical affections, especially such common conditions as tubercular disease of joints, diseases of the spinal column, and fractured bones, was insisted upon by John Hilton in his classical work on 'Rest and Pain,' and the teaching of that great surgeon dominates the practice of to-day.

Very various are the methods employed to this end—

bandages, soft or rigid, splints of wood, poroplastic, gutta-percha, etc., the application of weights to prevent the movement of limbs, and so on. The most careful watching is necessary when these different appliances are being used, because in spite of the most cunningly devised apparatus patients often continue to move injured and diseased parts, and so time is wasted and labour lost. Children are especially ingenious in defeating attempts made to fix the limbs and spinal column.

EXTENSION APPARATUS.—*Uses.*—Extension may be applied to the lower limb in almost any condition in which it is necessary to keep that part at rest. Most frequently it is used in tubercular disease of the hip-joint, but very often also in the same condition of the knee. In such affections also as abscess of the thigh, psoas abscess, spinal disease or injury, and so on, this means of keeping the limb at rest is found very efficient. Many surgeons use extension, with or without splints, in the treatment of fractures of the femur and bones of the leg. It is especially useful in children, in whom the long splint, which was the older method, is so apt to get wet and soiled. The necessary cleaning of the child interferes very much with the older apparatus, and so prevents the maintenance of that absolute rest so necessary in the treatment of such cases.

Materials Required:

1. A quantity of strong moleskin or holland adhesive plaster.
2. A quantity of strong broad tape.
3. A number of boracic lint bandages.
4. An ordinary domette bandage.
5. Scissors.
6. Strong needle and thread; and tape measure.
7. Safety-pins.
8. A square piece of wood with a hole in the middle, and leather strap with buckle fixed to each side.
9. Apparatus to fix on foot of bed.
10. Weights attached to rope.
11. Blocks to raise foot of bed.
12. Cage.
13. Means of heating plaster.

Method of Preparing the Materials.—The Plaster.—Perhaps the best way to begin the preparation of the plaster is by making a paper shape of it first, and then cutting the plaster from this pattern. Measure from the middle of the thigh to the sole of the foot. This is the length of the plaster. The breadth is about half the circumference of the limb, which is, of course, greater above than below, and the plaster must therefore be shaped accordingly. At the level of the upper end of the malleolus or ankle-bone the plaster should be cut (or folded) so as just to equal the width of the tape used (Fig. 285, *a*). At the upper end divide the plaster longitudinally into three tails, each about $2\frac{1}{2}$ to 3 inches long (*b*). All along the edge of the plaster make a series of short cuts with the scissors (*c*). These permit of closer apposition of the plaster with the

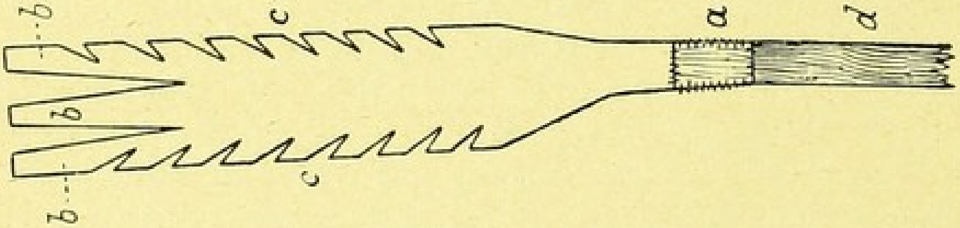

FIG. 285.

leg. Two such pieces of plaster are necessary, one for each side of the limb.

The Tape.—This should be strong twilled tape (*d*), about 1 inch wide and $1\frac{1}{2}$ foot long, and is firmly sewed to the narrow lower end of the plaster, the two being attached for about an inch of their length.

The Boracic Bandage should be long enough to cover in the whole limb from the toes up to the middle of the thigh, and of the appropriate breadth of the limb to which it is to be applied.

Method of Applying the Extension Apparatus.—The plaster may be applied next the skin of the limb, but as this is rather uncomfortable for the patient, and causes considerable pain by pulling on the hairs when being removed, it is better to apply it outside of the boracic lint bandage. We shall, however, describe both methods.

1. *Next the Skin.*—The limb having been thoroughly washed with soap and water, the hairs should be shaved off, to avoid unnecessary pain when the plaster comes to be removed. Apply a few turns of boracic lint round the foot and ankle, to prevent pressure of the tapes on the malleoli. Next heat the plaster by applying its non-adhesive surface to the side of a vessel containing hot water, or by other means. In warm weather the heat of the body is quite sufficient. Apply the plaster to the surface of the skin so that it adheres evenly, from the upper edge of the patella or knee-pan to the upper level of the malleoli. By folding the nicks you have made along the edge you will get very accurate apposition. The three tails at the upper end are not to adhere to the skin. Now, apply a domette bandage from the toes upwards as far as the plaster goes, leaving out the tapes at the lower end. When you reach the three tails at the upper end, fold down the middle one so that it lies on the bandage, bring round another turn, covering in this tail, then fold down the remaining two, and cover them with another turn of bandage. By this means the plaster is not only adherent to the limb, but also to the bandage, which increases its security. Lastly, fix the bandage by a safety-pin inserted in the long axis of the bandage.

2. *On the Top of a Bandage.*—The advantages of this method are that the apparatus is more comfortable for the patient; there is no pain in removing it, and the limb is left clean and comfortable. It is advisable to use boracic lint bandages next the skin, because they are non-irritating, and at the same time are toxic to fleas, etc., which is often important. It is essential that the bandage be carefully and accurately applied, else the plaster is apt to drag it down when the weights are attached. The plaster is applied just as in the last case, leaving the tails free above, and avoiding the malleoli below, and covered over by a domette bandage with the same precautions, and dealing with the 'tails' in the same way as before. The plaster is allowed to get fixed for a few hours before adding the weights.

Apparatus to Fix on Foot of Bed.—Perhaps the most convenient form of apparatus for this purpose consists of a framework which is hooked on to the foot of the bed. Through the flat board which forms the top of this a short piece of wood is passed. This is surmounted by a pulley, and can be raised or lowered to suit the height of the bed to which it is applied. The rope is passed through this pulley, and then through the hole in the centre of the small square piece of wood to which the leather straps are attached. The tape on the plaster is then fixed to these straps, and the appropriate weights attached to the rope. A simpler apparatus may easily be extemporised by lashing two strong uprights to the foot of the bed or crib, and

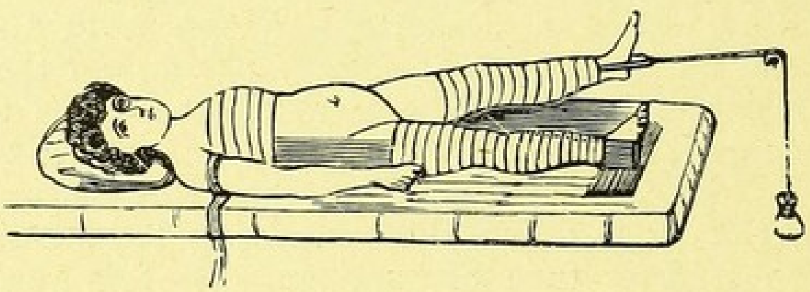

FIG. 286.—EXTENSION APPLIED IN THE AXIS OF THE DISEASED LIMB.

using an empty cotton-reel suspended between them on a stout piece of wire or wood as a pulley.

The Weights.—These may be either ordinary weights used in commerce, or masses of lead or iron, each weighing ½ lb. to 1 lb., and with a hole in the middle for attaching them to the rope. Bags of sand or leaden shot of known weight may be used when others are not available. The plaster should always be allowed to fix for an hour or two before the weights are attached, otherwise it is very apt to be dragged off. A light weight should be put on at first, and gradually increased, as by this means the muscles are not unduly fatigued at once. For a child of six years begin with 2 lb., and go up to about 3 lb. or 4 lb.; for an adult begin with 4 lb. or 5 lb., and go up to 8 lb. or 10 lb.

Raise the Foot of the Bed.—The object of this is to use the weight of the patient's body as a counter-extending force, so that the weights attached to the limbs will not tend to pull the patient to the foot of the bed rather than to pull on the limb, and so retain the diseased joint at rest. In hospital suitable blocks are always available for this purpose, but in private one or two bricks or blocks of wood will serve equally well.

Cage.—After all is fixed a cage should be put on *over the rope and tapes* to protect them from the pressure of the bed-clothes, which of course would prevent the proper traction of the weights.

After-Treatment.—As a rule, the comfort resulting to the patient from the apparatus makes him lie quiet, as only when he does so is he free from pain. In the early stages of joint disease, however, when the patient has not much pain, he may be restless, and attempt to move about. A long splint, applied from the axilla to beyond the foot on the *sound* side, will usually keep a child at rest, or if necessary he may be tied down by means of a sheet passed over his chest and secured to the sides of the bed. In all cases in which the leg is bandaged up, the toes should be left exposed, and should be examined periodically to make sure that no part of the apparatus is interfering with the circulation of the limb. Should the toes get cold or blue, or show any other evidence of obstruction to the circulation, the cause must be sought for, found, and rectified at once.

CHAPTER XXX.

PLASTER AND STARCH CASES.

PLASTER OF PARIS CASE.—*Uses.*—In chronic diseases of joints—*e.g.*, tubercular disease or chronic synovitis—rest of the diseased part is often obtained by enclosing the limb in a case of plaster of Paris, either with or without a Scott's dressing. In the treatment of fractures of the bones of the leg also a plaster case is often found useful, as it enables the patient to be up and about, with the aid of crutches, much earlier than would be possible with any less rigid form of apparatus. In fractures, however, it should not be applied till all the swelling, which is usually present at first, has subsided, otherwise when the limb has resumed its normal size the case becomes too slack, and no longer controls the movements of the fractured ends of bone, the result being an ununited fracture. After the excision of a joint, more especially the knee, the limb is often put up in a plaster case, so applied as to leave a 'window' through which the wound may be dressed, but sufficiently rigid to prevent any movement between the opposed ends of the bones. In disease of the hip-joint the case should be applied to the whole length of the leg, and continued round the pelvis, to secure immobility of the joint. As a matter of experience, however, it is found that unless combined with some form of rigid splint these turns round the pelvis are of little advantage.

Materials Required:

1. Muslin bandages.
2. Plaster of Paris (best quality).
3. Dextrine.

4. Boracic lint bandages.
5. Scissors.
6. Pail of tepid water.
7. Melted paraffin.
8. One or two old blankets or sheets.

Method of Preparing Materials.—Bandages.—These are made of coarse muslin, and must not exceed 3 yards in length. If longer, the water will not percolate all through, and much of the bandage will be wasted. They should be from $3\frac{1}{2}$ to 4 inches wide, according to the size of the limb to which they are to be applied, and when charged they must be rolled very loosely. Unless the plaster of Paris be of the very best quality, it will not set well, and the rigidity of the splint will be diminished. Before it is used the plaster must be well dried in the oven for some hours. As this is important, in hospitals or where much plaster is used, a supply should be constantly kept preparing in the oven, so that there may be no delay when it is needed.

The case is rendered more rigid and fewer bandages are required if one part of dextrine be added to every two parts of plaster. These are thoroughly mixed and prepared otherwise in the same way as plain plaster.

To *charge* the bandages, spread a layer of brown paper on a large flat table, and unroll part of a bandage on it. Take from a basin a handful of the prepared plaster, and with the palm of the hand rub it thoroughly and equally into the muslin, so that all the meshes get filled up with the powder. Roll up *very loosely* the part charged, and proceed to the next part, and so on, till the whole bandage is impregnated with plaster. The reason for rolling up the bandage loosely is that the water may easily and rapidly percolate to the very centre, and to every part of the bandage.

To *apply* the bandages, spread an old sheet on the floor, and another on the bed or couch on which the patient lies. Wrap a third round yourself to avoid soiling with the drippings from the wet bandages. Wash the limb with soap, water, and turpentine. Apply a boracic lint bandage neatly and evenly, avoiding crossing and creases as much as possible, from the toes up beyond the part to be encased. Carefully pad any prominences, *e.g.*, malleoli, condyles, etc., with nests of corrosive wool or boracic lint. Now count out the number of bandages you expect to require, and lay them apart. You are apt to lose count if you simply pick them out of the stock-box as you proceed. Eight or nine plies, *i.e.*, about a dozen bandages, are required for an adult; five or six plies, or about nine bandages, for a child. Next, put one bandage into the pail of tepid water with which you have provided yourself. How do you know when it has been long enough in the water to become thoroughly saturated? When bubbles of air cease rising to the surface the bandage is saturated. Then take it out, and after squeezing from it most of the water begin to apply it to the limb, but before doing so put another bandage into the pail, so that it may be getting saturated while you are applying the first. The bandage is put on in the usual way according to the part you are covering in. When you have completed the application, let the limb lie exposed for about half an hour or an hour to enable the plaster to set. If you cover up the limb before the plaster has set, the blankets prevent the evaporation of the moisture, and the result is unsatisfactory. You should not set the patient down beside a fire to dry the case, as this only bakes the outer layers, and prevents the moisture escaping from the deeper ones; thus the bandage remains soft, and when weight is put upon it it bends. In children it is desirable to render an application of this sort waterproof, and this can be done by painting over it a layer of melted paraffin.

After-Treatment.—Keep a look-out on the toes to guard against vascular interference. The patient often complains that the upper margin of the case is uncomfortable. If so, you may snip it all round with scissors and turn down the edges a little.

SAYRE'S JACKET.—*Uses.*—This application is used most largely in curvature of the spine due to disease of the vertebræ. It may be augmented by applying extension either to the lower limbs with the foot of the bed raised, or to the upper part of the spine from the axilla, in which case the head of the bed will be raised. When the disease is in the cervical region extension may be applied to the head, and when in the middle of the back it may be applied both to the head and legs.

Caution!—It is of the very first importance that the nurse should understand the rational treatment of disease of the spinal column, especially when it is situated in the cervical region. The great danger is that the ligaments which protect the spinal cord from pressure by the bones should become softened and useless, and that during some movement of the patient's head or body the diseased bones will become displaced and pressed on the cord. In the lower part of the canal this would cause paralysis, but in the upper cervical region instant death would be the result. This has not infrequently been the result of the nurse moving the patient against the doctor's orders.

Materials Required.—*Vide* plaster case (p. 222).

1 to 8. Same as for plaster case.
9. A quantity of absorbent wool.
10. Vest made of boracic lint.
11. Tripod for suspending patient.

The bandages should be broader than for an ordinary plaster case for a limb. The vest is not made to fit very closely, and should extend a few inches beyond the plaster. It is in such cases that the toxic action of boracic acid on fleas and other body vermin is most valuable, because the case is usually left on for a considerable time—six or eight weeks.

Method of Applying Jacket.—Having thoroughly washed the skin with soap and water, all bony prominences, such as the vertebral spines and iliac crests, are carefully protected with pads of antiseptic wool or of boracic lint. 'If the patient be a female, and especially if she be developing at the time, it will be necessary to apply a pad under the shirt over each breast before the plaster bandage is put on. These pads should be removed just before the plaster sets, and at the same time pressure should be made over the sternum for the purpose of indenting the central portion of the plaster jacket, and of thus giving form to the body and removing pressure from the breasts' (Sayre). Sayre uses in addition what he calls a 'dinner pad.' This is a pad put over the region of the stomach, and removed just as the plaster is setting. The space thus left permits

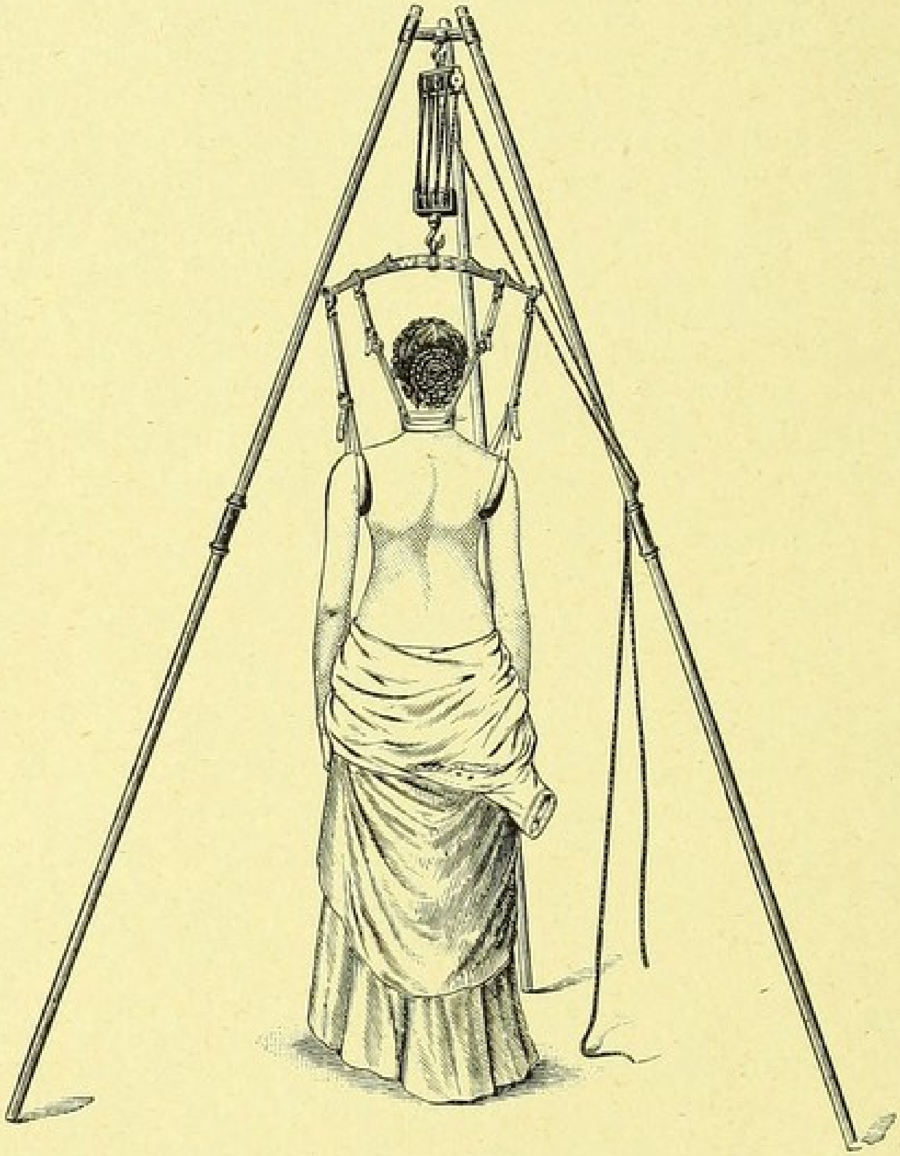

FIG. 287.

of the dilatation of the stomach after food. The suspension apparatus is used so that the spinal column may be rendered as straight as possible when the jacket is being applied, in the hope that this position will be maintained by the rigid apparatus. A child may be held up by the arms, but in an adult this is obviously impossible. The apparatus (Fig. 287) consists of a tripod, from the centre of which hangs 'a curved iron cross beam, to which is attached an adjustable head and chin collar with straps, and also two axillary bands.' The patient is raised by the head and axilla till the toes just touch the ground, and in this position the jacket is applied. The bandages, which are prepared and applied in exactly the same way as those used for a plaster case, only differ in being somewhat broader.

After applying a plaster jacket or case, some difficulty may be experienced in removing the plaster from the hands and nails. This will be obviated by adding a handful of sugar to the water, plaster of Paris being soluble in a saccharine solution.

To Remove a Plaster Case or Jacket.—This requires to be done with the greatest possible care, as any sudden or excessive movement, such as might result from roughly trying to remove the plaster, may undo all the good the application has accomplished, *e.g.*, as in excision of the knee or fracture of the leg. Various methods have been suggested for removing the plaster without force, such as dissolving it with strong hydrochloric acid poured into a narrow groove, cutting it through with bone pliers and a strong knife, with a short, strong saw, or with specially constructed pliers. Whatever instrument is adopted it must be used without force. The best method is to place the patient in a tepid bath till the case is completely saturated, when it comes off quite easily.

STARCH BANDAGES.—*Uses.*—This appliance is used to fix on light splints, such as pasteboard or poroplastic, where the main object is to fix the joint rather than to give it support. Starch is rarely used alone as a splint, because it is not sufficiently strong and takes a long time to set—about twelve hours. Its great advantage over plaster of Paris is its lightness.

Materials Required:

1. A quantity of ordinary household starch (Glenfield).
2. Bowl and spoon.

3. Kettle of boiling water.
4. Jug of cold water.
5. Supply of ordinary cotton bandages.
6. Boracic bandages.
7. Pasteboard, poroplastic, or other splints.
8. Scissors.

Method of Preparing the Material.—Starch.—First break down about 6 ounces of starch with cold water till it is of the consistence of a thick paste, and white in colour, then add boiling water, and stir thoroughly till the starch assumes a blue tint, and becomes so fluid that it pours freely from the spoon. As it cools it sets into a jelly, and it may either be used in the state of jelly or in its fluid state before cooling. The addition of one part of powdered boracic acid to nine parts of starch is an advantage.

Splint.—Cut the poroplastic to the required length and breadth, and then having moistened it in hot water, carefully mould it to the exact shape of the part after all the necessary padding has been applied. The writer has found that one or two plasterer's laths incorporated in the starch bandage make a very efficient light splint.

Mode of Applying the Materials.—The limb, having been thoroughly washed with soap and water, is covered from the extremity towards the trunk with a boracic lint bandage of appropriate size. All bony prominences and other parts where it is undesirable to have pressure are carefully padded. The splint, having been accurately moulded to the shape of the limb thus protected, is fixed by means of an ordinary cotton bandage. Over this is smeared a coating of the starch, which is then rubbed thoroughly into the bandage. Another layer of bandage is applied over this, and covered with starch in the same way, and so on till three or four layers have been applied. The starch takes about twelve hours to dry thoroughly, and until it has done so no weight may be borne by it, as it will yield and be useless. Placing the part between hot bottles or in front of a fire will hasten the drying process. The appliance may be rendered waterproof by a coating of melted paraffin.

CHAPTER XXXI.

APPLIANCES FOR JOINT AFFECTIONS.

SCOTT'S DRESSING.—*Uses.*—This application is used in the treatment of chronic joint diseases, especially those of a tubercular nature. It combines the advantages of the local application of mercury and of pressure, both acting in the direction of promoting absorption of the morbid products. At the same time it gives a certain amount of fixity to the joint, so securing rest, but this must be augmented by the use of some form of splint if it be deemed an important part of the treatment.

Materials Required:

1. A quantity of plain white lint.
2. A quantity of mercurial ointment (*Unguentum hydrargyri compositum*).
3. A quantity of strong moleskin plaster.
4. Domette bandage.
5. Spatula.
6. Scissors.
7. Safety-pins.
8. Sheet of brown paper.
9. Means of heating the plaster.

Method of Preparing the Materials.—Cut a piece of lint to extend all round the affected joint, and for an inch or two above and below it, and shaped so that when applied it will lie smoothly without overlapping. With the spatula spread on the lint a fairly thick and even layer of the ointment. By laying the lint on a sheet of brown paper you will avoid soiling the table while covering the edges. It is immaterial on which side of the lint the ointment is spread; as a rule, it can be applied more evenly on the plain side. Next cut about twelve or fourteen strips of adhesive plaster about 1 inch wide, and long enough to extend a little more than once round the limb at its widest part, also one piece of the same breadth, but long enough to go twice round the limb at the upper level of the lint.

Method of Applying the Dressing.—Having washed the whole limb with soap and water and turpentine, examine it carefully to see that there are no scratches or open sores, as by these the ointment may be absorbed too rapidly, and cause symptoms of mercurial poisoning. Any scratch should be covered with some wool and friar's balsam or collodion. Of course, a joint in which sinuses exist is not suitable for treatment by Scott's dressing. The limb is now placed in the position which it is to retain while the dressing is on, and the lint spread over the part so that it lies as smoothly as possible. Heat a strip of the plaster strapping by placing its non-adhesive side against a jar containing very hot water, or by some other means; pass it round the joint so that the two ends cross in the middle of the leg in front. The first strip is at the lowest level of the lint, and each succeeding layer overlaps two-thirds of its predecessor, so that the pressure will be directed from below upwards. All the crossings should be kept in the middle line, and the ends should go about 1½ inches beyond the point of crossing, all being cut to the same length. When the upper limit of the lint is reached, the long strip of plaster which has been prepared is wound round the limb so as to cover in the loose ends at the top, and so to complete the dressing and give it a neat appearance. The whole dressing is now covered by a divergent spica bandage. If necessary, an appropriate splint may be applied over all.

After-Treatment.—Keep a careful look-out on the toes to guard against undue pressure and interference with the venous return. Should the patient complain of the dressing being too tight, the edges may be snipped with scissors to relieve it a little. After a fortnight or so the whole dressing will usually be found to have become quite slack and untidy. This is partly due to the movement of the limb, but mainly to the decrease of the swelling on account of the absorption of the diseased material. It should then be removed, the joint washed, and if necessary the dressing reapplied.

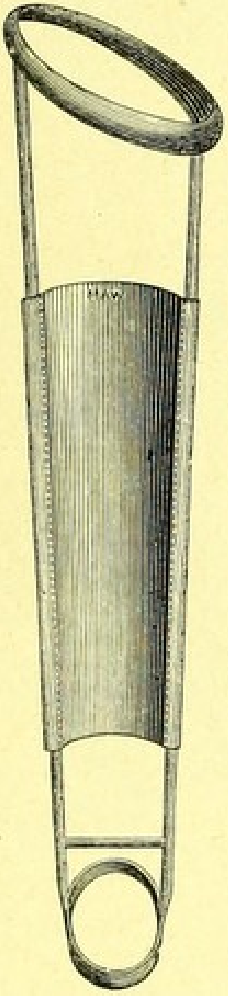

FIG. 288.

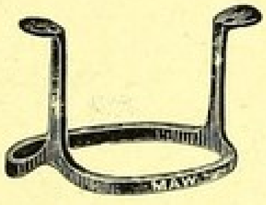

FIG. 289.

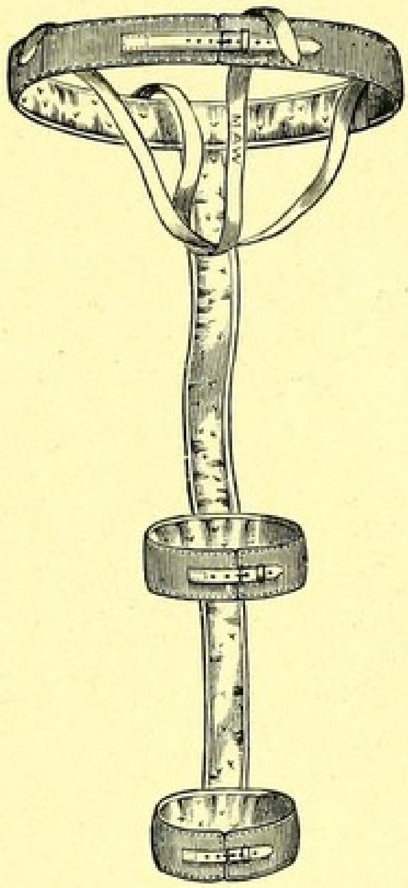

FIG. 290.

THOMAS' SPLINTS.—These appliances, introduced by the late Mr. Thomas of Liverpool, are very largely used in the treatment of joint diseases.

1. *Thomas Knee Splint* (Fig. 288) consists of two parallel iron bars surmounted by an oval padded metal ring, which is formed to fit into the perineum on the affected side.

The lower end also consists of an oval ring, which rests on the ground, but beyond the level of the patient's foot. In this way the patient really sits on the upper end, with the diseased leg hanging in the splint. A patten (Fig. 289) is fixed to the boot of the opposite foot to equalise the length of the limbs. The limb is bandaged to the splint above and below the knee, and a brace is passed from the upper ring behind, over the opposite shoulder, and fixed to the upper ring again in front.

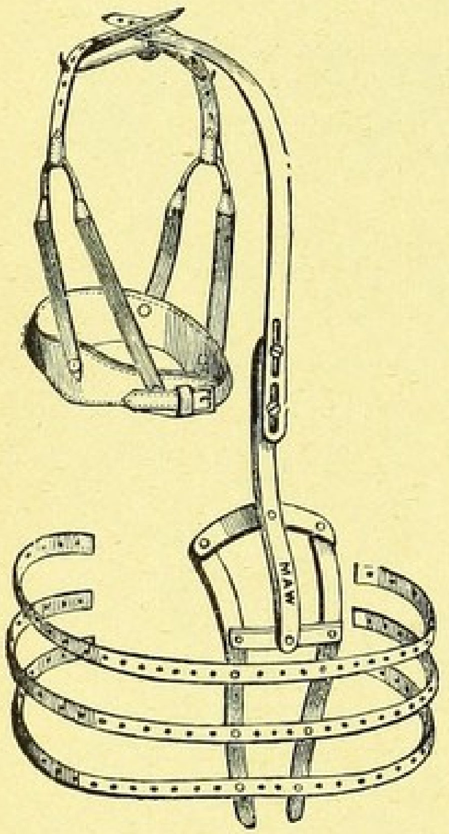

FIG. 291.

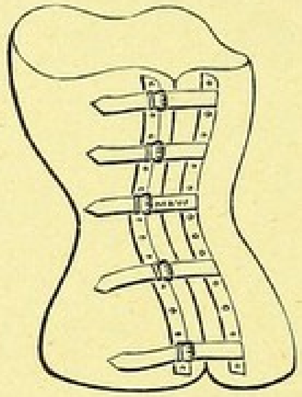

FIG. 292.

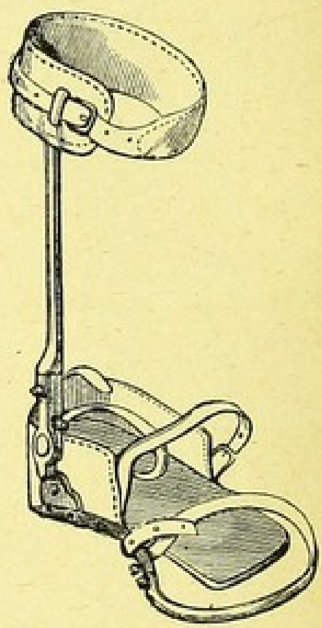

FIG. 293.

2. *Thomas' Hip Splint* (Fig. 290).—This consists of a long bar of malleable iron fitted with three transverse pieces or crescent wings, which grasp respectively the chest, the thigh, and the calf. The splint is bandaged to the leg and thigh, and fixed to the body either by a strap with buckle or by a roller bandage.

APPARATUS FOR DEFORMITIES.—It is beyond the scope of the present work to describe the almost endless variety of appliances used in correcting deformities. Among the more commonly used are :

1. *Sayre's Jury Mast* (Fig. 291), often incorporated with a plaster jacket (p. 224) ;

2. *Felt Jacket and Jury Mast ;*

3. *Simple Poroplastic Jacket* (Fig. 292) ; all of which are useful in the treatment of diseases or deformities of the spinal column.

For the different forms of club foot various forms of boot are used—for example that of Scarpa (Fig. 293).

CHAPTER XXXII.

FRACTURES.

FRACTURES are divided into two great classes: (1) *simple*, in which the skin is not broken; and (2) *compound*, in which there is a wound of the soft parts leading down to the broken bone. Other terms are used in connection with fractures which may here be explained. By a *green-stick* fracture is meant one in which only a portion of the thickness of the bone breaks, as in snapping a piece of green wood; a *comminuted* fracture is one in which the bone is broken into several fragments. When one fragment of a broken bone is wedged into the interior of the other, the fracture is said to be *impacted*. When the growing end of a young bone is separated from the shaft, the condition is spoken of as a *diastasis*.

The *symptoms* of fracture are unnatural mobility in the course of the bone, *i.e.*, between joints; deformity, or the part being 'out of drawing'; crepitus, the name given to the grating between broken fragments of bone, loss of function, pain, swelling, discoloration, and alteration in length of the limb.

Principles of Treatment.—In treating a fracture the deformity is first *reduced* by bringing the bone into its natural position, after which it has to be *retained* there by splints, bandages, etc.

The nurse's duties consist in preparing the various splints and other appliances necessary for the *setting* of the fracture, and in seeing that the part is kept at rest and the apparatus not interfered with after. She may have to change the position of the limb, readjust pads or bandages to relieve pain, but she should never do anything more without orders from the doctor.

Appliances for Fractured Bones.

As a general rule, it may be said that in the treatment of fractures the less specialised splints are the better.

Ordinary Pieces of Wood.—In cases of emergency or in private practice ordinary pieces of wood cut or sawn to the proper size and shape make excellent splints.

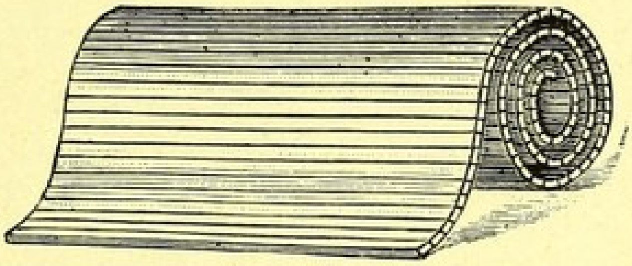

FIG. 294.

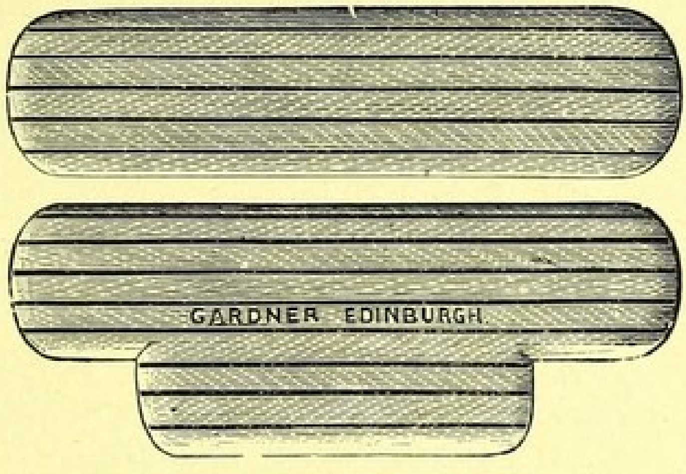

FIG. 295.

Gooch Splints.—A great variety of splints are prepared from Gooch's material (Fig. 294), which 'consists of flat boards about $\frac{1}{8}$ inch thick, glued on to oil-cloth or leather, and split into parallel strips about $\frac{1}{3}$ inch wide by longitudinal incisions, which do not completely divide them. It is flexible in one direction and quite rigid in the other.'

To form a splint one should have:

1. Gooch splint material.
2. A medium-sized saw.
3. A strong knife.
4. Wool for padding.
5. Bandages.
6. Slings.
7. Scissors, safety-pins, etc.

The desired splint is cut to fit the part, provision being made to avoid pressing on bony prominences; it is carefully padded and fixed in position with slip-knots, over which a bandage is applied to secure all. Sometimes—*e.g.*, in fractures of the shaft of the humerus or femur—the leather side is put nearest the skin, and so the splint adapts itself to the shape of the limb, while in other fractures, especially where there are two bones—for example in the forearm—the wooden side goes inside to keep the splint rigid.

Hoop-Iron Splints.—Very economical and useful splints may be made out of hoop-iron carefully padded with wool. This material has the advantage of being strong and rigid, although it is sufficiently flexible to be moulded to any shape that may be desired. By filing a shallow notch across the metal, and then bending it backwards and forwards once or twice, it is easily cut to any length required.

Poroplastic Felt is a strong form of felt which when hot may be moulded to any surface. It is best heated by placing the piece, roughly cut to the shape of the part, into a basin of boiling water, when it becomes perfectly limp and pliable. It should then be placed in position and bandaged firmly on. After it has dried and hardened it may be removed, and by paring and moulding can be got to fit very accurately. As this material is very expensive, it should not be used for splints which are only to be in use for a short time.

Pasteboard or *Millboard* splints may be cut and moulded to the limbs, and form very satisfactory temporary splints. The material should be incised at right angles to its long axis.

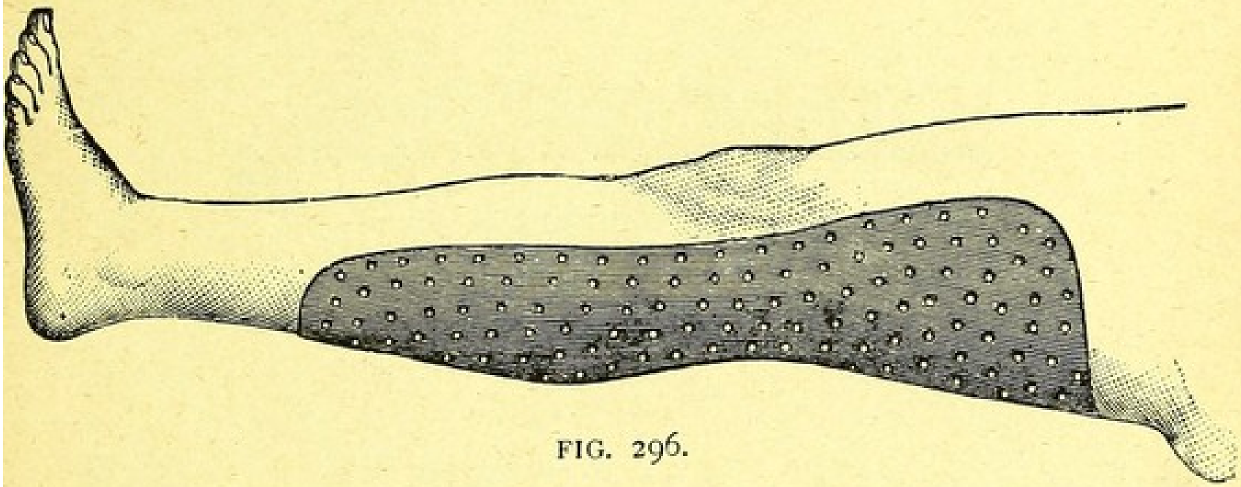

FIG. 296.

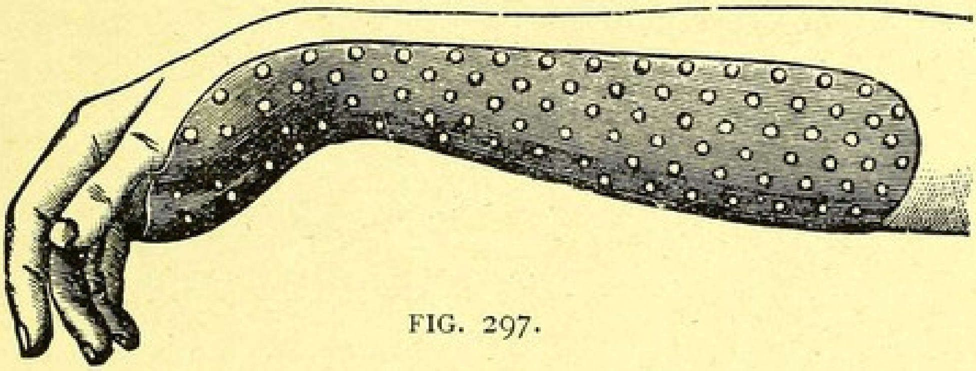

FIG. 297.

Perforated Zinc forms a useful light rigid splint for many purposes (Figs. 296, 297).

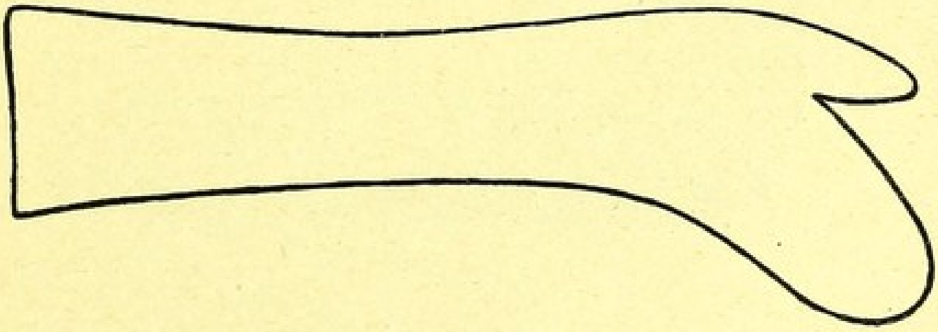

FIG. 298.

There are certain cases in which particular forms of apparatus are advantageous.

Apparatus for Superior Extremity.—Very many forms of splint have been introduced for the treatment of Colles' fracture of the lower end of the radius. No one is superior

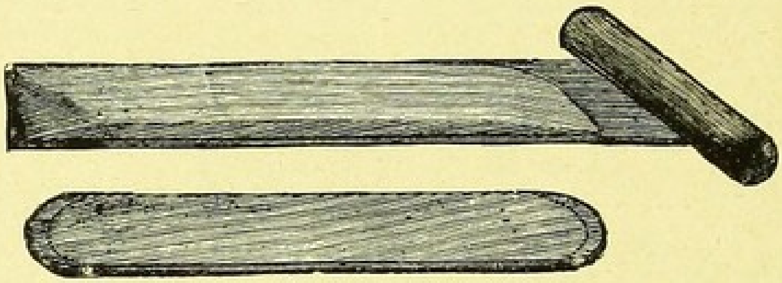

FIG. 299.

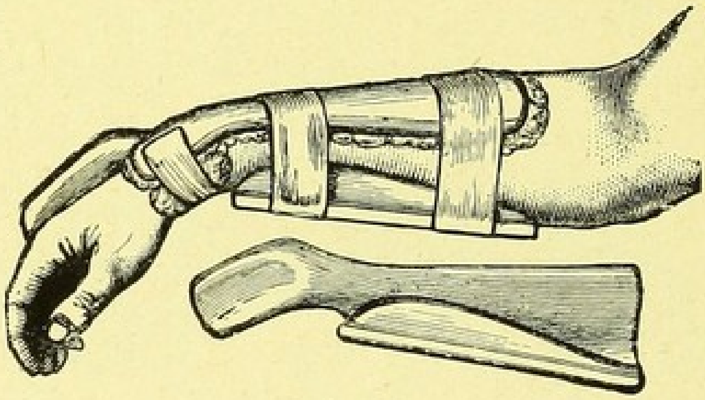

FIG. 300.

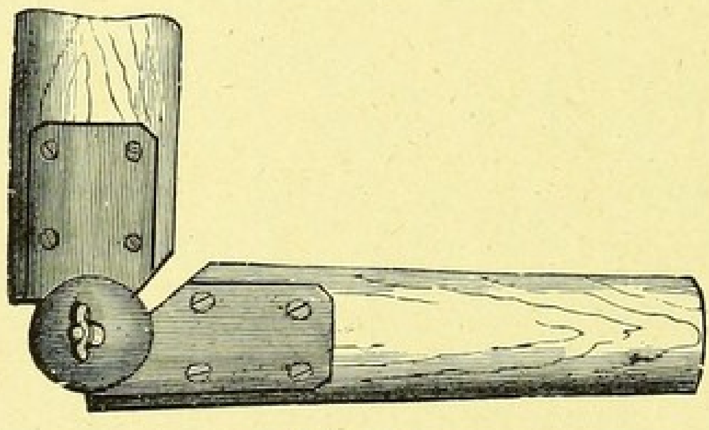

FIG. 301.

to that made from *Gooch material*, cut so as to avoid pressure on the ball of the thumb, and padded and bandaged in such a way as to correct the characteristic deformities. Of the others may be mentioned the *pistol-shaped* splint

(Fig. 298), *Carr's* splint (Fig. 299), and *Gordon's* splint (Fig. 300), all of which are designed to counteract the displacements peculiar to fracture in this situation.

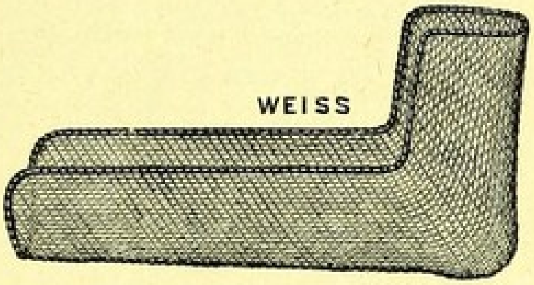

FIG. 302.

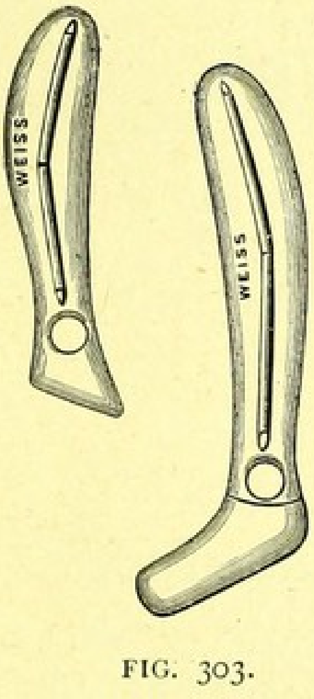

FIG. 303.

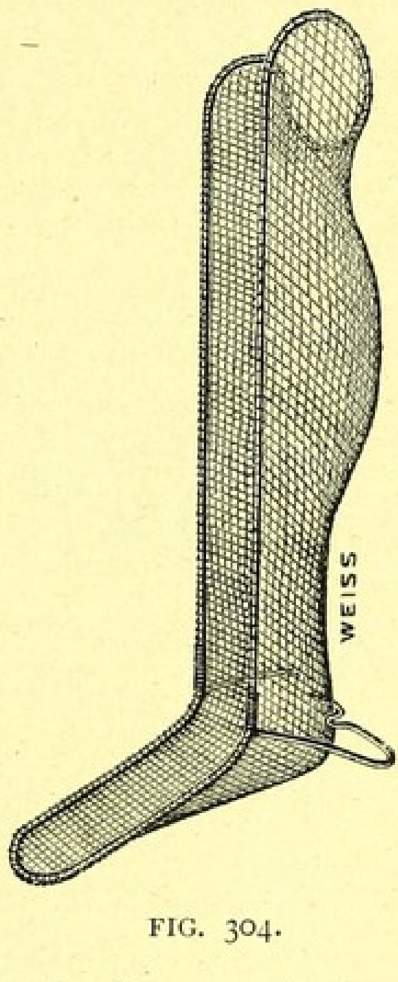

FIG. 304.

For the arm an angular splint is often required, and it is an advantage to have it joined so that the angle may be varied to suit individual cases (Fig. 301). In some cases a shoulder-cap is added. Both of these can be readily moulded in poroplastic. To support the elbow a hollow splint of poroplastic or wire gauze may be employed (Fig. 302).

Apparatus for Inferior Extremity.—Of the specially made splints used in fracture of the bones of the leg it is perhaps only necessary to mention those of Cline (Fig. 303), the outer half of which is furnished with a foot-piece, and the hollow splint of wire gauze (Fig. 304).

Malgaigne's Hooks (Fig. 305) are employed to approximate the fragments of a fractured patella, the claws being

FIG. 305.

fixed into the fragments of the bone, or, as suggested by Professor Annandale, into adhesive plaster applied round the limb above and below the fragments.

Box Splint (Fig. 307).—This splint, which is often associated with the name of the Edinburgh school, is largely used there in the treatment of all fractures of the bones of the leg, as well as in other conditions in which it is necessary to control the movements of this part of the limb. It has the great advantage of being readily and quickly made, all the requisites being procurable anywhere.

Materials Required (Fig. 306):

1. Two wooden splints.
2. A small sheet.
3. Two towels.
4. Some cotton-wool, antiseptic if possible.
5. Four 'nests' of cotton-wool.
6. A cotton bandage for slip-knots.
7. A domette or elastic bandage for foot.
8. Scissors, safety-pins, etc.

Method of Preparing the Materials.—The *splints* (*a*) should be of strong wood, measuring 4 to 6 inches in breadth and extending from above the knee to 3 or 4 inches beyond the sole. The *sheet* (*b*) having been folded to correspond with the length of the splints, one of the latter is laid on each end of the sheet and rolled up in it. Three sides of a box are thus formed. The splint should be fitted on to the sound limb (allowing for padding) to avoid disturbing the injured part unnecessarily. If it be

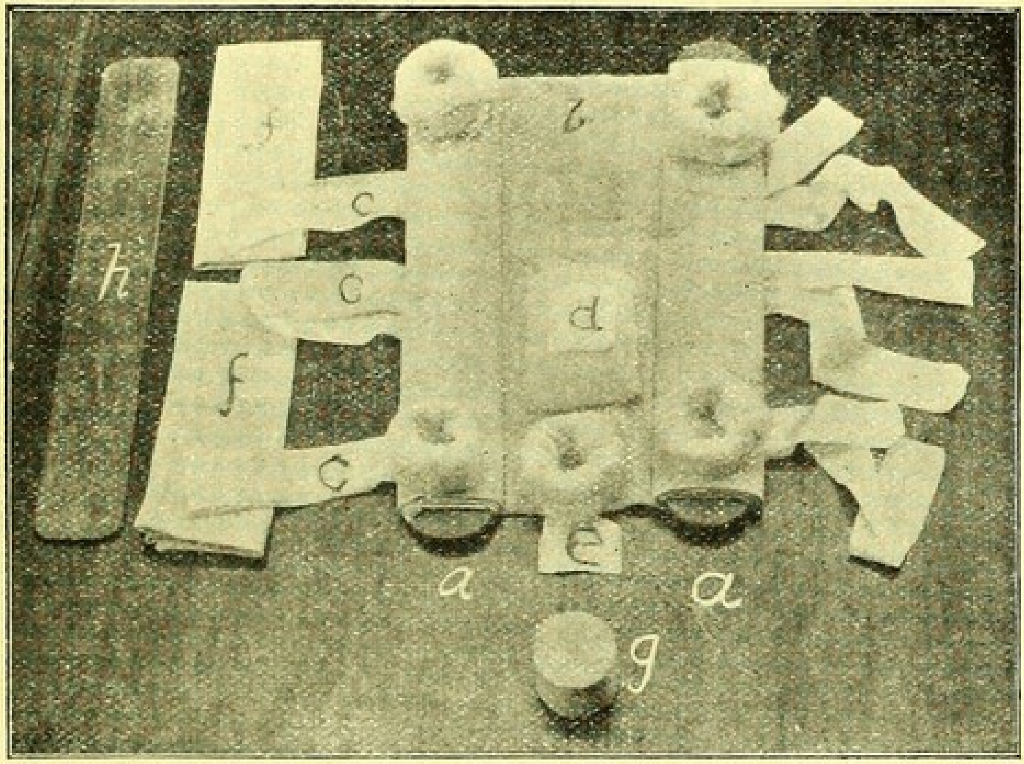

FIG. 306.—MATERIALS FOR BOX SPLINT.

a, Wooden splints ; *b*, sheet ; *c*, slip-knots ; *d*, pad of wool under tendo Achillis ; *e*, nest for heel ; *f*, towels for front of limb ; *g*, bandage for foot ; *h*, spare splint.

found that the space between the two sides is not accurate, only *one* end should be unrolled, and by folding in or letting out the sheet the proper size will be obtained. The *wool* is used to pad the whole of the inner surface of the box, and with it small round rings or 'nests' (*e*) are made to place over the internal condyle of the femur and head of the fibula at the knee and the malleoli at the ankle, to avoid undue pressure on these prominences. The hollow behind the heel, *i.e.*, under the tendo Achillis (*d*), and the space behind the knee (popliteal space), also require special support. The *towels* (*f*) are then folded so as to cover in the front of the leg, forming, so to speak, the lid of the box. By using *two* towels, one covering the upper and the other the lower half of the limb, the parts may be examined frequently by undoing the middle slip-knot and folding the towels up and down. In this way the apparatus is very little disturbed. The *slip-knot* loops (*c*) are made thus: An ordinary 6-yard cotton bandage is run

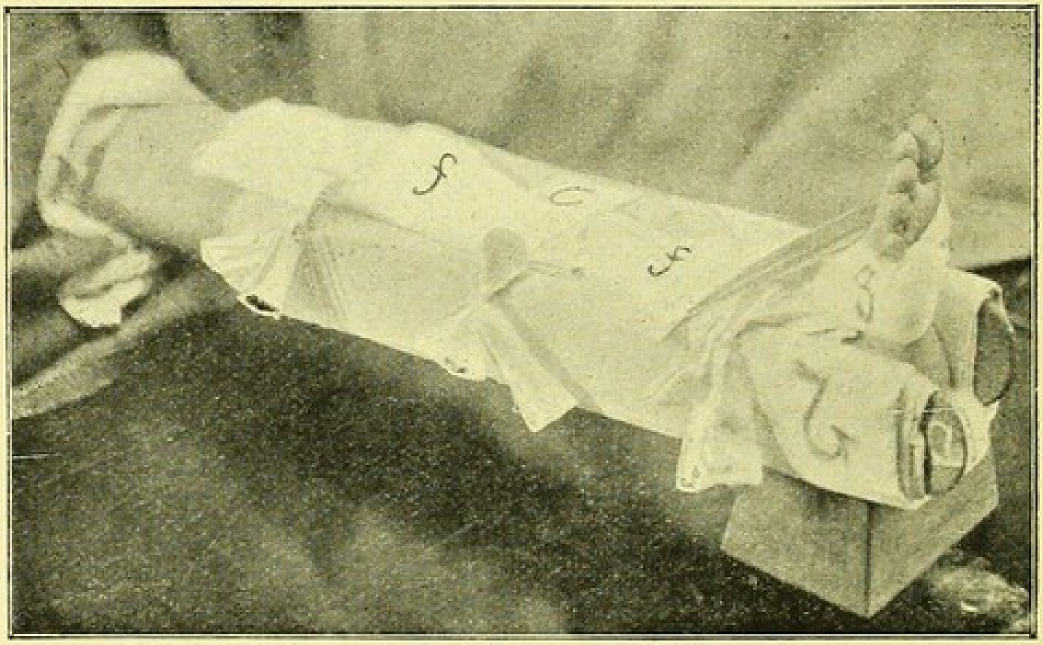

FIG. 307.—BOX SPLINT APPLIED.

a, Wooden splints; *b*, sheet; *c*, slip-knots; *f*, towels; *g*, bandage round foot.

out and divided into three equal parts. Each part doubled upon itself constitutes a slip-knot loop.

Method of Applying the Splint.—The bones having been put into proper position, and being held there, the splint is slipped under the limb, and the sides of the box are then folded up, the pads carefully adjusted, so that the pressure is properly distributed, and the folded towels laid on the front of the leg. While the whole apparatus is fixed by an assistant, the three slip-knot loops are passed under the limb from without inward, so that the two free ends lie towards the outside. One is placed at the middle, one just above the ankle, and the other just above the knee. The middle one should be tied first. This is done by passing one free end through the loop of the double end and pulling tight, then fixing by means of a reef bow, which should be placed over the outer splint. The others are then fixed in the same way. The *domette bandage* is applied to correct any twisting of the foot that may exist, to keep the foot at right angles with the leg, and to support the part generally.

Advantages of the Box Splint.—(1) Its simplicity; (2) material always available; (3) its general applicability; (4) the limb can be examined without removing the splint, and thus rest can be constantly maintained.

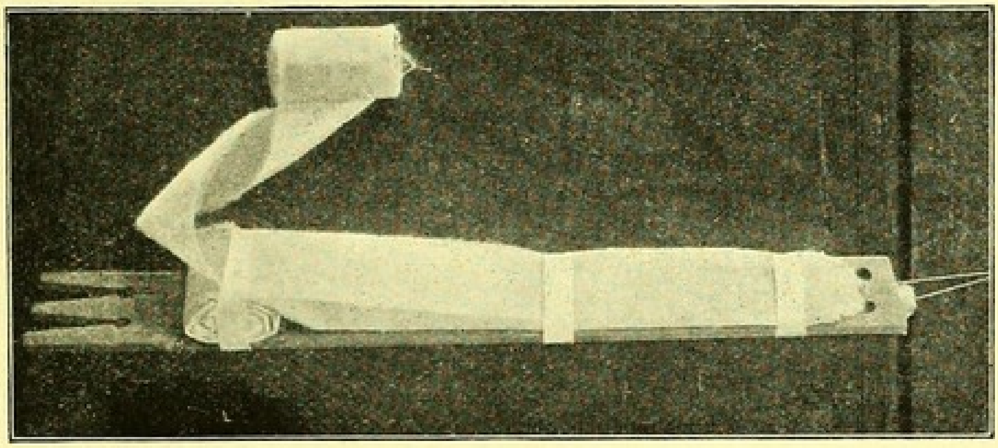

FIG. 308.—DUPUYTREN'S SPLINT MOUNTED.

Special splints used in the treatment of Pott's fracture of the fibula are: (1) *Dupuytren's Splint,* which is simply a "short long-splint." In preparing this appliance, the *materials necessary* are:

1. The splint.
2. One towel.
3. Two bandages.
4. Slip-knots.

The towel, folded to the width of and somewhat longer than the splint, is laid on one side, and the surplus folded in to make a pad; the tail of one bandage is split longitudinally for 2 inches, and the ends fastened through the holes at the top of the splint. The bandage is then carried along the towel and fixed there by two or three slip-knots (Fig. 308).

The *Horse-Shoe Splint* is also sometimes used. It is prepared in the same way as that of Dupuytren.

McIntyre's Splint is also used for various conditions of the leg (Fig. 309), for example, serious injuries and some joint affections. It may be used as a straight posterior splint or as a double-inclined plane, the angle being varied by means of a screw acting on a hinge which joins the

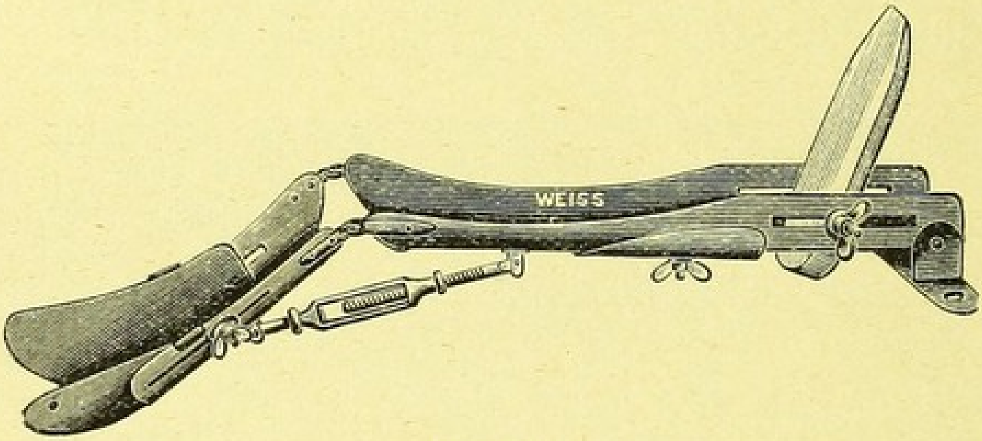

FIG. 309.

upper and lower parts. It is furnished with a foot-piece, which may be placed at any desired angle, and which may be moved up or down to suit the length of limb of the patient. Precautions must be taken to support the heel, either by bandaging under it or by fixing the foot securely to the foot-piece.

Sand Bags are very useful for securing and maintaining rest. They can be placed alongside broken limbs, and so act as a temporary splint. The sand must be very fine and *perfectly dry*, and the bag should be filled only about two-thirds full, otherwise it does not adapt itself readily to the shape of the parts. The bag should be made of some very close material, such as bed-ticking, to prevent the and escaping.

The Long Splint (Fig. 310).—*Uses.*—This splint, which is associated with the name of Liston, who introduced it, is largely used in the treatment of fractures of the femur, whether of the neck or shaft. It controls the whole limb and the movements of the trunk on the thigh at the hip-joint, thus securing absolute rest to the injured part. It may be used single or double, *i.e.*, one on each leg. It is

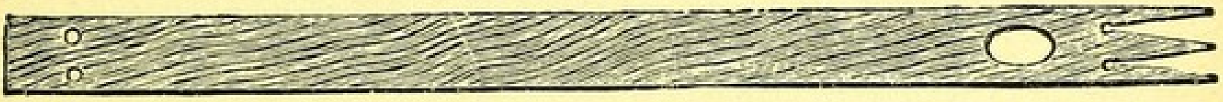

FIG. 310.

often used as an addition to other splints, as in fracture of the shaft of the femur, where the break in the bone is first controlled by means of short Gooch splints, and then the whole limb by a long splint. The double long splint is used chiefly in children, where the difficulty of keeping them from wriggling about is so great. It also facilitates the cleansing of the child. Some adults are not less easily kept quiet than children, and in such a double long splint is of great value.

1. *Single Long Splint.*—There are two methods of employing this splint: the old way, in which extension is applied by means of a perineal band, and the more modern and much preferable way, in which the ordinary apparatus with weight and pulley affords the necessary extension.

(*a*) *Old Method.—Materials Required:*

1. Long splint, with foot-rest.
2. Sheet.
3. Wool for padding.
4. Several long strong pins (cap pins or safety-pins).
5. Many-tailed domette bandage or a broad binder.
6. Two large handkerchiefs.
7. Safety-pins.

Method of Preparing Materials.—The splint is about 4 inches broad, and extends from the axilla to 1 or 2 inches beyond the foot. About 2 inches from the upper or axillary end are two holes about the size of a shilling piece, 2 inches apart, while at the lower end two triangular wedge-shaped pieces are cut out, giving a double fork.

Lay the splint alongside the patient, with the upper end well up in the axilla, and mark on it with a pencil the level of the great trochanter at the upper end of the thigh, and of the external malleolus of the ankle. Now fold the sheet to this width, and roll it carefully round the splint, covering only the part between the two pencil marks, and leave as much of the sheet unwound as will encircle the limb and leave a margin with which to fix the apparatus. To compensate for the greater circumference of the leg at its upper part the sheet should be folded slightly obliquely. It is sometimes desirable that the sheet should pass from the splint over the front of the limb, and then encircle it, sometimes over the back of the limb. This depends on whether eversion or inversion has to be corrected, and the sheet will be folded round the splint accordingly. Having enclosed the splint in the sheet, carefully pad the upper part which comes into contact with the side of the chest. This is best done with evenly cut pads of wool tied on to the splint with pieces of bandage, leaving the holes free. The leg should be thoroughly washed with soap and water, and dusted with a mixture of powdered boracic acid and starch, and then all bony prominences carefully padded with antiseptic wool. All being ready, the free part of the sheet is passed under (sometimes over) the limb, which is carefully steadied and held in the proper position by a competent assistant, and having been brought round is fixed to the part enclosing the splint by means of long pins. The foot is fixed to the lower end of the splint by passing one of the handkerchiefs, folded *en cravatte*, round the foot, beginning at the sole and crossing over the dorsum, then around the ankle, and passing the loose ends under the turns which cross the dorsum, and then tying the ends through the notches at the foot of the splint (Fig. 310). Now, by gently pushing on the upper end of the splint in its long axis, the leg is drawn upon and extended. How is this extension to be kept up? By means of the other handkerchief, the perineal band. This is folded *en cravatte*, and passed through the perineum, and the two ends brought through the holes at the top of the splint, passing from within outward. By tightening these

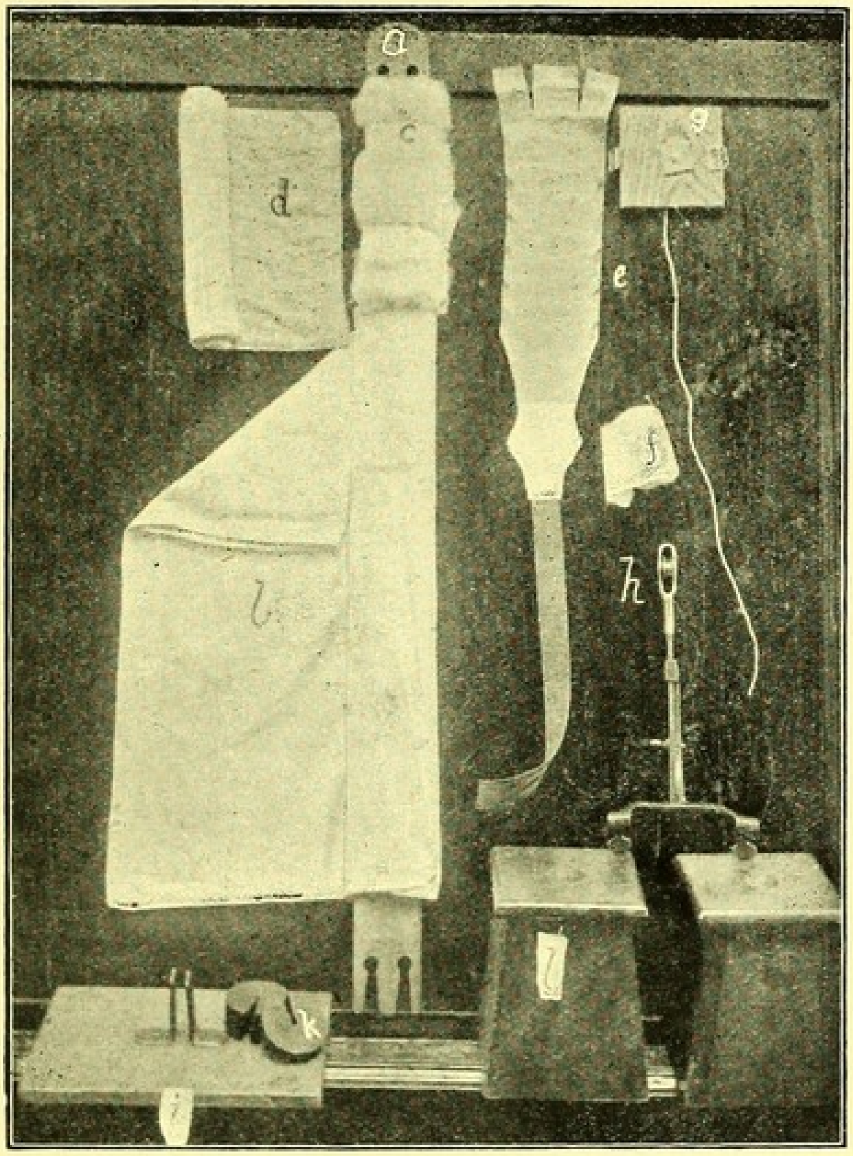

FIG. 311.—MATERIAL FOR LONG SPLINT, WITH EXTENSION.

a, Long splint; *b*, sheet: *c*, padding; *d*, binder for chest; *e*, extension plaster; *f*, bandage to fix same; *g*, stirrup for attachment of weights; *h*, pulley; *i*, foot-piece for splint; *k*, weights; *l*, blocks for foot of bed.

ends the splint is pushed down, and keeps up the extension on the foot. The splint is prevented from rocking by means of a foot-piece. The many-tailed bandage or a broad binder fixes the splint to the patient's body, and prevents movement at the hip-joint.

The Disadvantages of the Perineal Band Method are: (1) That the handkerchiefs gradually yield to the strain, elongate, and so the extending action is lost, and the constant readjustment interferes with the absolute rest which is so essential to the successful treatment of these cases;

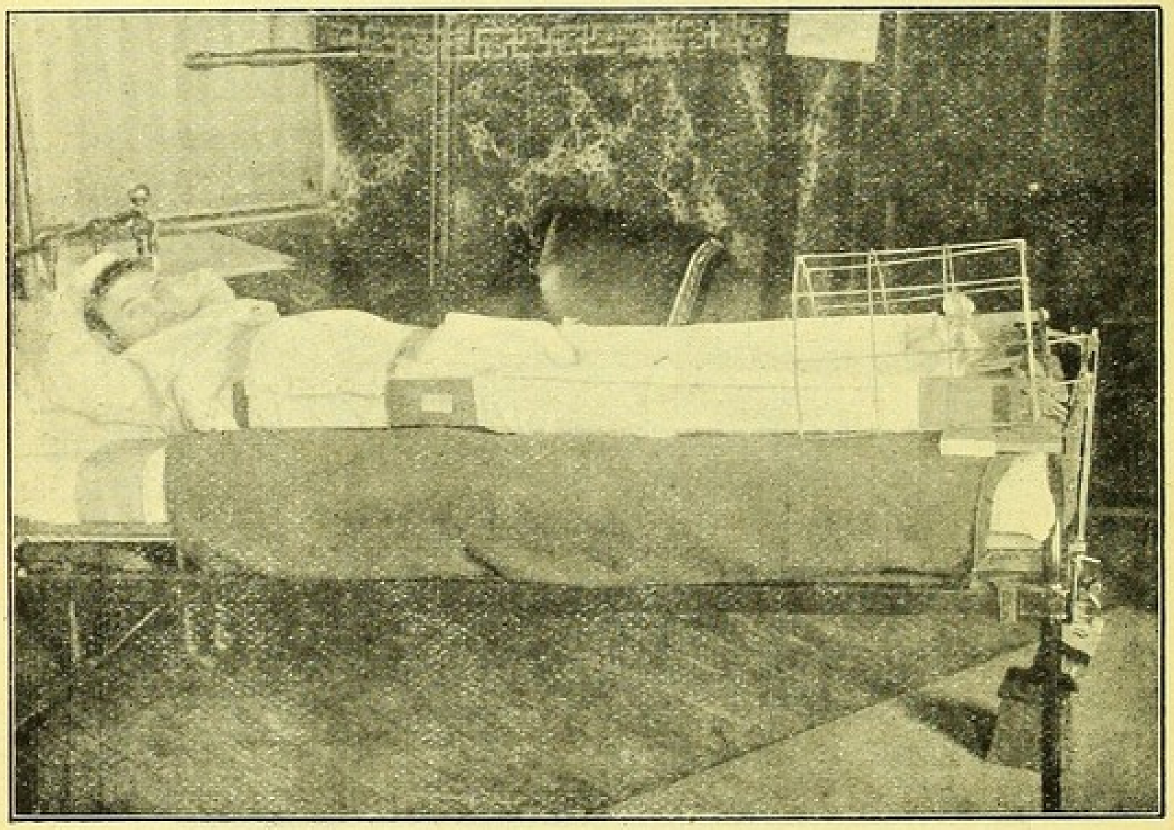

FIG. 312.—DOUBLE LONG SPLINT APPLIED WITH EXTENSION.

(2) the parts with which the handkerchiefs are in contact are constantly being chafed, and soon get excoriated, adding additional inconvenience to the patient; (3) in spite of all precautions the perineal band gets soiled, especially in children, and the necessity for changing it interferes considerably with its usefulness.

We have described this method fully because it is very useful, especially in district and private nursing practice, where, on account of the shape and arrangement of beds, and for other reasons, the extension apparatus is unavailable. When it is possible, however, it is advisable to use the extension apparatus.

Double Long Splint.—This is simply the application of a single long splint to each leg, the lower ends of the two being fixed into a common foot-piece. The advantage of thus fixing both legs is that it prevents all movement, and in children especially facilitates cleanliness.

(*b*) *Long Splint with Extension Apparatus.—Materials Required* (Fig. 311).—Same as for the old method, and in addition all the apparatus needed for extension (p. 217).

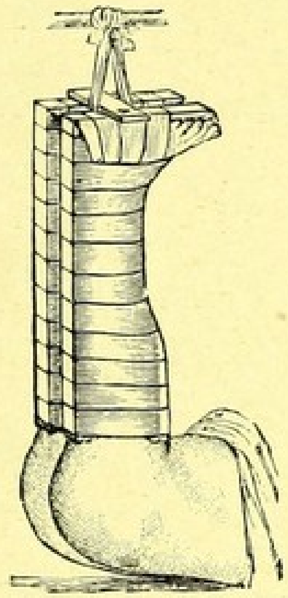

FIG. 313.

Method of Application.—The extension being applied as before directed, the splint is prepared and adjusted in exactly the same way as already stated, save that the perineal band is omitted. The foot of the bed must be raised to obtain the necessary counter-extension.

Advantages of this Method.—The extension is constant; there is little chance of the apparatus being soiled, and no danger of excoriation if proper precautions be taken to pad all prominences. It is thus easier to insure the maintenance of absolute rest, which is the secret to rapid and accurate union.

Vertical Extension (Fig. 313) is another method of treating fracture of the thigh in children. It consists simply in hanging the child up by the feet with the limbs at right angles with the trunk. Extension plasters are applied to each limb, and the tapes attached to a cross-bar over the bed. This is of great assistance in keeping children quiet, as well as clean and dry.

Fractures of the lower jaw are usually treated with splints moulded out of gutta-percha or poroplastic (Figs. 314, 315), and held in position by means of a four-tailed bandage (Fig. 316).

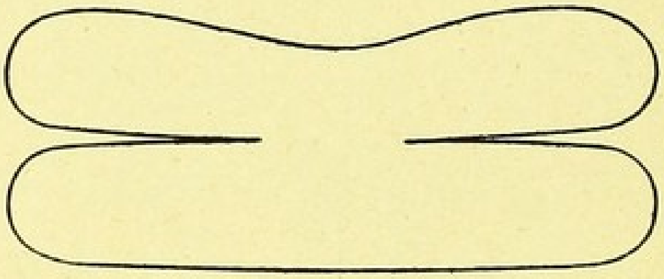

FIG. 314.

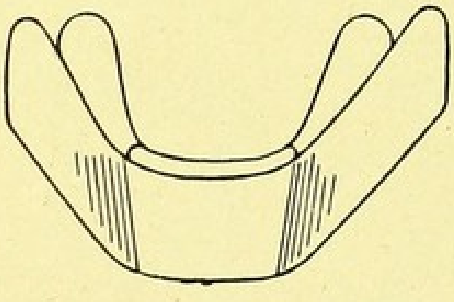

FIG. 315.

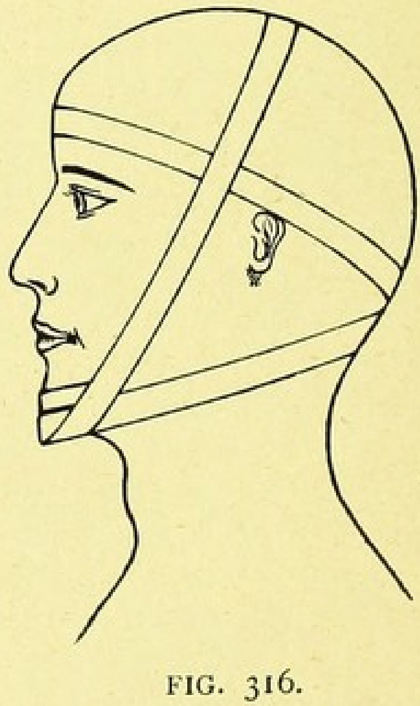

FIG. 316.

For *fractures of the nose* a special apparatus is sometimes used, but is by no means necessary in most cases.

SECTION IV.

BANDAGING.

CHAPTER XXXIII.

PRINCIPLES OF BANDAGING.

It is scarcely necessary to indicate in any but the briefest manner the numerous uses to which the bandage is put in surgery. All dressings, fomentations, and compresses are fixed and retained in position by one or other form of bandage, and almost all splints, whether applied to control fractured bones, to insure immobility of joints, or to correct deformities, are similarly secured. Bandages are oftenest used alone, but are sometimes impregnated with various substances, such as starch and plaster of Paris, to give rest or stability to different parts. As a means of preventing and of arresting hæmorrhage, and of influencing the size of certain forms of swelling also, different varieties of bandage are of great value.

Materials.—The variety of uses to which bandages are put is only exceeded by the materials from which they are made.

1. *Linen, cotton,* and *calico* form useful, strong bandages, varying in strength and stiffness according to the quality and newness of the material. They are softest and lie best when made of old stuff which has been frequently washed. These bandages are not antiseptic.

2. *Gauze.*—This material is usually charged with some

antiseptic agent, and so can be employed with safety in dressing aseptic wounds. Lord Lister first used gauze impregnated with carbolic acid, and later with the double cyanide of mercury and zinc.

3. *Domette* is a variety of soft, elastic flannel, and bandages made of this material fit nicely to the part, and do not tend to slip, as stiffer forms sometimes do. They are often rendered antiseptic by being charged with sal-alembroth, and as they wash well may be used repeatedly.

4. *Muslin*, strong and coarse, with wide meshes, is used in making plaster of Paris bandages, the dry plaster being rubbed into the muslin filling up the meshes.

5. *Elastic Webbing* is a form of bandage in which the longitudinal strands are made of rubber, the transverse ones of cotton. Such a bandage is used to apply a moderate amount of pressure or elastic support to any part, *e.g.*, a joint into which there has been some effusion, or in a case of varicose veins. The open network has the advantage over simple elastic bandage of permitting evaporation of the sweat, which if retained irritates the skin.

6. *Martin's Elastic Bandage* is made of a sheet of thin indiarubber. It is chiefly used in the treatment of varicose veins of the leg, but, as just mentioned, is objectionable in retaining perspiration.

7. In cases of emergency *old household linen* (short of being rotten, the older the better) makes very good bandages.

Varieties of Bandages.—The commonest form of bandage used in surgery consists of a length of material rolled tightly up from end to end, constituting a simple *roller bandage*. When rolled from one end only it is spoken of as a *single-headed roller;* when from both ends as *double-headed*. It will be necessary later to describe certain forms of compound bandage, such as the *many-tailed*, *four-tailed*, *T-shaped*, and so on, each having a special use.

Names have also been invented to indicate the various methods of applying a bandage to a part, depending on the arrangement of the turns of the bandage. For example, a *circular* bandage is one in which each succeeding turn exactly covers the one which preceded it; an *oblique* bandage simply takes its own course round the limb, covering parts, and leaving others bare; a *spiral bandage*, evidently from its name, winds spirally round the limb, but each succeeding turn overlaps only two-thirds of its predecessor. An important modification of the last is the *spiral bandage with reverses*, in which the bandage is folded over on itself at regular intervals, to insure that no spaces are left between the turns uncovered. The *figure-of-eight bandage*, as its name implies, consists of two almost equal circular turns, one being above, the other below, the point of crossing. It is chiefly employed in covering in joints. Closely related to it is the *spica bandage*, so named from a fancied resemblance to a spike of barley. In it one circle is larger than the other, and it is employed in bandaging parts where two unequal cones meet, as, *e.g.*, at the shoulder or groin. The indications for selecting one or other of these forms will be pointed out later on, as well as the means of carrying out the manipulations.

Parts of a Bandage.—For purposes of description names are applied to different parts of a bandage. Thus, the part of a roller bandage which is still unrolled is spoken of as the *head*, and naturally the loose end is referred to as the *tail*. The *anterior surface* is that on which the head rests, while, of course, the opposite side is *posterior*. As the bandage is being applied to a limb, the edge nearer the trunk of the body—that is, higher up the limb—is called the *upper margin*, and the other the *lower margin*. Such names are not necessary when a practical demonstration of bandaging is being given, but they facilitate a word description of the appropriate manipulations.

Sizes.—It is obvious that different widths of bandage will be necessary for different parts of the body, bearing some proportion to the circumference of the part to which they are applied. The sizes usually recognised are:

For upper extremities and head, $2\frac{1}{2}$ inches wide.
For lower extremities and pelvis, 3 to $3\frac{1}{2}$ inches wide.
For thorax and abdomen, 4 to $4\frac{1}{2}$ inches wide.

These are respectively known as 'sixteens,' 'twelves,' and 'eights,' because from a piece of calico 1 yard wide sixteen bandages of the first size, twelve of the second, and eight of the third can be obtained. They should all be 6 yards in length.

To Make Bandages.—In their surgical handbook Caird and Cathcart describe the process briefly as follows: 'Procure 6 yards of calico about 1 yard in width, and remove the selvedges. Mark off with scissors short strips of the desired breadth, then grasp the alternative strips gathered in two bundles, and pull in opposite directions.' In this way a number of strips can be rapidly and evenly torn, and must then be rolled. This may be done either with the hand or with a machine made for the purpose, the main objects being to have the bandage tight and evenly rolled. When using the bandage machine some difficulty will be experienced in withdrawing the pin from the centre of the bandage unless the first few turns be made rather slack, and the handle reversed once or twice while the completed roll is firmly grasped by the hand. Tie a few threads from the edge of the bandage round the roll to prevent it coming undone.

The Parts to be Bandaged.—The exact variety of bandage to be used in any given case depends entirely on the shape of the part to be covered in, and if we consider the shape of any segment of the body we shall find that it is either a *cone* or part of a cone, or else is made up of the *junction of two cones.* Here and there short areas, more or less *cylindrical,* are to be met with, but these soon become conical. For example, take the upper extremity. From the finger-tips to the middle of the palm of the hand we have a slight cone, the base being at the latter level, and from this starts another with its apex at the wrist. Just above the wrist we meet with a short cylinder, which, however, soon expands into the cone of the forearm. At the elbow-joint this cone meets that of the upper arm, giving us a well-marked junction of cones. And so on all over the body, the lower extremity, the trunk, and even the head and neck being each capable of resolution into these geometrical forms.

For cylinders use the simple spiral bandage.
For cones use the reversed spiral.
For junctions of cones use the figure of eight.

Rules for Bandaging.—There are certain general principles and special rules always to be borne in mind in applying a bandage, and trifling and unimportant as some of them may appear at first sight, it is well to pay some attention to them, as much of your success as a bandager, and still more of your patient's comfort, depends on the way in which they are appreciated and applied.

1. If possible, stand in front of your patient in applying a bandage.

2. Never put a bandage next the skin. Always have a layer of absorbent wool, however thin, between the bandage and the skin of the patient. This will prevent the retention of the cutaneous secretions, which, decomposing, cause irritation, as well as the chafing and even abrasion of the skin so often induced by hard, non-porous bandages. Sometimes it may be allowable to use domette without wool, *e.g.*, when the bandage is only to be left on for a few hours; but when applied for lengthened periods you will be wise to keep by the rule.

3. Never let skin surfaces be apposed. Thus, when the hand or foot is bandaged up, the fingers or toes should be separated by layers of absorbent wool; when the arm is bound to the side, a pad should intervene between it and the chest wall; and in females with pendulous mammæ the adjacent skin surfaces should be similarly protected. The result of neglecting this precaution is that the decomposition of the sweat and other skin secretions is the source of irritation which may set up an inflammation or even superficial ulceration of the skin.

4. In bandaging a limb, always place it in the position it is intended to occupy afterwards. By doing so you will avoid the risk of your bandage becoming slack on the one hand or constricting the part on the other, when the part is moved.

5. Fix the bandage to begin with. The reason for this is obvious. It is best done by making a figure-of-eight turn round the nearest joint.

6. Apply the bandage *from below upwards* and *from within outwards*, passing over *the front* of the limb. By proceeding from the distal extremity towards the trunk you avoid engorgement of the limb, which would inevitably happen did you reverse the direction. Passing from within outwards and over the front of the limb is rather a matter of convenience than necessity.

7. Use equable pressure throughout. This is most important, as otherwise you will have one part of the limb tightly constricted, leading to congestion and œdema of the part beyond, and all degrees of harm, from slight discomfort up to actual gangrene of a limb, have resulted from want of attention to this rule. A watch must always be kept on the tips of the fingers and toes, and on the appearance of the least œdema or discoloration, remove the bandage at once and reapply it, using more padding or less tension as you find indicated. These precautions are specially necessary in children.

8. Each turn of the bandage should overlap two-thirds of that which preceded it. This helps to insure equable pressure, and gives the bandage a certain amount of rigidity, in addition to making it look neat.

9. Keep all the margins parallel, all the crossings and reverses in the same line, and rather towards the outer aspect of the limb. By so doing you will attain to some degree of neatness.

10. Finish the bandage by securely fixing it. This is best done by means of a safety-pin, which should always be inserted in the long axis of the bandage, and not across it. Failing a safety-pin, the end of the bandage may be slit into two tails, one brought back round the limb and tied in front with the other. This should be tied in a reef bow or knot.

Knots.—In bandaging the only knot which is permissible is the *square or reef knot* (Fig. 317), in which both ends of the bandage pass in the same direction through each loop, and when tied the loose ends lie parallel with the turns of the bandage. In tying it, keep the end which is further from you in making the first turn, also the further away in making the second.

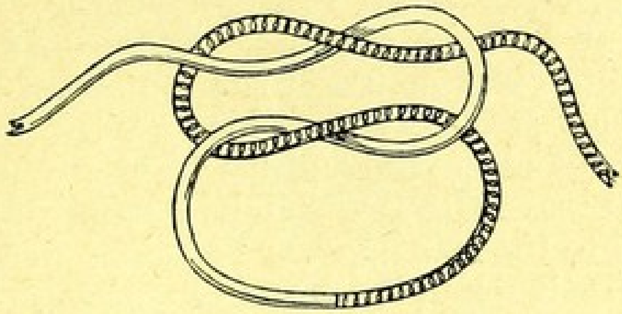

FIG. 317.

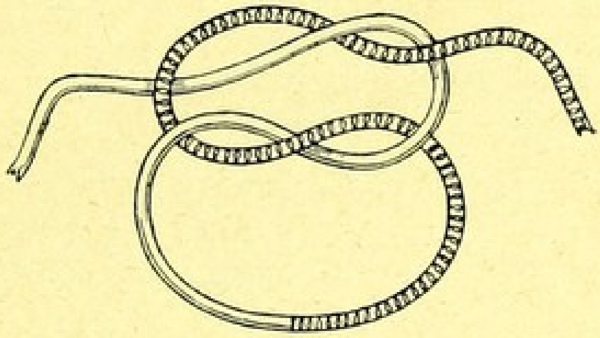

FIG. 318.

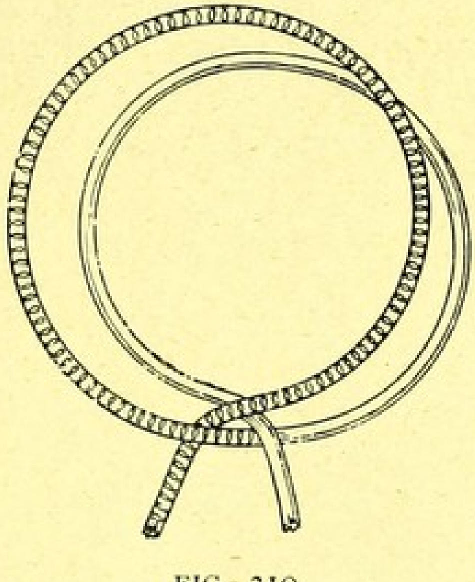

FIG. 319.

The *granny-knot* (Fig. 318) is more apt to slip, and the loose ends lying at right angles to the first turn, it is less neat.

The *clove hitch* (Fig. 319) is used to fix a patient in the lithotomy position, or to restrain the limbs during an operation. It has the advantage of never getting tight enough to injuriously constrict the limb, however much it is pulled upon. It is made as follows: 'Grasp the bandage with the left hand supine and the right prone; now pronate and supinate the two hands respectively, and slide both loops into the left hand.' 'Another plan is to make two successive loops in the same direction, and place one behind the other' (Caird and Cathcart).

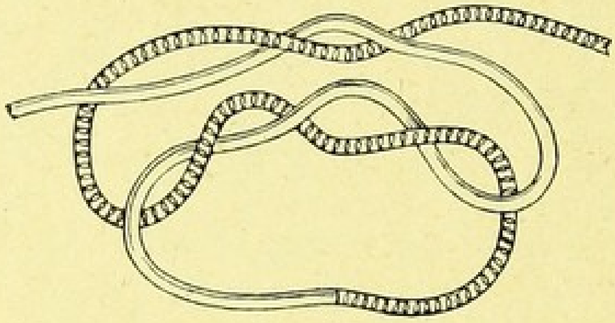

FIG. 320.

The *surgeon's knot* (Fig. 320) is made by doubling the first turn of a reef knot. It is less likely to slip and become slack while you are making the second turn. It is especially useful in ligaturing bloodvessels.

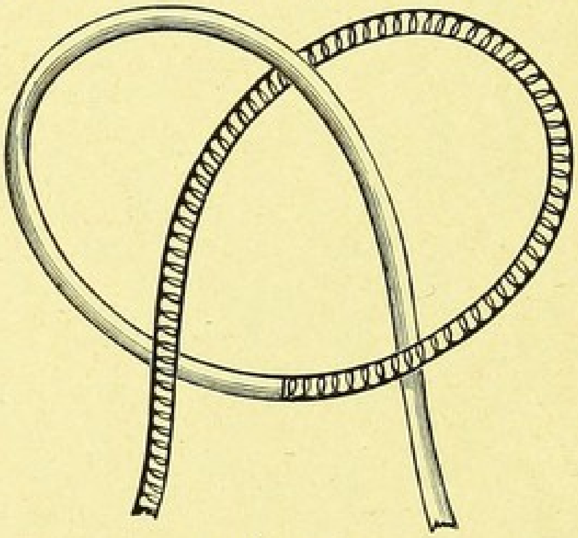

FIG. 321.

Staffordshire Knot.—This knot is used chiefly in the ligature of piles or of the pedicle of a tumour (Fig. 321).

How to Remove a Bandage.—This should be done by simply reversing the manipulations made in applying it. The terminal end should be taken in one hand and then passed behind the limb into the other, and so on from one hand to the other as each turn is removed, the loose bandage being gathered evenly into a bundle, and not twisted upon itself. This means of removal facilitates the re-rolling of the bandage or the washing of it if this be necessary and permissible.

Having thus laid down the general principles which are to guide us in applying all forms of bandages, it may be well to describe in some detail a few of those more commonly used, and if the manipulations described be actually gone through by the reader, the descriptions will be very much more easily followed—in fact, without practising the application of the bandages the time spent in reading the directions will be simply wasted.

CHAPTER XXXIV.

SPECIAL BANDAGES.

BANDAGES FOR LOWER EXTREMITY. — *Bandage for the Foot and Leg.*—If we examine the shape of these parts of the body, we shall find that we have first to deal with 'a cone' extending from the toes to the heel, and this will require to be covered in by a spiral bandage with reverses. At the heel this cone meets another, that from the heel to the ankle, giving rise to a 'junction of cones,' in which case a figure of eight is indicated. At the ankle we have a short 'cylinder,' for which the simple spiral is employed; and higher up for the cone of the calf we return again to the reversed spiral. Bearing these points in mind, and applying the other rules already given, stand in front of the patient, having the limb held in the position it is intended to occupy, and carefully apply the wool. The initial end of the bandage must now be fixed. This is done by making a figure-of-eight turn round the ankle. To do so (*a*) lay the tail of the bandage against the ball of the great toe, and fix it there with the thumb; (*b*) carry the bandage across the dorsum of the foot to the outer malleolus; (*c*) go behind the ankle to the inner malleolus; (*d*) across the dorsum again to the ball of the little toe; and (*e*) across the sole to the point of starting. The bandage is now fixed, and we have to proceed to cover in the foot. Allow the bandage to go spirally round the foot, leaving one-third of each turn uncovered by the succeeding one, so long as the folds lie evenly. So soon as ever the bandage tends to stray we must begin to make reverses.

To make a reverse neatly three points are to be attended to: First, to fix the part of the bandage already applied by pressing on it with the thumb of the disengaged hand; second, to free about three inches of the tail, and to allow this to remain *perfectly loose;* then, third, turn the head of the bandage down and allow the loose tail to fall into position. Do not try to twist it into position, or you will fail to make a neat reverse.

Now pull the bandage tight, and proceed as before, repeating the reverses, keeping them all in the same line, and rather towards the outside of the foot, until the heel is reached. The figure-of-eight now is to be made. Instead of reversing let the bandage go across to the external malleolus, then round the back of the ankle to the internal malleolus, then over the dorsum, keeping the crossing in the same line as the previously made reverses, and passing round the outer border of the foot, travel under the sole to the point at which the figure-of-eight started. This is to be repeated until the heel is sufficiently covered in, and then the ankle and calf are to be bandaged after the appropriate methods. To finish the bandage a figure-of-eight turn is made round the upper part of the calf, and the terminal end fixed by means of a safety-pin inserted parallel to the edges of the bandage, or by tearing the end into two tails, and tying these in a reef knot.

Of course, should it be necessary to cover in *the whole of the lower extremity* right up to the groin, the bandage just described, instead of being finished at the upper end of the calf, is continued upwards over the knee, which is covered in by a series of figure-of-eight loops, on to the thigh, where the reversed spiral is employed; and to finish and secure the terminal end, a figure-of-eight turn is made round the pelvis.

To cover in the Heel Alone.—This is best done by what is called a *divergent spica,* that being merely a modification of the figure-of-eight. It is called divergent, because the first turn covers in the most prominent part of the heel, and from it the succeeding turns diverge. As elsewhere, the bandage must first be fixed. To do so, place the tail over one malleolus, carry the bandage downwards across the sole to the other malleolus, thence across the dorsum and round the ankle, catching in the tail with which you started. The bandage is now fixed. Carry it straight across the tip of the heel, and in doing so you will leave small pockets above and below (Fig. 322). The next turn

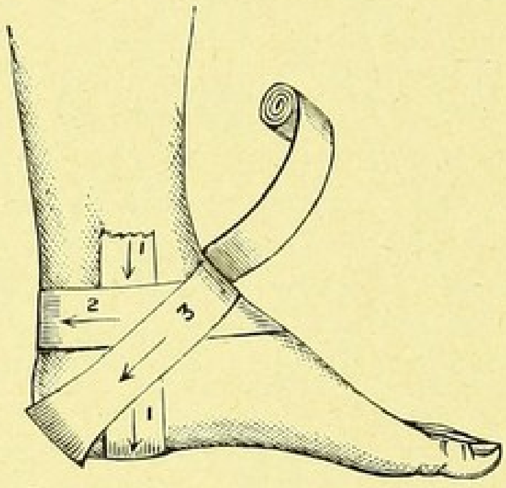

FIG. 322.

goes a little lower than the last, catching up and covering the corresponding pocket, and the succeeding one, going higher, similarly disposes of the upper pocket. With one or two more turns diverging from the tip of the heel that part can be completely covered in.

Bandages for the Knee.—(*a*) *Divergent Spica.*—This is employed when it is desirable to permit of a slight amount of movement at the knee-joint, as the different layers of bandage glide over one another like the plates of scale-armour. Slightly flex the limb, and begin by making a turn round the most prominent part of the knee, a second turn overlapping the lower part of this, and a third overlapping the upper part. Succeeding turns continue to diverge till the whole joint is covered in. It is obvious that the anterior aspect of the knee is the least firmly supported by this bandage, but the presence of the patella renders many layers unnecessary here.

(*b*) *Convergent Spica* is simply a figure-of-eight put on, so that the successive turns converge towards the centre of the patella. It is used when fixation of the joint is aimed at, or to approximate the fragments in fracture of the patella.

Bandages for the Groin.—Bandages for the groin are used to retain any form of surgical dressing or apparatus in position, as well as in the treatment of hernia. The spica is the form of bandage selected in this region, and it may either exert pressure from below upwards or from above downwards, according as the ascending or descending spica is applied. The ascending spica, in which each succeeding turn goes higher up the limb than its predecessor, is that usually chosen when fixing a splint or a

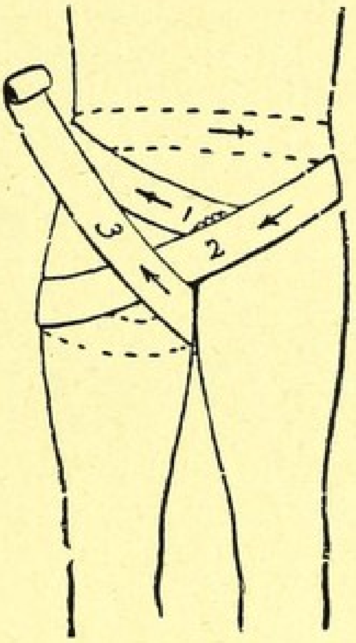

FIG. 323.

dressing. In exerting pressure on a hernia, however, the form of spica varies according as we are dealing with a femoral or an inguinal hernia.

Thus, it will be remembered that an inguinal hernia leaves the abdomen at the internal abdominal ring, passes *downwards* through the inguinal canal, out through the external ring, and continues to pass *downwards* into the scrotum. Therefore, to return this form of hernia to the abdominal cavity, and to retain it there, pressure must be exerted *upwards,* and this is effected by the ascending spica.

On the other hand, in femoral hernia, although in the first instance the bowel passes downwards in the crural canal, when it emerges from the saphenous opening its direction is changed, and it passes *upwards* over the front of the abdomen. Hence, for its reduction, pressure must first be from above *downwards*, the direction in which a descending spica presses.

(*a*) *Ascending Spica of Groin.*—Place the tail of the bandage over the external abdominal ring—that is, at the upper and inner aspect of the groin, on the ruptured side—and thence carry a turn round the pelvis, going towards the *same* side, back to the point from which you started. This is one loop of the figure-of-eight (Fig. 323). The other is made by continuing the bandage across the front of the thigh, round its outer and posterior aspects and into the perineum from behind, again reaching the starting point. Each turn overlaps two-thirds of the one before it, and with three or four such turns the bandage is complete.

(*b*) *Descending Spica of Groin.*—Again begin with the tail over the point from which the hernia emerges, in this case the saphenous opening. Then carry it round the pelvis, going first towards the *opposite* side, however, and so it will come across the front of the thigh and enter the perineum from the *front*, thence round the opposite side of the limb, back to the starting-point. The following turns pass from above downwards, and exert their pressure in this direction (Fig. 324) :

(*c*) *Double Spica of Groin.*—This bandage may be used for fixing dressings to both groins. In the treatment of hernia, it would only be applicable in cases where there was an inguinal hernia on one side, and a femoral on the other, as one side is an ascending, the other a descending, spica. Such a combination of herniæ is rare, and when we have to deal with a double hernia of the same kind we apply two similar bandages rather than the double spica.

To apply the double spica, make one figure-of-eight turn as for an ascending spica, say on the left side, and then, instead of making a second, cross the middle line of the body and make a figure-of-eight round the right thigh. This will be a descending spica. Repeat these turns alternately till both groins are covered in.

Bandages for Perineum.—The *St. Andrew's Cross bandage,* or looped bandage, for the perineum, is useful for retaining dressings on that part. It consists of a series of loops applied alternately round the pelvis and across the perineum. Begin by laying the tail of the bandage over

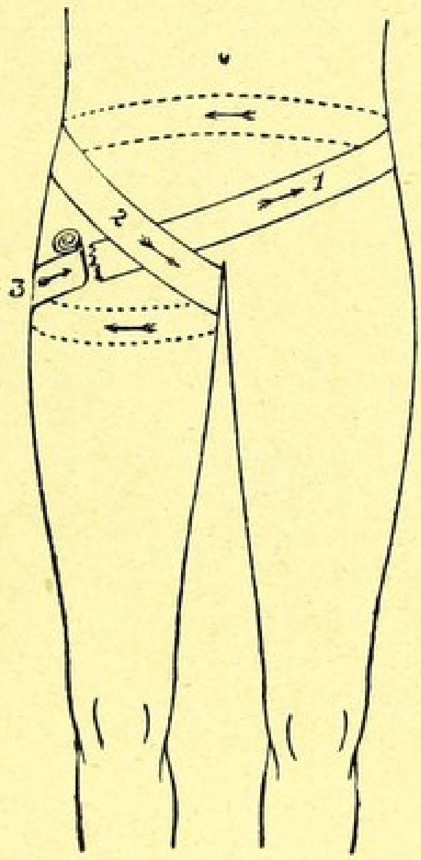

FIG. 324.

the right side of the pelvis, and make a turn round the body, so as to catch in and fix the tail. Now pass across the front of the right thigh into the perineum and, *crossing the middle line,* let the bandage pass round the back of the left thigh and across the buttock to the pelvis, round which a turn is made, and then the second perineal turn is made in the same way as the first, only from the opposite side; the two turns crossing in the centre of the perineum form a St. Andrew's Cross. Similar turns are added till the dressing is secured.

The **T**-*shaped* bandage for the perineum is made by sewing together two pieces of bandage so as to form a letter **T**. The horizontal part of the letter is to encircle the pelvis, with the vertical part hanging down behind. The latter is then brought forward between the thighs,

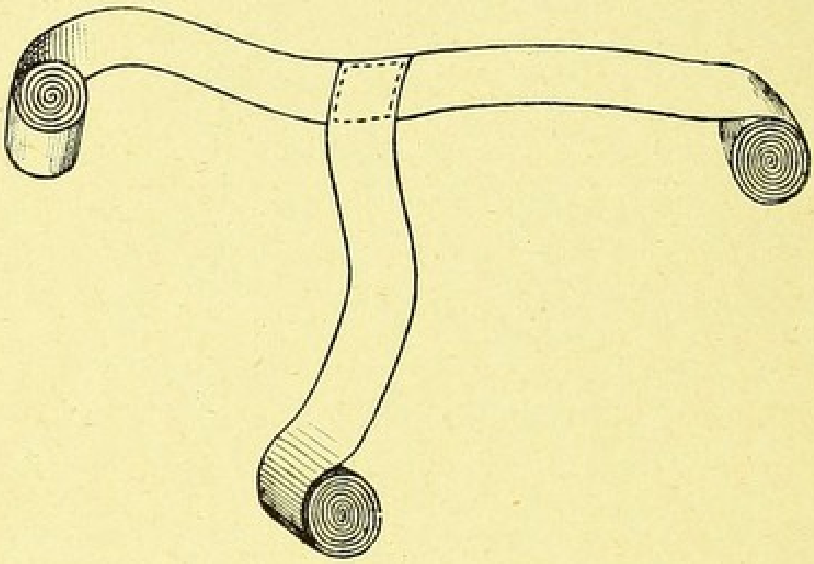

FIG. 325.

the ends split to avoid the scrotum, and fixed to the former, and a perineal dressing is thus retained in position. By using this bandage dressings can be frequently changed without much disturbance to a recumbent patient. (Fig. 325).

Two triangular handkerchiefs make a good perineal or suspensory bandage. One is applied round the pelvis as a belt, to which the apex of the other is tied behind, the base being carried through between the legs, spread out, and fixed to the belt in front.

Note that the turns of these bandages go round the *pelvis,* which is a fixed portion of the body, not round the waist, where the movements of the patient soon permit it to become quite loose.

HANDKERCHIEF BANDAGES FOR LOWER EXTREMITY. —The handkerchief bandage originally used by Gerdy and Mayor of Lausanne, but usually associated with the name of Esmarch of Kiel, is particularly useful for temporary and emergency dressings, and is largely used in

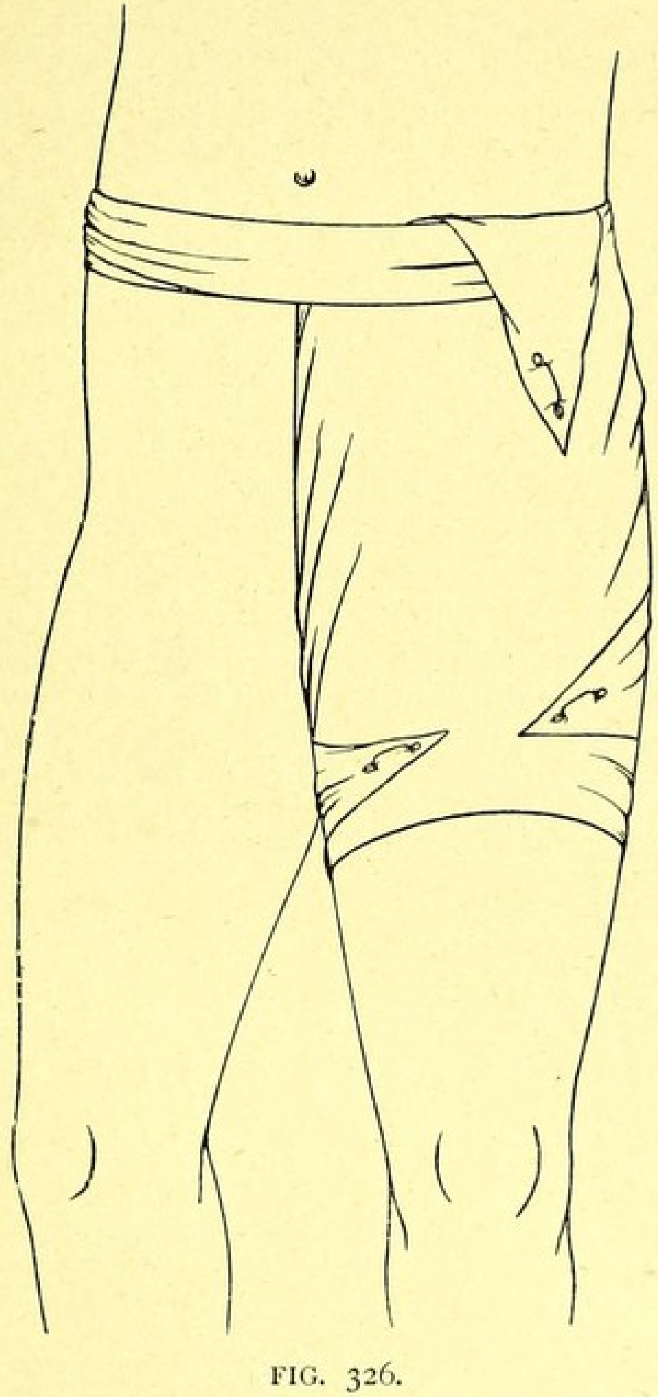

FIG. 326.

military surgery. The handkerchief may be square or triangular in shape, the latter being more generally useful. The base of the right-angled triangle should be a yard and a half long, and the material from which it is cut should be at least one yard wide. The ends are tied into a reef-knot, or bow, or fixed with a strong safety-pin (Fig. 326).

For the Foot.—The base is folded up for a short distance *en cravatte*, and then the foot is laid on the handkerchief, the apex being well beyond the toes. The apex and edges are neatly folded up over the foot, the base passed round the ankle and instep, and the ends secured.

For the Knee.—The triangular handkerchief is laid over the dressing and the ends brought round and firmly tied, the loose edges being carefully folded in.

For the Hip or Buttock.—Two triangular bandages are required. The first is folded *en cravatte*, and tied round the pelvis as a belt. The second is held with the base downwards and the apex up, the intermediate part covering over and securing any necessary dressing. The base is fixed round the upper part of the thigh ; the edges are spread out so as to cover in all the dressing ; the apex is pushed between the patient's skin and the belt, then folded down and secured with a safety-pin (Fig. 326).

There are many other applications of this form of bandage figured by Esmarch in his " Surgeon's Handbook."

CHAPTER XXXV.

SPECIAL BANDAGES (*continued*).

BANDAGES FOR UPPER EXTREMITY.—*Bandage for Thumb* is simply a figure-of-eight, the turns going alternately round the ball of the thumb and the wrist till the whole of the former is covered in.

Bandage for Fingers.—It is rarely necessary to bandage each finger separately. In doing so, however, the ordinary spiral bandage is employed, the ends being fixed by a figure-of-eight turn round the wrist. When all the fingers require to be covered in, it is better to pad them carefully, and apply a single bandage to support all of them together, than to apply a bandage to each individually.

To Bandage the Hand and Forearm, place the limb in the position of pronation—that is, with the palm turned towards the ground, so that it corresponds in position to the sole of the foot. The other parts of the upper extremity will then correspond to those of the lower. Thus the hand represents the foot, the wrist the ankle, and the forearm the leg. The forefinger corresponds to the great toe, the little finger to the little toe, and the thumb to the heel. Applying the general rules, and employing the appropriate form of bandage, the hand and forearm are covered in exactly the same way as the foot and leg were. The thumb is left free (Fig. 327).

As in the lower extremity, so here, the *whole limb* may be covered in by continuing the above bandage in the form of a figure-of-eight over the elbow, of a simple or reversed spiral as may be necessary over the upper arm, and finishing with a spica round the shoulder.

To Bandage a Closed Fist—e.g., in treating fracture of the metacarpal bones by a pad in the palm of the hand—the best means is by a series of figure-of-eight turns. The hand being closed and pronated, a fixing turn is made round the wrist, and then a series of figure-of-eight loops are applied alternately round the wrist and the hand, passing from the little finger towards the index. To finish off the bandage a turn is made circularly round the hand, and this catches in all loose pockets.

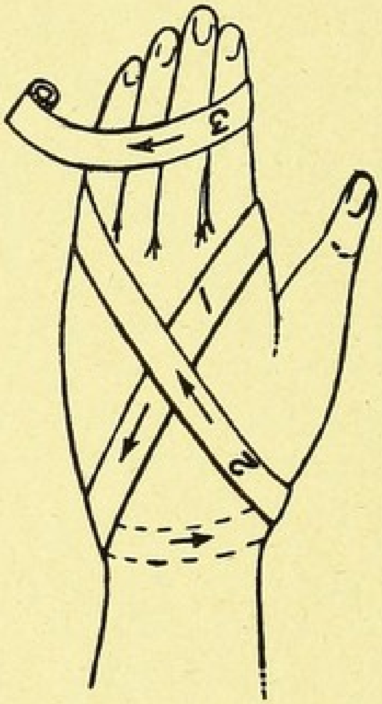

FIG. 327.

Bandages for Elbow.—The most convenient form of bandage to employ here is the figure-of-eight or spica, which may be either *convergent or divergent*. The former is simply a figure-of-eight, the turns converging towards the tip of the elbow; the latter is applied in exactly the same way as the corresponding bandage for the knee. Begin over the internal condyle, making the first turn cover in the tip of the olecranon process. The pockets left above and below are disposed of by the succeeding diverging turns. Such bandages are used to keep the elbow joint at rest after operations or injuries, the converging spica being specially useful in cases of fractured olecranon, as it tends to approximate the fragments.

Bandage for the Shoulder.—Again the spica is used, the turns being alternately round the arm and the chest. It is not permissible to put the second turn of the spica round the neck in place of the chest, because the movements of the patient's head inevitably relax these turns and the bandage becomes inefficient. To apply this bandage continue that of the upper arm as far as the axilla, then pass over the shoulder from within outwards, across the back into the opposite axilla, thence across the front of the chest and round the shoulder to the point of starting. By three or four such turns, proceeding from below upwards, the whole shoulder may be covered in by an ascending spica. The descending spica is rarely, if ever, indicated in the region of the shoulder.

Bandage for a Stump.—To bandage a stump, begin by carrying a few turns antero-posteriorly across the face of the stump, extending pressure so as to give support to the long flap. Then fix these turns by a spiral series, carried well above the next joint to prevent the whole dressing slipping off.

HANDKERCHIEF BANDAGES FOR UPPER EXTREMITY.—*For the Hand.*—A useful temporary bandage to retain a dressing on the *palm of the hand* is obtained by folding a triangular bandage *en cravatte*, laying the centre over the palm, carrying the ends across the back and then round the wrist, on the back of which they are tied. This obviously consists of a double figure-of-eight. This bandage reversed would retain a dressing on the *back of the hand.*

The *whole hand* may be covered in the same way as the foot.

For the elbow, the same method is adopted as for the knee.

For the shoulder, as for the hip, two bandages are required. The extra one is passed across the chest, passing under the opposite axilla (Fig. 328).

SLINGS.—These are used to support different parts of the upper extremity, and are in the form of triangular handkerchiefs. In applying a sling the base of the triangle is placed towards the part to be supported, the elbow, wrist, or hand, as the case may be. The ends are carried across the shoulders, either directly or crossed, and fixed by a reef knot, and they alone bear the weight, the apex being folded up neatly and fixed by a safety-pin.

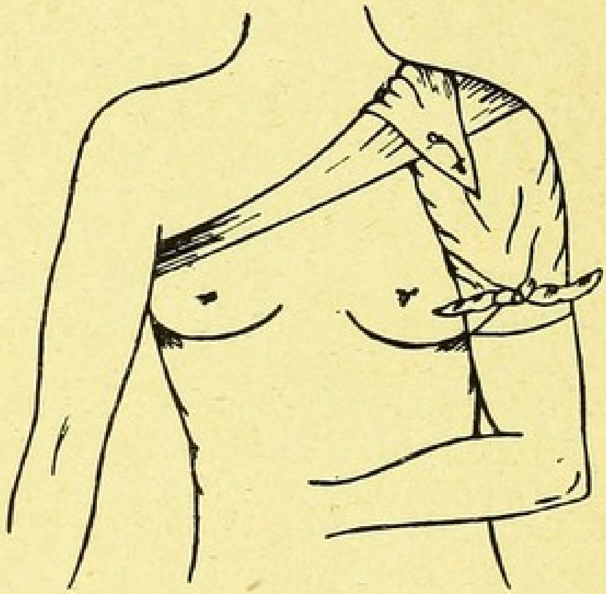

FIG. 328.

To Bandage a Stump.—Fix on the dressing by means of a few spiral turns, and then cover in the end of the stump by a series of divergent folds carried over the face of the stump so as to give support to the long flap, these being secured by a second set of spiral turns.

A *handkerchief* may be used for this purpose, as for almost any other.

The Many-tailed Bandage of Scultetus is used when frequent dressing of a part is necessary, and where it is at the same time undesirable to disturb the limb. It consists of a firm backbone, to which are sewn at right angles a number (16 to 20) of shorter pieces. These are made to overlap one another for two-thirds of their width, and are long enough to encircle the limb once and a half. The backbone is placed along the posterior aspect of the limb, the dressing applied, and the lowest turn folded into position, and successively all the others. The last turn is fixed by safety-pins. As often as is necessary the turns may be unfolded, and the dressing reapplied without the limb being in any way moved (Fig. 329).

The stability of the many-tailed bandage is increased if a second row of transverse pieces be sewn on behind the first row (Chiene).

BANDAGES FOR THE TRUNK.—*Bandages for Mammæ.*—The ascending spica is the form of bandage selected, the

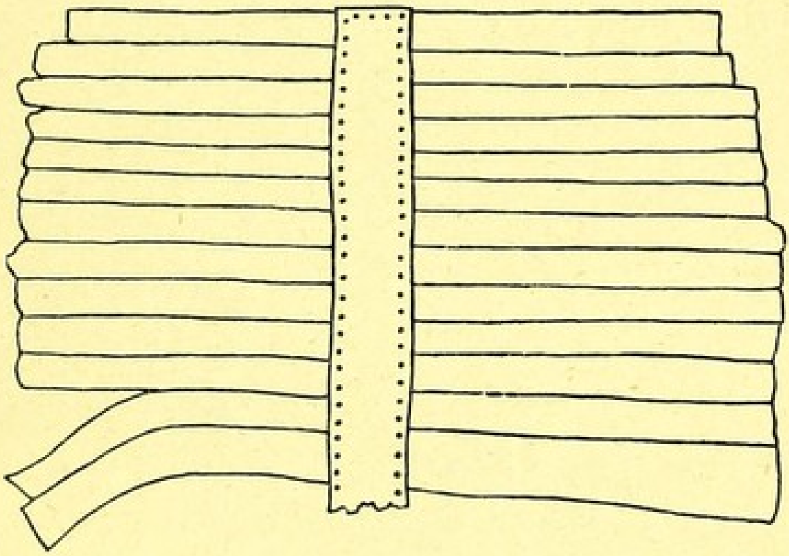

FIG. 329.

object being, as a rule, to give support in cases of inflammation and suppuration of the breast. Supposing the *left* mamma to be the one affected, place the tail of the bandage against that side of the chest just below the breast, carry the bandage towards the right, and go round the body. As you reach the starting-point catch in the tail, and elevating the inflamed gland with the palm of the hand, carry the bandage across the chest, so that it will take the place of the supporting hand. Pass over the right shoulder and across the back to the starting-point, thus completing the first figure-of-eight. Similar turns are applied, each going higher than the one preceding it, till all the mamma is covered in and supported (Fig. 330).

In cases where both breasts are the seat of inflammation, two such bandages should be applied separately, rather than the double spica, in which the pressure on one side is directed from below upwards, and on the other in the opposite direction. This—the double spica—is rarely, if ever, indicated in preference to two single bandages.

Bandage to Retain Dressing after Excision of the Breast.—As this bandage is first applied while the patient is still only semi-conscious from the anæsthetic, it will be described as she lies on her back in bed. Suppose the right breast to be the one removed, and that the necessary dressing has been applied and the arm flexed to a right angle and

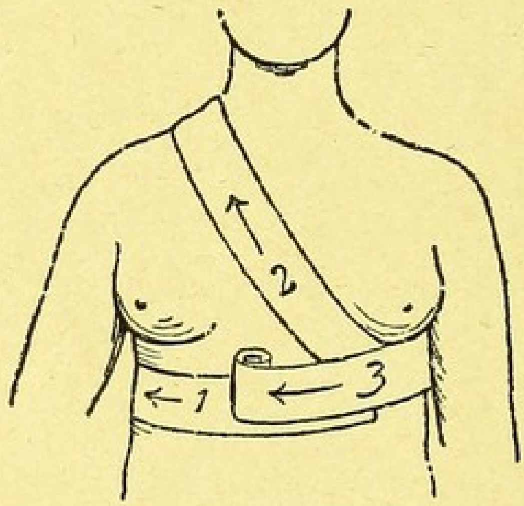

FIG. 330.

placed across the front of the body. Protect the sound breast, especially if it be pendulous, by a layer of wool, and also the axilla. Begin the bandage by laying the tail over the sound breast, and carry it across the dressing to pass over the right arm just below the shoulder. Pass under the back to the point at which it started and there catch in, and so fix the tail of the bandage. Another turn is made round the body at a slightly lower level than the first, and continued across the front as far as the affected elbow. At this point the direction is changed, and the bandage is made to travel across the back to the left shoulder, in doing so supporting the right elbow. It then goes obliquely across the front of the body to the right elbow, round the tip of it, and thence up along the back of that arm to the shoulder, after crossing which it runs across the chest obliquely from right to left, thus making a St. Andrew's Cross with the previously made oblique turn. Passing to the back, and there also making a St. Andrew's Cross by running to the right shoulder, a turn

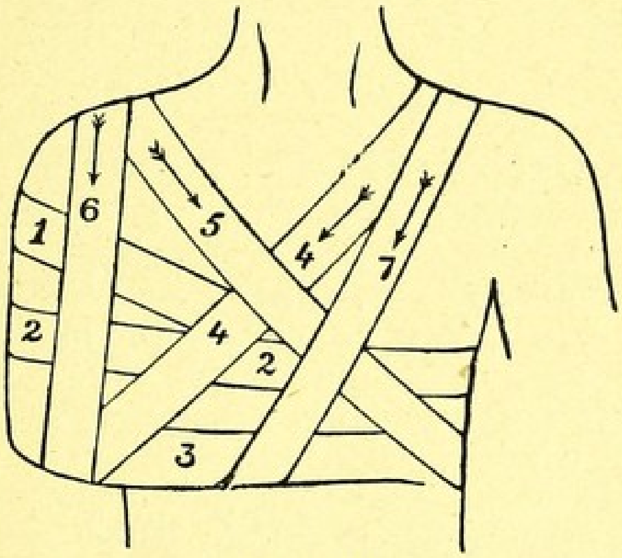

FIG. 331.

is carried down the front of the affected arm, corresponding to a similar turn already made along the back of it. Looping round the elbow once more, a turn goes across the back to the left shoulder, and thence vertically down to the lower margin of the dressing on that side, where the bandage ceases. Pins are inserted liberally at all the points of intersection, and thus is secured a very efficient mammary bandage. Such a bandage may, of course, be used for any other condition in which it is necessary to fix the upper extremity (Fig. 331).

CHAPTER XXXVI.

SPECIAL BANDAGES (*continued*).

Bandages for the Head.—In applying bandages to the head, it is well to make use of the various prominences of the skull as fixing points to prevent the bandage slipping. The chief projections useful in this way are: (1) *the external occipital protuberance*, which is situated at the back of the head close to where the head joins the neck. It is always a well-marked elevation, and a bandage placed below it will be effectually prevented from slipping upwards; (2) *the parietal eminences*, which are placed right above the ears on the side of the head. They vary greatly in size in different persons, but are always sufficiently prominent to fix a bandage placed between them and the upper edge of the ear, and prevent it slipping upwards; (3) the *ear* prevents any downward displacement; (4) *the superciliary ridges* or upper margins of the orbit on which the eyebrows are placed prevent the downward displacement of the turns passing round the forehead; while (5) *the frontal eminences* or prominences of the brow equally prevent their passing upwards.

The *divergent spica* is the type of bandage chosen for covering in the head, and in applying it three sets of turns are made: (1) A *horizontal* set, which pass *round* the head above the level of the ears, being fixed in position by the anatomical points just mentioned, behind by going below the occipital protuberance, and in front between the ridges of the eyebrows and the prominences of the forehead. (2) A *coronal* set, which travel across the crown of the head from side to side and under the chin. These turns sometimes pass in front of the ears, sometimes behind them, depending on the part of the head which is being covered in. If the front part, then they go behind the ears, so that the turns will be prevented from slipping forward; if the back part, then of course in front of the ears. (3) To fix the horizontal and coronal turns a single loop is made from behind forwards, and to it the others are pinned. This turn is not absolutely necessary, but it makes the bandage look neater, and if properly applied

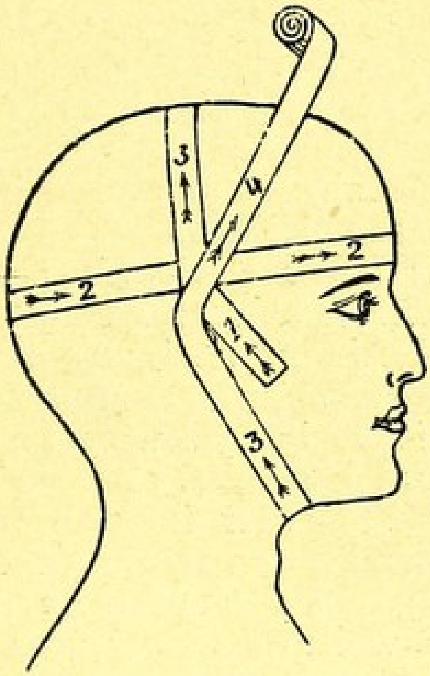

FIG. 332.

gives additional security. At the crossings of the different turns safety-pins are inserted, or they may be stitched together with a needle and thread.

To Bandage the Fore Part of the Head (Fig. 332).—Grasp the loose tail of the bandage in the left hand, leaving about 1 foot of the bandage free (1). From the left ear carry a turn *horizontally* round the head (2), and on reaching the starting-point let the head of the bandage pass *under* the loose tail. The next turn is to go *vertically* round the head, *i.e.*, across the crown and under the chin (3); these two turns fix the bandage. Now begin the divergent spica by making a turn pass across the middle of the front part mapped out (4), and from this let succeeding turns diverge till all is covered in. The loose tail is used as a fixed point round which all the turns are twisted. It will be seen that only one turn goes under the chin, the others going horizontally round the head. The antero-posterior turn is now made by carrying a turn from the occipital protuberance forward to the root of the nose, and to this turn all the others are pinned or stitched.

To Bandage the Posterior Part of the Head.—The divergent spica is here also selected as the type of bandage, but on account of the shape of the head greater difficulty is experienced in preventing the turns slipping. Turns must be made round the chin or forehead as is found necessary to give security to the bandage.

To Cover in the Whole of the Head.—The *Capeline or Double-headed Roller* is a very secure bandage for this purpose, but it has the great disadvantage of heating the patient's head too much, and on this account is seldom used. To apply it, begin by sewing together the tails of two ordinary 6-yard bandages. As one of the bandages should be somewhat longer than the other, roll about 1½ yard of one bandage on to the other. The shorter of the two bandages is to repeatedly traverse the head antero-posteriorly, while the longer goes round and round the head, fixing in the antero-posterior turns. Stand behind the patient, who should be seated on a chair, and holding the larger roller in the left hand and the smaller in the right, begin by placing the bandage across the forehead, just above the root of the nose; carry both rolls to the back of the head, and then change hands, letting the smaller one pass under the larger, and so be fixed by it. Here the first antero-posterior turn is made by passing from the occiput forward across the centre of the head to the root of the nose, where the circular turn catches it in. From this mesial turn the succeeding ones diverge first on one side and then on the other, being fixed always in front and behind by the circular turns till all the head is covered in. By diverging slowly and coming well down in front and behind a very firm bandage will be applied. Pins or stitches may be inserted here and there to add to its security.

The *Four-tailed Bandage* (Fig. 333) for fracture of the lower jaw consists of a piece of bandage about 1 yard long split longitudinally, save for a short distance near the middle. In the centre of the unsplit portion a small diamond-shaped slit is made, and into it the tip of the

FIG. 333.

chin is placed. The two anterior tails are carried backwards and fixed above the occipital protuberance, while the posterior ones are tied over the crown of the head. The ends of these two turns are now tied together to prevent slipping. If properly applied the patient should have difficulty in opening his mouth.

Bandage for Side of Neck.—It is often difficult to fix a dressing on the side of the neck in such a way that the wound may be securely protected from access of air at its edges. The best way is to apply a large dressing of wool, and to fix it by means of a bandage passing alternately *obliquely* round the forehead, neck, and under the chin.

To secure the lower edges of the dressing one or two turns may pass under the axilla.

Handkerchief Bandages for the Head.—These are particularly useful because of their lightness, their ease of application and their security.

(*a*) A triangular bandage is laid over the top of the head, so that the base passes straight across the forehead, the apex lying over the occiput. The ends are gathered up and carried to the back of the head, where they cross below the occipital protuberance, and then pass above the ears to the front, and are there tied. The apex is turned up over the occiput, and fixed with a safety-pin.

(*b*) Esmarch describes a 'four-tailed bandage' for the head as follows: 'A rectangular cloth, 24 inches long, 8 inches wide, split at both ends like a split compress. To secure a dressing to the top of the head with this cloth, the two posterior ends are to be tied under the chin and the two anterior ends under the occiput. On the other hand, to secure a dressing upon the occiput, the anterior ends are tied under the chin, and the posterior across the forehead.'

(*c*) A large square head-cloth is also used by the same surgeon.

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