

THE TECHNIQUE OF GYNECOLOGICAL OPERATIONS.

TECHNIQUE, in gynecology, is a word used to designate certain features in the details of an operation essential to its proper performance, and is the most powerful factor in ensuring its success. It has nothing to do with the diagnosis, the prognosis, or the determination to operate, but, having determined to operate, it concerns itself with every act, from the preliminary preparations to the completion of the operation. To assert, therefore, that the technique in a given operation is faultless, is to credit the surgeon with the highest scientific knowledge of his specialty, and the skill to properly utilize it for the benefit of his patient.

Imperfect technique implies errors of omission or commission on the part of the operator which may prove detrimental to the recovery of the patient or even cost her her life. With a perfected technique, therefore, the surgeon is acquitted of personal responsibility as to the result, providing his judgment in electing to operate has been good; while if his technique is bad he always stands arraigned before the bar of criticism, and is directly responsible for the bad results of his work.

The technique of an operation is thus made to include all those features which scientific investigation and consensus of opinion have shown to be conducive to success in the greatest number of cases.

It has nothing to do with dexterity, rapidity, or any other personal element in the operation, but is the basis or pervading principle of the work.

As it is the animating principle of successful operations, it is in the highest degree important to devote a separate chapter in a practical work on gynecology to the consideration of such technical details as are more or less common to operations in general, or to certain classes of operations. The variations in the technique of each individual operation must be left to the systematic description of the operation in its appropriate chapter.

The evolution of gynecology to its present high position as a specialty is due undoubtedly to the improvements in the operative technique.

In the earliest times there was no technique: the operator treated each case according to his own inclinations. Gradually, as the results of observations accumulated, individual operations crystallized in definite forms, and the technique of the operation was thus established. Further experience demonstrated the existence of certain underlying principles common to groups of operations, and culminated in one grand principle, antiseptic technique. This principle has proved the quickening element in the whole field of modern gynecology, giving life to old operations, calling new operations into existence, and yearly saving thousands of lives.

SEPSIS, ASEPSIS, ANTISEPSIS.

A proper realization of the significance of these three terms to practical gynecology constitutes the very essence of successful work. The cause of death after operation, in the vast majority of cases, is sepsis or germ-infection.

There is no longer any discussion among intelligent men as to whether certain forms of germs are dangerous and destructive to life, but the question is: Under what circumstances do these germs invade the tissues, and what are the best methods for excluding them?

Sepsis is the condition of infection resulting from the presence of one or more pyogenic organisms, such as the staphylococcus pyogenes aureus, staphylococcus pyogenes albus, streptococcus pyogenes, bacillus coli communis, gonococcus of Neisser, and also other rarer pyogenic forms.

Any of these organisms may be found pre-existing in the genital tract; the first and third are found oftenest in tubal abscesses. The second is found chiefly in stitch-hole abscesses. The colon bacillus exists in the intestinal tract, and may occasion a general peritonitis after an operation if the intestine is seriously wounded. Streptococci are for the most part found in the purulent inflammatory conditions following abortion or puerperal fever.

These are peculiarly virulent, and a little of the pus remaining in the pelvis is often sufficient to cause the death of the patient by a rapidly developing peritonitis.

The most harmless pus is that containing gonococci, as it is probable that these organisms die early. Pyogenic organisms are intro-

duced into wounds by the fingers of the operator, or on instruments, sponges, ligatures, or other objects not properly sterilized.

Asepsis means freedom from pyogenic organisms, and is the ideal condition for the hands of operator and assistants and for the instruments, sponges, ligatures, etc.

The surfaces of all objects exposed to the air are covered with bacteria; the hands not only become contaminated, but pyogenic bacteria may multiply beneath the finger-nails, and the most virulent germs may be transported from case to case. Relative to the operation, therefore, all objects not specially prepared and cleansed are germ-infected or septic.

Antisepsis is the application of any efficient means for getting rid of germs. It may be *mechanical*, as by scrubbing or washing; *chemical*, as by the use of carbolic acid or bichloride of mercury; or *thermic*, by boiling water or steam.

Mechanical antiseptic measures are of the utmost value in removing *from the hands* those germs which can be easily dislodged, though by this means alone the hands cannot be rendered perfectly sterile.

Chemical sterilization by drugs is becoming of less and less importance. A prolonged immersion of the hands in bichloride-of-mercury solutions as strong as 1:500 does not render them so sterile as the permanganate of potash and oxalic acid, yet it answers the purpose and is used by a large number of operators. Carbolic acid cannot be used for this purpose in efficient strength without injury.

Sterilization by Steam and Boiling Water has with complete satisfaction replaced all other measures in the sterilization of instruments, dressings, and ligatures.

An exposure to steam heat at 100° C. or 212° F. for a half hour will destroy all germs in cotton, gauze, bandages, or other dressings. If repeated on two successive days, the spores are destroyed, and objects so treated will remain sterile until exposed to contamination. A boiling 1 per cent. solution of the carbonate of soda will sterilize instruments in five minutes without tarnishing them or dulling the edge.

TECHNIQUE IN GENERAL.

1, *Operating-room*; 2, *Surgeon, assistants, nurses*; 3, *Instruments*; 4, *Ligature and suture materials*; 5, *Dressings and sponges*; 6, *Towels, sheets, blankets, operating suits*; 7, *Drainage*.

OPERATING-ROOM.

The requisites for a gynecological operating-room are—a floor on which water can be used freely, a good illumination, and an abundant supply of hot and cold water. A closely-joined wooden floor, if well paraffined, is satisfactory. The best floor, however, is made of encaustic tile, closely laid, as it does not absorb moisture.

The light in the operating-room should come from windows with a northern exposure and from a large skylight. Too strong light or direct rays from the sun embarrass the operator and spectators, blinding the eyes, and throwing the parts below the surface into deep shadow.

FIG. 19.

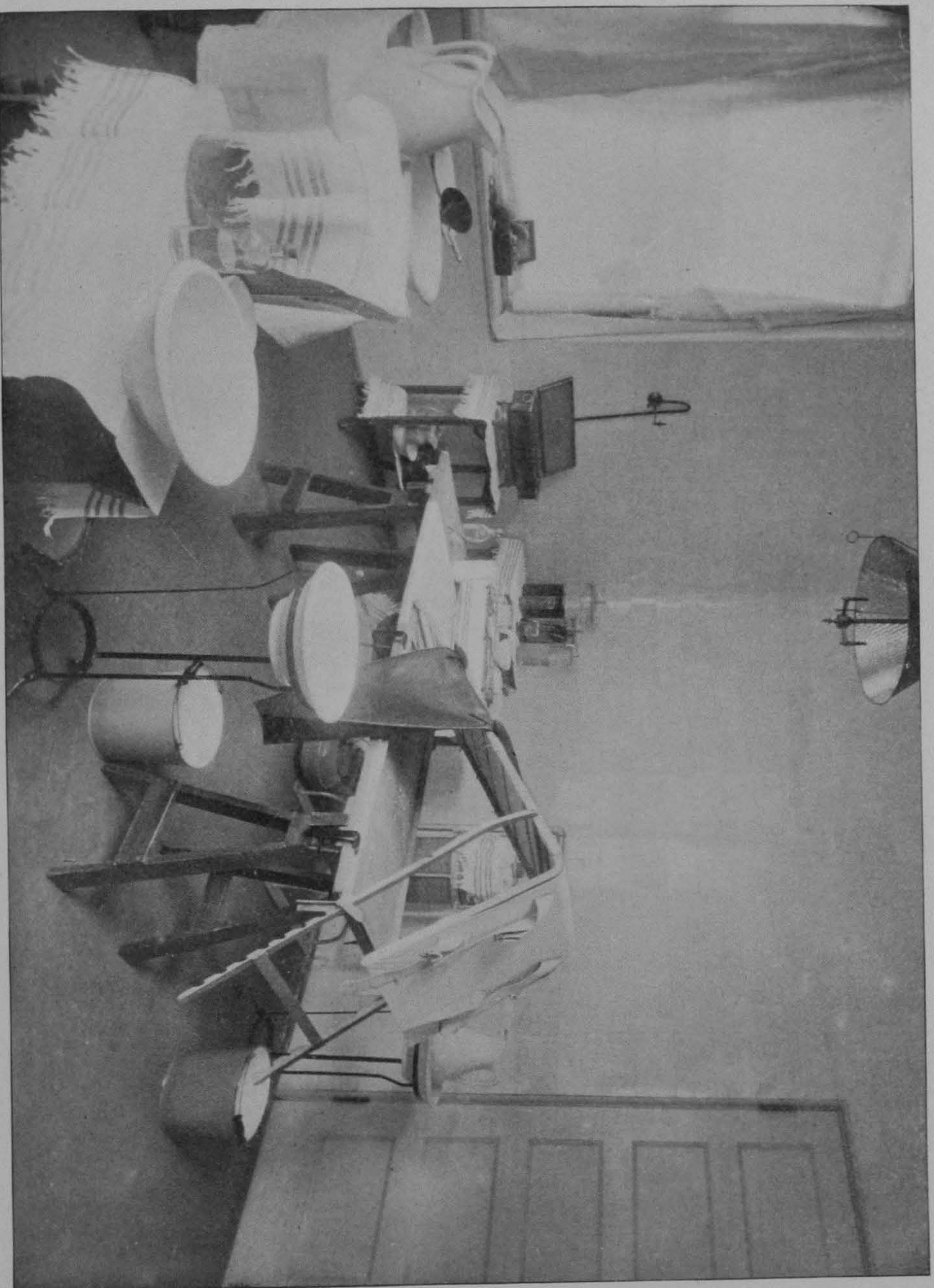


Sterilizer, Demijohn, Basin-holder, Sponges, Drainage-tubes, Syringes, Sutures, etc.

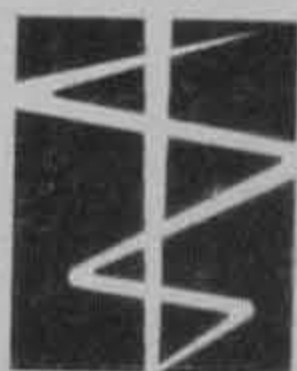
There should be an abundant supply of hot and cold water. The hot or cold water circulating in the pipes will do for the purpose of preliminary cleansing and for washing the hands, but should in no way come in contact with the field of operation unless previously sterilized by boiling.

In the operating-room there must be several wash-basins supplied with hot and cold water; also a large sink with an abundant

PLATE IX.



Operating-room of the Gyneccean Hospital prepared for an operation.



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water-supply, and drip-stones near by for dishes. There must also be an apparatus for steam disinfection, and vessels for the boiling soda solution and for boiling water.

In another part of the room the ligatures, gauze drains, sponges, and the sterilized gauze and cotton are stored in glass jars.

The instrument-case is provided with glass shelves, as they are easily kept clean and expose all the instruments to view. The instruments are kept properly classified in groups—scissors, knives, forceps, etc.

Adjoining the operating-room is a small room for the administration of anesthesia. The patient is brought here from the ward and anesthetized without witnessing any of the preparations which have been made for her reception in the operating-room.

After each operation the floor is cleansed by mopping with water. Occasionally the walls should be gone over with a damp cloth. A good enamel paint will resist the discoloring effects of the moist atmosphere of the room.

Some operating-rooms are conveniently arranged with subsidiary rooms in which all the preparations for an operation are made, leaving the room for the operation perfectly clear for operator, assistants, and spectators. This is a more convenient arrangement when the operations are frequently performed in the presence of large classes. These same principles may be carried out in a private residence as efficiently, if not so elaborately, as in the hospital.

The accompanying cut of one of the operating-rooms of the Gyncecan Hospital, Philadelphia, prepared for an operation, shows at a glance how easily and simply the indications can be met. It will be seen that there are but few articles in the room which cannot be obtained or substituted in any well-regulated private residence. A plain kitchen table may be made to answer the purpose of the operating-table. If it is desirable to use the Trendelenberg position, a Krug frame can readily be taken to the house in the physician's carriage. Instruments may be boiled in any conveniently-sized tin basin. Five- or ten-gallon demijohns of distilled water may be usually obtained, but if not, boiled water will answer all purposes. If it be muddy, it should of course be filtered before boiling.

THE OPERATOR AND HIS DIRECT ASSISTANTS.

The responsibility of the operator and his assistants does not begin, as it is commonly believed, in the preparation immediately before the operation. It is a duty, always devolving upon all persons who come in direct contact with wounds of any sort, to avoid at all times unnecessary contact with septic matter. Unhealthy or suppurating wounds should never be touched with the fingers when it is possible to avoid it; dressings of such wounds should be removed and replaced by forceps.

The gynecologist has no right to conduct post-mortem examinations or handle pathological specimens. When contact with possibly infected objects is necessary, the lodgement of infection in the skin and under the nails should be prevented as far as possible by coating the surface of the fingers and hand with vaseline, and making the contact as brief as possible; and this should be followed immediately by a thorough scrubbing of the hands.

The surgeon and his assistants, like obstetricians, should avoid the habit of wearing gloves which cannot be washed. Contamination is often conveyed by examining a septic case, hurriedly washing the hands, and drawing on gloves which become thus contaminated, and which in turn reinfect the hands each time they are worn.

Both surgeons and assistants should bathe frequently and wear clean apparel. It adds to the comfort, as well as harmonizes with the sense of cleanliness, if the surgeon can step from his bath into his operating suit. Operating suits for surgeon and assistants should be made of stout butcher's linen. The jacket should be open in the back; the pantaloons may be separate or attached to the jacket. Tapes should be used in place of buckles for the pantaloons. The sleeves should be short, reaching to within two or three inches of the elbow. Before putting on the suit the outer clothing should be removed down to the under-clothes. It is in better keeping with the appearance of the rest of the costume to wear also white linen caps and white canvas shoes with rubber soles. The nurses must wear wash dresses with fresh white front and *short sleeves*.

For operations in private houses aprons of stout butcher's linen sufficiently long to cover the clothing from the neck to the ankles will give the proper amount of protection.

Cleansing the Hands and Forearms.—The first duty after enter-

ing the operating-room is to cleanse the hands and forearms thoroughly at the basin with a stiff scrubbing-brush, soap, and warm water, frequently changing the water. At least ten minutes must be spent in scrubbing the hands and forearms, paying especial attention to the finger-nails.

After washing the hands and forearms they are immersed in a hot saturated solution of permanganate of potash until they are stained a deep mahogany-red, when they are decolorized in a hot saturated solution of oxalic acid. The hands are then washed off in milk of lime or in plain water to remove the oxalic acid. The nurses who handle sponges, gauze, prepare ligatures, etc. must also wash and sterilize their hands in the same way.

A common and excellent substitute for this method of sterilization is to bathe the hands and arms in alcohol after scrubbing them with the nail-brush and soap. They are then soaked in a strong bichloride-of-mercury solution (1:500) for five minutes, and the bichloride is finally washed off with sterilized water.

After such preliminary sterilization the operator must avoid contact with non-sterilized objects, such as lids of jars and vessels, door-handles, tables, any part of his own person, such as the hair or eye-glasses, or the patient; above all must such inconsistencies as shaking hands with visitors, putting the hands in the pockets while waiting, etc. be avoided.

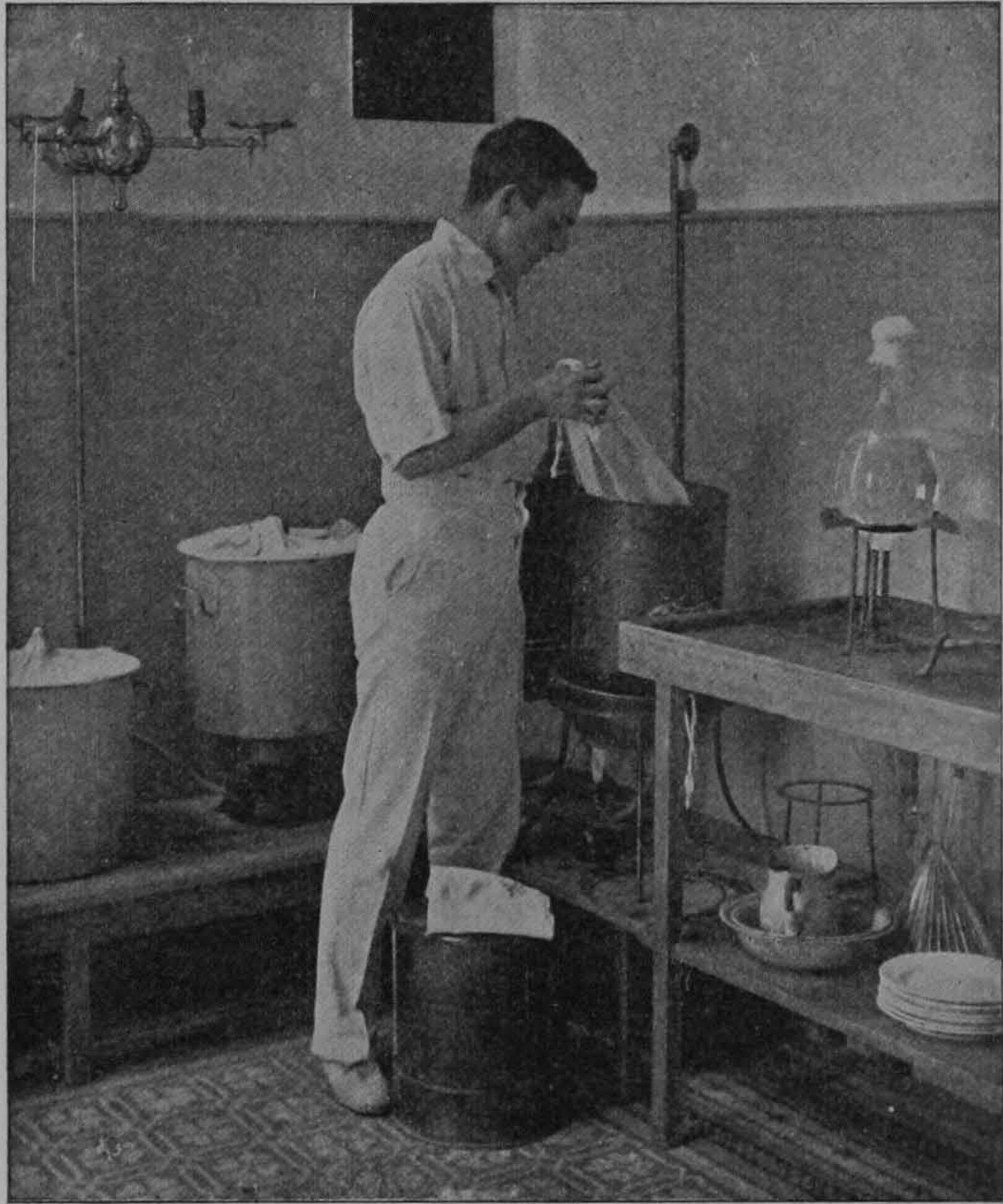
When it is necessary to come in contact with the patient, as in placing her on the pad or in removing the bandages, the hands must again be cleansed by washing for two minutes. During the course of the operation the operator and assistant should frequently rinse off their hands in a basin of warm sterilized water which is kept standing in a convenient position for that purpose.

INSTRUMENTS.

After each operation the instruments are immersed in hot water and scrubbed with soap and a scrubbing-brush. They are then rinsed in hot water and placed upon a clean dry towel, and rapidly dried, the heat from the water assisting in this process. After drying the instruments they are classified in separate groups on the shelves in the instrument-case. Before the next operation they are collected in a linen bag and placed in the sterilizer. If the operation has been a septic one, they are sterilized before putting them away, and again just before the succeeding operation.

The sterilization of instruments is simply and efficiently effected by boiling them in a solution of carbonate of soda, of 1 per cent. strength, for ten minutes. The bag is then picked up by the draw-string, which has been left hanging out over the edge of the vessel, and carried to the instrument dishes, which have been arranged on a table convenient to the operator or assistant who is to handle them, into one of which it is emptied. If a wire or perforated tray be used upon which they are boiled, the tray may be lifted from the

FIG. 20.



Placing Instruments in Arnold's Sterilizer, in Linen Bag.

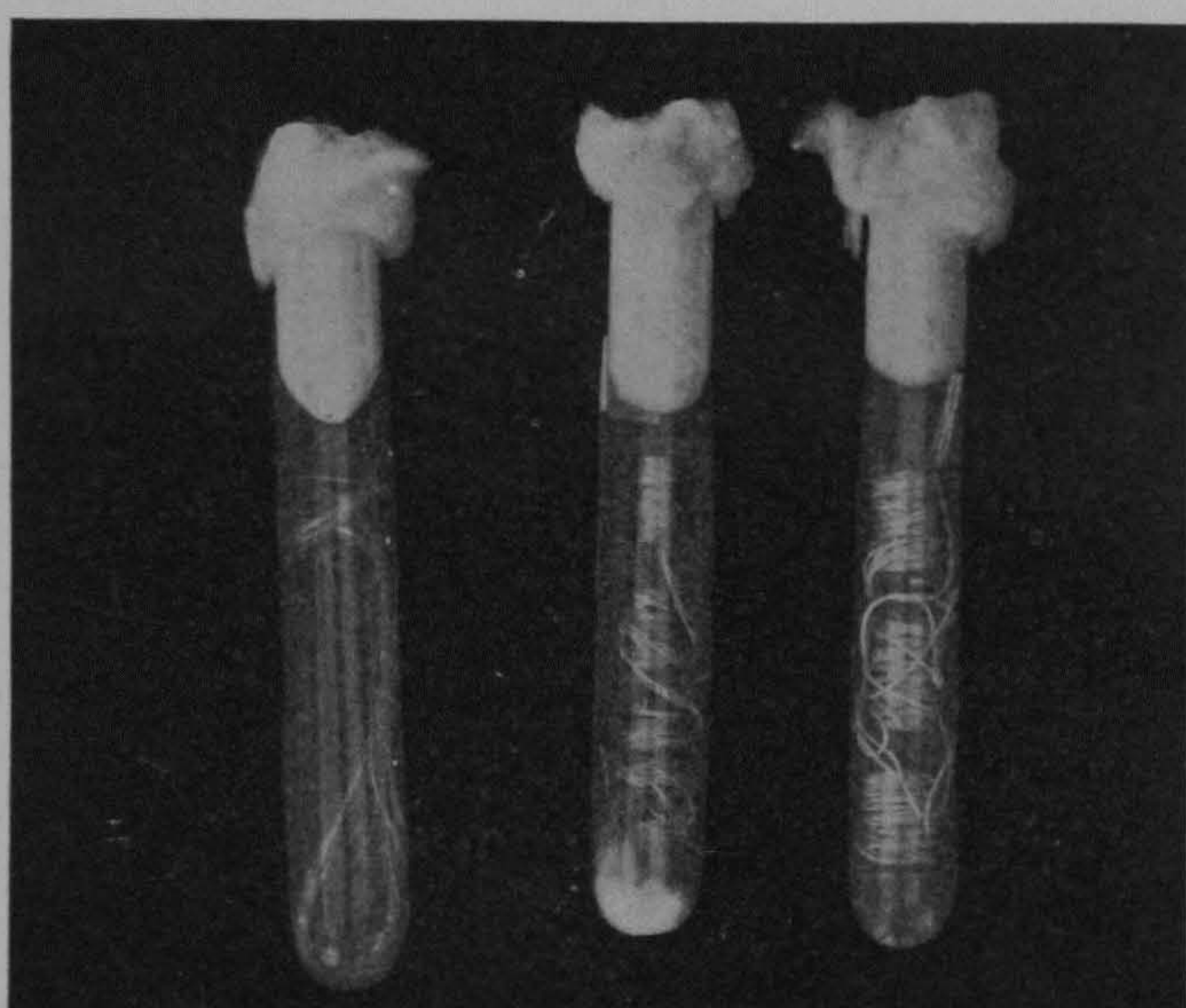
sterilizer, placed on the instrument-table, and the instruments used directly from it. Cold sterile water is poured over the instruments, and when cooled they are appropriately classified. The instruments should be kept bright and free from tarnish by the occasional use of a fine soap, such as sapolio, used for polishing metallic surfaces.

LIGATURES AND SUTURE MATERIALS.

The ligature and suture materials used in gynecology are silk, catgut, silkworm-gut, and silver wire.

Tendon sutures, while excellent, are too expensive to come into general use. The silk should be of the twisted Chinese variety of three grades—fine silk, used as carrier threaded in the needle, by means of which the sutures are pulled through the tissues; intermediate silk, for all ordinary purposes of suture and ligature, even for ligating the ovarian and uterine arteries and approximating the edges of the stump in hysterectomy for myoma; and heavy silk, for ligation in vaginal hysterectomy.

FIG. 21.



Silk in Tubes for Sterilization.

The *silk* is sterilized by placing it in stout glass tubes made for this purpose, or in pieces of stout glass tubing an inch in diameter, plugged at both ends with cotton. The silk should be cut in convenient lengths and rolled loosely on glass reels which fit the inside of the tube. The tube is then placed in the sterilizer, steamed for an hour, taken out, and the process repeated a half hour on two succeeding days. The cotton is left in place until the sutures are used. The ligatures are sterilized by this fractional method of sterilization with absolute certainty, as this is the method employed in the bacteriological laboratory for sterilizing culture media. The steam penetrates the cotton and circulates with perfect freedom in the tube.

Where steam is constantly circulating through the establishment, it may conveniently be utilized for sterilization by tapping the pipe into a copper cylinder. A coil of pipe filling the inside of the cylin-

der, also connected with the steam system, serves to keep up a high temperature and to dry out the dressings when the free steam is turned off.

Of the steam sterilizers, that of Arnold is the best for transportation to private houses and for clinics not fitted with special conveniences.

Silkworm-gut is sterilized in the same manner as the silk. It should be assorted into light and heavy sizes.

Catgut.—Catgut is ruined by water or steam, and requires, therefore, a different mode of sterilization. The following method is that of Krönig, modified in some particulars:

1. Cut the catgut into the desired lengths, and roll twelve strands so that they may be slipped into a large test-tube.

2. Bring the catgut gradually up to a temperature of 80° C., and hold it at this point one hour.

3. Place the catgut in cumol, which must not be above a temperature of 100° C., raise it to 165° C., and hold it at this point for one hour.

4. Pour off the cumol, and either allow the heat of the sand-bath to dry the catgut or transfer it to a hot-air oven at a temperature of 100° C. for two hours.

5. Transfer the catgut with sterile forceps to test-tubes previously sterilized, as in the laboratory.

If convenient, it is better to use the hot-air oven for the drying process, but this is not absolutely essential, as a sand-bath can be improvised to serve this purpose.

A beaker-glass of at least a half-litre capacity is imbedded three-fourths of its height in a tin or agate-ware vessel of sufficient capacity to permit three-fourths of an inch of sand to be packed about the sides and beneath the glass.

In drying or boiling the catgut should not come in contact with the bottom or sides of the vessel, but should be suspended on slender wire supports or placed upon cotton loosely packed in the bottom.

During the drying process the beaker-glass is covered with a sheet of pasteboard, through which a centigrade thermometer is thrust, so that the mercury bulb may be suspended about midway in the vessel. In this way the temperature can be regulated perfectly.

A Bunsen burner is placed under the sand-bath, and the temperature in the beaker-glass is slowly brought up to 80° C., where

it is held for one hour, to dry the catgut. A higher temperature than 100° C. before the catgut is thoroughly dry renders it brittle; this step in the method must be carried out most carefully.

When the drying process is completed the cumol is poured into the beaker-glass and brought up to a temperature of 165° C., a little short of the boiling-point, with two Bunsen burners. A copper wire netting should be placed over the beaker-glass to prevent the ignition of the cumol. This temperature is more than sufficient to kill all micro-organisms, and it is not necessary to allow the cumol to boil, which causes unnecessary evaporation. The catgut is left for one hour at this temperature, when the cumol is poured off for subsequent use.

Cumol, which is of a clear limpid or slightly yellowish appearance when procured from the chemist, is changed to a brownish color by boiling.

The catgut is allowed to remain in the sand-bath until the excess of cumol is driven off and it appears entirely free from any oily matter. A period of one to two hours is usually sufficient to dry it thoroughly.

From the sand-bath or hot-air oven it is transferred with sterile forceps to sterile test-tubes, such as are used for culture media, in which it is preserved from contamination until ready for use. Small quantities should be placed in each tube to obviate the necessity of opening them too frequently. The tubes should be plugged with sterilized cotton.

In conclusion, it is well to bear in mind that while cumol is not explosive it is very inflammable, and great care should be observed in lifting the wire screen from the beaker-glass to prevent drops of the cumol from falling in the flame or on the heated piece of metal on which the sand-bath rests, as it will take fire, flare up, and ignite the fluid in the beaker-glass. Such an accident has occurred three times in our experience.

Another equally efficient method of preparing catgut is as follows:

(1) Soak the raw catgut for one week in oil of juniper, (2) forty-eight hours in ether; (3) forty-eight hours in plain alcohol, and finally boil for two hours in an alcohol bath. Keep in alcohol until wanted.

Each portion of catgut taken from the stock-jar for an operation is to be boiled for twenty minutes in alcohol before being used.

Only a small portion of gut should be prepared at one time, as too frequent boiling renders it brittle and liable to break.

DRESSINGS AND SPONGES.

Sponges are prepared by pounding them in a wooden bowl to loosen the grit, and then washing them in warm water until the water remains clear. It may be necessary to change the water eight or ten times. From the water they are transferred to dilute hydrochloric acid (3ij to Oj) and allowed to stand for twenty-four hours. This part of the process is necessary to remove all chalky particles. From the hydrochloric acid they are passed quickly through permanganate-of-potash solution (5 per cent.), which stains them a dark purple; the sponges are then decolorized by immersing in a saturated solution of oxalic acid. Before transferring the sponges to the oxalic-acid solution the hands should be disinfected after the same method as for operation, as the permanganate of potash and oxalic acid are the essential factors in the process of sterilization, and the sponges must not be contaminated from this stage on. From the oxalic-acid solution, where they have remained only a sufficient time to effect decolorization, they are transferred to sterilized lime-water, which neutralizes the acid, and then into bichloride-of-mercury solution (1 : 1000) for twelve hours, after which they are rinsed twice in sterilized water and preserved in carbolic-acid solution (3 per cent.) until they are desired for use.

After being washed free from the hydrochloric acid another good method for cleansing is to immerse the sponges in a saturated solution of washing soda for forty-eight hours, from which they are taken, thoroughly washed free from the soda, and immersed in a bichloride-of-mercury solution (1 : 1000) for twelve hours, after which they are placed in alcohol, where they are kept until used. After being soiled at one operation they may be prepared for further use by the same method: prior to placing them in the mercurial solution, however, they are immersed in a strong sulphurous-acid solution for twelve hours for the purpose of decolorization.

When gauze is used for sponges it should be thoroughly sterilized in steam by the method used for sterilizing the dressings.

Gynecological dressings consist of sterilized absorbent cotton and iodoformized gauze and abdominal and T-bandages.

Absorbent cotton is unrolled from the bales in which it is bought and cut into pieces of various sizes or made into loose balls. The

large pieces are laid in a towel, which is pinned together so as to completely protect the cotton. They are then thoroughly sterilized for several hours in the steam sterilizer. The balls are sterilized for several hours in a glass jar, which is left open during the process; at the end of this time the free steam is cut off and that circulating through the coil allowed to dry them out thoroughly.

Gauze.—Gauze is bought in rolls of one hundred yards each, at a little over three cents a yard. It is cut into strips of several yards' length, and then sterilized in the same manner as the cotton and other dressings. Both gauze and cotton are used preferably by many operators after they have been impregnated with bichloride of mercury. Such material should never be used inside the peritoneal cavity. It may be bought already prepared in the shops, but should be resterilized by steam for several hours before using.

Iodoformized gauze is prepared by impregnating rolls of sterilized gauze with an emulsion of iodoform in soapsuds and water. This should also be subsequently sterilized for several hours in steam.

TOWELS; SHEETS; BLANKETS; OPERATING SUITS.

All towels, sheets, blankets, bed-clothes, or any similar articles used about the patient or brought into the operating-room, as well as the doctors' and nurses' aprons and operating suits, after being securely wrapped in towels should be subject to several hours' sterilization in the steam sterilizer. All glass-ware, iron, wooden, or rubber utensils used in or about the operation must be sterilized by being scrubbed with soap and water, douched with boiling water, and finally mopped with a strong bichloride-of-mercury solution (1:200). .

DRAINAGE.

Roll Gauze and Mikulicz Drains are rarely useful. These drains are difficult to remove, and cause the patient much distress, as they cling closely to the skin and the underlying tissues. They not infrequently defeat the object for which they are used by damming back and allowing an accumulation of the fluids to be drained. The roll-gauze drain is made by forming a piece of gauze a yard long into a loose roll about three-quarters to one inch in diameter. Pieces of the length desired can be cut off. The Mikulicz drain is made of a gauze bag one or two inches in diameter and about eight inches long, with a string tied to its bottom, the end of which string

protrudes from the mouth of the bag. This bag is loosely filled with three or four long strips of gauze, about two and a half inches wide, which project from the top of the bag. A good substitute for this drain is to fill loosely a soft-rubber tube (an ordinary rubber condom with the closed end cut off), open at both ends, with a strip of roll-gauze drain.

All these drains are carried to the point which it is desirable to drain, and the opposite end is left protruding from the lower end of the wound. The drainage is effected by capillary attraction, which carries the discharge to the surface, where there must be an abundance of sterilized cotton to take it up. It is necessary to change the dressings frequently the first day or two. The drains are removed in several days, and a small rubber tube substituted temporarily until the drainage tract has contracted. It may be preferable to pass a single strip of gauze to the bottom of the drainage tract instead. This is ordinarily removed permanently within another day. Circumstances may, however, demand its retention several days longer. At times it becomes necessary to pack the pelvis or a portion of it with gauze for the purpose of checking oozing, which cannot be controlled otherwise on account of the difficulties of so doing or because it is dangerous to prolong the operation. This is best accomplished with long strips of gauze several inches wide and several yards long. But one strip should be used if possible. Great care must be observed to pack the gauze in concentric layers, else it will be found exceedingly difficult to remove. This pack holds the bleeding in check by direct pressure, and at the same time, to an extent, serves the purpose of a capillary drain. The end is left hanging out of the lower opening of the abdominal incision, and requires the same care as do all gauze drains. It should be removed within two days, and better still at the end of one day, by pulling on the protruding end.

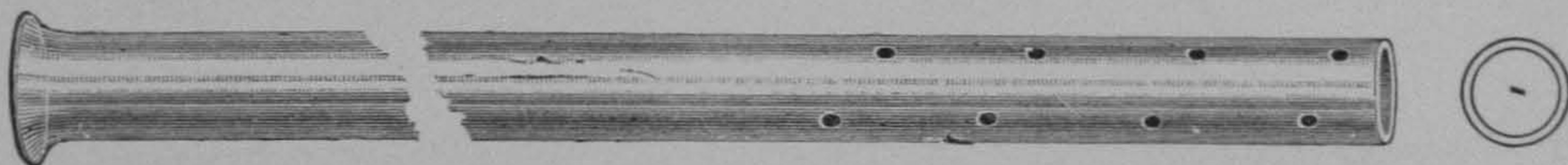
In all gauze drains it will be found necessary to free with a probe that portion of the gauze passing through the abdominal wall and adherent to its tissues. Not infrequently after withdrawing the gauze a knuckle of the intestine or omentum will be found to have been drawn into the incision. This must be carefully replaced by means of a sterilized probe, the parts cleansed, and the gaping incision brought together by means of a piece of sterilized gauze and a strip of adhesive plaster.

Glass drainage is used more frequently than gauze, but in care-

less hands it is exceedingly dangerous, and should be avoided, as should all drainage, except when absolutely necessary. Drainage of any kind is rapidly becoming a thing of the past in abdominal surgery.

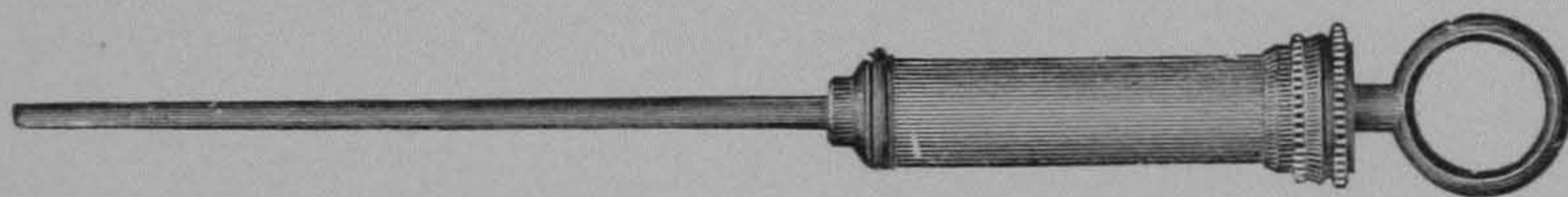
The drainage-tube should be about six inches in length and of a calibre just sufficient to admit the nozzle of the syringe used in cleansing it. It should be sterilized by being boiled with the instruments in soda solution. The object of the tube is to keep the cavity to be drained perfectly dry. To accomplish this it is necessary, at times, directly after the operation, to cleanse the tube every fifteen minutes. In the course of a few hours the intervals of cleans-

FIG. 22.



Glass Drainage-tube.

FIG. 23.



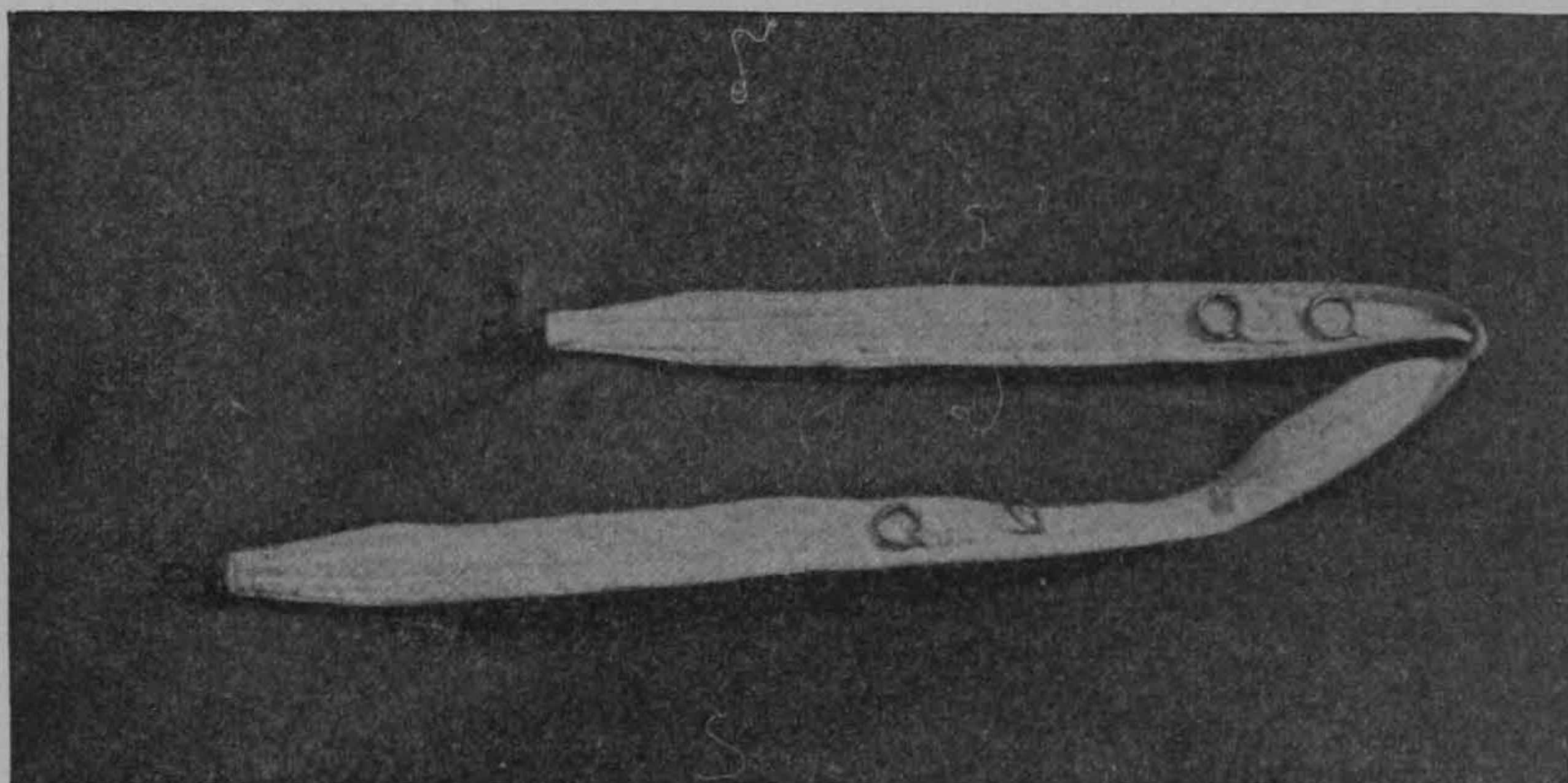
Hard-rubber Syringe, for cleansing drainage-tube.

ing are lengthened, until it is not repeated oftener than three or four times a day. The tube is removed as soon as the discharge assumes the straw color of the normal peritoneal fluid and the amount is diminished to a few drachms at each cleansing. The tube is kept dry, while *in situ*, by passing a long-nozzled syringe to its bottom and removing the accumulated fluids by suction. Before and after each cleansing the mouth of the tube and the rubber-dam through which it projects must be washed carefully with a piece of cotton dipped in bichloride-of-mercury solution; the syringe should be disinfected both inside and out with bichloride solution and boiling water. The hands of the person cleansing the tube must be carefully disinfected before each dressing, no matter how often repeated. In no other way can the safety of the patient be ensured. Fresh sterilized cotton is placed over the mouth of the tube each time it is disturbed, and is held in place by a square piece of rubber-dam, through the centre of which the free end of the tube protrudes.

THE TECHNIQUE OF VAGINAL OPERATIONS (NOT OPENING THE PERITONEAL CAVITY).

Preceding a plastic operation upon the vagina or external genitals the bowels should be thoroughly evacuated by two or three free purgations, started with a laxative, such as a pill composed of aloes gr. j, belladonna gr. $\frac{1}{6}$, and strychnia gr. $\frac{1}{30}$, taken thirty-six hours before the time of operation, followed, if necessary, by citrate of magnesia. A Seidlitz powder or several large (3j) doses of magnesium salts twenty-four hours before operation, followed by a rectal enema the next morning, is also efficient. A vaginal douche of bichloride of mercury (1:3000) should be administered daily for some days prior to operation where possible. The day before the operation the diet should be light, with no breakfast the following morning.

FIG. 24.



Robb's Modification of Kelly's Leg-holder.

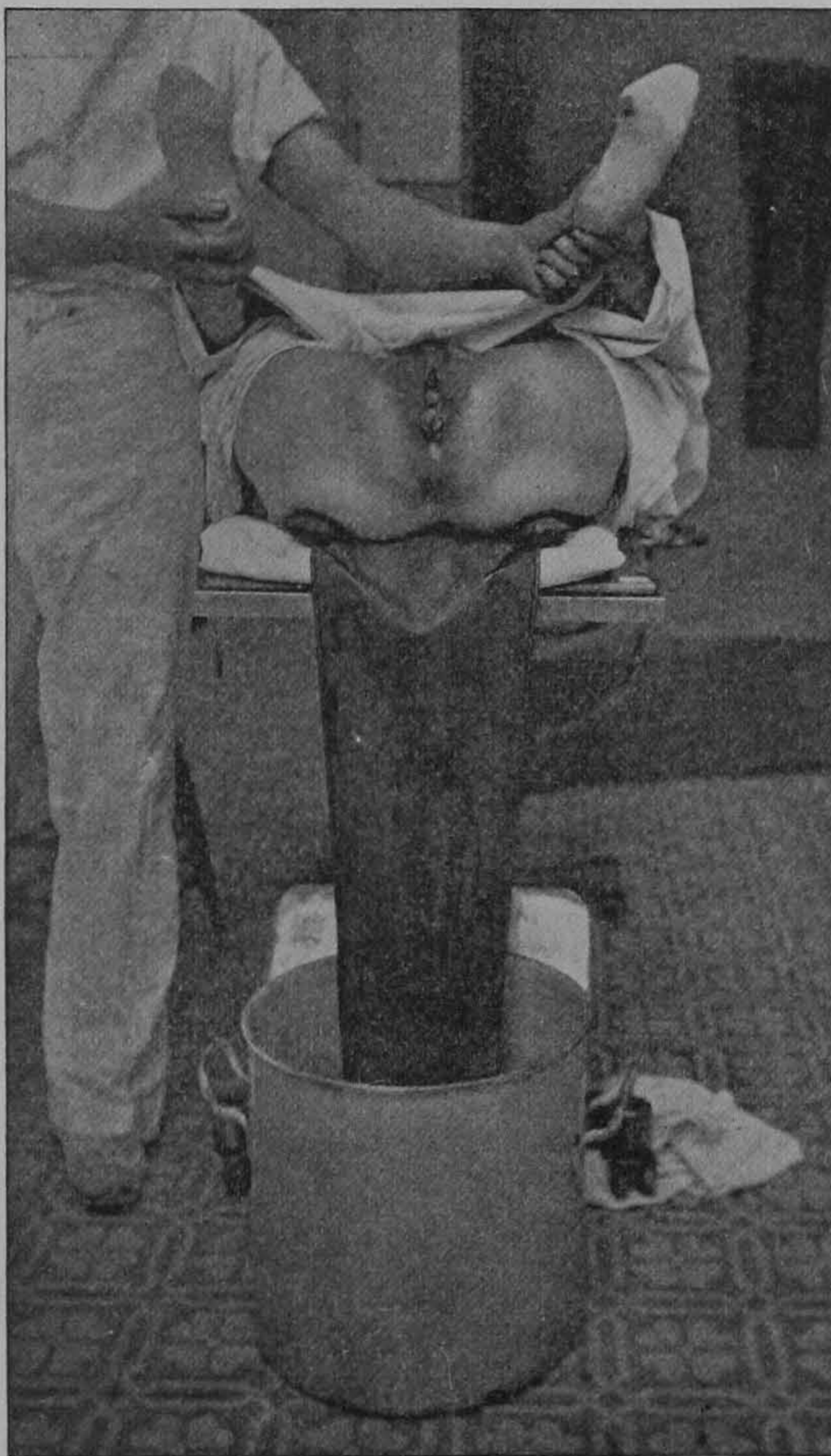
In perineal, vaginal, and rectal operations the patient is brought down to the edge of the table, with the thighs well flexed on the abdomen and held in this position by a leg-holder. The simplest form of leg-holder is that devised by Robb. One of the ends is placed around the leg just above the knee, and is then hooked into one of the rings on the shoulder-strap. The other end is drawn under the arm, around the back of the neck, down over the opposite shoulder, and hooked about the opposite leg above the knee. Like everything else used about an operation, it should be sterilized. This is readily done by means of the steam sterilizer.

The leg-holder may be dispensed with, and an assistant's hands substituted.

The perineal pad is next inflated and placed under the buttocks, with the apron dropping into a bucket at the foot of the table.

In vaginal operations the preparatory cleansing is conducted as follows: The external genitals are thoroughly soaped, and this worked up into suds with warm water; the hair is next shaved off the vulva, although this procedure is by no means absolutely necessary, provided the operator takes sufficient care to render the

FIG. 25.



Assistant Supporting Legs.

hairs aseptic. The vagina is thoroughly cleansed with soap and warm water. A 10 per cent. solution of creoline makes an excellent detergent if applied vigorously by means of a ball of absorbent cotton in the grasp of a pair of forceps, so as repeatedly to stretch out and cleanse every little fold and rugosity. The parts around the field of operation are protected in the following manner: A dia-

phragm composed of three or four thicknesses of gauze is laid over the vulva, inner surfaces of the thighs, and buttocks, reaching well down below the border of the table. Through a slit in the centre of this the operation is performed. The legs of the patient are covered with loose sterilized stockings reaching above the knees, where they are tied with draw-strings.

The irrigator is of great service in perineal work. By its use sponges are dispensed with, and the blood which is at once diluted fails to clot, and does not cling to the fingers.

The best form of irrigator is a large glass jar placed on a shelf three feet above the head of the operator. An opening near the bottom provides for the escape of the water, which is conducted through a rubber tube and ends in a glass nozzle with an intervening stopcock.

THE TECHNIQUE OF ABDOMINAL OPERATIONS.

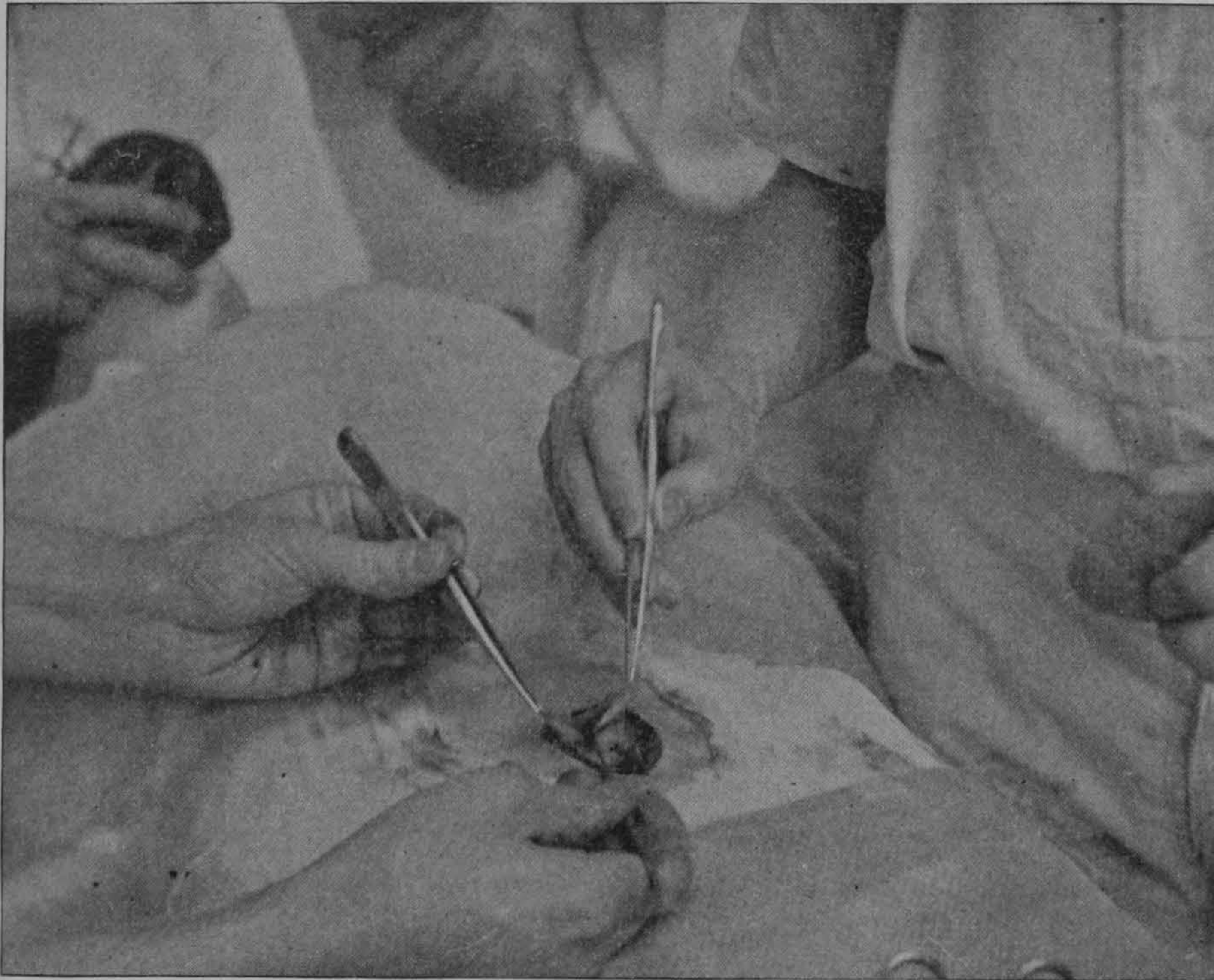
The technique of abdominal operations begins with the preparatory treatment of the patient immediately before operation, and includes all the details in the preparations for and the carrying out of the operation. Certain features are common to all abdominal operations. Of these but two will be described: the opening and closing of the abdomen.

Preparatory Treatment.—It is necessary to begin in some cases weeks beforehand if the patient be in an enfeebled condition and there is any prospect of building her up for the operation. The most important elements of the treatment are rest in bed, digestible food at frequent intervals, stimulants and tonics if well borne, regulation of the bowels, and quickening the activity of the skin by baths, massage, and electricity. Strychnia in doses of $\frac{1}{30}$ of a grain three times daily is indicated in all such patients. In other cases, where the general condition is good, a delay of but one or two days is necessary in which to bathe the patient and thoroughly evacuate the bowels. Almost all chronic cases, not excluding pelvic abscesses, will be benefited by preparatory treatment.

Such cases as extra-uterine pregnancy with internal hemorrhage, rupture or strangulation of a cyst, acute septic conditions, or rupture of an abscess call for immediate operation. Here all the advantages of rest and preparation are subordinate to the paramount danger which threatens to destroy life. Occasionally it will be necessary to give the patient an anesthetic, and without preliminary prepara-

tion lift her on to the ovariectomy pad upon the table, where the vagina is douched out with a strong boric-acid solution, or a 10 per cent. creoline solution, or a 1:1000 solution of bichloride of mercury. The mons veneris is shaved well down to the labia, the abdominal walls cleansed, and celiotomy performed at once.

FIG. 26.



Opening the Peritoneum

Ordinarily the patient has a warm bath and a vaginal douche of bichloride of mercury (1:2000) daily for several days. The morning before her operation purgatives are administered: magnesia salts in some form in half-ounce doses are taken hourly until the bowels begin to move, which will generally be after the administration of four or five doses. A full dinner is allowed, but only a light supper; no breakfast is taken the next morning. In the morning an enema of soap and warm water is given, and the vagina is prepared by being washed thoroughly with soap and hot water, followed by alcohol and a bichloride-of-mercury solution (1:1000), and finally packed with sterilized gauze, after which the patient is put in a hot soap-bath, where she is well scrubbed with a flesh-brush, special attention being given to the abdomen and buttocks.

On coming from the bath she is given a fresh sterilized night-gown and goes to her bed, which in the mean time has been made up with fresh sterilized bed-clothing. The abdomen is to be thoroughly prepared in the bed by first scrubbing with soap and hot water with the aid of a nail-brush, followed by alcohol and ether, and this by a strong bichloride-of-mercury solution (1:1000). The abdomen is covered with a pad of sterilized gauze, to prevent contamination of the skin in transporting her to the operating-room. While the anesthetic is being administered a nurse whose hands have been thoroughly cleansed empties the bladder with a sterilized catheter, after which the vulva is mopped off with a bichloride-of-mercury solution.

The patient is placed on the table with her hips resting on Kelly's ovariectomy pad, the apron of which hangs over the side of the table into a bucket. The assistant, after removing the sterilized gauze pad, now finally cleanses the abdomen by first scrubbing it with a ball of cotton and ether, and then with pure alcohol.

Sterilized towels are used to protect the thighs and chest, and over the abdomen, chest, and thighs a large piece of sterilized gauze, three folds thick, is laid. This is split open for a short distance in the median line, and through this opening the operation is conducted with a minimum danger of infection from the patient's skin.

Opening the Abdomen.—The usual location for the incision is in the median line between the umbilicus and pubes, nearer the pubes.

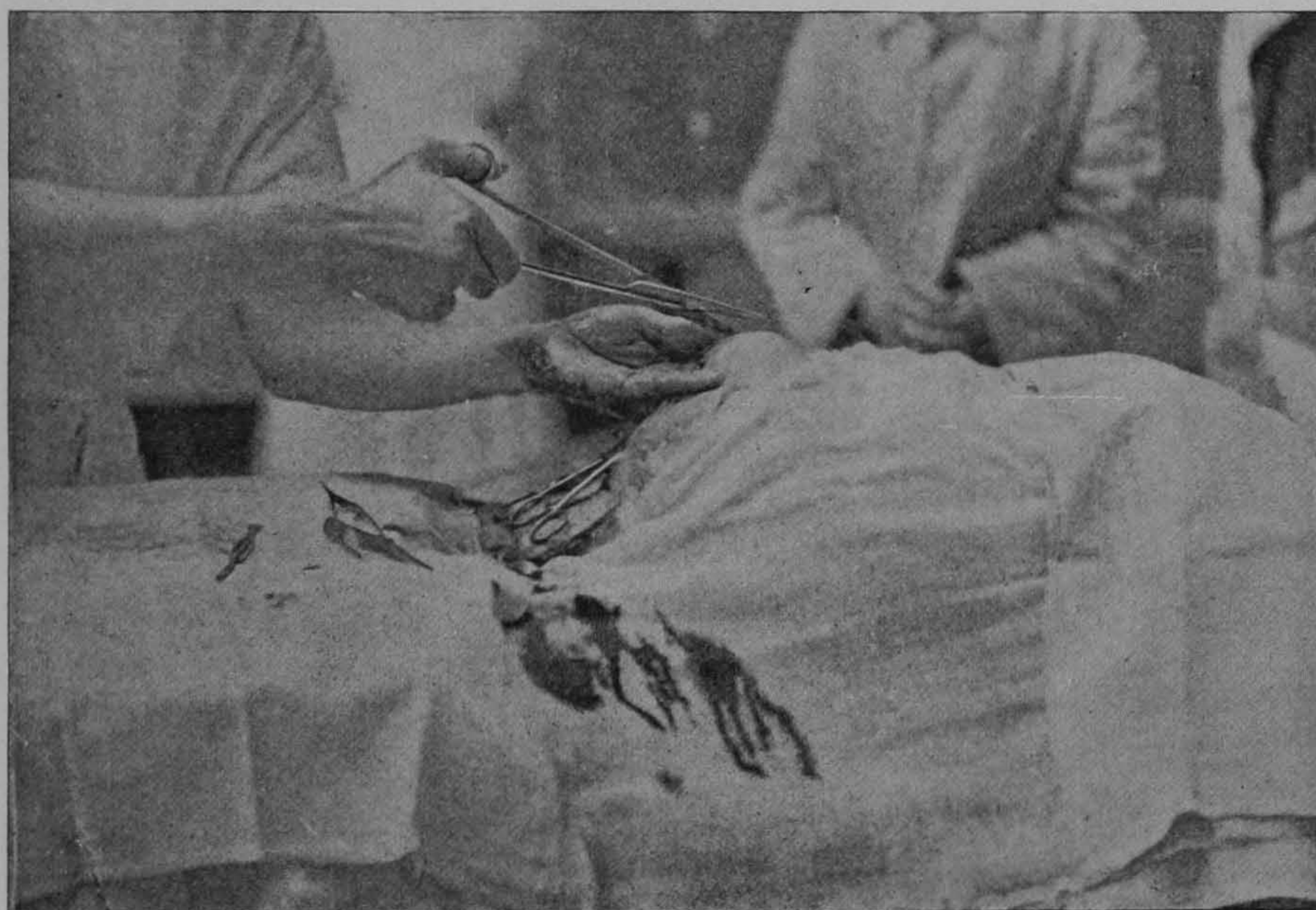
For making the incision a sharp scalpel, two pairs of rat-tooth forceps, and one or two short sharp-nosed artery forceps are necessary.

The operator steadies the abdominal wall and holds the skin a little taut, between the thumb and middle finger of the left hand, while the right hand makes a sweeping incision vertically downward in the median line from two to eight inches long, according to the nature of the operation. In doubtful cases a shorter incision should be made first, and afterward lengthened if necessary.

After passing through skin and fat the sheath of one of the recti muscles appears. This white and fibrous layer may be cut a little obliquely, when the incision is almost sure to cross the linea alba, seen between the two red muscles. The incision is continued down between the muscles in the linea with the aid of an assistant, who catches the tissue of one side with his forceps, while the operator does likewise on the opposite side. Thus the tissues are lifted up and drawn apart, layer by layer. The superficial fat, which is of variable

thickness, appears next, and beneath this the thin, delicate peritoneum. The peritoneum must be caught very superficially in the forceps and gently incised, so as merely to nick it. The intestines drop back the moment the smallest opening in the peritoneum is made, and then the incision can boldly be enlarged upward and downward to both extremities of the incision. In enlarging the incision the operator should always glance through the peritoneum which is lifted

FIG. 27.



Method of Enlarging the Abdominal Incision.

up by forceps, to assure himself that he is not opening an abnormally high bladder.

The bleeding from the walls of the incision, although stimulated by the massage given in scrubbing the skin just previous to the operation, is usually slight, and ceases spontaneously, as a rule. If too free, one or more vessels may be caught with artery forceps, which can be removed at a later stage of the operation, when the bleeding will have ceased. Occasionally a large spouting artery requires immediate ligation with the finest silk or catgut ligature. If the incision proves too small, it may quickly be enlarged by cutting upward with a pair of scissors rounded on the points, guided by a finger within the abdomen, which protects the viscera from injury.

Closure of the Abdominal Incision.—The incision should be

closed by two or three rows of sutures; one continuous suture of fine catgut uniting the peritoneum, transfixing each side three or four times to the inch. Immediately overlying the peritoneum are the recti muscles, and over these, often a little retracted from the margins of the wound, are the cut edges of the strong fibrous fascia. These are approximated by a layer of interrupted, buried silver-wire sutures, about one or two to the inch, taking great care to bring together the edges of the fasciæ of the two sides from top to bottom of the wound. This is the most important step in the closure, as in this fascia lies the strength of the abdominal wall, and in its proper reunion lies the protection against a ventral hernia which may arise as a sequel to the operation. The interrupted sutures should be drawn sufficiently tight to hold the parts snugly together, but never tight enough to constrict the tissues. The ends are twisted together, and then turned downward to prevent any irritation. The approximation of the skin may be secured either by an interrupted silkworm-gut or a continuous fine catgut suture, entered below the lower angle of the wound, passing from side to side subcutaneously, and reappearing above the upper angle.

A simpler and more satisfactory method of closure is to place a series of interrupted silkworm-gut sutures about one-third of an inch apart, each including all the tissues of the abdominal wall (skin, peritoneum, and all intervening tissues). Before tying these sutures the edges of the divided deep fascia are brought together by means of a continuous catgut suture, the ends of which are cut short. The through-and-through silkworm-gut sutures are then securely tied.

Dressing the Wound.—The skin is first carefully dried with sterile gauze or with a sterile sponge, and three sheets of sterilized silver-foil are laid over the wound, covering it entirely. Over this are placed several layers of sterilized gauze held in place by adhesive straps; sterile absorbent cotton is laid over all, and the sterilized six-tailed bandage holds this in place.

Another simple and effective method of dressing is, first, to place half a dozen layers of sterilized gauze over the incision, completely covering it, then a pad of absorbent cotton covered with sterilized gauze large enough to cover the abdomen, and the whole held in place by means of a six-tailed bandage. In all emaciated women all inequalities in the abdominal wall are to be filled in with pads of sterilized cotton placed over and about the gauze dressing.

THE TECHNIQUE OF VAGINAL OPERATIONS (IN WHICH THE PERITONEAL CAVITY IS OPENED).

The bowels should be opened by a gentle calomel purge four days, if possible, before the operation, and thereafter are to be kept regular by compound rhubarb pills given at bed-time.

If the operation is to be in the forenoon, the rectum is emptied by an enema the previous night, and a liquid supper of toast and broth given. No food or drink is given in the morning.

If the operation is to be after one o'clock, the evening enema is given, and in the morning early coffee and toast are admissible.

Preparation of the Field of Operation.—A routine practice is to be adopted for all cases. The abdomen should be prepared as for an abdominal section. It is necessary to prepare the abdomen, as the operator may be at any time obliged to abandon the vaginal method and adopt the abdominal. The day before the operation the vagina is filled with a wet bichloride-of-mercury dressing. The pubes and vulva may be shaved either before or after the patient takes ether.

The operator cleanses the vagina after the patient is on the operating-table. The vagina, vulva, and buttocks should be cleansed with soap and hot water by means of a long brush, sterilized, such as jewellers use to clean watches. The vulva is further rendered sterile by means of ether, alcohol, and bichloride-of-mercury solution. All parts about the field of operation are then covered by sterilized towels. A diaphragm composed of three or four thicknesses of gauze laid over the vulva, inner surfaces of the thighs, buttocks, and pubis, reaching well down below the border of the table, covers all. Through a slit in the centre of this the operation is performed. The bladder is emptied by the operator by means of a sterilized catheter prior to the disinfection of the vagina. The operator then disinfects himself again.

GENERAL DETAILS FOR ALL OPERATIONS.

During the progress of all operations the sponges should be handled by one nurse alone, who has no other duty to perform. She should pass the sponges directly to the operator or assistant, and should take them again for cleansing directly from his hands. A sponge should never be laid down anywhere, excepting in its basin of water, by either nurse or surgeon or assistant. In no other way can one be sure they will not become contaminated.

Instruments should be placed in trays convenient to the operator or assistant, and should be handled by no one else. Like sponges, they should always be returned to their trays when not in immediate use.

Needles, ligatures, sutures, etc. should be handled exclusively by the nurse or assistant assigned to that duty, and, like everything else, should pass directly from his or her hands to those of the operator or assistant alone.

Every assistant or nurse should be assigned to an especial duty, and under no circumstances be allowed to depart from it; nor should any visitor in the operating room be allowed to at any time touch any person or article in the room under any circumstances. Clean linen "dusters" should be provided for visitors, in the pockets of which they should be requested to keep their hands.

Should it become necessary for a nurse to open a door, a window, pick up a bucket, or in any way risk contamination of her hands, she should first take up a sterilized towel and with it in her hand perform the duty: the towel should at once be thrown on the floor, so as not to be again used.

As in all operations of any kind whatsoever, all organs of the body should be given a thorough overhauling, else some lesion which may form a contraindication for anesthesia and operation may exist. More especially should the kidneys be carefully examined for the purpose of eliminating the presence of albumin or renal casts.

SALINE INFUSION.

In patients who have been profoundly septic for a long time or have nephritis, or because of hemorrhage either before, during, or after an operation, it may be found necessary to fill the vessels with saline solution. This acts beneficially in three ways: it washes into the general circulation the leukocytes which are in a state of stasis, thereby increasing the resistant power of every tissue; it supplies fluid which has been lost by inability to assimilate drink or by hemorrhage; and it so dilutes the blood that damaged kidneys can eliminate the deleterious salts which should be removed from the blood. There are two ways of administering the fluid—subcutaneously and intravenously.

The essentials to the operations are—an eight-ounce glass funnel, six feet of rubber-tubing attached to the funnel, and a large aspirating needle or small trocar. A 1 per cent. solution of ordi-

nary table salt is made and filtered through plain cotton or several thicknesses of closely woven muslin (unstarched). The salt solution is boiled in a perfectly clean kettle, and cooled to about 110° F. by setting the kettle in iced water. In testing the solution the degree of heat should be determined by passing a small portion of the solution over the naked arm. When once the solution is made, the kettle should be kept closed. The infusion apparatus should be boiled in plain water, not soda solution, for twelve minutes.

Subcutaneous Infusion.—The operator carefully sterilizes his hands. He then washes with 2 per cent. lysol or bichloride-of-mercury solution a small spot of skin over the margin of the latissimus dorsi muscles at the level of the nipples. A cone-shaped piece of ice is dipped into salt and pressed against the cleansed skin. When the skin freezes it is incised with a sharp scalpel. Filling the funnel with salt solution, the operator raises it, and allows the solution to flow through the cannula, and while the stream is running he inserts the cannula or needle just beneath the skin or under the breast. As the fluid flows, a large swelling forms. An assistant watches the pulse. Often to encourage the flow it is necessary to strip the tube with the fingers from above downward. The procedure can be repeated each twelve hours so long as deemed advisable. From eight ounces to a pint can be thus introduced into the subcutaneous tissues at each puncture-point.

Intravenous Infusion.—An assistant holds the bared arm of the patient and constricts the veins above the elbow by circling the arm with his hand. The hollow of the elbow is sterilized. The injection is made into the median basilic vein where it crosses the middle of the bend of the elbow. For a space of a half inch alongside, not over, the vein the skin is carefully incised. As soon as the operator passes entirely through the skin he comes to the loose subcutaneous tissue, which may be filled with fat lobules. Having passed through the skin, the cut is made to slide over the centre of the vein and the edges retracted. The operator grasps the distal portion of the exposed vein with artery forceps and lifts the vessel up. He separates the vessel from underlying tissues by blunt dissection, and grasps the wall of the vein with artery forceps above the first pair. He must hold the proximal part of the vein securely, yet must not obliterate the calibre. The vein is then cut entirely across. The mouth of the proximal end is grasped with mouse-toothed forceps and the assistant starts the flow of saline solution through the can-

nula. After all bubbles have escaped and the fluid flows at a proper temperature, the operator inserts the cannula into the proximal end of the severed vein and holds it there, while the assistant releases his grasp around the arm above. The funnel should be held four feet above the patient, and should be refilled before entirely empty. While the assistant fills the funnel the operator compresses the tube lest air-bubbles be drawn into the vein. In this way from one pint to two quarts of fluid can be inserted into the vein. Having completed the operation, the proximal and distal ends of the vein are ligated. The skin wound may be sutured or left open under an iodoform-gauze dressing, according to the cleanliness of the technique.