

MEYER (W.D.)

A Portable Sterilizer for
Private Operations

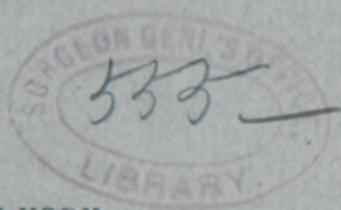
BY

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NEW YORK

PROFESSOR OF SURGERY AT THE NEW YORK POST-GRADUATE MEDICAL SCHOOL AND
HOSPITAL, ATTENDING SURGEON TO THE GERMAN AND NEW YORK
SKIN AND CANCER HOSPITALS

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A Portable Sterilizer for Private Operations.¹

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SINCE von Bergmann, of Berlin, has shown, at the Tenth International Medical Congress (Berlin, 1890), that with the aseptic wound treatment we can accomplish the same results as with the antiseptic, and that, moreover, it is simpler and exposes the patient to less risk, the operating physician has to follow this progress, lest he should be left in the rear.

Certainly it is not easy for the surgeon to give up a method which he has long learned to master in every detail and upon the good final results of which he has looked as sure, almost guaranteed, to put in its place another one. And yet, anyone who, by employing the aseptic method, has been freed from anxiety in regard to corrosive-sublimate- or iodoform-poisoning; anyone who, after an operation conducted according to strict aseptic principles, has seen the wound rapidly and firmly heal without the slightest reaction, although it was entirely closed with stitches and not drained, will no doubt at once be equally enthusiastic in his praise of the aseptic method as he formerly was of the antiseptic one.

Of course we cannot claim that we now have entirely passed the antiseptic era and have entered the aseptic. Both methods of wound treatment will continue to co-ex-

¹ Apparatus presented and paper read before the Section on Surgery of the New York Academy of Medicine, January 8, 1894.



ist and must in many respects be combined, though the aseptic will generally take the lead.

The two established fundamental principles of aseptic surgery—sterilization of the instruments by boiling in one to one and a half per cent. soda solution, and of the gauze for the dressings, of silk, drainage-tubes, gauze-sponges, nail-brushes, and towels by steam—are well known. They cannot be improved, nothing new can be added to them. What has been left to us is: to make use of these two principles in as practical a manner as possible, especially by constructing apparatuses which can be bought and easily used by every practitioner in his private work.

In public and private hospitals matters have been arranged for us in a most commodious way. The operating nurse boils and steams the material in large vessels, put up in or near the operating room. We enter the latter and can, after proper self-disinfection, begin our work.

Different in private practice. As far as I know there is at the present time no handy "portable sterilizer" for sale, at least, not in this country, which is adapted for private operative work; provided you do not look upon the clumsy so-called Arnold's milk sterilizer as one fit for general use.¹

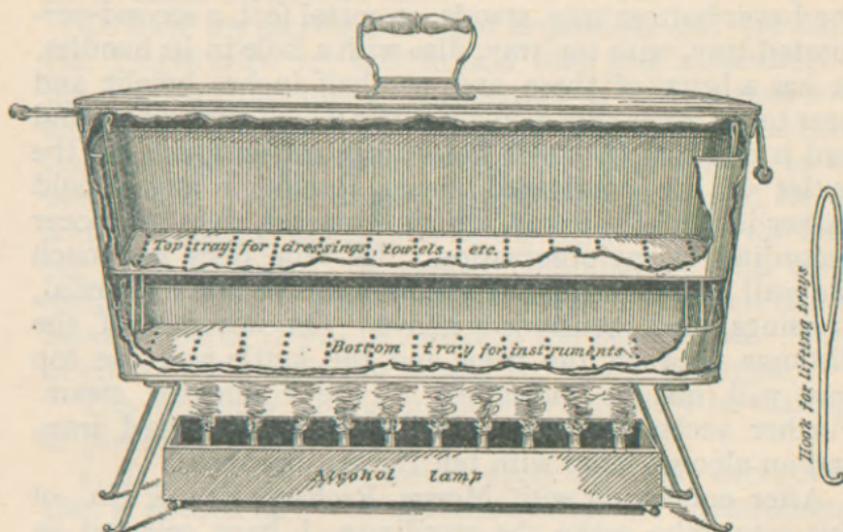
Of course, we always could boil our instruments at the patient's home, with a special facility if we use the well-known Rotter's sterilizer. But dressing, drainage-tubes,² gauze-sponges, nail-brushes, etc., had to be prepared at the doctor's home and carried along in special covers, best metallic ones. With reference to the towels, which surround the operating field, we had to satisfy ourselves

¹In the Arnold's sterilizer one can steam all the material for the dressing, etc., but cannot boil instruments. Another apparatus is thus needed for the latter purpose.

²Drainage-tubes contain sulphur. They are, therefore, once boiled in soda solution and then preserved in a three per cent. carbolic or 1 to 1,000 sublimate solution until use, when they are steamed with the other material.

with those which had been ordinarily washed and then before the operation immersed in an antiseptic lotion.

Eugen Braatz, the former scientific assistant of Professor Czerny, of Heidelberg, at present head of a private surgical clinic at Koenigsberg, Germany, a gentleman who has done a great deal for developing and simplifying aseptic surgery, has devised a portable sterilizer.¹ It is, however, as it seems to me, according to his description, comparatively small and not well adapted for preparing



all the material needed for a major operation at the patient's home. It is possible, also, that other colleagues have constructed something similar to, or even better than, that which I am going to present to night. If so, it is unknown to me. If better, especially if more practical, it shall and will, no doubt, have the preference.

As you see, Mr. Chairman and Gentlemen, my apparatus has been constructed according to the well-known Koch's steam-pot (see Fig.). A kettle of copper, nickel-

¹ Die Grundlagen der Aseptik, etc. Stuttgart (Ferd. Enke), 1893, p. 65.

plated, top, 17 by $8\frac{1}{2}$ inches; bottom, $15\frac{1}{2}$ by 7;¹ height, $6\frac{1}{2}$ inches, with two lateral wooden handles² and a lid, which also has such a handle, carries in its bottom a perforated tray, as we know it from Rotter's apparatus. The latter has a brim an inch and a half high, and two upright perforated metal handles in which you can engage a blunt nickel-plated hook for the purpose of lifting the tray out of the boiling water.³ A pair of such hooks accompany the apparatus. Two and one-half inches above the lower bottom tray, stands, on metal feet, a second perforated tray, with top tray, also with a hole in its handles. It has a brim of three and one-half inches height and near to its inner side a small gutter which runs all around and is punched by small holes three inches apart, for the outlet of the condensed steam, provided any should gather inside of the tray, which, however, does not occur according to my observation. Its brim does not touch the wall of the kettle. It receives all the other material, dressings, etc., mentioned above. On account of the distance between the brim and the kettle-wall the top tray will not be moistened by the condensed steam. Further accessories are: a stand of nickel-plated iron, and an alcohol lamp with ten Bunsen burners.⁴

After conferring with Messrs. Richard Kny & Co., of this city, who make the sterilizers, I have selected as material, nickel-plated copper for the outside kettle as

¹ This is amply long to also receive an obstetrical forceps. The latter should have metal handles. The wooden or hard-rubber handles do not stand frequent boiling.

² During sterilization both handles must be turned up, lest they should be burned by the immense flame.

³ This tray may, of course, be subdivided, as in Rotter's apparatus, if so desired and ordered.

⁴ The sterilizer is sold in three different sizes. The one described above and represented in the figure is No. 1, the largest. It is the one the surgeon should buy; it will answer all purposes. Price, \$21. No. 2 measures: bottom, $15\frac{1}{2} \times 6\frac{1}{2}$; top, 17 \times 8; height, $5\frac{1}{2}$ inches; price, \$20.50. No. 3, for minor operations; its measures are: bottom, $15\frac{1}{2} \times 5\frac{1}{2}$; top, 17 \times 7; height, $4\frac{1}{2}$ inches; price, \$20. All three have the same lamps and need half an hour for sterilization. They are all made of copper, nickel-plated. Without nickel-plating they cost \$2 less.

well as for the trays. They can thus be easily and well cleansed. They are simply rubbed off and wiped dry with a piece of gauze or a towel and need no special scrubbing.¹ If so ordered, the apparatus can also be had of agate- or emaille-iron, and of the so-called German silver, a combination of sixty per cent. copper, and twenty per cent. each of nickel and tin. However, the agate, also emaille, will in time come off the iron, which then cannot be cleansed so well, and the German silver made here is too thin.

To have my sterilizer as light as possible and yet durable, I have tried my best to find here and in factories of the neighboring cities a combination of other metals with aluminium which would enable the latter to permanently stand the boiling soda solution. My efforts have so far been futile. Aluminium alone, though now used for all sorts of cooking utensils, is slowly dissolved by the boiling soda solution. A proper combination with other metals to make it more resistant has not yet been found. Most probably it will be found in the near future. Then of course the aluminium should be "the" material.

The following points might with propriety be claimed as practical in my sterilizer :

1. It has sufficient inside space to hold everything that is needed for "the operation as such." Instruments (best wrapped up in a piece of gauze or a towel), dressings, etc., all can be easily put into the sterilizer at home and the latter then carried along with the help of this cover of gray canvas with a leather handle, as a doctor's satchel.

It would be absurd to call a "portable" sterilizer only then practical, if it is large enough to receive "everything" that we should like to sterilize for an operation. It is and must be sufficient if the apparatus permits of sterilizing at the patient's home, right before the operation, all that material which will come in direct contact with the wound and its immediate surroundings. The linen aprons or coats for the operator and his assistants will naturally never find

¹ Tin will not hold nickel-plating for any length of time. If not nickel-plated, it rusts. Copper needs polishing.

room besides all the other things in a "portable" sterilizer. They must be steamed at home, probably best in the cheap Arnold's milk sterilizer, then wrapped in a clean or sterilized towel and carried along. Two, not too heavy, linen aprons will, however, find room in my large-size sterilizer, besides the other material. It certainly means a great saving of time and annoyance, if the doctor need not sterilize all the material at his home and then carry it along either with the whole apparatus or separately wrapped in sterilized towels or pieces of gauze. Besides, the material boiled and steamed just before the operation is more reliable, because it was not handled before.

2. All material necessary for the operation as such, can be sterilized at the patient's home just before the operation. The only exception we need make is for catgut, which will best be rendered aseptic for private use by the well known method: roll on glass spools; then immerse for *a*, twenty-four hours in ether; *b*, twelve hours in alcohol; *c*, twenty-four hours in a "watery" solution of corrosive sublimate 1 to 1,000; *d*, preserve in alcohol.

3. Instruments and dressings, with all the other necessary materials for the operation as such, are rendered aseptic in the same apparatus at the same time.

4. The inner space is so arranged that two quarts of water fully cover all the instruments which will be needed for a major operation. There is a mark on the inner aspect of one of the handles of the lower tray as well as on one of the narrow sides of the kettle which corresponds to the level of the water when two quarts have been filled in. Thus measuring is avoided. If we add two heaping table spoonfuls of pulverized soda, the 1 to 1½ soda solution ordinarily used for boiling instruments is ready.

5. The alcohol lamp, if filled up to a mark near the upper border of the two outside-burners, viz., No. 1 and 10, holds exactly as much alcohol as is needed to bring to thorough boiling (bubbling), these two quarts of soda water of a middle temperature of about 55 to 60° F., viz., the average temperature of the Croton-water here in winter (this takes six minutes), and keep it boiling

for fully twenty-four minutes. Thus the act of sterilization lasts exactly thirty minutes. As experiments have shown me, two quarts of water of about 60° F. heated with this lamp need six minutes, of 50° seven minutes, and of 40° nine to ten minutes to proper boiling. With water of a temperature of 50° the material is then steamed for twenty-three minutes, of 40° F. for twenty to twenty one minutes.

This time is fully sufficient to "reliably sterilize" all the gauze, towels, etc., no matter how tightly they have been rolled or packed (Braatz), in this apparatus. Schimmelbusch says, in his "Anleitung zur aseptischen Wundbehandlung, Berlin, 1892, page 84: Steaming of the dressings ought to continue for one-half hour;" and on page 92: "In order to have the dressings thoroughly sterile, half an hour's steaming might suffice, counting from the moment the apparatus is fully filled with steam." On page 86 he states with reference to a small-sized sterilizer of his own device, which also works with boiling soda solution: "Experiments with reference to killing anthrax-spores, and disinfecting dressing material, which had been saturated with pus, showed certain death to all micro-organisms within fifteen minutes in every instance." Schimmelbusch does not give any reason why he nevertheless puts down thirty minutes as the proper time for sterilizing gauze. E. Braatz remarks, in explaining the proper handling of his portable sterilizer (l. c.): "All objects to be sterilized by steam are left in the same for about twenty minutes, counting from the moment the water boils thoroughly." And on page 139 he says: "The objects remain in the apparatus for half an hour, in the small pot (page 135) at least one-quarter of an hour after steam is in full generation. Then everything is absolutely sterile and more reliable than it might be accomplished with a strong antiseptic in days, with five per cent. carbolic in weeks." Basing on these facts I have set down the time for sterilizing gauze, etc., as stated.

A thermometer put low down in the tray in the middle of a gauze compress, which was besides tightly wrapped in a towel, showed 212° F. four and a half minutes after the water had commenced boiling.

It is self-understood that a gas-, or gasoline burner may as well be used, and that anybody, if he be in a hurry, may at once pour into the kettle hot instead of cold water. He then, however, must note the time when boiling commences and stop sterilization about twenty

to twenty-five minutes later. I had to arrange my sterilizer for cold water, of course, in the assumption that hot water was not always on hand at our arrival at the patient's home. It must be stated that the lamp produces a very intense heat. If possible, the sterilizer should be placed, therefore, at the patient's home, on a table with marble top or on the range.¹

On account of the time needed for proper sterilization—one-half hour—it is advisable to at once put up the apparatus after our arrival at the patient's home. To do so we will then best proceed in the following way: Lift out upper tray; take instruments out of their cover (gauze, if boiled, produces an annoying foam on the surface of the water); replace them in bottom tray; pour in two quarts of cold water, that is, up to the mark on the handle, and add two heaping tablespoonfuls of pulverized soda;² put the top tray into the kettle and place in it all the other materials;³ close the kettle with the lid and put it on stand; fill the lamp with alcohol up to the mark near the upper border of the two outer burners;⁴ light it.

¹ When once lighted, the alcohol should burn until used up. It is almost impossible to extinguish the lamp at any given moment. The lid, as it is at present, with short borders, shuts off the air from the surface of the alcohol. But oxygen can be still drawn through the Bunsen burners. In order to be able to extinguish the lamp at will, the lid must go down to the surface of the object on which the lamp stands, or the burners must go up to the lid. The latter will probably be arranged accordingly.

² The knives should not be put in; a few minutes' boiling makes their sharpened edges perfectly dull. They will be best rubbed with a piece of sterilized gauze which has been soaked in alcohol or ether. A few seconds' boiling in the soda solution the edge stands well. This time suffices to kill the ordinary infectious cocci.

³ Gauze, cotton, etc., may be rolled very tightly in small packages, as stated above; it has been proved that the steam reaches and disinfects every spot. However, the top tray of sterilizer No. 1 has sufficient space for loose gauze, cotton, etc. The gauze and cotton should be cut and rolled, or folded into compresses of proper size and then rolled "before," not after, sterilization.

⁴ We should always order to send for one pint of alcohol, which costs 35 cents. The lamp, up to the mark mentioned, holds exactly 400 c.c. equal to 13 $\frac{3}{8}$ ounces. The rest can be utilized for disinfecting the hands after scrubbing with hot water and green soap, and before using the sublimate solution 1 to 1,000 or 1 to 2,000 (Fuerbringer's Method).

Now the apparatus is self-acting. If the lamp extinguishes, that means, if after thirty minutes the last drop of alcohol has been consumed, we can rest assured that everything in the apparatus is sterilized and ready for the operation. It will be found that the gauze thus steamed is not wet, but almost entirely dry. To be quite sure, one of the towels should be spread on top of the dressings.¹ Meanwhile the patient will have been narcotized, shaved, and prepared on the table.

The boiled soda-water in the kettle can be well used for immersing the instruments in other vessels, during the course of the operation as is required in an operation which is conducted on strict aseptic principles. If anybody prefers to adhere to his former mode of proceeding, he may keep the instruments immersed in a two or three per cent. carbolic solution. He ought to be aware, however, that the water must be boiled which he uses for making up the solution. He will better add two tablespoonfuls (six teaspoonfuls) of pure carbolic acid to the two quarts of soda solution (vide Schimmelbusch: *Aseptische Wundbehandlung*, Berlin, 1892, page 69), thus making a one to one and one-half per cent. solution of carbolate of soda, and put the instruments in this fluid. This seems to me to be the best mode of proceeding, as the plain soda solution makes the instruments quite slippery. Or at last he may keep them spread on a sterilized gauze compress and have the blood, etc., now and then washed off in a vessel filled with the sterilized soda solution.

The only plausible objection which could be found to my sterilizer is that the instruments boil four times longer than necessary, namely, twenty-four minutes.

¹ Too much stress has been wrongly laid upon the necessity of a dry condition of the steamed (aseptic) gauze. Aseptic (steamed) gauze, which, say, is moistened by the condensed steam, is absolutely harmless and perfectly reliable, just as much as that which had been artificially dried or kept dry in the apparatus. The direct application of moist "steamed gauze" on a fresh aseptic wound may perhaps be uncomfortable, but will certainly never involve a risk.

They only need five minutes for proper sterilization. The surgical instruments of to day, made entirely out of metal, in one piece, will, of course, stand this. Nickel-plating is superfluous, since we use soda solution for boiling (Schimmelbusch, loc. cit., page 72). It therefore need not be renewed, if in course of time it be damaged by the boiling.

If anybody is very particular in this respect he may proceed as follows: If he be busy with the patient, he can make use of the self-acting feature of the sterilizer, viz., first fully steam the material in the top tray, everything being arranged as stated above, only leaving out the bottom tray with the instruments. (For this purpose one of the narrow sides of the kettle also has a mark inside, to show when two quarts of water have been poured in.) When the water ceases to boil he will lift out the top tray with the help of the two hooks, put in the lower one with the instruments; replace the top tray and lid; pour two ounces of alcohol (= five tablespoonfuls) into the lamp (which keeps the hot soda solution boiling for exactly five minutes longer), light it. The material in the top tray will then be steamed five minutes longer, that means, in all, almost half an hour. If the doctor be at leisure, or the assisting doctor or nurse has charge of the preparations, five to six minutes' time and a little trouble can be saved by noting the time the lamp has been lighted. Twenty-five minutes later the lid should be removed, top tray lifted out, bottom tray with instruments put in, top tray and lid replaced. When the lamp gives out, everything will be ready for use; the instruments boiled five minutes only.¹ If the appa-

¹ On account of the continuous slight loss of steam at the sides of the lid and therewith continuous slow decrease of the amount of water, it may be wiser for a doctor, who does not want to have his instruments boiled all the time, to use five intermediate minutes for sterilizing the instruments. It might, with other words, be preferable to remove the lid, say, at the twelfth, fifteenth, eighteenth, twentieth minute of the act of sterilization, lift out top tray, which alone had been put in at first, put in bottom tray with instruments, replace top tray and lid. Five minutes later the bottom tray is lifted out. Top

ratus shall be used for sterilizing instruments only (forceps, etc., in confinement cases), five ounces (= twelve tablespoonfuls) of alcohol will be found sufficient to bring to thorough boiling the two quarts of soda solution and keep it so for five minutes.

Mr. Chairman and Gentlemen: I should be pleased if this small apparatus should be found practical also in the hands of other colleagues and thus contribute to still more rapidly generalize and introduce the aseptic method in our private operative work.

tray and lid having been replaced, the apparatus is left to its self-acting work.

