minute. The other speeds of course would also be marked upon the dial, in each case corresponding to the time taken by the shaft to complete one revolution.

In order that the rate at which the pointer travels may be perfectly uniform, it is, previous to each observation, replaced to its zero position, the mechanism being so arranged that the replacing of the pointer to zero winds up the spring actuating the mechanism of the instrument, and thus insures a constant motive power.

The mechanism of the indicator has been very carefully designed so as to insure great accuracy in its action, and at the same time it is simple in its construction and not liable to get out of order.

A further point we would mention is that from the construction of the instrument the revolutions of the shaft may be read off by sound as well as by the indication on the dial. This, under many circumstances, would be found an advantage. By this means a thorough check can be kept upon the adjustment of the indicator.

A number of these indicators may be connected by a single wire in different parts of a factory or steamship, the same battery used for one being sufficient to work the whole of them. Again, the distance at which the indicator may be placed from the shaft is, within reasonable limits, immaterial. The battery will only be in action at the moment the indicator is being used, so that the battery power expended would be in direct proportion to the number of readings taken. It is evident, therefore, that for a variety of purposes this indicator would be very applicable, such as indicating the speed of dynamos, engines of steamships, etc., etc., and we feel sure that it only requires to be thoroughly known to be largely employed.—*Elec. Review.*

ON THE ELECTRIC THERMOMETER IN MEDICINE.

WHEN the temperature of a natural cavity, such as the mouth, armpit, etc., is to be taken, what is called a *medical* thermometer gives sufficiently accurate data. The same is not the case, however, when we desire to know the temperature of a surface, or of a given point.

For a long time past the electric thermometer has been thought of, and this apparatus has rendered immense service in physiological laboratories. It is but just to recall the fact that this mode of determining temperatures, and its application to physiology, are due to Mr. Becquerel, senior. Among the best known apparatus are those of Hankel, Helmholtz, and Claude Bernard. These apparatus, which are excellent in physiology, cannot be used in clinics, since they are bulky, of complicated mechanism, and difficult to maneuver, and the accuracy of the observations requires a very correct galvanometer placed in a stationary position, and the reading of this must be done by means of a mirror and spy glass.

It became necessary, then, in order to employ the thermo-electric method for ascertaining temperatures in medicine, to modify the apparatus, and, while preserving their accuracy, to simplify them and render them portable and of easy management. This is what a certain number of physicians have endeavored to do in recent years. Two apparatus especially seem to us worthy of being made known, that of Mr. Lombard, of London, and that of Mr. Redard.

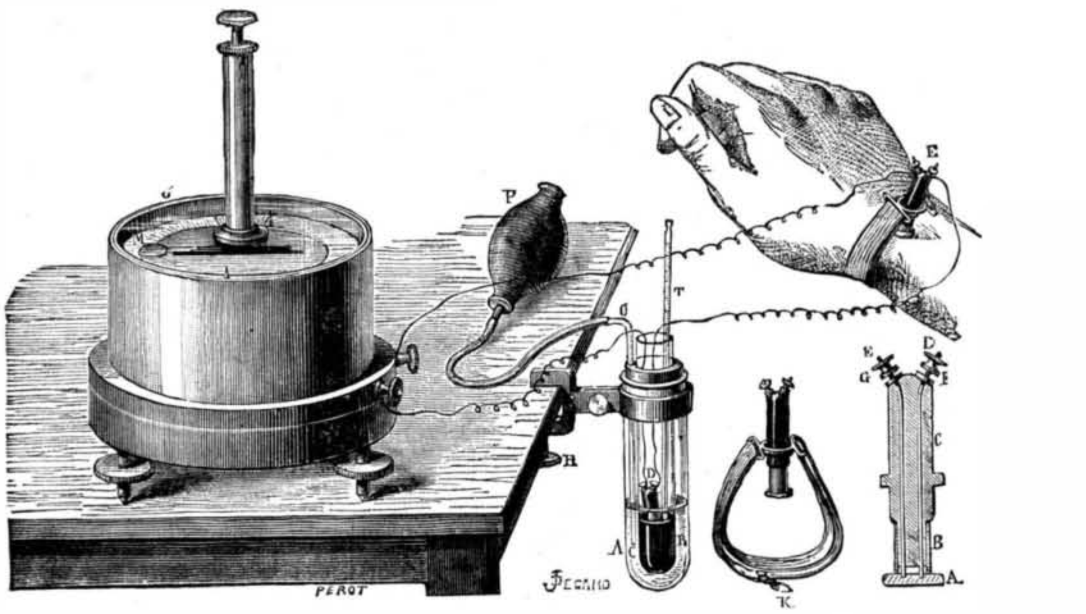
Mr. Lombard compares the temperature of two points of the body by means of two Melloni piles of special construction that act upon a Thomson mirror provided with a reflecting scale. A system of resistances and commutators interposed between the piles and the galvanometer permits of equalizing the currents produced by the two piles when they are at the same temperature, and of afterward regulating the sensitiveness of the apparatus according to requirements. This apparatus, which has already given very accurate results in Mr. Lombard's hands, is still too complicated, and especially is not easily transportable.

The problem appears to us to have been solved in a more practical way in the apparatus invented by Mr. Redard, and which is a modification of the electric thermometer employed by Dr. Becquerel for determining temperatures at different depths of the soil. It consists (see figure) of the following parts:

1. Of *thermo-electric plates* formed by soldering two metals, and of a special arrangement designed to facilitate the application to cutaneous surfaces. The metals selected for this purpose are iron and German silver, which give great sensitiveness. At A there is an iron disk, which at B is connected with a rubber sleeve, C. The enlarged part of the disk is designed for putting it in connection with the part to be explored. In the interior of the rubber sleeve there are two wires, one (D) of iron and the other (E) of German silver, which are each fixed in apertures in the iron disk, but do not traverse the latter. At G and F are two nuts (one of iron and the other of German silver), which are designed for connecting the thermo-electric plates with the wires of the circuit. The solderings of these plates are *concentric*, and the method adopted for their construction is the one indicated by Dr. D'Arsonval. The thermo-electric plates take an equal temperature very quickly. The application to the part to be explored is facilitated by means of the mode of fixation, shown in the figure at K.

2. The *galvanometer* differs from ordinary ones in its form and its small size. It consists of a sort of copper drum, G, covered with a plane glass which allows the divisions of the scale to be seen. At the zero point there is a mirror that is designed to allow of an accurate reading of that division. The galvanometer wire is short and coarse, and one millimeter in diameter. The astatic system which forms the needles is very light, and is suspended by a cocoon fiber contained in a copper sheath which is provided with a screw that permits of raising or lowering the needle. The form of the galvanometer allows of its being easily carried. The sensitiveness of the instrument is very great; for example, for one degree of difference in temperature between the two solderings there is obtained a deflection of from 20 to 22 degrees of the galvanometer, and, as it is easy to read ½ a degree of the divisions of the graduated circle, we get the temperature to within one-fortieth.

3. Two German silver wires and an iron one form a circuit which connects the plates with the galvanometer. The iron wire extends from the iron nut, F, of one plate to the similar nut of the second soldering, and the two German silver ones are affixed to the two German silver nuts of the plates, and end at the terminals of the galvanometer. The iron wire, which is 1 mm. in diameter, is 30 cm. in length, and the German silver ones are 1 mm. in diameter and 60 cm. in length. Mr. Redard uses an iron wire circuit 1 mm. in diameter which joins the iron pieces of the two couples. The German silver pieces are soldered to two wires of the same material, which are connected with two copper ones that run to the galvanometer. In this way the resistance of the circuit is diminished and the sensitiveness increased. The solderings of the German silver wires to the copper ones are insulated and surrounded with the same envelope, so that they are always at the same temperature, and no error is to be feared.



REDARD'S THERMO-ELECTRIC APPARATUS.

These first pieces of the apparatus permit of making researches in comparative local thermometry; thus, knowing that Becquerel has demonstrated that when the two solderings are at the same temperature the galvanometer needle stands at zero, we may, by placing the two plates upon symmetrical regions, find the warmer or colder side from the direction of the deflection. If we obtain a deflection of 20 degrees, we know, from the graduation of the galvanometer, that there is a difference of one degree between the two regions explored. We may thus very quickly learn with sufficient accuracy whether there exist differences of temperature of $\frac{5}{10}$, 1 degree, and 1½ degrees. This method of comparative thermometry by means of the apparatus gives very sure and quick indications, and suffices in a large number of cases.

In order to obtain the temperature of a surface in thermometric figures, the apparatus is arranged as follows: The principle adopted is that of the Becquerel apparatus for determining temperatures at different depths of the earth and at different heights of the atmosphere. Being given a thermo-electric circuit composed, for example, of wires, one of them of copper, the other of iron, soldered together at their extremities and covered with gutta-percha throughout the rest of their length, if we interpose a galvanometer in the copper wire the current will be null, and the galvanometer needle will stand at zero every time the two solderings are at the same temperature. If, then, we place one of the solderings in the medium that we desire to study, and the other in a medium whose temperature may be readily varied, and in which there is likewise a sensitive and accurate thermometer, it will only be necessary, in order to know the temperature of the other medium, to cool or heat the second until the galvanometer needle comes to zero, and to then read the thermometer.

When the two thermo-electric plates are at the same temperature, the needle will remain at zero.

The circuit employed is the same as the one described above. The medium with variable temperature is mercury contained in the tube, B, which is itself suspended by means of a cork in another and wider tube, A, partially filled with alcohol. The tube, A, is fixed very simply to a table by means of a support, K. The cork is traversed by a tube, C, which runs to the bottom of the tube, A, and is connected at its upper part with an atomizer built, P. In this way, by forcing a few bubbles of air into the alcohol, quite a notable cooling may be effected; when it is a question of reheating, we plunge the tube, A, for a few seconds into water at 50°.

In practice, we proceed in the following manner: Say we want to ascertain the cutaneous temperature of the back of the hand. A thermo-electric plate is applied, at E, to the hand, and assumes an equal temperature. The second, D, dips into the mass of mercury, whose temperature is indicated by the thermometer, T. The galvanometer is set at zero, and the circuit is closed. If the two plates are at the same temperature, there will be no deflection, and it will suffice to read the thermometer in order to have the temperature sought. If the plate, E, is warmer than D, a deflection will occur. Then the tube, A, is warmed, and the needle returns to zero. When it is stationary, the thermometer is read. If, on the contrary, D is warmer than E, a deflection will occur in the opposite direction. Then the tube is slowly cooled by a few bubbles of air, and when the needle comes back to zero and remains stationary the thermometer is read and the temperature is obtained.

The heating and cooling must be done slowly, so that the solderings and constituent parts may have time to come to an equilibrium as regards temperature. Besides, it is necessary before beginning the experiment to raise the soldering that dips into the mercury to a temperature near that which we desire to observe, and to afterward allow it to cool slowly, according as the temperature of the explored region is higher or lower. It is necessary to wait until the thermometer is fixed and the needle stands at zero for a minute or two.

The apparatus, which is constructed by Mr. Carpentier, is contained in a box of very small bulk, and is thus very portable.—*Dr. E. Renault, in Science et Nature.*

SANITATION.*

By THOMAS WILLIAMS.

THE scope of the subject entitled Sanitation possesses a universal and intimate bearing in connection with the existence and well-being of all living things.

The term sanitation may be applied to conditions occurring in nature, or to such circumstances as are brought into existence by mankind.

Sanitation includes a great number of duties ministering to the wants, safety, and comfort of the living, and the decent disposal of the dead. Arising from the practice of sanitation we have the branch of knowledge known as sanitary economy and sanitary science.

Necessity compels, owing to the vastness of the subject, that we should limit the communication that I have the honor to bring before you for discussion this evening to one department in sanitation, namely, the air we breathe.

We are aware that there is an enormous supply of air around us; approximately there is 15 lb. weight of air on every square inch of the earth's surface; it is also known that it is the principal article consumed, as regards quantity, by the animal economy. It is, therefore, of vital importance that we should have a pure atmosphere, as under such conditions we should be practically sure of the purity and wholesomeness of all other requisites, the preservation and storage of water and food would be easy, and the maintenance of health simple. Scientific chemists have pointed out that in the main the natural component parts of common air are three substances, namely, oxygen gas, nitrogen gas, and water vapor. It is known that there are some localities on the earth's surface where the air is so impure that it cannot be breathed, and in some mines, manufactories, etc., without ventilation, and a large admixture of common air, work-people could not exist, and the health of the individual is ruined even in breathing the mixture. In towns, again, ordinary air is unknown, and as a result of the degree of its pollution thousands of lives are injured and lost annually. It is almost impossible to ventilate the narrow alleys and courts of our large cities, as, unfortunately, the air in the street is no fresher than that inside the house. It needs little observation to discern the sources, and, to some extent, form an estimate of the quantity of the pollution which the air receives, especially in a city like Liverpool. For if an observer views the air of the town from any elevated position, he will see the ten thousand chimneys pouring down their contents on to the inhabitants below, and again in walking the streets you have every few yards the sewer ventilators discharging their foul emanations.

The impurities are various in their nature, and include bodies or gases invisible and inodorous, odorous invisible bodies, odorous visible bodies, such as coal smoke and flue dust, etc., organic exhalations bodies, microscopic organic germs. It will be unnecessary to dwell on the production and injurious nature of each individual substance enumerated above; for our purpose we will classify them into two groups, namely, smoke or chimney exhalations and sewer gas. It will, however, be as well for us before proceeding to examine the sanitary arrangements of the present day to take a glance back as far as we have any record, and endeavor to trace the progress from the earliest period.

The first records of any laws upon the subject of health are the Mosaic, and in studying them over, although at a distance of three thousand five hundred years, we cannot but be struck with the fact of how little we have advanced, or, perhaps more correctly, how those ideas have guided succeeding generations, especially in diseases of an infectious character, such as leprosy, those afflicted being placed in quarantine for seven days, and if at the expiration of that period the disease had not spread, the priest pronounced them clean, and after offering certain sacrifices the sufferers were again allowed to mix with their brethren; but if at the end of seven days the leprosy continued, the poor unfortunate was banished the camp. Wherever the houses became infected with leprosy, the infected part was to be taken out and cast into an unclean place without the city, new stones and plaster were to be used in their place; if, after this repairing, the disease again showed itself, the house was to be razed to the ground and the stones cast into an unclean place outside the city. If, however, the plague did not show itself after the repairing, the walls were sprinkled with hyssop and cedar and blood, partly, doubtless, as a

* Read at an evening meeting of the Liverpool Chemists' Association, October 23, 1884.

disinfectant, and partly as a religious ceremony. The laws of quarantine are practically the same to-day as they were three thousand years ago, and the separation of the infected from those that are free, which seems to be dawning upon the authorities as desirable, but by no means essential, was very stringent, any failure upon the part of the infected being punishable with death.

We next find that the Italian tribes worshiped the pastoral goddess Pales, and were in the habit of calling down blessings for the fruitfulness and health of their flocks; but evidently at that date full reliance was not placed upon the blessings of the goddess, as they found it necessary or helpful for the health of their flocks to pass them through the fumes of sulphur. We also find that Ulysses was acquainted with the value of sulphur, as he used it for removing the smell arising from the dead bodies of the suitors for the hand of his wife after their massacre.

For many centuries little was done to prevent the spread of infectious diseases, the ravages of the plague decimating the world; and as the population increased the huddling together of the poorer classes always gave a foothold to any epidemic, as was so vividly witnessed by the plague in London, in 1665, when the deaths were over 100,000; and during the visitation of cholera to Europe in 1830 to 1834, the deaths in the Caucasus were 10,000 in a population of 16,000, and in one province of Russia the deaths were 31,000 in 54,000. In 1666, the year following the plague in London, came the great sanitary engineer, the fire, destroying the unhealthy and unsanitary rookeries where, during the previous year, the plague had held high festival. At the end of the eighteenth century some attention was paid to antiseptics: the list of those recommended, at any rate, gave sufficient for any one to choose from, but their value, in most instances, was verysmall, as the following list will show: alkalies and salts, gum resins, such as myrrh, assafœtida, etc., decoctions of Virginian snake root, pepper, ginger, saffron, sage, mint, valerian, rhubarb, senna, wormwood, celery, turnips, carrots, garlic, onions, cabbage, horseradish, and molasses. More attention was also paid to drainage of houses and streets. Wooden pipes, of which a specimen in oak 6 feet 6 inches long, 7½ inches square, and 3½ inches bore is shown at the Health Exhibition, taken from Hackett's Hotel, Piccadilly, London, and supposed to have been laid down about one hundred years ago, brick drains, wood troughs, and common tiles being used, generally having an outlet into a cesspool for all the matter that had not previously percolated through the wooden troughs and joints of the tiles, the heavier portion settling to the bottom and the liquid running over. The cesspool, being placed generally in a place not lending itself to easy access, was only cleared out when the stench became unbearable or some serious outbreak of disease drew attention to it. Following this period we come down to the visitation of cholera to this country in 1832, when the public mind was specially directed to improvements in sanitary matters. It is only, therefore, within the last fifty years that the subject of sanitation has had much attention paid to it; but during that period much work has been done under the Public Health Act and the separate Acts of Parliament for most of our large boroughs and local board districts. The engineer has been called in, vast waterworks have been formed, and water at high pressure is now obtainable in all our large towns and most of our smaller ones; thousands of miles of sewers and drains have been made; thousands of miles of streets have been paved with sets, and the parapets flagged; thousands of old houses, veritable dens of disease, have been swept away; time-honored graveyards have been closed and cemeteries opened, originally placed at some distance from the centers of our dense populations, but which now, unfortunately, with the rapid growth of our towns, are surrounded as much as the old churchyards were. The question of the disposal of our dead is a matter that will have to be faced, and let us hope that public opinion may be guided to the rational system of cremation. The great demand for sanitary work has called into the field inventors by the hundred, with their patent sockets, glazed earthenware pipes in place of the old wooden trough, stench traps and ventilators for the streets, patent water-closets by the score, etc., etc., so that the engineer of the day has had nice material to work with, and with it he has doubtless made a good show in our houses and left substantial work in our streets. But still, with all this skill and all these improvements, and the many millions of pounds sterling that have been spent and still are being spent to carry them out, the undeniable fact still remains that the death-rate of the kingdom is fully one-third greater than it should be, and that the general sanitary arrangements are provocative of disease instead of being preventive. Sir Robert Rawlinson, C.B., states that in Dublin and its vicinity there is not a single residence in a satisfactory condition; and in the metropolis it is stated, on the experience of sanitarians, that there are not five hundred houses properly and safely drained. You may go further, and say that there are not five hundred in the kingdom, and also that, to a great extent, the millions spent on the vast sewerage schemes have been literally, not figuratively, thrown into the gutter, and thence into the sewer; that in all these great and small schemes, whatever the object has been, the effect is to make sewer gas and poison the people, and that the first principles of sanitation have been openly and willfully neglected—"*the prevention of decomposition or fermentation.*"

What is the result of decomposition? Sewer gas and germ development. Sewer gas is formed of various bodies or component parts, as CO, CO_2, C_nH_nN, etc.; SO_2, SH_2. While the fermentation is going on, zymotic or development is caused. That is, pre-existing germs becoming active organisms by fermentation taking place, as Pasteur demonstrates, by atmospheric influence, "not upon its oxygen or any gaseous constituents, but upon minute particles suspended in it, which are germs of various low forms of existence." Professor Tyndall calculates that germs equal to the population of the world could be placed on four square inches, and that one million could be piled on the head of a pin. Among the interesting facts pointed out by Dr. Duclaux, in his valuable work on fermentation, the rapidity of development of some of the lower forms of life stands out in prominent array. Speaking of the development of certain germs (bacteria) he says Cohn "found that it would take two hours for two living organisms proceeding from segmentation in certain bacteria to attain the dimensions of the parent, and in their turn to multiply. Hence in three days the progeny of a single specimen if unhampered would number 4,772 billions. As it is about the thousandth of a millimeter in breadth and two in length, and as its density is about the same as that of water, 536 millions would be required to make the weight of a milligramme (about 0·015 of a grain English). It is then easy to calculate that the offspring of a single specimen would in twenty-four hours only weigh the fiftieth of a milligramme; but at the end of three days it would weigh 7,500 tons." Such figures show us, in truth, that we must cease to wonder at the rapid spread of diseases when these germs multiply and increase at such an alarming rate. We thus find that our tens of thousands of miles of sewers and drains are forcing-houses for germ development, the matter passing into the sewer. Commencing immediately to decompose, the sewers becoming one immense gas factory provided, as the law directs, with street ventilators which pour forth, both when we are asleep and when we wake, sewer gas laden with myriads of germs in a more or less active condition, ever ready and willing to attack the weak and ailing. The fatal results arising from this dissemination of sewer gas into our streets is indeed great, but can bear no comparison with the effects of sewer gas entering into our houses from water-closets, slopstones, etc. It is generally supposed that the water-traps attached to water-closets, etc., are a perfect seal against the back pressure of noxious vapors from the sewer; but we only have to think for one moment and the fallacy is apparent. The depth of water in ordinary traps is some six inches, and the atmospheric pressure being sufficient to balance a column of water of thirty-four feet, it is self-evident that an increase of pressure in the sewers of only three ounces per square inch would overcome the six inches of water in the trap, and that as at present arranged they are only a delusion and a snare. Mr. C. P. Cotton, Engineering Inspector of Sanitary Work in Ireland, in a valuable paper read at the Sanitary Congress at Dublin, states, "I have seen sewer gas pouring back through a sink into a house in one of the best parts of Dublin (indeed, my attention was attracted by the noise), owing to the filling of the low levels of the sewers by the tide." If further proof be needed that gas can overcome the water in the stench traps of houses, we have only to refer to the account of the correspondent of the *Daily News* in Naples, that in burning sulphur in the sewers to disinfect them the fumes entered the houses through the closets during the night, nearly suffocating the inmates, driving them out into the streets, where they aroused their neighbors and crying out that they were being poisoned intentionally.

Having proved that sewer gas is the result of decomposition, and that fermentation is the cause of germ development, and that the sewers are always fully charged with the death-dealing compound, and that the sewer and closet traps are inadequate to deal with the gas, the question comes, Is there any method or means by which decomposition can be hindered and sewers utilized, as originally intended, for the conveyance of sewage to a given point without the matter undergoing change? Many schemes have been devised.

The system of Mr. Shone is one that has many features to recommend it, being very superior to the present plan; it is in operation at Warrington and Eastbourne. The plan is to connect the house drains with the sewer, this sewer being connected at one end with a tank sunk to a depth to allow any desired fall in the sewer. When this tink is filled to a certain point, a float connected with the valve of an air compressor is opened and the sewage matter is ejected into a sealed pipe, and forced either into another tank at a higher elevation or direct, it may be, to a sewage farm several miles distant. The pressure of air employed is about 50 lb. to the square inch, and at an exhibition at Warrington to show the power, the sewage was ejected from a tank into the open air to the height of about 80 feet. The olfactory nerves were soon satisfied of its efficiency, and if further proof was wanted, the descent of the vile compound among the invited guests quickly decided the matter. The late Mr. Spence, of Manchester, whose personal friendship I had the honor of having for many years, suggested, many years ago, a system of atmospheric or gaseous sewerage, the idea being to connect the chimneys of the houses with the sewers, leading them to centralizing conduits converging to a point where an immense chimney, 600 feet high, would be erected to discharge the gases into the atmosphere, the ascensive power being obtained either from the retained heat of the gases, or if this was not sufficient, by the addition of artificial heat or a fan. Mr. Spence gave the figures for a chimney necessary for the purpose, proposing that the chimney should have an internal diameter at the top of 100 feet, and an external diameter at the bottom of 140 feet, and estimating its cost at about £40,000. The capacity of the chimney for conveying smoke gases, on the calculations of a velocity of 40 feet per second, would be in twelve hours 480,000 cubic yards. The gases from the combustion of two million tons of coal per annum represent 46,000,000 cubic yards per day. So that the calculations allow room for nine times as much gas from the sewers, which would be very ample.

Mr. Spence stated that the value of the sewage from Manchester and Salford, with the ammonia contained in the coal, would have a commercial value of £800,000 per annum; during this gaseous process the sewage would be throughly disinfected by the sulphurous acid gas contained in the smoke. The Corporation could easily try the plan at Kensington fields, and it would have been very advantageous in the erection in Nash Grove for purifying the sewer gas pouring out of the ventilators; by this means the sewage would be disinfected, and the manurial properties contained in the smoke deposited. This scheme would undoubtedly act very well, though the expense of remodeling our houses and sewers puts the adoption of it out of court for the present. But where new towns are being laid out, the adoption of the principle could easily be carried out, and as the central smoke stack would carry all deleterious vapors clear away, the houses could be made with flat roofs and laid out as flower gardens.

I could also propose the burning of fires in the streets over the ventilators; this would doubtless draw out all the bad gas, and the number of ventilators could be reduced, but this would interfere with the traffic, besides being an eyesore.

The placing of charcoal over the ventilators has an effect, but for a brief period only, as was proved at Southport during the visit of the British Association. The poor levels of the sewers there always cause a pressure of sewer gas when the tide is up, and walking down any part of the town the smell is anything but pleasant. The visit of such a learned body to Southport was an event of which capital could be made, and the Corporation, always zealous in forwarding the interest of the inhabitants, bethought them that if they could only get the sewer smells done away with during the meeting they would be enabled to get a testimonial as to the salubrity of the place and its freedom from noxious inhalations. Charcoal filters were applied for a few weeks, and the result was all that was required, but they were, I believe, done away with as soon as the object was attained.

With the exception of Mr. Spence's system, decomposition of sewage matter must and will take place, for even if Mr. Shone's system were generally adopted the sewage matter would require deodorizing prior to being placed upon the land. In nature's economy it was doubtless intended that refuse matter should return to the land to increase the productiveness, but so far, with only one or two exceptions, such as Aylesbury, Aldershot, etc., sewage farming has been a failure commercially. Not that the ratepayers would grumble at being taxed to cover the loss; but the enormous quantities to be treated, and the confession by those in authority that the money already spent on sewage schemes was of little value, will prevent for a long time the subject being grappled with. What we must look to in any case is the prevention of decomposition, and the application of antiseptics in our houses before the kitchen refuse and excreta from our water-closets pass into the sewers. By this means the enormous amount of sewage matter daily discharged into our rivers would be thoroughly disinfected, and no ill effects from sewer gas would be perceptible. In the case of the Thames, 160,000,000 gallons per day are discharged into it, and often in consequence of the lowness of the upland water there is from fourteen days' to thirty days' sewage washing backward and forward at the rise and fall of the tide, awaiting a freshet to carry it out to sea, in the mean time throwing off its vile gases continually.

If the Commissioners of Sewers were to see to the application of antiseptics prior to the matter passing into the sewers, the houses and streets of the metropolis would be pure, and the Thames, although often containing sewage matter in motion, would not throw off any objectionable or dangerous exhalation. When we know that at the outlet works on the Thames the Commissioners used during August 180 tons of chloride of lime per week, the effect being extremely beneficial as far as the river was concerned, although the matter had then undergone considerable decomposition, it is self-evident that if the antiseptic were applied before fermentation commenced a much less quantity would be necessary.

This being proved, the question will be, What are the most powerful antiseptics and disinfectors? The most effective and active are those which evaporate or throw off their essential gases, as chloride of lime and tar acid. The objection to chloride of lime is that it so quickly deteriorates and becomes worthless, and acts only, as Angus Smith says, "upon putrefaction that already exists," but tar acid acts upon the process, and prevents the tendency to putrefy. The action of the best known tar acid—carbolic—upon germ development has been so amply proved by the highest authorities that it is needless to discuss further upon its merits; but I would draw your attention to a rival preparation that undoubtedly will be much heard of in the future: it is made from a combination of tar acids, and has many points in its favor for which it will doubtless receive the preference.

THE PREPARATION OF COCAINE.

By A. CASTAING, Ph.G.

COCAINE is undoubtedly the great object of interest of the moment, and there is not a physician of progressive ideas who is not anxious to test the marvellous effects of the new anæsthetic. The drug trade, taken unawares by the sudden and sustained demand for cocaine of the various brands which are guarantees of genuineness, is unable to keep pace with it, and is therefore compelled to offer a substitute in many cases inferior to the article called for by the doctor's prescription. The natural consequence is that the anticipated effect is not produced, and the wished for and confidently expected local insensibility is not attained. The practitioner is disappointed at his first experiment, his professional pride receives a shock, and in his mind doubt takes the place of the enthusiasm he was at first inspired with. Yet it would be wrong to cast the blame upon cocaine, for the alkaloid, when real and chemically pure, does truly possess the power of producing local anæsthesia, not only on mucous membranes, but also on the whole surface of the epidermis, and, to a certain depth, beneath it.

Considering the difficulties attendant on obtaining the genuine article, we think we shall do well to make known a way, which repeated trials have shown us to be the most effectual, to extract the alkaloid from the *Erythroxylon Coca.* Having observed that cocaine is extremely susceptible of change under the influence of acids, we studied how to exhaust the coca leaves without using acidulated liquids, and discovered the following method, by which one grain of cocaine can be extracted from four hundred and eighty grains of leaves. To obtain this result, however, it is requisite that the coca leaves be of good quality—that is, gathered at the right time and place, properly dried (a leaf with brown spots on it, resulting from moisture, has lost all value)—and, above all, not injured by age or by exposure to the air and consequent evaporation.

MODUS OPERANDI.—On one part (by weight) of coca leaves pour eight parts of boiling water, and let them steep for half an hour in a closed vessel in a water bath. Pour the whole into a percolator, and, when all the liquid part is strained off, continue the exhaustion of the leaves by pouring on them eight parts of alcohol at 85°. Mix the two liquors and precipitate them by means of acetate of lead, draw off with a siphon, and then add sulphate of sodium to remove the salts of lead. Filter, and evaporate at a gentle heat until the liquid has attained the consistence of sirup. Treat the whole