Papers Presented to Local Branches

PEROXIDE PRODUCTION, PAST AND PRESENT.*

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A vast amount of literature exists relating to peroxide of hydrogen, or hydrogen dioxide. It has for many years been one of the foremost topics of discussion among scientific men in both chemical and medical circles. It has formed the subject of conversation at meetings of chemical societies and other learned bodies. It presents, nevertheless, at all times a deeply interesting subject for study and discussion.

Its peculiar properties, its instability and its production has long been a puzzle to some of our best scientific men, particularly those who have endeavored to produce a permanent medicinal solution for commercial purposes. Hours, days, months and even years have been spent in experimenting. Thousands of dollars and even life and limb have been sacrificed to produce the present-day product, conforming to the requirements of the United States Pharmacopœia. The modern preparation falls far short of the ideal, although it is placed in the hands of the consumer in such a form as to meet the average requirements.

HISTORICAL.

The chemical union of two atoms of hydrogen and two atoms of oxygen was first effected and established as a definite chemical body by Thenard in 1818. A curious fact in this connection is that the experiment at that time was conducted with the use of dilute acids and barium dioxide in the presence of water, the same agents which are used today for the manufacture of peroxide.

Peroxide of hydrogen is said to occur in minute quantities and may be formed in the presence of water, by the oxidation of such substances as bismuth, cadmium, copper, phosphorous, zinc, tin, turpentine and some few essential oils. It has been pointed out that it is produced in certain metabolic processes of chlorophyll-bearing plants. For many years after its discovery, peroxide of hydrogen was considered a chemical curiosity, and it was not until the year 1856 that its value as a medicinal agent was presented to the world by B. W. Richardson, who found it to be a valuable remedial agent.

Regnault, Staedel and Kennedy were other experimenters who succeeded in producing peroxide in a more or less pure state. Passing over the only partially successful efforts of some of the best known chemists to produce a successful marketable solution, let us observe the patience and persevering efforts of the first really successful manufacturer in America. This man became deeply interested in the chemical possibilities of this article and knowing that if a permanent and

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stable product could be produced a fortune awaited him, he worked for more than two years before he was able to manufacture the first successful quantity to offer the public. In all his experiments he worked along the lines of the first discoverer, using barium peroxide and dilute acids. Beginning with very small quantities and shaking the acids and barium together with water in a loosely stoppered bottle, he obtained sufficient encouragement to warrant his operating upon larger quantities in a wooden tub made from an old wine barrel. In this experiment lumps of ice were always kept in the mixture and the whole agitated with a wooden paddle. Attempt after attempt failed to bring the mixture up to the requisite strength and permanency. The reaction progressing rather slowly, each trial occupied the better part of a day and, while this patient experimenter often worked until a late hour at night, the batch had to be left to settle until morning before the actual result could be obtained.

It is recorded by friends of this man that he became fascinated with the work he had undertaken. He scarcely took time to eat or sleep. Each morning after the previous day's effort, at an early hour he would seek the place of his operations and with a shaking hand insert the key in the lock of the outside door. One glance in the tub in which he performed the test and he would find that he had not yet obtained the desired result. Like many other experimenters he was determined, but he had become, after several months of fruitless endeavor, somewhat discouraged. One morning he came eagerly to look at the batch of the preceeding day and the condition of the contents of the tub produced a new encouragement. A quick test assured him that his optimism was well founded. He had at last made a batch that came up to the desired strength. This point signaled the beginning of successful peroxide manufacture in America.

Reviewing the hardships and disasters of the first year of this man's business, it is pleasant to recall that in after years he built up a splendid business and reputation for his product, secured a considerable competence and retired to enjoy the fruits of his labors. It is an interesting fact that this manufacturer continued for several years to place his product on the market without a competitor. It was principally through his efforts that the medical profession was educated in the uses of peroxide, and the layman given a knowledge of its value as a household article.

A rather amusing story is told by a friend of this manufacturer who was familiar with the early undertakings and work of this man and who often dined with him and talked over his peroxide difficulties. In the later years of peroxide manufacture many new brands were coming into the market, which fact naturally did not please the first producer. Immediately a new product came into existence, and an original bottle was purchased by this manufacturer and placed with his own and others on a convenient table by his desk. Upon the occasion of a visit from the friend on a hot summer's day and during the course of an earnest conversation, a cork popped from one of the bottles on the table with as much noise as might accompany the drawing of a cork from a champagne bottle. The mighty peroxide manufacturer almost leaped from his chair and turning to his stenographer inquired, "What brand was that?" The stenographer replied, "That was yours sir." Settling back in his chair, the manufacturer said to the friend, "That shows the others are no good."

Since that time the popping of corks has gone merrily on more or less in connection with each brand manufactured.

For several years this first manufacturer was the only one to produce medicinal peroxide and market it, and for several years more he had only one competitor. This competitor's product gained rapidly in popularity by reason of its more stable character as it contained a preservative which through all the years has proven to be the most satisfactory, namely, Acetanilid.

PROCESS OF MANUFACTURE.

The chemicals employed to produce the now well-known solution of peroxide are the basic substance, barium dioxide, various acids and water. The acids which have been used are phosphoric, hydrochloric, sulphuric, oxalic, hydrofluoric. Experience has demonstrated that the most satisfactory acids for the manufacture of the medicinal article are the phosphoric and sulphuric, and the best products today are made with these two acids. Barium peroxide is produced by heating barium oxide, Ba O, to a high temperature with access of air. The tremendous heat causes it to take up oxygen forming the dioxide. The barium dioxide of commerce may be classed under two general headings, the German and the English. The English product is considered superior by manufacturers of peroxide on account of its better settling properties, besides it is known to give a better yield. The German barium is much more difficult to work, it forms a light and difficult to settle precipitate and manufacturers generally endeavor to secure the English product for the manufacture of their preparation. The Pharmacopœia in 1890 gave a process for preparing peroxide of hydrogen, and for a type of pure peroxide the components of this formula can hardly be surpassed. The U. S. P. process with slight modifications was for years and is even now used by one or two manufacturers, but the expense of this process prohibits its use on a large scale, as it costs nearly twice as much as the sulphuric acid process followed today. Experience with both processes has taught that undeniably a peroxide made by the action of phosphoric acid on barium dioxide is the purest and best keeping product. Were I a physician I would endeavor to secure the peroxide made with these ingredients for use in my practice.

For those who would prepare a high grade solution of peroxide in a small way the following outline of the barium and phosphoric acid process may be interesting:

Fifteen pounds of barium dioxide are placed in a wooden or stone vessel and washed successively five or six times with separate portions of clean water. The barium is allowed to settle after being agitated five or ten minutes with each portion of water and this wash-water is decanted off and thrown away. This removes soluble impurities such as chlorides, etc. The wash-water from the previous batch is placed in another wooden or stone vessel, all of the phosphoric acid is added, several large lumps of ice are introduced and two or three pounds of the washed barium also added; the mixture is then stirred slowly with a wooden paddle or mechanical agitator for a period of from four to five hours, care being taken to regulate the temperature by the addition of lumps of ice from time to time. The balance of the barium is added in small quantities every half hour until all has been introduced. The reaction is carefully watched during the latter part of the stirring by introducing a piece of litmus paper into the solution. When the solution has

reached a neutral point, or has become very slightly alkaline, agitation is stopped, the lumps of ice removed and the precipitate allowed to settle. This requires about fifteen minutes. The clear supernatent liquid is then removed by decantation and a quantity of wash water from a previous batch is added to the sediment left in the tub. This wash water is really dilute hydrogen peroxide and containes a certain amount of free acid. The contents of the tub are again stirred briskly for a period varying from one hour to one and one-half hours. Ice is added as in the previous treatment and when the mixture again becomes slightly alkaline it is permitted to settle and the clear solution decanted off as before, the two decantations being mixed together. The solution obtained in this manner will have a strength varying from 3.4 per cent to 3.8 per cent. This should be carefully diluted to 3.1 per cent, a sufficient quantity of chemically pure sulphuric acid added to make the product slightly acid and to precipitate the barium in solution as barium sulphate. The acetanilid is also added at this time and allowed to dissolve in the solution. The resultant product may then be filtered or the precipitate allowed to settle and the clear peroxide decanted off.

To the sediment in the tub is now added about ten gallons of pure water, the mixture stirred for about one hour, allowed to settle and the clear liquid decanted off. The sediment is then treated the second time with about seven gallons of water in the same manner, the clear liquid being poured off at the end and mixed with the first decantation. This forms the wash water for the next batch.

Peroxide manufacture has long been regarded as a secret by those who have not had the privilege of observing its production. This idea is rather falacious inasmuch as it is really a very simple process, it being only a formula of proper proportions and careful manipulation. The above process will answer admirably for those who desire to operate on a small scale, and produce a superior and permanent solution of hydrogen dioxide. The best known manufacturers of today, however, are compelled, in order to operate on a profitable basis, to follow the hot process or the sulphuric acid process on a large scale. No ice is used in this method and during the manipulation the temperature rises so that the mixture at times becomes hot enough to produce steam. The operation is carried on in large wooden vats which hold as much as one thousand gallons each in the larger plants. By this process the manufacturer can turn out a product costing about twenty-five cents per gallon which is quite satisfactory. Even at this low cost of production the profits accruing to the producer are extremely meagre. One can readily see that when a gross of one-quarter pound bottles are sold as low as $5.50 per gross, there is very little left for the manufacturer after the cost of the material, bottles, corks, labels, wrappers, packing case, finishing labor and selling expense are deducted. More peroxide manufacturers have entered into and gone out of this business during the last ten years than are now in existence.

CONSUMPTION OF MEDICINAL PEROXIDE.

The actual amount of peroxide consumed in America each year is enormous, and is hard to appreciate until we recall the fact that there are in the United States over one hundred factories which manufacture this article. The output of each one of these factories varies from fifty to a thousand gallons a day and in several instances even more. The increase in the sale of peroxide during the last ten years

has been phenomenal. It is said that one department store alone in New York City sells nearly three-quarters of a ton each day during the summer season; there are other department stores selling in proportion to their size in all the large cities of the United States. Add to this the still greater output of the combined druggists of the United States, the five and ten cent stores, general stores, etc., and we have a tremendous quantity, the exact amount of which would be difficult to even estimate, as manufacturers will not give out truthful statements regarding their yearly production. The manner in which this tremendous business has been created, the part which the druggist, the chemist, the physician, the surgeon and the manufacturer has played in educating the public to see and to recognize the value of this really wonderful preparation would occupy many hours in the description and fill many volumes in type. Suffice it to say that the intelligent person of today rushes for the peroxide bottle for every minor ailment or accident, and it is needless to add that Peroxide of Hydrogen deserves the popularity it has attained by reason of its ready activity, its harmless action on healthy tissue and its great prophylactic power.

PROPERTIES.

Peroxide of Hydrogen in a pure state is a thick, colorless liquid having a specific gravity of 1.499, and boils at 69 degrees under a pressure of 26 millimeters. It has a color much darker than the blue color of water. It is reasonably stable at an ordinary temperature, but when heated to 60 degrees or over it explodes with considerable violence. Impurities decompose it rapidly. It oxidizes organic matter with such rapidity that the reaction is often accompanied by a flame. Particles of dust, metals in a finely sub-divided state decompose it with extreme violence. At a low temperature crystals of pure peroxide are formed. By freezing much of the water may be separated from the peroxide; by distilling in vacuo solutions may be increased in strength to as much as 100 per cent. A well known 25 per cent solution is made by distillation and admixture with ether. Distillation of peroxide is an extremely hazardous undertakiing and should be conducted with great caution. The presence of the faintest trace of foreign matter may cause an explosion; the whole breaking up into oxygen gas and water. Loss of life and limb mark the attempts that have been made in the past to perform this operation. The ordinary 3 per cent solution of the market, however, may be made with comparative safety, providing its generation is not attempted in a closed vessel. This aqueous solution contains a certain percentage of free acid usually sulphuric, and possibly various preservatives such as acetanilid, boric acid, salicylic acid, sodium salicylate, alcohol, glycerine, caffeine, sodium benzoate, salol, benzoic acid, boroglyceride, sodium chloride, etc.

Some manufacturers keep the solution strongly acid throughout the process and at the end neutralize the acidity with barium hydrate, but the most careful manipulators bring the product to a neutral and slightly alkaline point with barium dioxide at the end, the latter process being considered the best, and producing the most satisfactory results. Peroxide changes odor and flavor of most viatile oils. Those which are not affected are: Oil of eucalyptus, oils of pine, oil of star aniseed, anethol, oil of aniseed, borynlacetate, eucalyptol, thymol.

METHODS OF CLARIFYING.

On a large scale the best method is by settling. If left undisturbed in large vats for four or five days the precipitate, usually of barium sulphate, will settle to the bottom of the tank and the clean solution may be syphoned off. Another method is by pressure filtration with a filter press made of wooden frames. Gravity filtration through filter pulp is also employed. The centrifuge is also used by one or two manufacturers; this, however, only removes the bulk of the precipitate, and is usually employed for separating the large bulk of the precipitate in the process of the manufacture. The liquid must be passed through paper after this for complete clarification.

IMPURITIES.

The most likely impurity in peroxide is barium. This will not be found, however, if sulphuric acid is present in a sufficient quantity, as this will have removed any barium that may have gone into the solution. Arsenic may be found in minute quantities. This usually comes from using a cheap sulphuric acid. Hydrochloric acid, however, may be present, but hydrofluoric acid is seldom present in the medicinal solution.

PRESERVATIVES OF PEROXIDE.

The most common preservatives for peroxide is acetanilid. For many years this article was used by one or two manufacturers and its employment jealously guarded as a secret. It was some time before it became generally recognized by chemists, that the reason some brands kept better than others was on account of the preservative used. Many of these chemists, in analyzing various brands, overlooked acetanilid because this article is not recognized as a preservative. Others made the mistake of examining too small a quantity. By the concentration of four ounces or less a very minute quantity of material is obtained to work upon. The first disinterested chemist to discover acetanilid in a brand of peroxide concentrated one gallon of the solution. The presence of acetanilid was determined rather by accident than by any prearranged system of examination. This man was perhaps more surprised to find acetanilid present than was the first man who used it to discover that it was a good preservative for peroxide. Only by repeated tests and the checking of results, did he finally convince himself that he had found acetanilid. When it became known that acetanilid was a preservative, it was an easy matter to extract it from a solution of peroxide by shaking it out with ether, and chlorform, evaporating off the solvent at a low temperature. This procedure will remove about 95 per cent of the amount present. The proportion of this article which has been found to give the best results is about one-fifth of a grain per fluid ounce. Since the introduction of the Foods and Drugs Act, the manufacturers using acetanilid have been compelled to designate its presence on the label, but before that time the secret of its use by the first manufacturer was stolen by an assistant whose curiosity got the better of him when he observed his superior introduce a small weighed quantity of a white flaky crystalline substance into every batch at its completion. It is related that this assistant noted carefully the source of this unknown substance and watching for a favorable opportunity, abstracted a few ounces from its hiding

place and took it to an analytical chemist for analysis, carefully concealing the purpose for its identification. This assistant carried this secret to several new companies, several of which have since failed, greatly benefitting his personal assets thereby.

Thus the secret leaked out and some time before the Food and Drugs Act,, at least a dozen manufacturers were using it.

Kebler reports that many samples free from acetanilid have been known to develop an odor of aldehyde upon standing some length of time, indicating the presence of alcohol. Distillation, however, fails to give positive results with the iodiform tests. By testing a sample direct affirmative results were obtained. The distillate gave the usual reaction for aldehyde with Tollen's reagent and with fushsin and sulphurous acid. Flourids have been noted in several samples in minute quantities. Boric acid has been found in one or two instances. Several samples which were examined by Kebler showed the presence of caffeine.

PACKING FOR SHIPMENT.

Many of the larger manufacturers put peroxide in barrels and ship to the bottler. New barrels are selected for this purpose with a thick coating on paraffin wax on the inside, as contact with wood for any length of time decomposes the solution. It is also shipped in ten-gallon carboys and, of course, glass bottles of various sizes. In view of the low price at which peroxide is now sold, one of the bottlers' greatest difficulties is filling. As no metal of any description should come in contact with it, it follows that only glass and rubber can be utilized and up to the present time no satisfactory bottling device has been produced to handle this article. Each manufacturer or bottler has had the experience of constructing a filling machine more or less complicated, usually at considerable expense, which failed to do the work as it was easily broken, the glass or rubber hose parts being too fragile. Most bottlers use a simple glass syphon or rubber hose, the rubber hose being preferable on account of its flexibility. Some fillers can operate a hose with each hand at the same time. Before the standard peroxide bottle came into general use, some ingenious persons immersed the bottles entirely in the solution, filling them full to the lip, afterwards removing them a placing them in a drain trough. By inserting a wooden tube in each bottle considerable solution was forced out which left sufficient space for the expansion of any gas that might be liberated; however, bottles now in use have too narrow a mouth for this procedure. One mechanic is now workiing on a hard rubber and wood device which the writer has seen and which promises to give fairly satisfactory results. It is needless to say that such a filling device will be a boon to the peroxide manufacturer. One peculiarity that confronts every first purchaser of peroxide is the fact that the bottles do not seem to be completely filled, and every seller must go through the patient explanation as to why this condition exists. Even in the best products a certain amount of gas is sure to escape and room must be left for expansion, otherwise the bottle will be fractured or the cork expelled.

CORKING THE BOTTLES.

Experience has proved that it is best to use XXX extra long corks; the better the cork the less liable the product is to decompose. A few manufacturers put a

thin coating of paraffin wax on these corks. This fills the pores and prevents the cork dust from getting into the solution. A poor grade of corks will invariably cause deterioration in peroxide solutions.

Some manufacturers wire the corks in the bottles. If a solution is properly made this is unnecessary. In fact, a bottle with a wired cork is to be regarded with suspicion, as the bottle is very apt to break, thus causing injury to any one handling it. Several accidents are on record caused by wired corks. A nurse in a large hospital in New York City on a warm day attempted to open a bottle of contract peroxide in which the cork was secured with a piece of muslin. The bottle exploded lacerating a hand with pieces of glass which had to be removed by a surgeon. The nurse being in poor health at the time contracted blood poisoning and only with the greatest difficulty was the hand saved from amputation. A pint bottle in the hands of another user burst at an inopportune moment, causing disfigurement of one side of the face and almost the loss of sight. Innumerable reports are on record of bottles breaking on the counters and in display cases in drug stores and other places of sale, breaking other bottles and causing damage to labels and wrappers of expensive goods.

One of the early manufacturers was compelled to originate a safety value stopper and these have been known to go off at unexpected moments with considerable force and noise. This ingenious device has probably prevented many explosions which might have been more or less serious. Glass manufacturers are today making bottles with a ridge within the neck of the bottle. After the corks are introduced they naturally swell and fill this crevice, overcoming any pressure from within.

A pure solution of peroxide without preservatives decreases in strength under ordinary conditions at an average rate of about seven-twelfths of a volume per month. Preservatives retard this decrease considerably. It is evident that a number of manufacturers believe that a solution of peroxide keeps best when strongly acid, as many brands are found to be above the U. S. P. standard in this respect. The Pharmacopœia allows for every 25 cc. of tenth-normal alkali, about 0.049 per cent in terms of sulphuric acid. Excessive acidity is unnecessary as a properly made solution will keep as well if only slightly acid. Care must be taken, however, to allow for any neutralization by the alkalinty of the glass bottles.

Decomposition of peroxide may be occasioned by the slightest trace of impurities. If a bottle of peroxide is stored upside down or in an inverted position, decomposition takes place more rapidly, as the solution comes in contact with the cork. Bright light and heat causes rapid loss of strength. Dozens and even gross quantities of solution have been known to decompose within a few hours when exposed to the sunlight in a show window. Some manufacturers have adopted a time limit label for their peroxide, thereby being able to trace its age. They place the limit at six or eight months. A solution properly made should keep for a period of six months and even after one year it should not be much below 3 per cent in strength. Some manufacturers place a batch number on every label and in case of complaint they are able to tell the exact age of the preparation. Some manufacturers who do not use acetanilid decry its use, pointing out the injurious affects of this article on the system and its heart depressing properties, etc., while other manufacturing agents who use this pre-

servative in its defense claim that acetanilid adds to the preservative action of peroxide. The small amount present, however, can hardly have any effect one way or the other and these arguments can only be regarded as advertising talking points. Samples of peroxide taken from the same batch, or bottled at the same time under the same conditions, stored in the same position and place and kept under the same restrictions regarding temperature, light, etc., will show a marked variation in keeping. The contents of one bottle will lose scarcely no strength, while another will deteriorate rapidly. The reason for this is hard to explain unless we attribute it to the action of the cork or possibly some particles of foreign matter left in the bottle after washing. This argument can hardly be sustained, however, as experiments show that the same phenomena takes place with peroxide stored in glass stoppered bottles previously washed with distilled water and alcohol and afterwards sterilized. It is possible that a variation in the composition of glass may have some decomposing influence.

CONCENTRATION OF PEROXIDE.

The ordinary 3 per cent solution may be concentrated in vacuum to as much as 100 per cent. It may be made to about 15 per cent by carefully concentrating on an open water bath, using as little heat as possible. This practice is frequently resorted to by dentists in their practice, where a powerful bleaching or cleansing action is desired extemporaneously.

Staedel has produced peroxide in pure crystalline form of 100 per cent purity, by solidifying a concentrated aqueous solution 95 per cent in strength in an ether carbonic freezing mixture. Explosive decomposition of the crystals took place immediately in contact with foreign matter. A 3 per cent solution of peroxide may be concentrated to as much as 50 per cent in strength by cautiously evaporating on water bath at a temperature of not over 60 degrees C. The solution becomes stronger by the evaporation of water as the water is driven off much faster than the oxygen can be liberated.

TESTING FOR STRENGTH.

Glycerin and boroglyceride affects the titration of peroxide with permanganate. The permanganate method is worthless if the peroxide is preserved with salicylic acid. Smith, after very exhaustive experiments, thinks the permanganate method of titration is worthless in the presence of organic substances. The thiosulphate method of estimating the strength of solutions of peroxide is the safest and best for all-around purposes, as it is unaffected by any of the ordinary presevatives. It is simple, rapid, and accurate and is based upon the fact that hydrogen dioxide liberates a definite quantity of iodine from iodides in acid solution.

USES.

Peroxide of Hydrogen was formerly thought to be valuable for diphtheria but subsequent experience has proved it to be valueless for this purpose. It is fearful and wonderful to observe the light in which the ordinary layman regards peroxide. It is used as a gargle in sore throats, as a mouth wash, for cuts, scratches, bites of insects, bruises, and even burns, although its employment for the latter use is questionable and is apt to do more harm than good. It is em-

ployed for disinfecting sick rooms, and for bleaching linen, removing stains, cleaning straw hats, bleaching feathers and last but not least for lightening the golden locks of the blonde. As a general prophylactic and antiseptic, peroxide of hydrogen offers the surest and best all-around agent. No other preparation will act so quickly without harm to the healthy tissue. Dentists, physicians and surgeons would at times find themselves greatly inconvenienced without its aid. Its supply of active oxygen gives it many superior qualities over bi-chloride of mercury, carbolic acid and various other antiseptics. It has been found that a one to twenty thousand solution is equivalent to a solution of carbolic acid sixty-six times as strong. In cheapness, freedom from caustic and poisonous properties it cannot be surpassed.

ODOR.

Peroxide of hydrogen when freshly made has a peculiar odor characteristic of no other preparation. On standing for several months products preserved with acetanilid sometimes develops a marked odor resembling nitro-benzol. La Wall obtained positive tests for aniline; he states that about four months were required for the development of this odor.

PEROXIDE IN COSMETICS AND OTHER TOILET PREPARATIONS.

Peroxide has come into considerable prominence as an addition to greaseless creams, which are marketed as peroxide creams. In making these creams, the solution is usually employed as the peroxides of various metals are rather coarsely powdered, and make the cream gritty. Peroxide creams are unsatisfactory as the peroxide rapidly decomposes after being combined with organic matter such as stearic acid. In addition to this most greaseless creams or peroxide creams are slightly alkaline which neutralizes the acidity of peroxide causing its rapid decomposition.

Peroxides of the metals such as calcium, magnesium, zinc, sodium, and strontium are much used in dental preparations. Their stability in dental pastes is questionable, but in powders they are of considerable value, only giving up their oxygen in the presence of moisture.

These metalic peroxides are employed in foot powders and deodorizing powders.

L. Gallois has found that repeated applications of peroxide to a hairy surface on the skin act as a depilatory, the hair first becoming brittle and breaking off.

C. T. Tyrer considers hydrochloric acid the worst protective agent and phosphoric acid the best, glycerin coming second. Champagne, soda water and beer bottles with patent stoppers he finds the best for holding peroxide.

In treating a case of Rhus or ivy poisoning, peroxide was used. A white cloth bandage was wrapped about the wrist and kept wet with peroxide. The treatment was discontinued in the afternoon and the bandage removed before retiring. On the second day treatment of the patient was continued by moistening the bandage with several applications of peroxide in the morning. Several hours later an odor of burning cloths and a severe pain in the wrist directed the patient's attention to the bandage which was smoldering and already charred black in many places. Before it could be removed it had caused several burns on the wrist which required weeks to heal and left scars for several years. The probable

cause of this phenomenon was the presence of a slight amount of free sulphuric acid in the peroxide.

CHEMISTRY OF PEROXIDE.

Peroxide of Hydrogen is produced by the action of dilute acide upon Barium Dioxide by which an exchange of atoms is effected. When manufactured with phosphoric acid the reaction takes places as follows:

$Ba\ O_2+H_3PO_4=Ba\ HPO_4+H_2O_2$.

When sulphuric acid is used in conjunction with phosphoric a further reaction occurs:

$Ba\ O_2+Ba\ H\ PO_4+2\ H_2SO_4=H_2O_2+2\ Ba\ SO_4+H_3PO_4$.

Hydrochloric acid reacts as follows:

$Ba\ O_2+2\ H\ Cl=Ba\ Cl_2+H_2O_2$.

Hydrofluoric acid reacts on barium dioxide in the following manner:

$Ba\ O_2+2\ HF=Ba\ F_2+H_2O_2$.

The titrimetric estimation of peroxide with N/10 potassium permanganate takes place according to the following reaction:

$5\ H_2O_2+2\ K\ MnO_4+3\ H_2SO_4=5O_2+2\ Mn\ SO_4+K_2SO_4+8\ H_2O$.

Estimated with N/10 sodium thiosulphate the equation is as follows:

$H_2O_2+2\ K\ I+H_2SO_4=I_2+K_2SO_4+2\ H_2O$;

$I_2+2\ Na_2\ S_2O_3=2\ Na\ I+Na_2\ S_4O_6$..

AS IT LOOKS TODAY.*

D. A. THOMPSON.

There is one subject which we should keep constantly in mind, for it is of the greatest importance to our business and profession, and that is, the tendency toward the continual lowering of retail prices. I think I am safe in saying that no other business or profession is so beset with this evil. Why should we be compelled to see our profits continually dwindling away to nothing, while the cost of doing business, instead of decreasing correspondingly, is continually on the increase? Our professional brothers, the physicians, have not had the slightest difficulty in advancing their fees 50 per cent., yet we are compelled continually to fight this tendency within our own ranks toward a lessening of the legitimate profits to which we are entitled and which are necessary to our existence. I have an old-fashioned notion that there should be a reason for everything done. Can anyone here tell us why our profession should be singled out from all others, and by its own members, as the one which must do business on a losing basis? That is to say—throw legitimate profits away—and I can speak advisedly on this

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