previous to its being put into the still. This was done in several ways, amongst which may be mentioned the hot box. This was an oblong box, sufficiently large to hold a charge for the still, placed in an elevated situation with a large copper pipe or cylinder passing through the centre, and connected at one end with the arm of the still, and at the other to the worm; a considerable degree of heat might be imparted to the wash by making this cylinder very large. It was soon found however that the thick part of the wash settling on this, formed a coat which confined the heat, and though a scraper was contrived to clean the cylinder, it was still found liable to objections.

These objections were obviated, and other deficiencies in the then method of distilling, remedied by Colonel Anderson's "condenser or plan of heating the wash or other subject to be distilled, by means of a half globe."

This half globe made of copper, was placed in the condenser or charging tub fixed above the still. The steam was conveyed by means of a pipe to the half globe where it became condensed by the operation of the charge above, to which it imparted considerable heat, and the liquid thus condensed, was conveyed by means of another pipe to the worm. Stirrers were contrived to keep the wash constantly in motion in the still, and also in the condenser; these stirrers were moved, by means of machinery, by water, by a horse or any other power; a charging cock and pipe between
the tub and still, prevented the necessity of moving the head to charge the still. The advantage gained by heating the wash in this manner was such that a still which in the old way could be run off only three times in twenty-four hours, was now run off eight or nine times.

Many absurd objections were made to this plan of distilling by those who were unwilling to leave the beaten track, and such as were desirous of depriving the inventor of the credit due to his ingenuity.* But the real errors were not discovered until after a few years experience, when they were remedied by Mr. Witmer's improvement, a draught of which is given in this work. They consisted in the shape of the half globe, and in the steam-pipe, it being very difficult to clean the former, and the latter being much exposed to the action of the cold air, much of the vapour was condensed in its passage to the half globe, and returned into the still, thereby retarding the process and weakening the product.

A reference to the plate will afford a particular explanation of Mr. Witmer's improvement, it may be therefore sufficient to observe, that the whole appa-

* Without entering into the question as to the original application of steam as the means of conveying heat, we are willing to give full credit to the colonel for his mode of applying it. We notice it as a new era in distillation and the importance of it is fully evidenced by its use, as well as by the numerous evasions of his right, which we constantly see in the different methods of using steam.
ratus is very compact, not liable to get out of order, and may be taken apart and put together again in a few minutes whenever it requires cleaning, and so well contrived that this may be effected with great ease. The cold wash which is pumped into the condenser or charging tub, operates as a condenser to the vapour arising within the globe, and at the same time acquires so much heat from the steam, that it will boil in a few minutes after it is let into the still.

That the superiority of this plan may be still more apparent, I subjoin a short notice of the Scotch stills, with a comparative estimate of the expense attending them and Anderson's stills upon a large scale, from which it is evident that the Scotch stills will not suit us; our object is to do the greatest quantity of work in a given time with the least expense of labour and fuel. The still for this purpose then (for Anderson's and Witmer's improvement's may be added to a still of any shape,) should be of such dimensions that the charge should be about sixteen inches deep, in a still calculated to run one hundred gallons, and proportionably increased with the capacity so as not to exceed thirty or thirty-six inches in a still of five hundred gallons.

And, that the evaporation be not retarded by the collection and pressure of the vapour in the vacant part of the still above the charge, and also to lessen the possibility of the still running foul; this vacant space should be very large—that is, a still to run one
hogshead or one hundred gallons should hold one hundred and twenty-five gallons without the head, and in the same proportion for larger stills.

From the experiments which I have made, I have no doubt, a still of this kind may be constructed to run off twelve times in twenty four hours.

It is difficult to fix the point of perfection in any art, the *ne plus ultra* beyond which improvements cannot be made. Here, however seems to be a resting place. And I would advise the distiller who becomes possessed of a still of any size,* which may be run off twelve times in twenty-four hours with the attention of one man only at a time, to charge, discharge, &c. to consider well, before he adopts any other plan termed an improvement.

It is the opinion of colonel Anderson, and as such, well worthy of attention, that the "quality of the spirit is determined in the *act of fermentation*; the form of the still having nothing to do therewith; the act of distillation being a mere separation of the spirit and water.†"

My own observations have satisfied me that much of the quality of the spirit is determined during the fer-

* Stills upon this plan, are run off in the same time whether of 100 or 500 gallons.

† See Archives of Useful Knowledge, Vol. 1. No. 1, by Dr. Mease.
Of Still.

mentation; but I have also been led to believe, that a fiery or mild spirit will be obtained in proportion as the distillation (in the doubling still) is rapidly or slowly conducted.

The form of this still perhaps is not material, though that of the wash still, to which the preceding observations are more particularly applicable, may possibly be found to have some effect upon the quality of the spirit. But it fortunately happens, should this be the case, that the same still which is preferred for other reasons is also found preferable for this.

Mr. Nicholson in his journal No. 108, says: that deep stills are best for distilling those simple or spirituous waters, where a full impregnation with the peculiar flavour of the vegetable substance employed, is desirable*; yet a shallow still is preferable, where the object is, to prevent as much as possible the peculiar flavour of the liquor distilled from rising as in distilling from grain or molasses, and this not only on account of the saving in time and fuel, but of the superiority of the liquor, in point of flavour.

The opinions of Mr. Nicholson are certainly entitled to consideration; it seems however not a little surprising that he should have formed any conclusion upon the assertions of Mr. Curaudeau, whose experi-

* Or, in making peach brandy.—Ed.
ments are published as the ground of the opinion here expressed*.

For instance, Mr. C. says "I satisfied myself, that, in the common still the evaporation of the spirit does not begin to be very copious, till the heat is from 190 to 200 degrees, F. while on the contrary, in the shallow still it is very abundant from 133 to 156 degrees, F."

Now in what way Mr. C. "satisfied himself" we know not, but his bare assertion does not satisfy us that wine can be made to boil at 133 or even 156 degrees F. when we know that the heat necessary to boil alcohol is 165 degrees F. and to boil water, 212 degrees. Now wine being a mixture of the two, and the boiling point, depending upon the proportions of the two liquids, must be at some intermediate degree of heat, consequently cannot be below 165 degrees.

Hence we conclude, that he must be mistaken in this part of his experiment.

Nor can we assent to his assertion that evaporation takes place at a much lower degree of heat in a shallow than a deep still; seeing that one particular degree of heat is necessary; this indeed may be given sooner in a

* See Archives of Useful Knowledge, Vol. 1, No. 1. Or, for original, Jeninis Bibilothque Physico, Economique, Paris 1808, tome 1, p. 106.
Of Stills.

shallow than deep still. When however the evaporation has once commenced, it may be increased or diminished by the addition or diminution of fire, but the temperature of the fluid will undergo very little variation.

The subject is worthy of further investigation.

A Mr. Kraft of Bristol, Pennsylvania, some years ago obtained a patent for a still, which he says he works off in fifty minutes. This still is so similar to, if not copied from, the Scotch stills, as to be liable to the same objections; yet in a book on distillation, which Mr. K. published some years ago for the purpose of recommending his stills to notice, he says there were then (in 1804) two hundred and seventeen distilleries at work on his plan.

Most of the objections that have been alleged against Anderson's condenser are mentioned by Mr. Kraft, and experience has proved them all to be unfounded; his prophecy that "it will dwindle into disrepute by fair experiment," remains yet to be fulfilled; and the absurdity of the opinion, that vapour or steam cannot be retained in wooden vessels, is fully proved, by the lately invented wooden stills by Mr. Phares Bernard, of Whitestown, Oneida county, New York; or, those of Mr. P. M. Hackley, a drawing of which is in this work. Proof on this subject however, was unnecessary to any one who knows that iron bound hogsheads have been burst by the fermentation of cider rather than
suffer the fixed air to escape through the pores of the wood. The opinion that any evaporation takes place from the condenser may be fully disproved by the thermometer, as it will be found that the heat of wash never exceeds 200 degrees. Cider however will boil in the condenser, and it may be, from this that Mr. Kraft and many others have adopted their erroneous opinions without knowing that a higher degree of heat is necessary to boil the one than the other.

NOTE.

About the year 1788, a considerable duty having been laid upon the capacity of the stills in Scotland, the ingenuity of the distillers was excited to lessen the duties, and in a short time they so far improved their method as to run off a still twenty times in twenty-four hours. They attained to this degree of dispatch by greatly reducing the size of their stills and enlarging their furnaces.

The duty then not costing more than one penny per gallon, no further improvement was thought necessary until about the year 1797, when the duty was increased to the enormous sum of fifty-four pounds per gallon on the capacity of the still. Every expedient was now tried to accelerate the process, and from repeated experiments, they found that the more shallow the stills are made, and the bottoms enlarged, the more they could increase the size of the furnace, and apply a greater quantity of fuel, and consequently bring the wash in the still to boil in a shorter time.

The liquor in the still being likewise on a more extended surface, the evaporation takes place in a more expeditious manner, thus they were enabled to run off their stills seventy-two times in twenty-four hours. A degree of dispatch, a few years before, thought to be impracticable.

But the still now in use is so powerful, that hardly any evidence short of that with which the fact is supported, could make it credible. The evidence however is complete; it is that of the distillers themselves, whose interest it evidently was to depreciate rather than overrate the power of their stills.
Of Stills.

"The depth of the body is only two and a half inches at the centre, and at the sides the sole and shoulder meet at an acute angle. No sooner was this still set to work than it was evident that the principle on which the shoulder was constructed was just; for though the body and head held only fifty-two or fifty-three gallons, the still could work with twenty-two gallons of wash if the workmen were careful; but steadily, and without foul running for a day together, with twenty gallons; and the time between charge and charge was only three minutes at an average, equal to four hundred and eighty times in twenty-four hours."

Now four hundred and eighty charges of twenty gallons each, will amount to nine hundred and sixty gallons of wash run daily; to do which will require four hands constantly attending the still, who on account of the severity of the duty, must be relieved at least every eight hours: but probably oftener. Hence it will require twelve men at 5 shillings per day,

\[ \text{£} 8.00 \]

To prepare the wash and do the other work about the house will require ten men at 5 shillings per day,

\[ 6.67 \]

\[ \text{£} 14.67 \]

That is, the charge for manual labour alone, on nine thousand six hundred gallons wash, is fourteen dollars and sixty-seven cents, with the Scotch stills.

The stills of Anderson and Hall at Lamberton, upon colonel Anderson's patent plan, were of capacity sufficient to run 500 gallons at every charge, and eight charges in twenty-four hours. That is, 4000 gallons daily.

One hand only was necessary to attend the still, who was relieved every twelve hours, that is two hands a day, and five hands to prepare the wash and do the other work of the house; being in the whole 7 hands, at 5 shillings,

\[ \text{£} 4.67 \]

That is, the charge for manual labour alone on 4000 gallons wash is \[ \text{£} 4.67 \] by A. and H's. stills.
Then by a simple statement.

If 4000 gallons cost £4 67: : 9600 gallons will cost £11 21
But by the Scotch plan, 9600 cost 14 67

The balance in favour of A. and H's. stills then is £3 46
upon the daily work of 9600 gallons for manual labour alone.

This calculation is imperfect, as the wash used in Scotland is different from ours. But it being almost impossible to work our wash in flat stills, adds to the argument against the Scotch stills.

We have no data by which to ascertain the quantity of fuel used; but a moment's reflection must satisfy us that as the Scotch still is all bottom, it requires more fire than ours, if we are allowed to guess, we should say four times as much.
CHAPTER VI.

Distillation by Steam.

THIS mode of distilling is becoming very prevalent throughout the United States; it is strenuously advocated by those who are interested in its adoption, and has some powerful friends amongst scientific men who have examined the subject.

The formation of a new establishment upon this plan is said to be considerably less expensive than upon any other, and in the daily expenditure for carrying on the work there is also a material saving.

These considerations render the matter well worthy of attention, and the author has been at no little pains to obtain such information as would enable him to state precisely the comparative advantages and disadvantages of this mode of distilling; for this purpose, he has visited several distilleries in this and the adjoining states, and he has corresponded with the owners of others, but he has not yet succeeded to his entire satisfaction. Few distillers in this country are sufficiently attentive to the minutiae of their business, and still fewer are willing to communicate information to others, generally supposing that any discovery made by them is unknown to all the world beside.
Whenever his own observation, or knowledge of a fact, enables the author to give a decided opinion, he is perfectly willing to do so; but, neither is he willing to hazard this opinion upon uncertain grounds, nor would his *ipse dixit*, unaccompanied by evidence, be entitled to regard. Let his readers then judge for themselves, upon the information which shall be laid before them.

Of the articles which follow, some may be found to contain matter unimportant to the mere American distiller, and the same remarks may be repeated more than once. It is not intended that the contents of this work be confined to what is only absolutely necessary for a distiller to know, but from the exhibition of the different modes, both of American and European distillers, the superiority of the former will certainly appear, and the very defects of the latter will suggest hints, from which our ingenuity and industry will not fail to improve. Undervalued as we are by their writers, let us still assert our equality at least with them, and when we compare our attainments in the useful arts of life, with those of any other nation, it is not too much to say, we may place confidence in ourselves.

Such reasons as these, it will be observed, could alone induce us to give an account of the expensive and complicated machinery of Monsieur Adam, but nauseated as we are with the flattery of French philosophers upon the improvements of each other, and the importance in which all their writings is given to the
most trifling subjects, we would willingly omit any notice of Isaac Berard's plan of distilling, had not Senator Chaptal, whose opinion is always entitled to respect, pronounced it to be "the *ne plus ultra* of perfection." It is not however a distillation by steam, nor can it be used in distilling from grain; for a particular description, we refer to the 20th vol. New Series of the Repertery of Arts. It will be sufficient here to mention, that his improvement consists in three cylindrical tubes joined together like the three sides of a square, and placed in a condenser filled with water; these cylinders are divided into twelve different apartments, with small holes to communicate from one to another. As the vapours from the still strike these different surfaces, the grosser particles become condensed and return to the still, while the finer portions containing the spirit pass over into the worm. M. Berard was induced to adopt this plan, from considering a principle long known in chemistry:—"That all liquors do not enter into ebullition at the same degree of heat, and that the most volatile boil at the least degree of heat. From an inverse mode of reasoning it follows, that when many liquors of different specific gravities are turned into vapour by the application of heat, and pass together into an atmosphere of a less elevated or colder temperature, the most volatile will be the last condensed."

A comparison of these different processes by Monsieur Lenormand may be found in the 21st vol. of the Repertery of Arts. There is nothing worth transcrib-
ing, except an observation of Senator Chaptal's, "that Adam's process affords the inappreciable advantage of extracting a great quantity of brandy from a given quantity of wine, which advantage is caused, without doubt, by the greater degree of pressure and heat which the wine undergoes, especially in the still and the first oval vessels." Mons. L. adds, "that this pressure is necessary to obtain the great effect which this apparatus produces."

If this be true, and we should like to see the fact established by a practical distiller, Bernard's or Hackley's plan possess the same advantage; but, though we admit that the great pressure may cause spirits to be produced of greater strength, we cannot believe, without further evidence, that the quantity will be increased.

So much for distillation by steam in France. We come now to the introduction of the American and English plans, and we think it will be abundantly evident, that America has the honour of the original invention, and of the greatest perfection in the mode of distilling by steam.

In the Emporium of Arts, vol. 5, No. 3, for October 1814, Professor Cooper asserts, that he was the first person who distilled by steam in this country, but that the original invention was Count Rumford's: he says, "the method of distilling by steam introduced into the wash, is doubtless the best yet found out."
Count Rumford first shewed how several vessels of water might be boiled by steam conveyed from one boiler common to them all. He is the inventor of the process. Whether steam be applied to boil water, to boil the liquor in a dyer's copper or the wash in a distiller's hogshead, the principle is the same."

"This is the reason why I did not think myself entitled to a patent for being the first in this country who distilled by steam. In the fall of 1809, I adapted a lid to a boiler in Dr. Priestley's laboratory, and soldered it on. A safety valve was made of an inch tube of copper soldered in the lid. The liquor was supplied by a small wooden cistern above, with a pipe going near to the bottom of the boiler. A tube from the boiler at right angles, conveyed the steam into the vessel containing the wash or beer; the tube reached within four inches of the bottom of the vessel. It had a cock adapted to it, so that the steam could be stopped off at pleasure. M. Schmidt, who afterwards conducted Mr. Joseph Priestley's distillery, assisted me. John Hall, Esq. late marshal of Pennsylvania, himself well conversant in the business, and Enoch Smith, Esq. of Sunbury, dining with me one day while this experiment was going on, I shewed them the process itself, as they will testify."

"I find a patent has been taken out for this method by some one who has just as much title to the invention as any reader of this article. The right of taking out patents is abused so egregiously, that it has become a perfect nuisance."
Col. A. Anderson also claims the invention of a mode of distilling by steam. In a communication received from him in reply to a number of queries on the subject, he observes:

"In the year 1790, I discovered that steam arising from water, or water itself might be made hotter than 212°, (the boiling point,) by confining it so that the vapour could not fly off, and that this principle might be applied to evaporating liquors that were liable to be injured by the naked fire; I immediately proceeded to put this into practice, and after a number of experiments in the year 1794, succeeded in completing a plan, agreeably to the accompanying plate, which fully answered my expectations, and for which I took out a patent, and made use of it on an extensive scale near Columbia, Pa."

"In using the above mode of distillation, I discovered that the steam in passing under the wash, communicated a heat of 190° to 200°, without pressure, but no higher, that the heat remained stationary until a pressure was put upon it. The pressure necessary was from 3 to 5 pounds to the square inch; with that pressure the distillation was rapid and very complete. Directly after this was put in practice, several attempts were made to evade the patent, amongst others, one from Kentucky, in the year 1796, by forcing the steam through the wash, instead of letting it pass under a plate of copper, placed between the wash and the steam. This was thought to be different from my
patent, but the principle, as far as I can judge, is certainly the same, as it requires a pressure of 5 to 7 pounds to the square inch before the steam could be driven through the wash so as to communicate heat sufficient to make it boil. This mode of distillation has lately been made use of in France, and is spoken of very favourably, but I am confident it is not equal to the mode adopted by me in 1790."

"The observation of the principle above stated, that steam without pressure would not, however long it continued to act, communicate to any liquor mixed with grain, a greater heat than 200°, and that wash being heavier than water, would not boil until raised to 214°, suggested to me a much more advantageous plan of distillation—to apply the steam arising in distillation to heat the wash or subject to be distilled. By this plan, double the work could be done, with the same expense of time and fuel, than by any other mode then in use. In 1801 I took out a patent, and this mode of distilling is in general use throughout the United States."

"I have made several improvements upon the original invention, and feel no hesitation in asserting that the present mode adopted by me is superior to any other in the use in the United States, as to the economy of labour and fuel; one cord of pine wood affords sufficient fuel for 45 bushels of grain, and three men will work 45 bushels per day."
This is not properly a distillation by steam, but yet we conceive it to be the origin of steam distilling; it was long antecedent to professor Cooper’s experiment, and previous to the publication of Count Rumford’s fifteenth essay, in which he speaks of the use of steam as a vehicle for conveying heat. This essay contains so much valuable information, that we have thought proper to insert it in this work.

The first patent which we have been able to find for steam stills, was obtained in London in 1802, by Mr. Charles Wyatt. His being the first publication which states with any clearness the alleged advantages resulting from this mode of distillation, they are given in his own words, as "facts ascertained by repeated and extensive experiments."

"The principal advantages are,

1st. An improvement in the quality of the spirit.

2d. A facility and security in conducting the operation.

3d. A reduction in the labour, and in the duration, of the process.

4th. A reduction in the expense of fuel.

5th. A reduction in the original expense and repair of utensils."
1. An improvement in the quality of the spirit.

A committee of the House of Commons, which sat in the year 1799, to enquire into the state of the Scotch distilleries, reports, that the disagreeable and unwholesome flavour frequently discovered in spirituous liquors arises, from rapid distillation. The essential oils and other particles of an offensive smell and taste, rise in rapid distillation with the spirit and communicate to it their peculiar flavour. In confirmation of this fact some extracts from the report are annexed to these observations.

On considering the nature of distillation, it will be obvious, that, to obtain a pure and genuine spirit no more heat should be applied than will detach the spirit from its basis, although, for the purposes of commerce, great niceties cannot be observed. But, rapid distillation requires great heat. Great heat expels the essential oils, and other adventitious substances; burns the extractive matter that falls to the bottom of the still; and is thus the true source of the depravation of the spirit.

By using steam as the vehicle of heat it is proposed to remedy these inconveniences. The heat as applied in this apparatus, can never exceed that of boiling water; the liquor will be constantly attenuated by the accession of condensed steam; the extractive mat
ter cannot be deposited nor burnt; the essential oils cannot in any undue proportion be expelled; and therefore the spirit will rise in a milder and purer state than by the immediate application of fire.

2. A facility and security in conducting the operation.

The fire not being in contact with any of the distilling vessels; but with the boiler only, which by a very simple contrivance, supplies itself with water during the operation, no danger is to be apprehended, from any sudden increase of intensity in the fire, nor can it injure either the quality or ultimate quantity of the spirit. One particular convenience is, that the fire may be situated in a distant or external part of the building.

3. A reduction in the labour and the duration of the process.

To make this intelligible, it is necessary to observe that the stills are double, i.e. that one still is placed upon the other, and that the steam is let into the lower, but not into the upper still. Both stills are to be charged at once. The roof of the lower still is so constructed, that any particle of steam, on being condensed
Of Steam Stills.

against it, runs immediately into the refrigeratory; and the heat that involves in that condensation, passing into the superior charge, prepares it for distillation.

The lower charge being let off, the upper charge supplies its place, and begins almost immediately to run.

If the upper still contain low wines, the operation will be partly simultaneous. Thus, four circumstances concur to accelerate the operation.

1st. No significant time is lost in raising the liquor, the first charge excepted, to the boiling point.

2nd. None of the steam that is raised within the lower still, returns in a liquid state into the general mass to be again raised.

3rd. Whatever is obtained from the upper still during the simultaneous operation, is so much time of the common process curtailed. And,

Lastly, as no cake will form within, all the time usually required to cool and clean the stills, is here dispensed with. In fifty successive distillations, the abridgement of the process cannot be so little as 150 hours.

4. A reduction in the expense of fuel.

This is a point of considerable importance. Three hundred pounds weight of New Castle coal, will pro-
duce from 550 gallons of molasses wash, undergoing two distillations, one puncheon of rum of 110 gallons, hydrometer proof. According to some reports from Jamaica, (possibly not accurate,) this is only one fifth part of the quantity of coal consumed there to produce the like quantity of spirit.* The difference however, even if less in favour of the new system, cannot fail to be an object of solicitude to every distiller. In Scotland, where the distillation is urged by every practicable contrivance, the waste of fuel is enormous.

5. A reduction in the original expense and repair of utensils.

It would be improper here, to state the cost of the apparatus, but it would amount to less money than is usually given for utensils of the common construction; and certainly, as the stills do not come in contact with the fire, as no harsh or destructive incrustation whatever can attach itself internally to the metal, the decay and consequently the repairs of the vessels, can hardly be a subject of calculation. It is probable that little or no expense may be incurred on that point, within twenty or thirty years, except for the boiler, which cannot be more than a septennial charge.

* Where wood is used as fuel it is necessary to allow 1089 lbs. of dry oak to 600 lbs. New Castle coal, as equal heats are produced by the respective quantities.

Vide: Thompson's, Chemistry.
Of Steam Stills.

In the distillery in which the experiments leading to these conclusions were made, the fermenting vats, the reservoir containing the condensers, the cisterns for receiving the spirit, are all constructed of brick, laid in and faced with Roman cement; and although upwards of 14,000 gallons of wash have been distilled, no perceptible injury has been communicated to any of them, nor have the stills ever been cleaned, except being washed out with warm water. In vats built of these materials, all liquors may be kept cooler than they can be in wood, and their durability is much greater.

Extracts from the Report of the Committee of the House of Commons on the Scotch Distilleries referred to above.

"From experience and observation, I have found that spirits are more disagreeable and fiery when distilled with a great degree of heat, than when distilled by a more moderate one."

Mr. Gordon, of Xeres.

"They who assert that rapid distillation has no influence upon the taste or flavour of the spirit, either try to deceive, or are ignorant of the art of distilling. " Why do we distil fine and delicate liquors in " balneo mariae?" Because the heat is equal and uniform, and cannot be increased by the vivacity of the fire."

Mr. E. G. I. Crookes.

"I am of opinion, that the essential or flavouring oils, cannot be separated so well from the spirits of fermented liquors or washes of any kind, by rapid distillation, as by slow distillation."

Dr. Joseph Black.

"The more rapidly the distillation is carried on, the more the spirits obtained by it will be affected with essential oils, and other particles of an offensive smell and taste, as well as with water or phlegm."

Dr. Inghenhausz.

"I have no hesitation in asserting, that rapid distillation brings over a very strong deleterious spirit, containing empyreumatic oil, which is highly obnoxious to those who drink it."

Mr. William Bannerman.

"I have no doubt that spirits are more unwholesome if distilled very rapidly, than when distilled slowly and with a gentle heat."

Dr. Skene.
Of Steam Stills.

In 1803, a patent was obtained by Samuel Brown and others of the state of Kentucky, which differs very little if any thing from the preceding; and in 1810, Mr. Phares Bernard, of New York, obtained a patent for steam stills; these were the first to be generally introduced into common use in this section of the United States. A number of certificates, from highly respectable gentlemen in favour of this mode of distilling, have been published in a small pamphlet. It is stated to effect a "saving of about one third of the labour and nearly one half of the fuel, and cause an increase in the produce of more than one quart from a bushel over the productions from common stills, the spirit of a superior quality." When apples are distilled in the pummice, more is saved than would pay all the expenses of manufacturing and distilling it in the usual way.

The apparatus consists of a boiler, (size not mentioned,) and three tubs, one of 600 gallons, one of 160, and one of 60; the first contains the wash, and the two others singlings.

Another patent was obtained in the year following, by Philo M. Hackley, of Herkimer, New York, for a perpetual steam still and water boiler, which he states contains the only American improvements on steam distilling. The improvements are,

1. In the boiler, which is so constructed that the water is divided into thin sheets, and the fire passes