Making Sparkling Wine

by Jack Keller

Sparkling wine has several names. The one most people use is *Champagne*. Champagne is sparkling white (occasionally pink) wine made from one or more of several grape varieties in the Champagne region of France. Grapes used in the Champagne region are almost exclusively Pinot noir, Chardonnay, and Pinot meunier, although Pinot blanc and/or four lesser varieties may also be used.

By various conventions, treaties (actually, the Treaty of Madrid and Treaty of Versailles), laws, and regulations sparkling wines not made in the Champagne region may not be called Champagne. French sparkling wines not made in the Champagne region are called *Vins Mousseux* or *Crémant*. Italians call their sparkling wines *Spumante*, *Asti* and *Prosecco*, the German designation is *Sekt*, the Spanish call theirs *Cava*, and South Afrikaners use *Cap Classique*. Americans, feeling somewhat independent of Europe, call their sparkling wines whatever they want, but usually Champagne. Call me weird if you want, but since I am not living or making wine in the Champagne region of France, I call mine *sparkling wine*.

While there are several ways of making sparkling wine, I will only describe here the one method I use -- *méthode champenoise*. This is a rather exacting methodology and one I do not recommend unless one can do it precisely as described. Even when so doing, accidents can happen with explosive results.

The Juice

The base wine is the most important variable in the *méthode champenoise*. While I have seen (and made) sparkling wines from dark or rosé base wines, if your goal is to make something similar to traditional *Champagne*, the base wine really should be white.

The base wine should not have an alcohol content lower than 10% or higher than 11.5% by volume. Grapes should be harvested based upon the flavor and aroma of the juice, as well as analysis of °Brix, acid and pH. Allowing the grapes to reach excess maturity could well be a mistake for this type of wine. In warmer climates, mature fruit flavors and aromas usually can be noted when the sugar concentrations are low (14.5 - 18°Brix) and titratable acidity is still high (12-18 g/L [measured as tartaric]). At these levels, the malic acid content is probably 50-65% of the total. The pH of the juice should be in the 2.9-3.2 range. Additionally, low flavonoid phenol content, low aldehydes, low volatile acidity, and little juice color are also desired.

Berries intended for sparkling wine should be harvested cool (early morning) and carefully so as not to break the skins. Skin breakage will result in two undesirables -- excessive phenolics extraction from juice-skin contact and early partial oxidation of the free run juice. The latter will reduce desirable flavor and

aroma and provide excessive phenols which could cause bitterness and reduce the aging potential of the base wine. It is therefore considered desirable to press the whole berries rather than crush them before pressing. Crushing could extract courser, undesirable components. Whole berry pressing reduces the yield but produces a more elegant, less varietal base wine.

Pressing should be gradual in order to extract the correct juice at the correct time. It has been shown that the juice in the grape occupies three distinct zones -- the juice from the main pulp (Zone 1), the juice from the pulp area around the seeds (Zone 2), and the juice from just beneath the skins (Zone 3). With whole berry pressing, the juice from Zone 1, which contains the most fragile cells, is extracted before the juice from Zone 2, which in turn is extracted before the juice from Zone 3. Tartaric acid is most concentrated Zone 1 and least concentrated in Zone 3. It should therefore be extracted early in the pressing. Malic acid is most concentrated in Zone 2 and thus is also extracted fairly quickly. Potassium, the dominant cation, is most concentrated in Zone 3 and is extracted last. The conclusion is that juice extracted from the Zones 1 and 2 will have the highest acidity, lowest potassium, and lowest pH. It will also have the lowest susceptibility to oxidation, resulting in a wine of greater freshness.

Using the information above, the press should be engaged to exert just enough pressure to break the skins and start a flow of juice. For a 150-pound pressing, for example, initial pressure should extract 0.5-0.7 gallons of juice. This initial flow will contain most of the dust brought in on the grapes and also any free run juice resulting from grape rupture caused by the weight of the grapes. Set this juice aside and label it in some manner as the initial flow. You can mix it with other juices to make a still wine, but it is unsuitable for quality sparkling wine.

Now increase the pressure slowly, allowing the juice to flow again until it slows, then exert more pressure. This exertion of pressure, waiting, and re-exertion is continued until approximately 70-75% of additional juice of the expected yield is extracted. Using the 150-pound pressing example with a 10-gallon yield expectancy, this would be about 7-7.5 gallons of additional juice. This is the juice you want to use for the base wine if making a sparkling wine by the *méthode champenoise*. Set this juice aside and continue pressing.

You will now extract the final juice, which should represent approximately 20% of the total extraction. In the 150-pound pressing example, this would be about 2 gallons. This is often done in two stages. About 14% of the total juice is extracted at one hard pressing (1.4 gallons in the example we are using) and the final 6% (0.6 gallons in our example) is extracted during a second hard pressing. Before this final pressing, some winemakers open the press and lift the grapes to reposition them, then continue pressing to conclusion. In so doing, they extract an additional 5-10% yield, but the resulting juice will have even greater skin contact and oxidation susceptibility. Whatever wine is made with it must be consumed young. If you follow the convention of two final hard pressings, label the juice (I use "first hard press" and "final hard press"). The juice from the first hard pressing can be fermented separately to make a still wine used later in the *méthode champenoise* process.

However, if one must use any of this juice in the sparkling wine base, whether to add complexity or stretch the yield to fill a carboy, use the juice from the first hard pressing -- not the final extraction -- only after fining the juice with a protein agent. The juice from the final extraction can be mixed with that of very ripe grapes to make a still wine.

Low pressure pressing reduces the chance of releasing bitter compounds into the juice by macerating the stems. Steady, gentle pressing of cool fruit will extract fewer flavonoid phenols responsible for astringency, bitterness and color. The last juice extracted, which comes from the pulp near the seeds and skins, contains more intense flavors and aromas, more flavonoid phenols, more nonsoluble solids, and, for dark-skinned grapes, more color. The latter will affect the wine's degree of foaming, its character, and even the rate of secondary fermentation. Therefore, unless you can remove these undesirables by careful protein fining, this juice is better suited for still wine.

Phenols are colorless but turn brown upon oxidation. For this reason, if no other, the juice should be sulfited to at least 30 ppm of SO2 -- more if you do not intend to encourage or induce a malolactic fermentation. Sulfiting will also deter contamination by spoilage bacteria. This pertains to all fractions of the pressing -- the juice from the initial flow, the main extraction, the first hard pressing, and the final

pressing -- although the two final pressings should be sulfited much heavier and fermented separately. The juices are then cold-settled for a day and pectic enzymes are dissolved in a sample and broadcast over the surface of the juice (not stirred in). Cold- settlement is continued for another day and the juice is removed from the nonsoluble settlement.

It is the main pressing, the 70-75% yield, that is best suited for sparkling wine base, or *cuvée*.

Primary Fermentation

There are opposing considerations in deciding whether to ferment cold or warm. Cooler fermentations (55-60°F) and a lower content of nonsoluble solids produce and retain more fatty acid esters, which contribute to fruity, floral and aromatic aromas in wines. On the other hand, if the *cuvée* is fermented warm (65-70°F), the floral intensity is reduced but malolactic fermentation is encouraged. This decision is yours alone. Except in the winter, I rarely can achieve a fermentation in the cool range without use of a modified refrigerator, but I almost always discourage malolactic fermentation unless the malic taste is just too severe.

The *cuvée* should be supplemented with nitrogen. The addition of 0.4 grams per gallon of diammonium phosphate is ample. The addition of 0.4-1 gram per gallon of bentonite before inoculation will promote protein stability.

The yeast one selects for the primary fermentation must not be intimidated by high sugar content, must not possess the ability to achieve high alcohol levels, and need not be chosen for special metabolizing abilities. It need only be comfortable in a must with 23°Brix maximum, ferment to 11.5% alcohol, ferment in the selected temperature range, and then expire. However, if one intends to use the same yeast for both primary and secondary fermentation, it must possess other qualities as well. These include an ability to tolerate pressure, alcohol to 13-14% and is comfortable in cold and SO2 environments; it should produce little or no SO2, ferment to dryness, die thereafter, create small, granular, non-clinging lees, not impart a stain in the bottle, and not produce off-flavors or odors. For those not aware, "yeasty" odors are not "off" odors.

For primary-only yeasts, Red Star's Montrachet and Pasteur Champagne are among the best. For secondary fermentation, Red Star Epernay (Lalvin EC-1118) and Lalvin DV10 are highly respected, but Epernay (EC-1118) is not recommended for both primary and secondary fermentations.

A yeast culture is gradually husbanded to high-density in a starter solution and slowly brought to the same temperature as the must. Inoculation begins in an aerobic primary and after 2-3 days is transferred to secondary and capped with an airlock. Fermentation is as normal for a still wine, with 2-3 rackings spaced 3-4 weeks apart to achieve clarity. Fining with Isinglass or gelatin to remove additional phenolics is at the discretion of the vintner. The *cuvée* should be allowed to age and develop anywhere from 6 months to a year without stabilizing. Oaking is an option but not usually considered appropriate for sparkling wines. Still, some producers do oak. Filtration is another option but usually unnecessary. SO2 should be maintained at a level of at least 30 ppm throughout most of the aging, but in the final two months it can be allowed to drop to 15-20 ppm.

When aging is deemed sufficient, the vintner should critically taste the wine to determine whether it can stand on its own or should be blended. Few base wines cannot be improved by blending. The following chart of grapes useful for sparkling wines is certainly only a sampling. Base wine grapes typically constitute 70-85% of the *cuvée*, while juice from a major blender may constitute 10-20%. The minor blenders contribute floral, spice and fruit complexity, but typically represent no more than 3-8% of a *cuvée*.

Varieties Useful for Méthode Champenoise

Base Wines	Major Blenders	Minor Blenders
Chardonnay	All base varieties	Gewurztraminer
Chenin blanc	Blanc du bois	Golden muscat
Gamay a jus blanc	Macabeo	LaCrosse
Pinot blanc	Parallada	Melody
Pinot meunier	Pinot gris	Orange muscat
Pinot noir	Sauvignon blanc	St. Pepin
Riesling	Seyval blanc	Traminette
Semillon	Xarello	Vignoles

After blending (or determining not to), the wine is prepared for secondary fermentation. This is a multi-step process.

Preparing the Wine for Secondary Fermentation

If the wine's acidity is significantly higher than 7 g/L, it should be refrigerated to at least 40°F -- 35°F is better -- for two to three weeks to precipitate excess tartaric acid as its potassium acid salt, potassium bitartrate. The wine should be racked cold off any precipitation. Even if the wine does not have a measurable excess in acid, it is a good idea to cold-proof it anyway, as the wine will be chilled to 40°F later and if potassium bitartrate is to form at all, it is best that it form now when it can be eliminated from the wine.

Since the wine will be riddled after secondary fermentation, some vintners add a fining agent to the wine to aid the yeast in its movement to the neck of the bottle. One can use bentonite, for example, at a dosage of not more than 1.2 grams per 5-gallon batch. Most other fining agents, employed at this stage, carry some risk of affecting the flavor of the wine or actually complicating disgorgement.

I must now assume the wine is bone dry. If it is not, the following must be adjusted to account for any residual sugar. I will not cover this in detail, but will offer my own rule of thumb adjustment below.

The wine now needs to be chaptalized (sweetened) for the secondary fermentation. Sucrose or dextrose are each suitable. For a finished sparkling wine with 4 atmospheres of CO_2 (about 58 pounds of pressure per square inch), 16.8 grams of sugar per liter are added, or 63.6 grams per U.S. gallon (318 grams per 5-gallon batch). In Champagne, the standard is 6 atmospheres of CO_2 (about 88 pounds of pressure per square inch). This requires that 25.2 grams of sugar per liter be added, or 95.4 grams per U.S. gallon (477 grams per 5-gallon batch). The amount of carbonation desired is your call, but I use 4 atmospheres when the primary fermentation has only gone to s.g. 1.000 and 6 atmospheres when it has gone all the way down to 0.990 or lower because the residual sugar in the wine *could* also ferment in the bottle with explosive results if not allowed for.

The sugar is best added as a sugar syrup of 50% solution -- *x* grams of sugar in a like number of milliliters of wine stirred until dissolved and added to the batch. If sucrose is used, citric acid in the amount of 1.5% the weight of the syrup in grams should be added to invert the sugar.

The addition of 0.9 grams of diammonium phosphate (DAP) per U.S. gallon will promote esters production, reduce the production of fusel oils, and minimize the production of sulfites by yeast. All of these are beneficial to wine quality. Just as important, however, is the nutritional value DAP provides the yeast.

Over a period of several days, bring the *cuvee* to the temperature you will ferment it -- 60-65ºF (15-18ºC) would be appropriate.

The Secondary Fermentation

There are many ways to do this, but I will describe the method I use. If you have another method you are comfortable with, please use it instead. In this method, I am assuming you will be making a 3-, 5- or 6-gallon batch of sparkling wine and thus will have enough *cuvee* to do what is described. While making the yeast starter by the instructions below, sanitize the necessary number of Champagne bottles and closures. Set the bottles upside down on a sanitized drain or rack and cover the stoppers. Do not, under any circumstances, use regular wine bottles to make sparkling wine.

A minimum of 1 million cells per milliliter should be added to each bottle to insure secondary fermentation. To be sure you attain this number, a yeast starter solution is absolutely necessary and a laboratory is required. However, the following method has served me well in the past. Remove 500 milliliters of the already sweetened *cuvee* to be further fermented. Take a hydrometer reading and write down the number. To the sample add 13 grams of sugar and stir to dissolve. Take another hydrometer reading and write down this number too. Bring this sample to 80°F (27°C); a few seconds in a microwave may help in doing this.

Add a sachet of the active dried yeast you have selected by sprinkling it onto the surface. Do not stir. If the yeast floats, fine; if it sinks, also fine. Cover the sample and leave it alone. Check it in an hour to ensure the yeast is viable. It is in a medium that already has 11.5% alcohol, so don't expect it to be bubbling...yet. But you should be able to tell if the yeast is viable. The granules of yeast will have swollen; if on the surface they probably will have flattened and expanded. If so, stir the sample and recover it. Wait an additional 5 hours and take a hydrometer reading. You should not expect a real change, but you need to do this at least every two hours to monitor its progress and know when the sample returns to its original hydrometer reading (the first number you wrote down). When it does, stir in another 13 grams of sugar, add 20 milliliters of bottled water, and recover the sample.

There are three things I need to explain here. The amount of sugar added to the *cuvee* creates a low sugar condition in an 11.5% alcohol environment. You want the yeast to acclimate to this environment while undergoing a vigorous reproductive phase in the starter solution. When the sugar you added to the starter is consumed, it needs to be replenished so the yeast do not feed on the sugar already in the *cuvee*, bring the starter to dryness and start to die off. At the same time, while consuming the sugar you added to the starter, the yeast created some alcohol and that increases the total alcohol in the starter. The reason for adding the water is to dilute the alcohol the yeast made in the starter solution. If you don't dilute it, the alcohol in the starter will rise too high and kill the yeast, defeating your purpose.

Take hydrometer readings about every 2 hours after adding the water and additional sugar. When the s.g. again drops to the original hydrometer reading, add another 13 grams of sugar and 25 milliliters of bottled water and repeat the procedure. The difference is that during the next few hours, bring the temperature of the starter solution to the temperature of the *cuvee*, but don't rush it. During this time, take periodic hydrometer readings as before. This time, when the s.g. drops to the original reading, add 30 milliliters of bottled water, remove 75 milliliters of wine from the larger batch (this is the amount of water you added to the starter, so you need to remove it from the *cuvee* or the starter will not all go into the carboy), add the starter to the *cuvee*, and stir it slowly but sufficiently to integrate it thoroughly into the wine. By the way, from the time the yeast is hydrated to the time it is added to the *cuvee* could take 24 hours or as long as 48. Don't be concerned about this. Just let the yeast multiply and get acclimated to the environment.

After the *cuvee* has been innoculated, it must be bottled immediately. Fill each bottle to within 3/4 inch of the top. The preferred method of closure is to insert a *bidule*, a small plastic reservoir which later aids in

collecting and removing bottle sediment, into the mouth of the bottle and cap the bottle with a crown cap. Crown caps for sparkling wine are different than those for beer. They must have the proper skirt length to grip over the lip of the bottle for a proper seal and must have a cork liner. However, it has been years since I have been able to find *bidules* and Champagne crown caps. Some people use regular beer bottle caps and wing it, but we will use an alternative but adequate Champagne stopper instead. These are readily available from most homebrew/winemaking shops.

The Champagne stopper is a hollow, plastic closure for Champagne bottles. A stopper is held in place in the mouth of the bottle and driven in with a wooden mallet. A wire cage is placed over the stopper, the lower wire edge is worked over the retaining lip of the bottle, and the excess wire on the lower edge twisted to secure the cage in place.

What occurs next is true secondary fermentation. The fermentation that occurs when a wine is transferred from primary to secondary is still the primary fermentation, meaning the first (or prime) one. The other kind of secondary fermentation is malolactic fermentation. Using terminology correctly is important, if only to communicate to others precisely.

The bottles are now stored upright for at least 9 months and preferably 12 to 18. For the first 4-6 months the wine should be held constant at a temperature in the 60-65ºF (15-18ºC) range, but no higher. Thereafter, it can be cellared at 55-60ºF but no lower. There are good reasons for this. During this period the lees undergo a slow autolysis in which time the amino acid content of the wine increases by as much as 12%. Commercial producers of fine Champagne age their wines on the lees for up to 4 years, during which time the amino acid content increases by 25%. Elevated levels of glutamic acid, isoleucine, leucine, lysine, phenylalanine, proline, serine, and valine contribute to the unique character and complexity of *méthode champenoise* wines, which is why it is the preferred method for making sparkling wine. It would be a waste of time and effort to go through all of this and then not reap the benefits because the vintner rushed the aging process or maintained the wine too warm or too cold for the yeast to undergo a correct autolysis and complete the slow transformation of the wine.

There are other reasons to age the wines at least a year to 18 months. Most notable of these is to allow the yeast cells sufficient time to die. It would be a shame to disgorge early, sweeten the wine and insert the final closure, only to have it continue fermenting and dropping unsightly lees once again or, worse yet, exceed the pressures the bottles can retain. Additionally, aging permits the development of the 'champagne bouquet,' a nose found nowhere else. And finally, it has been noted that the lees of young wines are much less homogeneous than aged ones and therefore difficult to riddle; as the wines age the lees change and are much more manageable.

To age the wines at 55ºF without a temperature-controlled cellar, an old refrigerator can be fitted with a thermostat that allows this temperature to be maintained fairly inexpensively.

When you have determined that the aging is sufficient, the bottles are then inserted in a riddling rack, an adjustable rack that holds the bottles horizontally but with the neck tilted slightly downward. After a day in this position, each bottle is given a sharp quarter-turn to the right and an equally sharp one-eighth turn back to the left, which serves to cause the yeast and other precipitants to be jarred from their resting position and resettle along a slightly different avenue along the bottom-most inner side of the bottle; because of the angle, gravity moves them slightly downward toward the neck of the bottle. This procedure is repeated each of the next two days and then the angle of the rack is decreased to drop the neck slightly lower. Do not decrease the angle too much at any adjustment.

Again, the bottles are given a sharp, quarter-turn right and eighth-turn left each day for three days. The rack is then again adjusted to drop the neck slightly lower and the procedure is again repeated. This routine is continued even after the angle of the bottles is severe -- straight up and down, actually -- until all the lees in the bottles have migrated into the hollow stopper. This should take a month to complete, but if the lees are difficult it may take up to 3 months.

When the bottles are perpendicular, one needs to examine the ogive of the bottle -- the sloping portion between the wider wall and the narrow neck -- very carefully with the aid of a strong flashlight. Very often it is this area where problems arise. To us, this area is smooth and we can see no reason why the lees haven't already slid down this area to rest in the hollow cap. However, to the yeast cells, which are, after all, microscopic, this surface is a long slope of inundating hills and valleys, offering many, many small "steps" for them to rest upon. It may take a week to several to "walk" individual lingering cells down this staircase. Since the cells are too small for you to see, all you can do is put on your best reading glasses, shine a strong flashlight along the lower portion of the ogive of one of the bottles, give that bottle the sharp twists, and try you very best to detect a slight rippling of fine dust on the inner surface when the twists are applied. The slightest trace of residual precipitant can cause problems later, so if in doubt, continue riddling a few more days. When the lees -- *all* the lees -- are in the stoppers, you can proceed to disgorgement.

If you cannot find, afford or build a riddling rack, you can store the bottles upright during aging and then turn them upside down in a wine case and give each bottle a sharp, quarter-turn right and eighth-turn left every day for a full month. Do not try to shorten this period, as contrary to appearances, it is not nearly as efficient and thorough as using an adjustable riddling rack. If anything, extend the riddling period if using this alternative.

The first "riddling rack" was made in 1805 by Nicole-Barbe Clicquot Ponsardin, who cut holes in her kitchen table in order to invert the bottles. She found that shaking the bottles helped loosen the sediments, but some still stuck to the bottle bottoms and sloping ogive. In 1810 Antoine Muller improved the procedure by starting with the bottle at a 45° angle and gradually increasing the angle with each shaking until the bottles were perpendicular. Anyone with a drill and a piece of heavy plywood can make a riddling rack. My first one was improvised by leaning a wine rack at a 45° angle.

Disgorging the Wine

When all the lees are in the hollow Champagne stopper, it's time to disgorge the sediment. Prior to disgorging, the wine is chilled to about 40ºF (4°C) to help prevent significant loss of wine or carbon dioxide. While the wine is chilling, take 500 milliliters of a still wine made from the same grape as the *cuvee* -- a wine made from the juice of the first hard pressing after pulling the juice for the *cuvee* is appropriate, especially if it has been oaked as that will add additional complexity to the sparkling -- and to it add 500 grams of sugar. Stir this until thoroughly dissolved. You will use this to "top up" the sparkling wine bottles after disgorgement and pull the wine off bone dryness. If you don't want to sweeten it at all, then just use the still wine for "topping up" but please note the following.

What I am calling the "topping up" wine/syrup is technically called the "dosage" or *liqueur d'expedition*. In the commercial production of Champagne or sparkling wine, the dosage is carefully calculated and can contain wine, sugar, brandy, sulfur dioxide, ascorbic acid, citric acid, or many other ingredients that alter both the taste and composition of the sparkling wine. The exact ingredients used are determined by carefully analyzing some of the wine and calculating its needs. The addition of sugar is usually the most significant ingredient and serves several purposes -- sweetening, balancing acidity, countering astringency or bitterness, and adjusting the flavor and character of the wine if only slightly. Sugar syrup, made either with sucrose or invert sugar, is almost always added to the dosage except for the very driest wines. Indeed, only the most perfectly balanced wines can "stand on their own" without some added sweetness. So, if the thought of adding a little sugar syrup to your sparkling wine somehow offends your sensibilities,

my advice is to get over it, make the syrup, and join the company of the best winemaking houses in the world.

The reason we will simply use sugar syrup in our dosage is that it is impossible for me to cover the analysis and range of possibilities at correcting the chemistry of your wine in a short essay. A 50% syrup will go a long way to round out most homemade sparkling wines. This requires some degree of trust on your part, but unless you are very experienced, have at least a minor lab at your disposal and know wine chemistry very well, this trust will reward you with good to excellent wine most of the time -- assuming you did everything else correctly.. With that said, we can now proceed.

There are several ways to disgorge the wine, but I will explain the way I have always done it. It works and I can describe it from experience, while trying to explain a method I have not used would lack conviction and insight.

While you can disgorge by yourself, it goes a lot faster and easier if someone helps you.

In a tub or bucket, prepare a brine one inch deep by mixing one part of coarse salt with four parts of crushed ice until the desired depth is reached. The bottles are placed upside-down in the brine, just deep enough so the Champagne stopper and a quarter-inch of the neck above that are in the brine. One and a half inches is usually more than sufficient. It is essential that not more than this is in the brine. If the brine level rises too high as the bottles are inserted, remove some of the brine.

I am always amazed how quickly the wine in the brine freezes, although I have never actually timed it. Just pay attention to the wine and you will see it freeze. However, the wine immediately next to the glass will freeze before the whole volume in the brine freezes solid. If you begin the next step too soon, the ice will not freeze solid, a "plug" will not form, and you'll end up with a mess. Give it a few more minutes.

You have to do several things in rapid succession, so have everything ready. The bottles will have to be re-closed, so have new sanitized stoppers ready with the wooden mallet to drive them in and the wire cages to secure them. It is also best to put some of the dosage syrup you will "top up" with in a creamer or other vessel with a pouring spout. You will also need some large pliers to pull the stoppers with -- don't think for a minute you can push them out with your thumbs. Finally, you will need a large bucket or pail (a primary works great) to receive the stopper, the ice plug, and any wine that escapes. I set the bucket on a chair next to the tub of brine so I don't have to work bent over. I set it on the chair at an angle, so I can hold a Champagne bottle horizontally over the lower rim of the bucket and the opposite wall of the bucket is higher than the bottle. If wine spewed from the bottle at this angle, it would all go into the bucket -- well, most of it would. You might have to use some towels to brace the bucket solidly and some twine to secure it to the chair. You'll have to work this out for yourself, but it isn't difficult.

I have never invested in a Champagne corker so I use the stoppers for closing the bottle both times (for the secondary fermentation and for the final sealing). If you have a Champagne corker, use the natural corks designed for it at this stage -- never for the secondary fermentation stage. The corks will mushroom out forming a cap when used correctly. If you are using one, have the corker and the prepared corks ready. These corks are usually prepared by soaking at least 15 minutes in warm, sulfited water.

From here on, speed is essential. Hold a bottle firmly upright and use the pliers to loosen and start pulling the stopper. Look at a Champagne stopper before you do this so you know exactly how much of it is lodged in the neck of the bottle. The stoppers have a series of successive beveled ridges that grip the inner walls of the neck of the bottle. The idea is to pull it out to the point where only one beveled ridge remains in the bottle. Now hold the bottle horizontally and point the stopper into the bucket. Use the thumb of one hand to pry the stopper from the bottle while using the other thumb to resist the stopper from simply shooting out. When the stopper is free from the bottle, slowly allow the pressure in the bottle to push it and the ice plug completely free. As soon as the plug is free, let it drop into the bucket while simultaneously raising the neck of the bottle and covering its mouth with one of your thumbs (I use the thumb I was pushing with). You have to stop the wine from spewing out or you could lose more than a little of it. If the wine were not chilled to 40°F prior to this, you would surely lose 1/4 to 2/3 of it.

After about 15-20 seconds, you can safely (but slowly) remove your thumb. You must now do two more

things rapidly. Carefully pour in just enough of the dosage syrup to bring the level to within one to one-and-a-quarter inches from the mouth and immediately insert a sanitized stopper with your free hand and drive it in with the mallet in the other. Here you may want your helper to tie down the cap with a wire cage while you remove the cage from the next bottle.

If you are using natural Champagne corks with a Champagne corker, you can lay the bottles down as soon as they are caged and labeled. If you use the plastic Champagne stoppers, you do not have to lay down the bottles (but I still do).

Potential Problems

A word here about problems you *might* encounter while disgrorging. If, when you remove the first ice plug, the bottle erupts with a gusher of bubbles and foam, the wine has not been chilled low enough in temperature for the pressure inside the bottle. The only thing you can do is stop and rechill the wine, lowering the thermostat to 34ºF (1°C).

If the wine gushes when you pour the dosage, the sugar in the syrup was not thoroughly dissolved. Usually, this is not a problem until you start pouring from the bottom of the syrup because sugar crystals settle to the bottom and are poured last, but it really could occur at any time. If it does, set that bottle aside and start stirring the syrup.

It is also possible that you did not fill the bottles enough when bottling for the secondary fermentation. If too much ulage is allowed, the trapped air can be driven into solution by the building pressure. Unlike CO2, which will largely remain in solution in a chilled wine even when the pressure is released, ordinary air will immediately rise to escape and a gusher will ensue. I know of no solution that can save this batch of wine except to disgorge in a pressure chamber (highly unrealistic), but it will serve as a lesson when making future batches.

It is also possible that the riddling procedure was not thorough enough or the bottles collected dust between the time they were sanitized and the time they were filled. If any lees or dust remain clinging to the walls of the bottle, they will almost certainly be dislodged by the handling of the bottle during disgorgement. Any particles moving in the wine, even particles as fine as precipitated tannin, can occlude microscopic air bubbles that will be released when the pressure is released, causing gushing. It is therefore essential that the bottles be sanitized almost immediately before they are to be used, stored upside down until picked up to be filled, and that one takes a full month (or longer, if needed) in riddling the wine and follows the riddling procedure religiously.

Finally, if the wine was not sufficiently chill-proofed earlier, when preparing it for the secondary fermentation, the chilling of the wine in preparation for disgorgement could have caused potassium bitartrate crystals to form and cling to the wall of the bottle. Handling the bottles during disgorgement would almost certainly dislodge them and cause gushing.

All of these potential problems, as you can surmise, can be avoided by following good winemaking practices conscientiously. More things can go wrong making sparkling wine than with any other type wine. For that reason one *must* focus on what he or she is doing, do each and every thing as thoroughly and competently as one can, and take no short-cuts. What should take a month must take a month. No essential step can be skipped. Most wines can be quite forgiving, but sparkling wines are not.

Do not misinterpret the previous statement. Making sparkling wine is not a rigid endeavor, but it is exacting. The rewards, however, are well worth the effort. I also like to believe that making sparkling wine builds and reinforces character.

The celebrated remark by Benedictine monk Dom Perignon, "I am drinking stars," may well epitomize the sparkling wine experience. As complex as *méthode champenoise* is, the rewards are well worth the

effort.

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